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THE MIAMI CONSERVANCY BULLETIN

AUGUST 1920



FIG. 168—LOOKING SOUTH ACROSS THE HUFFMAN BORROW PIT AND DAM. APRIL 18, 1920.

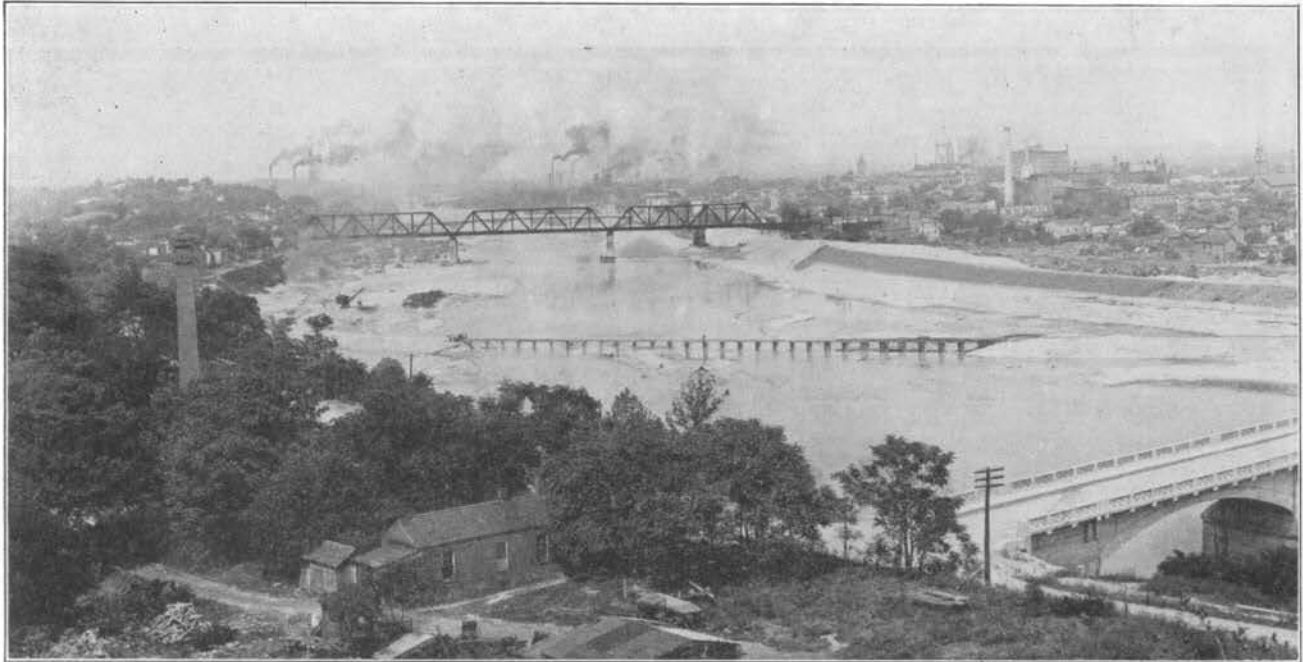


FIG. 169—LOOKING UP THE MIAMI RIVER AT HAMILTON. JUNE 10, 1920.

The view is from near the west end of the Columbia bridge, which is seen in the foreground at the right. Next upstream comes the trestle recently completed by Price Bros., which is now carrying the dump car trains across the river between the "dump" on the South Avenue spoil bank and the big dragline excavating the improved river channel on the west side just below High-Main street bridge, the trains being loaded with the material from the excavation. Across the river, opposite the trestle, the finished slope of the levee appears. This levee is now completed as far upstream as High-Main street bridge, (the second beyond the trestle). The dragline, which has just finished this work, together with the excavation of the east half of the channel, is just beginning to work down stream along the west bank, excavating the west half of the channel, and finishing up the west levee below the bridge.



FIG. 170—LOOKING NORTHERLY ACROSS THE GERMANTOWN DAM. JUNE 7, 1920.

The slope seen is the downstream slope. The levee at its top is now at elevation 800, only 30 feet from the top of the dam. The top of the upstream slope is at elevation 795. The final elevation of the dam may be estimated as being at the top of the cut-off trench seen climbing the further hillslope between the two levees. Between the levees is the core pool. The small house at the top of the slope is a telephone box for the use of the pipe line gang in communicating with the pumpman. The bridge crossing the pool carries the pipe line for use in pumping for the downstream beach and levee. The small dragline excavator at the left is building the upstream levee as described in the Bulletin for February, 1920, using material brought by the dredge pipe line to the upstream beach. The two towers are for the support of the pressure cells which record the earth pressure in the interior of the dam core, furnishing an estimate of its stability.

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THE MIAMI CONSERVANCY BULLETIN

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G. L. TERPLE, Assistant Engineer, EDITOR.

Lockington Dam Embankment Above 1913 Flood Level

Attention is called to the picture on page 15, showing the present condition of the work at Lockington. The entire embankment seen in the foreground, the east section, extending to the concrete outlet walls, has been deposited by hydraulic fill this season. Both east and west of the walls, the embankment is up to a level above that which would be reached, in the present open condition of the outlet structure, by a flood equal to that of 1913. Practically all danger of injury to the work from flood during construction is thus past.

It will be remembered that the borrow pit at Lockington is being excavated by hydraulic monitor, and sluiced down the hillslope to a sump, whence it is pumped to the dam. Careful study has been made of the special conditions at Lockington in this pit, and the efficiency of the work greatly promoted thereby. Thus the water in the sluice ditches is made to do its bit in the way of excavation, on its way down the slope, thus saving a considerable yardage which otherwise the monitor would have to do. Low pressure water, fed in at the head of the sluicing ditch, aids this action. At low levels in the pit, below possibility of sluicing directly, the material is excavated by dragline excavator, and dumped at a higher level whence in its loose condition it can be sluiced without a monitor to the sump. An article will be published in an early number of the Bulletin describing these expedients in detail.

The time lost in pumping at Lockington has been reduced to a very small fraction. During April, May and June, only 228 pump hours, or 7.8 per cent were lost out of a possible total of 2903. This includes the time lost from all causes, including high water and power interruption, except one week when all work was stopped to repair Plum Creek Aqueduct. During the last seven weeks the yardage pumped to the dam has averaged 3062 per day, or about 78,000 per month. The regular operating crew consists of 14 men on each of the two shifts. This includes four men each shift attending the discharge pipes on the dam embankment, but does not include the monitor movers.

Hydraulic Fill Cores

The recent paper of Mr. Allen Hazen, published in Vol. XLVI, No. 4, of the Proceedings of the American Society of Civil Engineers, calls attention once more to this subject. The upshot of his discussion is that all core materials finer than 0.0-milimeter should be wasted, and that the core, built of the coarser material remaining, should be made as narrow as possible. At San Pablo, the core pool was narrowed until it became "hardly more than a muddy creek remaining in the middle of the dam." Such a proposal, if adopted, would be a radical departure from practice which is the result of many years of successful dam building by this method. It would also involve a great increase in expense due to the finer core materials wasted. The one case of failure which can be brought against the hy-

draulic fill method when carried out under proper supervision, was due to a design involving the opposite extreme—an exceedingly wide core, of materials a large percentage of which were of extreme fineness. (Sixty per cent under 0.005 millimeter as against twenty per cent in the Conservancy dams). Considering carefully the record of hydraulic fill dam building, it was believed by the engineers of the District that a mean between the two extremes mentioned would represent safe, conservative, practice. A core width equal to the height of the dam above the core pool was therefore adopted, and is being carried out, with a grading of core materials which seldom requires waste. The actual solidification observed in the Conservancy cores bears out the practice adopted.

Gerard H. Matthes Goes to Tennessee River Investigation

The Bulletin announces with regret the resignation of Gerard H. Matthes from the engineering staff of the District, to take immediate charge of the preliminary surveys connected with the Tennessee River Investigation recently authorized by Congress, and now beginning under the auspices of the U. S. Army Engineering Corps. Mr. Matthes came to the District in 1915, as one of the staff of engineers engaged to carry out the preliminary studies necessary to the undertaking. He has thus been in Dayton five years. Of this period one year was spent in Hydraulic Studies; one in charge of the engineering end of the property appraisal; one as Office Engineer; and two in special work, in preparing for publication the early studies made by the District's engineering staff, and as an engineering expert testifying in the various law suits brought against the District, chiefly in matters of property appraisal.

The job to which he goes is perhaps more significant in certain features than any other now in progress. It is the first time that there has ever been undertaken in this country a complete and comprehensive survey of a river, involving all of its hydraulic resources—water supply, water power, flood protection and navigation. The entire possibilities of the Tennessee River, present and future, are to be studied, to the end that all of its resources may be correlated and conserved. Twenty-two dam-sites are now listed for investigation, representing water powers from 5,000 to 70,000 horse power, and totalling a million horse power. It is proposed to build the dams to elevations twenty feet or more above those which would be selected for power purposes alone, the excess storage, which on the upper levels of a reservoir are very great, being held in reserve for flood protection. This, which is not possible in the Miami Valley watershed, with its high percentage of valuable agricultural lands, its long season of low water flow, and its yearly rainfall of only 36 inches, is entirely feasible in the highlands of the upper Tennessee and its tributaries, where in the mountains the rainfall runs to 60 inches per year—nearly double the Miami Valley figure,—and is from 45 to 55 inches at lower elevations, and where the country is rough and wild.

Mr. Matthes has had twenty-one years' experience as a hydraulic engineer, divided almost equally between work in irrigation, water power and flood

prevention, and is thus specially fitted for his new task. He will be Senior Assistant Engineer under Major Harold C. Fiske, Engineer Corps U. S. A., who has the entire work in charge. The Bulletin wishes and expects for Mr. Matthes' continued success in his new and important task. The editor is under unusual obligations to him for help many times extended and views his departure with especial regret.

E. W. Lane Goes to China

Mr. E. W. Lane, Assistant Engineer with the District, will leave San Francisco on the steamship "China," on August 21, bound for Shanghai, where he will make his headquarters for the present, as the representative of the Morgan Engineering Co., in matters pertaining to reclamation, water power and flood control. The immediate matter demanding his attention is the reclamation project at Nantungchow, which is in charge of Mr. Chang Chien.

Mr. Lane is a graduate of Purdue and of Cornell University, and has been with the Morgan Engineering Co. and the Miami Conservancy District since 1912, excepting for a period of 18 months when he was an officer in the U. S. Aviation Corps during the war. He has specialized in hydraulic engineering, conducting several investigations in that branch in a manner to mark him out as a man of unusual originality and force. He is thus specially fitted for the task which he now assumes. His many friends in the District will wish him every success in his new work. His job is an unusually responsible one, yet they regard it as but the beginning of his career.

Englewood Again Breaks Record

The record of material pumped into the dam at Englewood was again broken on July 15, when during a single shift of 10 hours, 611 cars were delivered on the embankment of the dam. This makes 4,888 cubic yards. The preceding record, made on May 28, was 4,600 cubic yards. Cross dam No. 2, enclosing the river section of the hydraulic fill, on the west bank, is up to elevation 814, or 60 per cent complete. The total yardage in the Englewood dam to date is 1,441,000, making the earth fill 41.2 per cent complete. Hydraulic fill is now being deposited in the river section.

Grouting Under Bridge Piers at Hamilton

The grouting of the gravel under the piers of the B. & O. stone arch bridge at Hamilton, referred to in the article on the Fordson tail race conduits in the last issue of the Bulletin, was carried out on July 15, 16 and 17. The grout was introduced through 2-inch gas pipe cast in the walls of the tail race conduits at 12-foot intervals and extending into the gravel,—16 pipes in all. A Ransome grouting machine was used, forcing this grout under pneumatic pressure through a hose connected with the gas pipes, under a pressure of 45 pounds. The grout was of one part cement and two parts water by volume. The gas pipes were first cleaned by inserting a smaller pipe. Pipe No. 2 took two sacks of cement, No. 9 took one sack and No. 15 took six sacks. None of the other pipes took more than enough to fill the pipe itself. No. 15, which took six sacks, had a small

(Continued on page 10.)

Sluicing Directly Into the Dam Core at Huffman

Material from Hillside Borrow Pit Containing Excess of Clay Corrects the Deficiency in Clay of Valley Bottom Pit. Hillside Material Deposited in Dam at Half the Cost of Dragline Excavation and Sluicing from Hog Box.

In the Bulletin for February, 1920, there was a discussion of the hydraulic fill method of dam building, showing the relation of the core of the dam, which makes it water-tight, to the retaining embankments of sand and gravel which enclose the core on each side to hold it in place and give the dam stability. The ratio of the core thickness to the thickness of the retaining embankments, as there explained, is important. If the core is too narrow, there is danger that the core material, being thin mud when first deposited, and consolidating slowly, will be bridged across by protruding tongues of sand and gravel sliding in from the retaining embankments, thus reducing the imperviousness of the dam. If the core is too thick, there is danger (see the article referred to), of its bursting through the embankments, necessitating expensive work of reconstruction. Both these possibilities are avoided by properly proportioning the relative thickness of the core and retaining shoulders. In the Conservancy dams the rule adopted as a safe mean is to make the core thickness at any point in the dam equal to the distance from that point to the dam crest. This makes the core at the base not more than one-fifth of the dam thickness. With proper materials, such as are available for the Conservancy dams, and with this limit of core thickness, a hydraulic fill dam can be made as safe as any other type.

The "borrow pits," therefore, from which the materials are obtained to build the dams, ought to contain a ratio of fine materials, forming the core, to

sand and gravel, forming the shoulders, to fit the above ratio. Otherwise an excess, either of fine or coarse, must be thrown away after being excavated, involving an addition to the expense of the work. If a borrow pit lacks either fine or coarse, the lack must if possible be supplied by opening another pit containing a proper proportion to correct the difficulty.

At the Conservancy dams, preliminary explorations were made, by means of borings and test pits, to determine the grading of the materials, and the best locations for the borrow pits to be opened. In most instances a favorable grading was obtainable. At Huffman, however, the preliminary explorations showed that on the valley bottom just above the damsite, the most economical location from other considerations, there might be a lack of "fines," and the grading of the material deposited in the dam, when this borrow pit was opened and construction was begun, bore out the probability. The gravel retaining embankments rose at a normal rate, but the core did not. The core pool, kept at normal width, deposited so little silt along its sides, which are formed by the sand and gravel retaining embankments, that it was unable to keep itself water-tight. The water seeped away through the embankments at the rate of about 6,000 gallons per minute, requiring almost the entire capacity of a 15" dredge pump simply to counteract the leakage and keep the pool level at the proper point. This was of course a certain symptom, indicating the lack of sufficient fine



FIG. 171—LOOKING NORTH ACROSS HUFFMAN DAM FROM HUFFMAN HILL. MARCH 25, 1920.

The view is in the opposite direction from that of Fig. 168, and from the other side of the valley. The borrow pit in the foreground of that picture is on the hillslope across the dam in this. Mad River, seen flowing beyond the outlet structure walls, (in the foreground,) in a diversion channel dug for it, now flows between the walls; and the hydraulic fill is being deposited in the diversion channel. The valley bottom borrow pit shows as a narrow strip of white over the trees at the right, material for the dam being dug there and transported to the sump and pump house on the further edge of the dam embankment, which shows as a broad flat strip of white with a gray center, (the pool).

material in the borrow pit to build up a proper width of core.

Several methods of remedying the difficulty were proposed. One was to dig to a less depth in the borrow pit. The upper layer of the valley floor material, only a few feet thick, contains a much larger percentage of clay than the layers below. By adjusting the depth of digging, the material could be given the required proportions. But this shallower digging would require to be extended over a wider area to obtain the same amount of material, and this would require more construction track building, and would also increase the average distance the material must be hauled. Both items would increase the cost.

An alternative plan considered was to set a steam shovel to excavating in a clay bed along the edge of the valley, at the foot of the hills, and mix this clay in the hog box in proper proportions with the materials from the valley bottom pit. This would have required the purchase of additional large equipment, thus again increasing cost.

The third proposal was to "sluice" the additional fine material, necessary to a proper "mix," down from the hillside at one end or the other of the dam. At the south end the preliminary borings and test pits had showed but a few feet, and sometimes but a few inches, of the necessary fine clay and earth. At the north end, however, the tests showed a top layer of from two to eight feet of yellow clay, with some sand and gravel; and below this a layer of from four to twelve feet of hard blue clay; making from six to sixteen feet of the fine materials desired.

The general scheme as proposed was to wash down this material with a powerful water jet, or "monitor," and run it down the hillside by gravity in a ditch or "ground sluice" into a cistern or "sump" at the foot of the slope, when it could be pumped by a dredge pump up to the dam embankment. The only additional equipment necessary in this case would be the monitor and a pair of high pressure centrifugal pumps, with the electric motors to drive them. Much of the material would be quite tough to tear down with a monitor, but even so, the cost would be probably less than the excavation of the material in the main borrow pit (by dragline excavator), and would certainly be no greater. The monitor pumps would be placed at the foot of the north hill and fed by a ditch connecting with Mad River.

Further study of the topography showed that it was possible to improve this scheme by carrying the mixed earth and water from the upper part of the hillside borrow pit directly to the top of the dam embankment by gravity by means of a "flume," thus saving the cost of pumping this portion of the material—about half the total available—from the sump at the valley bottom to the top of the dam. This modification was therefore adopted.

Such a method of carrying the "hydraulicked" material from the borrow pit to the dam top was in fact the original one used in the development of this process of dam construction in the early days of California placer mining. The flume was usually an open topped square box or trough of plank, laid on top of a trestle, the latter being built on a slope of from three to six feet in a hundred, and leading from

See Fig. 173 first, which is a cross section of the layout on the line "XX." "A" is the pipe flume line; "B", high pressure pump house; "C", high pressure pipe line; "D", entrance to pipe flume; "E", upper limit of borrow pit, May 1; "F", upper limit of borrow pit, June 1; "G", upper limit of borrow pit, July 1; "H", $3\frac{1}{2}$ per cent grade line up the hill and limit of the borrow pit; "K", construction tracks; "M", supply ditch connecting with Mad River; "N", road; "S", sump; "T", first location of monitor; "U", second location of monitor.

Two ten-inch centrif-

(Continued below)

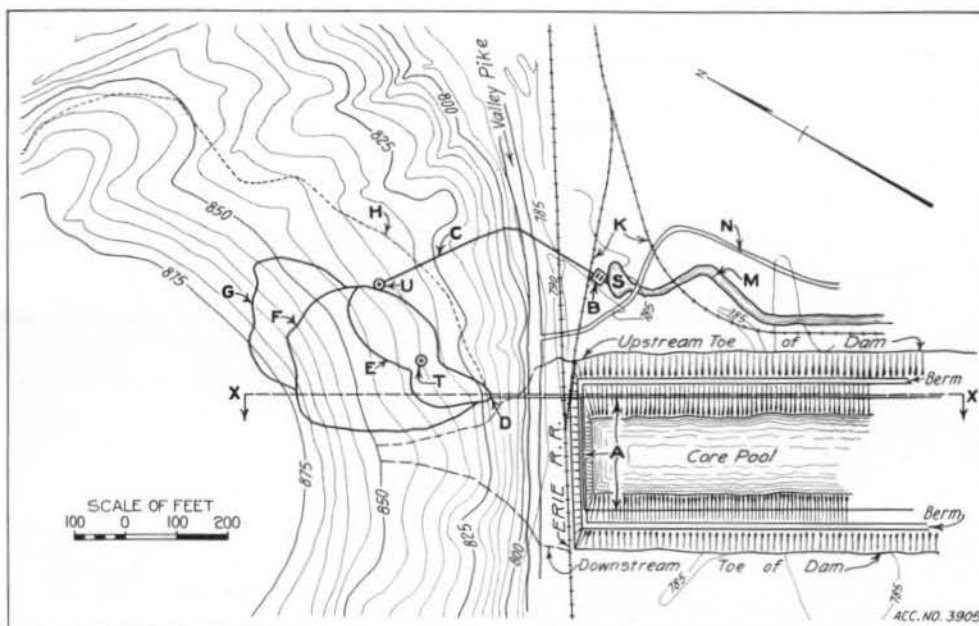


FIG. 172—HILLSIDE BORROW PIT LAYOUT AT HUFFMAN DAM

gal pumps at "B" take water from the sump "S" and pump it at about 310 pounds pressure through the pipe line "C" to the hydraulic monitor on the hillside at "U". The monitor jet washes the hillside material down about a $3\frac{1}{2}$ per cent grade ditch in the borrow pit, ("E", "F", and "G" being the uphill limit of the pit at different dates,) to the mouth of the 15" pipe flume at "D". The flume crosses over the Erie tracks on a $3\frac{1}{2}$ per cent grade trestle, (see Figs. 173 and 168.) Once across the tracks the trestle steepens its grade to 8 per cent in order to reach the level of the dam top with shorter length and thus save expense. From the end of the trestle the dredge pipe is carried along the dam top in the usual way, discharging its material on the beach of the core pool. (See Bulletin for February, 1920, pages 105-110.) The pipe flume branches so as to carry the material down both beaches of the pool, discharging alternately on each. The line "H", which climbs the hill from "D" on a $3\frac{1}{2}$ per cent grade, marks the easterly limit at which it is possible to sluice the material to "D". Farther east, the borrow pit ditches would lie on flatter slopes and would fail to give the water the necessary velocity to carry the material.

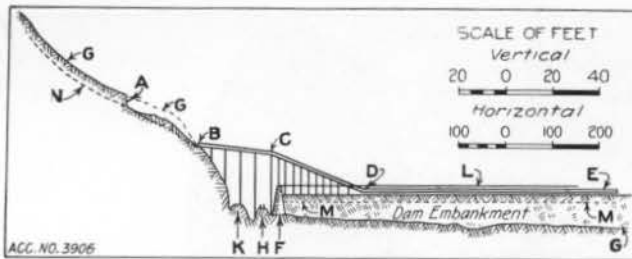


FIG. 173—PROFILE OF HILLSIDE BORROW PIT LAYOUT

Shows a section through dam and hillside along line "XX" in Fig. 172. "GG" marks the original ground surface; "AB" the limits of the borrow pit; "B" the entrance to the pipe flume; "BC" the $3\frac{1}{2}$ per cent grade of trestle and flume; "CD" the 8 per cent grade of the same; "DE" the level length of dredge pipe line along the top of the dam embankment. "M" is the level of the water in the core pool; "F" the cross dam next the Erie track to retain the pool on the dam top; "H" the Erie railway; "K" the Valley Pike.

a ditch or "ground sluice" in the borrow pit, up on the hill side, to the top of the dam embankment in the valley below. (See also Fig. 168). The slope of the flume is kept as uniform as possible, and sufficiently steep to give the water a velocity which will roll the coarsest material (which might be stones weighing hundreds of pounds), down the flume to the dam embankment. The finer the material to be carried, the flatter can be the slope, slower water velocities being sufficient for these finer materials. Evidently also, the flatter the slope, the farther the material will be carried, with a given drop from the borrow pit to the dam. This last principle was applied at Huffman, as will be seen.

There being plenty of 15-inch steel dredge pipe on hand at Huffman, this was substituted for the wooden box flume, with several advantages. One is a less frictional resistance to flow than with a box flume of the same section. A more important one is that no trestle need be built to support it, since it can be laid following the inequalities of the ground, the head of water in the pipe on the hilltop driving the water through the level pipe below. At Huffman a short trestle was in fact built (see Fig. 172), but it was only to carry the pipe line over the Erie Railway line, high enough to clear traffic, the track running along the foot of the hill between the borrow pit and the dam embankment.

The pipe flume has the additional advantage at Huffman, as compared with an open box flume, in the flexibility with which it can be adapted to carry both coarse and fine materials to maximum distances. The Huffman hillside borrow pit contains considerable coarse material. To give the water sufficient velocity to carry this, the trestle across the Erie tracks has to be given a $3\frac{1}{2}$ per cent grade, and the distance out on the dam to which the material can be carried is of course marked by the point where this $3\frac{1}{2}$ per cent grade strikes the dam top. With an open box flume, this would be the limit to which any material could be carried, coarse or fine, without building a second flume. With the pipe flume, however, a thousand feet of pipe has been run out along the level dam top from the foot of the trestle, carrying the fine materials this additional distance, under the driving power given by the head of water in the pipe on the trestle slope. With coarse materials this head is all used up just to keep the material moving down the $3\frac{1}{2}$ per cent grade, leaving no head available for further work.* The maximum gradient used with the finer materials has been as low as $1\frac{3}{4}$ per cent, these materials being about 80 per cent clay and the rest sand and gravel. The coarser materials contain about 75 per cent sand and gravel (up to stones about 12 inches in diameter), the remainder being clay. To carry the fine materials as far as they are carried by the pipe flume, a second box flume and trestle would have been required, built from end to end on a $1\frac{3}{4}$ per cent grade. Such a flume, if built, would not carry the coarse materials, but if fed with them would dam up and choke. On the other hand, the same pipe flume carries both coarse and fine, being extended length by length for the fine, down the length of the beach slope, just as in the usual operation for hydraulic fill. At Huffman, with fine materials occurring in one part of the borrow pit, and coarse in another, this flexibility of the pipe flume system has a great advantage.

Mention has been made of the tough blue clay of which much of the borrow pit is composed. It was known that this clay, inter-laminated with shale in places, would be hard to break down with a hy-

*The total head producing the flow is of course the vertical distance between the two ends of the pipe flume; and the "hydraulic gradient" is this head divided by the horizontal distance between the same two points.

The monitor has been elevated to exhibit the power of the stream. For excavating earth, its proper function, the jet is directed into the pit face at short range, from a foot to thirty or forty feet, so that the solid concentrated cylinder of water can develop its full boring power to break up the strata. (See Figs. 168 and 175.) The range of the jet in the picture is about 300 feet.



FIG. 174—THE HYDRAULIC MONITOR AT HUFFMAN, JUNE 14, 1920.



FIG. 175—THE MAN BEHIND THE GUN.

The picture shows Mr. George L. Albert, hydraulic engineer for the District in the special work of hydraulic fill, demonstrating the operation of the new hydraulic monitor in the hillside borrow pit at Huffman. (The regular operator, inadvertently beheaded by the photographer, is seen standing near.) Mr. Albert grew up with hydraulic fill in California, in the days when it was first applied to dam building, his father having been a mining engineer before him. He has remained "with the game" practically all his lifetime, and has accumulated a fund of experience which has been invaluable to the District in the hydraulic fill work at the dams.

draulic monitor, especially if the jet were small or if its velocity were low. It is usual to bring water to the borrow pit in considerable quantity at low head, to assist the water from the monitor in washing the material down the ground sluice after it is broken by the jet. At Huffman, to increase the power of the monitor, it was decided to make the size and velocity of the jet sufficient to yield all the water necessary to sluice the material after excavation. The design of monitor adopted was described in the Bulletin for April, page 136. (See also Fig. 168). Its length over all is 15 feet, and it can shoot a jet 5 inches in diameter with a "muzzle velocity" of about 140 feet per second, delivering 3,800 gallons of water per second, the pressure within the nozzle being about 135 pounds per square inch. The water is supplied by two ten-inch centrifugal pumps, each driven by a 200 horsepower motor. The two pumps are connected "in series," or "tandem," so that the outlet of one discharges directly into the suction pipe of the second. With this powerful equipment it has been possible, in spite of the hardness of the clay and shale strata, to break the material down without blasting. The location of the pumps at the foot of the hill slope, near the upstream toe of the dam, is shown in the plan in Fig. 172.

A notable feature of the sluicing layout described is the small force of men necessary to run it. One pumpman, one monitor man, one man at the pipe flume inlet to keep it clear, and two men at the discharge end on the dam, constitute the gang; five in

all. At intervals, when it is necessary to move the giant to a new location, some additional help is required. Another feature is the simplicity of the layout, and the consequent freedom from liability to shutdown for repairs. The efficiency of the plant is proved by the records of runs day after day without such delays.

The new plant began operating about the first of May, and the results of the first three months' work have been very satisfactory. The seepage from the core pool has been stopped, as was proved when a 42-hour shutdown over the Fourth of July vacation lowered the pool level only about two inches, whereas before the installation of the new layout a thirteen hour shutdown would lower it 1.9 feet. The increased fine material sluiced into the core has built it up to its normal height, where it is being kept at proper elevation in relation to the sand and gravel beaches.

Another satisfactory result has been the reduction in cost. In spite of the toughness of the borrow pit material referred to, the cost of excavating and sluicing it to the dam has been only about 48 per cent of the cost of placing materials in the dam by the other methods in use. This result would alone have justified the cost of installing the layout, and if the hillside contained sufficient material it would pay to enlarge the equipment, and use it for building the entire dam. The lack of sufficient hillside material, however, compels the continued recourse to the valley bottom borrow pit as heretofore.

The capacity of the new layout is sufficient to sluice all the available hillside material into the dam before it is completed, using at the same time the valley bottom borrow pit material as originally planned.

The work at Huffman is in charge of C. C. Cham-

bers, Division Engineer, J. S. Gena, Office Engineer, and Verne Clawson, Superintendent of Construction. The hydraulic fill work at all the dams is under the special superintendence of George L. Albert, Hydraulic Engineer for the District.

June Progress on the Work

GERMANTOWN

The pumping for the month of June brings the total embankment at the end of the month to 607,000 cubic yards, which is 77 per cent of the total. The upstream face of the dam has reached elevation 795 and the downstream slope is up to elevation 800, the dam crest being at 830.

The dragline has been excavating material continuously throughout the month, but has been forced to move ahead frequently on account of striking rock bottom, which lies a short distance below valley bottom.

The placing of the riprap, which is being laid up in mortar on the east bank of the inlet channel, and the facing of the dam with dry riprap, are both continuing daily and good headway is being made. Surface dressing is being placed on the downstream slope of the dam whenever weather permits and the teams are available.

The excavation on the spillway has been carried on continuously and at the present time about 5,000 cubic yards remain to be moved. A small concreting plant is now being erected for concreting the spillway and spillway bridge, and if cement can be secured it is the plan to start placing concrete not later than August 1.

The excavation for the part of Road No. 1, extending from the south end of the dam to the intersection with the state road, and also that part leading from the south end of the dam to camp, have been completed. The gravel surfacing will probably be placed during the coming months. A small gang is now building a guard rail fence on the portion of Road No. 1 on which the excavation has been completed.

Satisfactory progress is being made by J. C. McCann on Road No. 2, Feature No. 6. This work was started June 3 and is being rushed to completion as fast as possible.

Arthur L. Pauls, Division Engineer.

July 16, 1920.

ENGLEWOOD

The hydraulic fill has been continued in the river closure section during the month and at the present time the upstream and downstream levees are at elevation 812.5, that of the lowest berm of the dam. During the month of June 148,000 cubic yards of material were pumped. On July 1, 1,441,000 cubic yards of embankment had been placed. This makes 41.2 per cent of the dam completed. On July 15 the previous record of 510 cars of material pumped during one shift was broken. 611 cars were pumped during the day shift on that date.

Cross dam No. 2, on the west side of the old river bed, is at elevation 814 and is 60 per cent completed. The excavation for the temporary spillway has been finished and the concrete weir, located in the spillway at the downstream toe of the dam, is partially built. The object of this weir is to prevent wash of the soil at the spillway outlet when in use. Work has continued on the riprap and dry rubble paving at the inlet and outlet of the conduits.

H. W. Horner, Asst. Division Engineer.

July 16, 1920.

LOCKINGTON

Since July 8 the hydraulic filling has been going on over both the east and west parts of the dam, one pump unit depositing material continuously on each part. The edges of the fill have reached at all places an elevation of 916 feet, more than sufficient to care for a flood equal to that of 1913. There remains to be placed in the dam 303,000 cubic yards. During the last seven weeks the average run has been 3,062 cubic yards per day, which is equivalent to about 78,000 per month.

The stone surface dressing on the dam is being pushed in order that it may be finished at the same time as the fill. About twenty men are engaged on this work.

Arrangements are practically complete for resuming work on Road No. 9.

Barton M. Jones, Division Engineer.

July 20, 1920.

TAYLORSVILLE

The progress on the concrete outlet works to date this month is a little better than for the same date last month. On Monday, July 19, a new record of 568 cubic yards for a single 10-hour shift was made. Unless there are some very serious and unexpected delays we will also make new records for a week and for a month. About 14,000 cubic yards remain to be poured yet, which indicates that we can easily finish by the latter part of October if we are not held up for cement.

The B. & O. R. R. has moved to its new location, the old roadway has been stripped and the cut-off trench dug through, and the hydraulic fill is once more progressing on the valley floor section, extending from the cross dike next the river to the hillside west of the old railway tracks. The materials are being excavated by hydraulic monitor on the east river bank near the north end of the inlet channel of the outlet works, in the new borrow pit. The materials from the excavation of the inlet channel, which work will be done by the Lidgerwood dragline, will be delivered to the monitor in this pit, and be sluiced to the sump along with the pit materials. The inlet excavation only awaits the cutting away of the adjacent hillside by the monitor so that this delivery can begin, which will be within a few days.

Mr. Crampton is making fair progress on Road No. 12.

July 23, 1920.

O. N. Floyd, Division Engineer.

HUFFMAN

The amount of ballast gravel delivered for the railroad work in the Huffman Basin has approached the total requirements, and it is expected that, about August 1, the pumping of material into the dam will be resumed by both the day and night shifts.

A rolled clay blanket is being placed under the upstream half of the dam where it crosses the diversion channel, which carried the flow of the river during the construction of the concrete outlet works.

The cut-off trench excavated under the dam, along its axis, has been completed from the end dam to the north concrete wall of the outlet structure, and the embankment in this section of the dam is now being made.

July 19, 1920.

C. C. Chambers, Division Engineer.

DAYTON

Dragline D-15 has completed the work of lowering the 10-in. gas main below Washington Street and is now progressing up stream with channel excavation. D-16 has completed the channel excavation above Third Street and is preparing to move under the bridge. D-19 is excavating a channel under Third Street bridge to permit the passage of D-16 on its scow. D-8 is feeding gravel to the charging derrick at the gravel screening plant.

South Robert Boulevard wall is 89 per cent completed, 3,960 cubic yards of concrete having been placed. Bank Street crest wall, on the right levee between Third and Fifth Streets, is under construction, being now about 25 per cent completed. Good progress is being made with the excavation for Stillwater Drive wall, about 11,000 cubic yards having been removed to date. The driving of steel sheet piling is now under way.

Concrete revetment is being placed just above Van Cleve park on the left bank of the Miami River.

To date 27,000 cubic yards of sand and gravel have been issued from the gravel plant.

Channel excavation to date amounts to 851,500 cubic yards. The pay quantity in spoil banks and levees amounts to 572,100 cubic yards. Levee embankment alone amounts to 75,500 cubic yards, including 60,000 cubic yards on Contract No. 41. The total yardage handled in accomplishing this work amounts to 1,497,600 cubic yards. None of the foregoing figures includes excess excavation for the launching basin and scowing canals, which amounts to 94,000 cubic yards.

C. A. Bock, Division Engineer.

July 19, 1920.

HAMILTON

Excavation and levee embankment on the east side of the river south of Main street have been completed by the electric dragline, D-16-18. This machine has moved across the river and is now loading cars on the west side, just south of the Main street bridge.

Dragline D-16-17 has completed excavation and pile driving on pier No. 3, Black street bridge, and is stacking up gravel to be used in concreting. The pouring of the mass concrete in the east abutment has been completed and forms are ready for the first run on pier No. 3. The piers are being built in open excavation, i. e., without the use of sheet piling. The bottom of pier No. 3 is 22 feet below water level in the river. No difficulty was experienced in unwatering this excavation. A cableway has been purchased for the bridge work and the erection of the towers is under way.

The Marion dragline D-16-20 has completed the construction track work on the west side of the river and is at present excavating a sewer trench for the relocation of the sanitary sewer in "A" street. This relocation is necessary because of the existing sewer being within the lines of the proposed channel.

Price Bros. have started driving piling for the revetment on the east side of the channel north of the railroad bridge. The total number of revetment blocks manufactured to date is 60,000.

Excavation is being continued on the Black & Clawson wall and concreting has been started on the south end of the wall.

The grouting under the piers of the stone arch bridge over Old River has been completed.

The total of Item 9, channel excavation, to July 1, was 704,000 cubic yards. The total of Item 34, levee embankment from channel excavation, was 160,400 cubic yards. During June 25,000 cubic yards were placed in the levee.

C. H. Eiffert, Division Engineer.

July 20, 1920.

TROY

Clapp, Worstrom & Riley have excavated 92,000 cubic yards, pay material, from the cut-off channel to date. Of this amount 30,700 cubic yards has been placed in levee embankment and the balance wasted, mostly along the left bank of the river. The cut-off channel has been completed for a length of 3,800 feet.

Since the first of July the dragline excavator has been cutting into the old river levee and casting the material about half way to the new levee location, the material so handled to be placed in final position in the new levee embankment on the second throw.

The contract for excavating the main river channel on the left or north side of the river, between the Baltimore & Ohio Railway bridge and the old timber dam above Adams Street, has been let to the C. & C. Haulage Co. The material from the excavation will be used in building a heavy embankment of width sufficient for roadway and shallow house lots, and ten to twelve feet in height, along the left side of the river between Market and Adams Streets. The remainder will be wasted in spoil banks on each side of North Market Street from the new levee as far north as Staunton Pike. These spoil banks will be raised to the street level and be made available for fine building lots.

The C. & C. Haulage Co. has already delivered a part of their equipment, consisting of a No. 18 Osgood steam shovel with a three-fourths cubic yard dipper, and three seven-ton Sterling trucks. This equipment is to be supplemented by a similar shovel and four more trucks by August 1. Excavation on this section of the work started July 13. The handling of material over soft ground by trucks is an innovation on this work.

R. F. Griffin, Assistant Engineer.

July 15, 1920.

LOWER RIVER WORK

Miamisburg—Since June 15 the material for the levee between the Groendyke spur track and the point where the levee strikes the high ground just south of the Germantown Pike has all been placed and about 40 per cent of the finishing completed. The highway extending southerly from the twine factory has been brought up to sub-grade elevation, a fill of from eight to eleven feet, and will soon be graveled and opened to traffic.

Franklin—The levee from Miami Avenue westward to the gravel pit has been completed, but will not be dressed and seeded till fall. Twelve thousand cubic yards of this levee was placed during the past month. Trestle construction south of Lake Avenue is about 50 per cent complete. The contractor is now constructing the Lake Avenue approach, or road, extending over the levee. This will be completed in a few days and will be opened to traffic before Park Avenue is closed.

Middletown—Cole Brothers have placed 11,000 cubic yards in the levee between Fifth and Sixth Streets with the dragline and train outfit.

F. G. Blackwell, Assistant Engineer.

July 17, 1920.

RAILWAY RELOCATION

Big Four and Erie. The ballast on the Big Four has been all distributed with the exception of 4,000 feet at the west end, where the new line joins the old railroad. The latter will be raised to meet the new grade. The Big Four traffic will be diverted over the passing tracks while the track raising on this piece is being done. The new line in general on the Big Four will require about two weeks' dressing and surfacing. Arrangements are being made with the expectation of diverting traffic to the new line about the middle of August.

The progress on the Erie is keeping pace with that on the Big Four and will be completed shortly after the latter.

The signal systems at Tate's Point and Fairfield are very nearly completed. The Western Union telegraph line is also very nearly completed.

The District has a force of men doing odd jobs such as ditching, track signal work, pipe culverts, etc.

Baltimore & Ohio. The Baltimore & Ohio Railroad has been operating on the new line since July 7, 1920. The tearing up of the rails on the old line at Taylorsville dam, started on the 14th, making way for the Taylorsville dam. The rails on the old line were sold to the Baltimore & Ohio Railroad and they are beginning preparations for the removal of same. As soon as the old rails are removed at the Narrows the District will complete the widening out of the embankment with about 6,000 cubic yards of earth.

Ohio Electric. The first lift on the Ohio Electric ballasting is completed and the contractors are distributing material for the second lift. The overhead line wires on the trolley system are now being erected, the setting of poles being practically complete.

Albert Larsen, Division Engineer.

July 24, 1920.

RIVER AND WEATHER CONDITIONS

The river and weather conditions in the Miami Valley were comparatively normal during the month of June. The rivers were low during the entire month. The rainfall at the District's stations varied from 2.45 inches at Ingomar to 5.03 inches at Germantown, this wide variation being due to a succession of local thundershowers throughout the valley during the latter part of the month. At Dayton the rainfall amounted to 3.75 inches, or 0.21 inches less than normal.

Observations taken by the United States Weather Bureau at Dayton show that the mean temperature for the month was 70.3 degrees, or 1.7 degrees less than normal; that there were 13 clear days, 9 partly cloudy days, 8 cloudy days, and 13 days on which the precipitation amounted to or exceeded 0.01 of an inch; that the average wind velocity was 9.0 miles per hour, the prevailing direction being from the southwest; and that the maximum wind velocity for five minutes was 40 miles per hour from the northwest on the 2nd.

Ivan E. Houk, District Forecaster.

July 20, 1920.

Grouting Under Bridge Piers at Hamilton

(Continued from page 4.)

stream of water running out of it, indicating porous gravel. The grout forced this stream to find vent through pipe No. 14, till the latter was capped. The results as a whole, which were expected, are satisfactory as indicating a consolidated condition of the gravel under the piers.

Excavating Foundations by Dragline Excavator

Open Excavation, Without Sheet Piling, at Black Street Bridge, Hamilton, Effects Reduction in Cost.

An interesting variation of the usual methods used in excavating foundations for bridge piers is presented by the work on Pier No. 3 for the Black Street Bridge at Hamilton, construction of which, as announced in the last Bulletin, has been undertaken recently by the forces of the District. The finished excavation, with the piling driven, and the first section of the forms ready, is shown in Fig. 176. The pier is to be 28 by 62 feet in dimensions, of concrete, capping 150 piles spaced 3 feet apart each way. The usual plan for building such a pier is to drive a cofferdam of interlocking steel sheet piling around the pier site, bracing its walls against the external pressure, as the interior is excavated, by means of cross struts. The disadvantages of this method are the expense of the sheet steel piling, the cost of driving them, the necessity of using a clamshell, or similar bucket, of comparatively slow operation, in the actual work of excavation, and the interference of the cross bracing with both the digging and the final pile driving for the pier foundation.

Previous experience in excavating for the foundations of the wing walls which protect the abutments of the High-Main Street bridge in Hamilton, where a dragline had been substituted for a clamshell, had so demonstrated the superiority of the dragline in cases where the digging is tough or difficult, that the idea suggested itself to use the dragline for the excavation of the Black Street bridge piers. The nature of the proposed plan is clearly shown in Fig. 176. No sheet piling need be driven,

the sides of the excavation being given the necessary slope to stand, (in this case about 2 to 1). There would be no cross bracing to get in the way of either the digging or the foundation pile driving. The excavation would be easy to get into or out of. ("You could drive a flivver into it," as one man expressed it). And the cost of excavation alone, in spite of the fact that about three to four times the quantity of earth must be moved, would be less than in excavating a sheet piling cofferdam with a clamshell.

The experiment was tried and proved highly successful. The excavator used was a Class 14 Bucyrus, with sixty foot boom, and $1\frac{1}{2}$ yard bucket. The total depth of the excavation was about 26 feet, or which the upper 10 feet was porous river gravel, below which came 4 to 8 feet of clay, followed by cemented gravel the rest of the way. This lower stratum not being a hard gravel, yet with sufficient clay to be impervious, rendered the excavation easy. Thus the strata as a whole were excellently adapted to the desired end. The bottom of the excavation being 22 to 23 feet below water level in the river, the clay and cemented gravel rendered all but a six to seven foot thickness of the top layer tight, so that there was comparatively little seepage into the excavation; and this little was plugged to a large degree by seepage of silt into the porous layer, during a rise in the river which made the water muddy about the time the work of excavation was completed. The digging was done by the dragline bucket under water, pumping during



FIG. 176—OPEN EXCAVATION FOR PIER NO. 3, BLACK STREET BRIDGE, HAMILTON. JULY 21, 1920.
(See the descriptive article on this page.)

this period being therefore unnecessary. In a week after the digging was completed, the silting up of the porous gravel had cut the water seepage into the excavation by one half.

The Black Street bridge, it may be added, is to be a concrete structure, of seven arches, of 93 feet span each, center to center of the piers, with a 28 foot roadway and 6 foot sidewalks. The arches will be of the usual barrel type. The sidewalks and para-

pets will be partly cantilevered. The roadway will carry two street car tracks at the edges, with a driveway between wide enough to permit passing. At a later date, the roadway will probably be altered to a 40 foot width, and the tracks carried at the center as usual, the sidewalks being then entirely cantilevered to yield the extra width. Conduits are provided to carry gas, electric and water mains.

Three-Hinged Arch Road Bridge at Huffman

The reinforced concrete bridge, recently finished, carrying the relocated Springfield Pike across the new tracks of the Big Four and Erie Railways, just east of the Huffman Dam, is characterized by some distinguishing features. The pike runs approximately parallel with the new tracks both east and west of the crossing, and in order to reduce the curvature at the two approaches to a minimum, a pronounced skew was necessary, this being fixed at 40 degrees from the normal. The bridge had also to be built high and wide enough to afford clearance for four railway tracks, although only two will be constructed at this time. This meant a span of 125 or 130 feet. The materials of the rather heavy rock cut to be spanned are limestone and shale intermixed with thin layers of clay.

Under these conditions the type of bridge was determined only after much discussion. The bridge was being built by the Conservancy District for the two railways, and the latter, having the structure (excepting the roadway) to maintain after its completion, were interested in the design. The Big Four Railway proposed a steel girder construction incased in concrete, a reinforced concrete floor being provided to carry the highway traffic. This bridge was to be supported on heavy concrete piers and abutments. Such a design, while giving a very satisfactory and permanent bridge from many standpoints, was felt by the engineers of the District, on

account of its great weight and the heavy thickness of concrete provided, to involve a somewhat greater expenditure than would be necessary. They therefore proposed to make the structure a reinforced concrete arch, and to this the railroad company finally agreed.

The usual type of arch, whether in stone or concrete, is the so-called barrel type. It offers many advantages, and was first considered. With the heavy skew necessary, the construction of the concrete forms would be a comparatively simple problem. Moreover, the abutments in the side of the railway cut to be spanned appeared to be of sufficiently solid rock to form a satisfactory support for this type of structure.

The alternative design considered was the three-hinged arch, the advantages of which are chiefly in connection with its freedom from temperature stresses. A barrel arch is practically a monolith, with its ends, the abutments, maintained at a practically constant distance, summer or winter. The exposed parts, however, expand and contract appreciably, lifting and depressing the crown, and introducing bending stresses in the barrel which tend to crack its upper and lower surfaces. Such cracks in barrel arches may be not infrequently observed.

In the three-hinged arch this difficulty is avoided by making the structure jointed instead of solid. The arch is completely cut in two transversely at



FIG. 177—THREE-HINGED ARCH SKEW BRIDGE AT HUFFMAN. JUNE 26, 1920.

The opening in the center was necessary to provide passage for operation of a single track railway line. It was spanned by steel I-beams, as shown. The suspension cable of a slack line cableway can be seen above the timbering. This cableway was used to handle the false work bents, the spanning I-beams, and the stringers, as well as the concrete and the reinforcing steel for the concrete.



FIG. 178—FALSEWORK FOR HUFFMAN THREE-HINGED ARCH BRIDGE. OCT. 22, 1919.

each abutment, and at the top of the rise, and a ring and pin joint is introduced at each of the cuts. The arch as thus made consists of two entirely separate pieces, each piece being hinged at each end. When in hot weather such an arch expands, the crown is free to rise, each half swinging slightly upward on its abutment hinge, while the crown hinge by turning slightly prevents the formation of the bending stresses above referred to.

Besides this advantage, the three-hinged arch is somewhat easier of design owing to the simpler calculation of the stresses in the parts. On the other hand, the introduction of three hinges somewhat detracts from the rigidity of the structure laterally, and makes it important to provide lateral stiffness in other ways. On the whole, the advantages of the hinge design were believed by the Conservancy engineers to be sufficient to merit its adoption.

It should be added that, practically, the three hinged arch design provides two arch ribs side by side, instead of one arch, these two ribs being cross-braced to each other, and the bridge floor supported between them.

The Huffman bridge is the second of this design to be built by the District. The first, which is at Taylorsville, spanning the Baltimore and Ohio relocation, is not a skew bridge. It was described in the Bulletin for October, 1919, and illustrated at Fig. 28 of that article. See also Fig. 181 in this issue.

The span of the Huffman arch between end hinges is 126 feet, and the rise to the crown is 21 feet, the ratio of rise to span being therefore one to six. The arch ribs have steel reinforcement (round bars), but no structural steel shapes (channels, angles, etc.), were employed except for connections. The hinges are of cast steel, and the pins of bronze, $2\frac{1}{4}$ inches in diameter by 28 inches in length, the entire thrust of the arch being carried by each pair of pins.

The roadway is carried by the arches at an elevation a few feet below the crown hinge, being hung from the ribs near the crown and supported on columns the remainder of the span. The bridge is therefore of the type usually designated as a "semi-through arch." The roadway is 18 feet wide and is of the beam and slab type, three beams, one on each side and one along the center line, running the entire length of the structure, with cross beams every

11 feet. This arrangement divides the floor space into squares of about ten feet, occupied by concrete slabs 9 inches thick. The beams are 45 inches deep. A liberal provision for expansion was made in the floor, complete transverse joints being introduced at an interval of 18 ft. in case of the central division, and of 33 feet in the others. The same joints were carried through the parapets, which are anchored firmly to the floor.

It is one of the disadvantages of this type of arch that the concrete forms are more complicated than for a barrel arch, requiring thus greater labor in the construction. At Huffman also an additional difficulty was introduced, due to the fact that a single track railroad had to be operated in the cut while the work was in progress, thus requiring an opening to be left in the timber falsework sustaining the forms. This opening was spanned by heavy I-beams as shown in Fig. 178. The $\frac{1}{2}$ cubic yard Smith concrete mixer was at one end of the bridge, and the concrete was transported to the forms by a bucket hung from a traveller carriage running on a slackline cable way erected over the falsework. This cable way had a span of about 250 feet. One end was anchored beyond the end of the structure. The other was carried over a 45-foot mast and down to one drum of a two-drum steam hoist engine. The carriage was operated by a single line run back up to the mast and down to the other drum of the engine. It could be pulled back to the mast by the engine. In the other direction its own weight carried it. It could be lowered at any point by slackening away on the main cable. This rig picked up the framed false work bents and set them in place; also the longitudinal stringers and the steel I-beams spanning the opening for the railway track. It also handled the reinforcing steel and the steel hinge castings, as well as the concrete for the forms, the latter being carried in a one-yard bottom-dump bucket.

The work suffered materially from delays in delivery of the materials, due to labor troubles of one kind or other at the mills, and consequently the greater part of the concrete had to be placed in December, 1919, and January, 1920. This made it necessary to take precautions against freezing. An extra upright boiler was used to heat the water for

(Continued on page 16.)

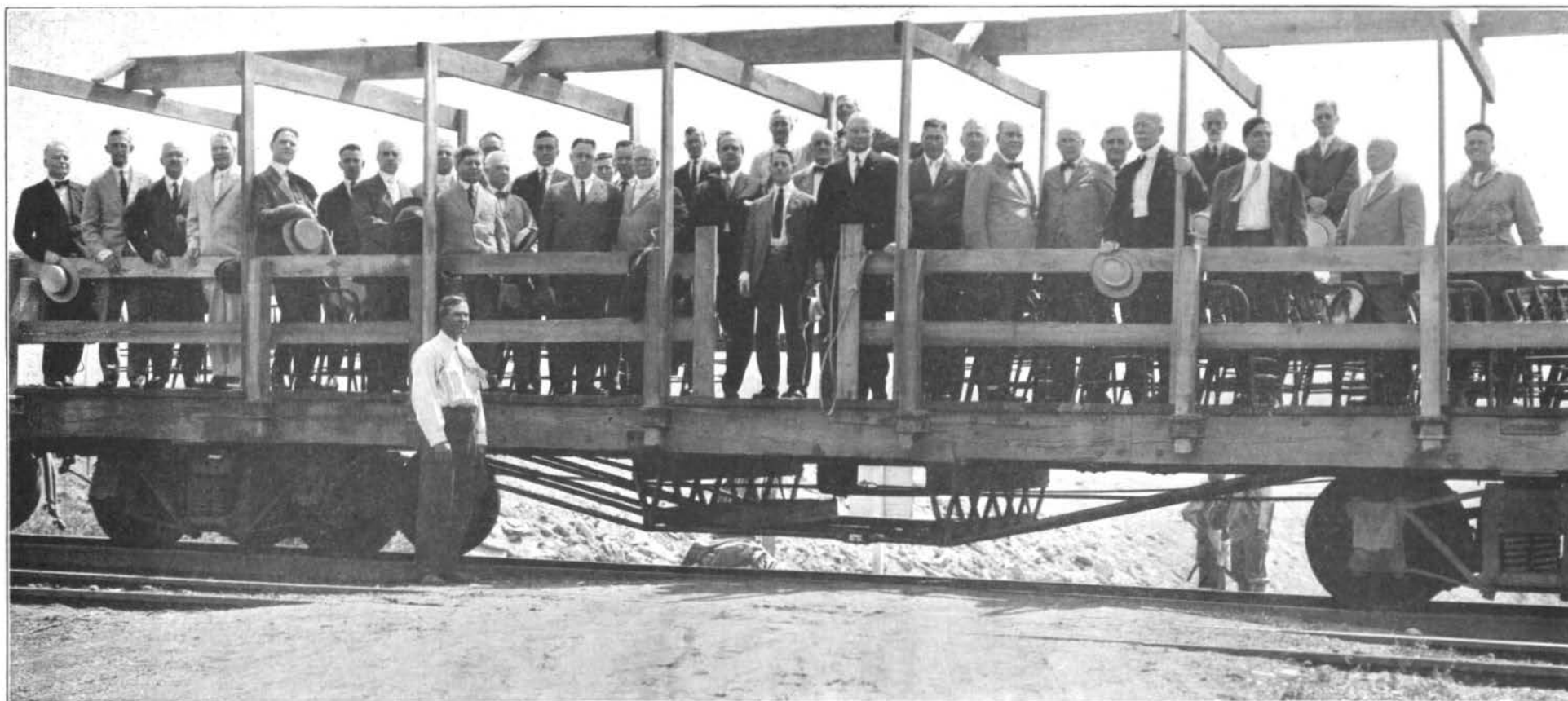


FIG. 179—THE DAYTON CITIZENS' RELIEF COMMISSION AT TAYLORSVILLE ON THE INSPECTION TRIP.

Reference was made in the last Bulletin to the tour of inspection of the Dayton Citizens' Relief Commission on July 7, as guests of the officers of the District, during which they visited the Conservancy work at the Germantown, Englewood, Taylorsville and Huffman dams, and the nearly finished work of the railway relocations. The above picture was taken at Taylorsville during this tour, and is published as an interesting memento of the occasion. The people on the car, from left to right, are as follows: John A. McGee, Fred H. Rike, A. M. Kittredge, John P. Breen, F. J. McCormick, Dr. C. W. King, E. E. Burkhart, T. P. Gaddis, Chief Engineer A. E. Morgan, T. A. Ferneding, Assistant Chief Engineer Chas. H. Paul, Ezra M. Kuhns, Division Engineer O. N. Floyd, Henry M. Allen, Assistant Engineer W. D. Kramer, Adam Schantz, Stanley M. Krohn (in front), B. & O. Trainmaster T. J. Daly, Construction Manager C. H. Locher, Col. E. A. Deeds, Judge Oren Britt Brown, Division Engineer Albert Larsen, Torrence Huffman, Mr. Blood, E. B. Weston, F. J. Ach, Edward Philipps, Edward Canby, J. Edward Sauer, J. F. Dodds, Fred Cappel, Assistant Division Engineer H. L. Freund. Standing beside the car, Superintendent H. M. Sherwood.

Many of the above men were members of the general committee appointed to assist

the Citizens' Relief Committee, at the meeting called by John H. Patterson on April 20, 1913, to take up the matter of permanent flood prevention. It was this enlarged Flood Prevention Committee which raised the \$2,000,000 flood prevention fund, the administration of which was then entrusted to the Dayton Citizens' Relief Commission, the latter including most of the men who had been acting on the Flood Prevention Committee. On the creation of the Miami Conservancy District, the Commission turned over to the District practically all of its activities, except the return of the \$2,000,000 fund. The expense of the flood prevention work being provided for by the Conservancy law in other ways, the larger part of the fund is being returned to the subscribers. The greater part of the money was refunded in the spring of 1918, but a small remnant remains.

The tour of inspection was the carrying out of a plan, which the officers of the District have long had in mind, to invite the members of the Commission, whose work they took over, to see the progress which had been made on the project, after it had been advanced to a proper stage. The opening of the relocated Baltimore & Ohio R. R. on July 7 seemed to be an auspicious occasion for carrying out the plan, and the date for the event was selected accordingly.

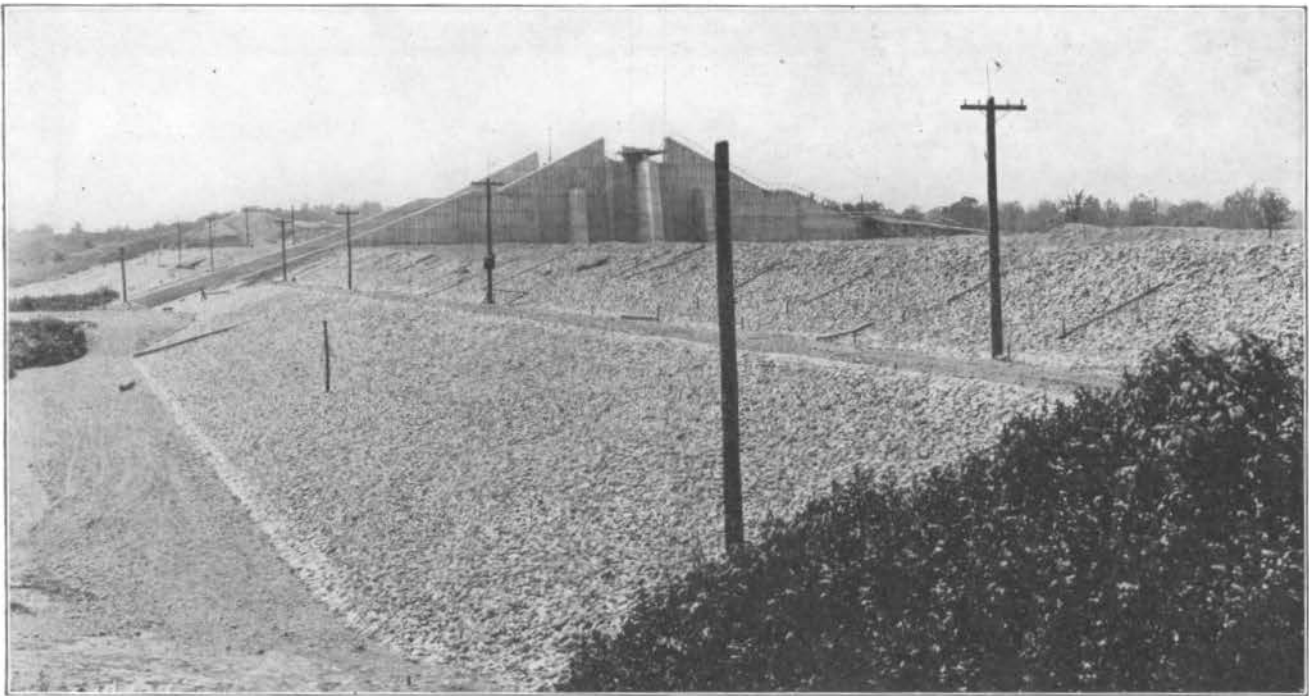


FIG. 180—LOOKING NORTHWEST AT THE LOCKINGTON DAM, JULY 20, 1920.

Special interest attaches to this picture, due to the fact that the elevation of the dam embankment, along the full length of both levees, is now up to a level above that which would be reached by a flood equal to that of 1913, in the present open condition of the outlet structure. This means that the danger of overtopping the dam during construction, to its possible injury, is now practically past. It also means that the valley below is given some measure of protection. Full protection will come when the concrete cross dam is built between the outlet structure walls, which work is expected to begin next spring. The earth fill will be up to full height before winter.

The slopes of the dam embankment are being surfaced with the larger rock from the borrow pit and the beaches of the hydraulic fill. It is not expected to grass the embankment as was planned at an earlier stage. Thus the slopes seen present nearly their finished appearance. The dam appears deserted, but in reality hydraulic fill is in active progress both east and west of the outlet structure walls. The east core pool is just beyond the top of the foreground slope. The pipe line going to the west core pool can be seen climbing the trestle just to the right of the outlet walls.

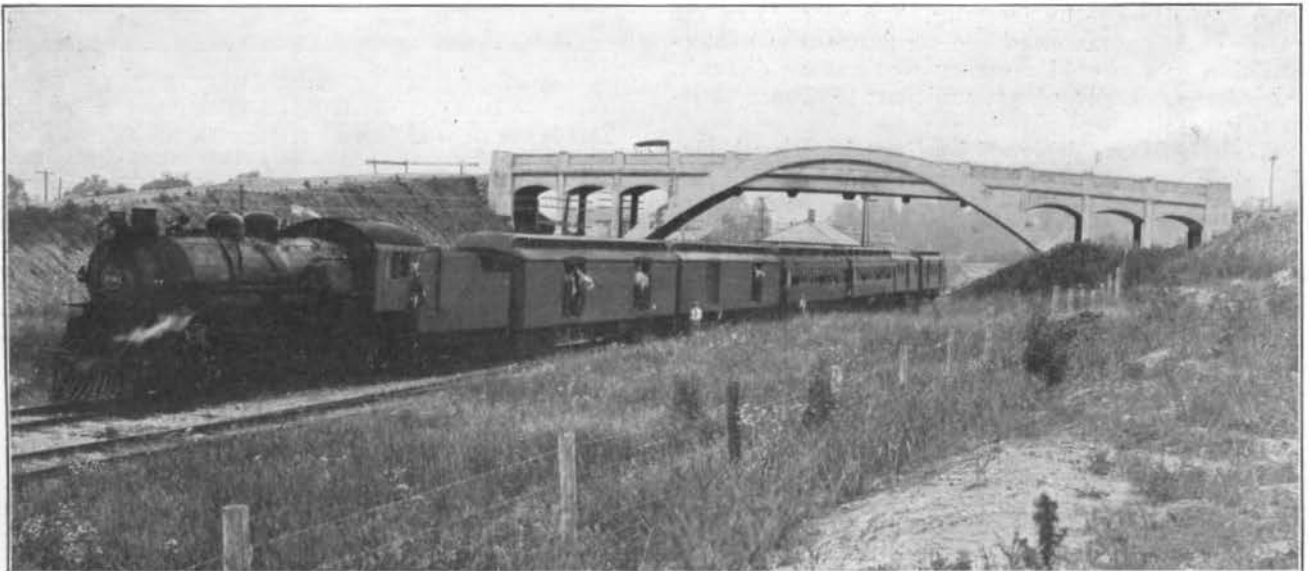


FIG. 181—THE FIRST PASSENGER TRAIN ON THE NEW B. & O. R. R. RELOCATION. JULY 7, 1920.

This is the regular passenger leaving Dayton at 7:25 a. m. It was preceded by a freight train, a few minutes earlier, the latter being the first train other than a work train to travel over the new line. The overhead bridge will carry traffic on the highway which is to be built on the crest of the Taylorsville dam, crossing the valley. The embankments to right and left of the train are levees, enclosing the new railway line for about eleven hundred feet north of the bridge, the track level being 18 feet below the dam crest. The latter required to be notched to that depth to accommodate the railway gradient between the dam and Dayton, which could not exceed 0.2 per cent. Hence the levees, which are virtual extensions of the dam embankment enclosing the railway and running north to higher ground. In case of extreme flood the opening between the north ends of the levees, permitting the exit of the tracks, will be closed temporarily with sand bags.

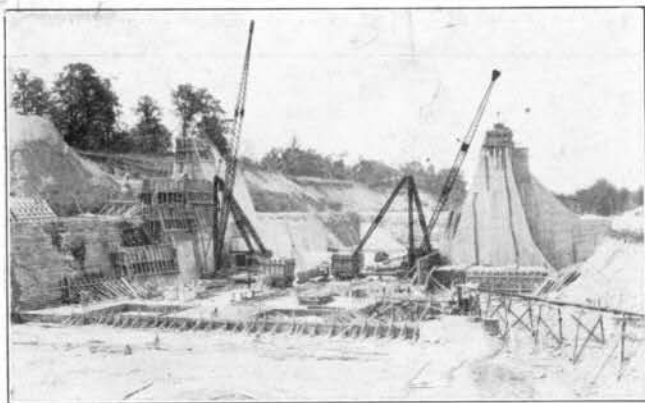


FIG. 182—OUTLET STRUCTURE AT TAYLORSVILLE, JULY 7, 1920.

This is shown here to indicate the relation of the west wall, Fig. 183, to the entire structure. The view is downstream. The floor is nearly completed, the edge of the level rock floor in the foreground marking its upstream limit. The locking of the left (east) wall into the rock ledge of the excavation shows clearly. The opening between the walls at the bottom is 93 feet, 4 inches. The concrete cross dam to be built between the walls will be pierced at the base by four rectangular conduits, with arched tops, each 15 feet wide by 19 feet, 2 inches high. These conduits will take the entire flow of the Miami River, (which is just out of the picture to the right,) except during extreme floods, when the excess will run through a concrete spillway channel carried between the walls on top of the cross dam. The total width of the concrete outlet structure, including both walls and the cut-off walls projecting into the earth embankment, is about 215 feet.

Three-Hinged Arch Road Bridge at Huffman

(Continued from page 13.)

the concrete. The sand and gravel were heated by being piled on old 15" dredge pipes, in which fires were kept burning. The top of the structure was kept covered with canvas, under which salamanders were placed until the concrete had set beyond all danger of damage by freezing. On account of the rather open character of the structure, the protection during the cold weather was rather difficult, but it has apparently been sufficient to secure satisfactory results.

The bridge was designed by Ross M. Riegel, Designing Engineer for the District, and was built under the direction in the field of Leslie Wiley, Superintendent of Construction.

Concreting Records Again Broken at Taylorsville

The concreting record on the Conservancy work, established at Taylorsville on June 18, as announced in the last Bulletin, was again broken at the same dam on Monday, July 19, when in one ten hour shift 568 cubic yards of concrete were poured. The June 18 record was 522 cubic yards. The record for a week, made at Taylorsville the preceding month, was also broken, during the week ending on July 24, when a total of 2408 cubic yards were placed in the Taylorsville outlet. This is at the rate of 401 cubic yards per day, and includes the high day noted above, 568 cubic yards. This daily rate beats the largest single day at any other dam, which was 374 cubic yards. The new single shift record of 568 yards was poured in 437 batches of about 1.3 cubic yards per batch. The concrete is mixed in a 1-yard (so rated) Smith concrete mixer, transported to the forms in buckets on small cars, and hoisted into place by two stiff-leg derricks.



FIG. 183—WEST WALL OF TAYLORSVILLE CONDUIT OUTLET, JULY 20, 1920.

This is the right hand wall of Fig. 182, which shows the entire outlet. This wall at the base, (not including the cut-off wall, seen projecting at the right,) is 4 inches short of 50 feet in thickness. As seen, the wall is about 70 feet in height from the conduit floor, which is 7 feet thick, making a total height of the structure at the present stage of 77 feet. The finished top will be ten feet higher. The thickness at top will be 3 feet. The massive thickness at the base is to resist the heavy pressure of the earth fill of the dam, which will rest against the right hand face of the wall from bottom to top. The pressure of the saturated hydraulic fill core during construction is very great, and acts on the wall to overturn it, as in any earth retaining wall. This is not the case with the east wall, (the left hand wall in Fig. 182,) which being built against bed rock ledge, does not receive this force tending to overthrow it, and is made only 10 feet thick in consequence. After the earth fill is completed, the space between the two retaining walls will be filled with a concrete cross dam pierced by four conduits. If this cross dam could be built before the earth fill, it would take most of the thrust of the fill, and the right (west) wall could be much reduced in thickness. To give a wide waterway in case of heavy flood during construction, however, and thus save backing up the water behind the dam during the work, possibly overflowing and seriously injuring the unfinished structure, the building of the cross dam is postponed until the earth fill should be completed. The batter of the inside wall face is 1 in 3; of the top 30 feet of the outside face, 1 in 20; of the next 30 feet, 1 in 4; of the remainder, 1 in 1½. The shelf at the left side of the wall, about 18 feet above the floor, marks the top of the side wall of the west conduit.

THE MIAMI CONSERVANCY BULLETIN SUPPLEMENT

"The News Letter"

To Promote the Conservancy Spirit on the Work

August 1920

GERMANTOWN Blackberries

This is the time of year for berry picking. On the thousand and one hills surrounding the Germantown Dam there are about two thousand and two brier patches. And in all these brier patches at the present moment there are blackberries. We advise all of the Headquarters force to spend at least one Saturday afternoon or Sunday picking them. They are worth 40 cents a quart on market, and there are wagon loads waiting for you. The exercise is mildly stimulating and the surroundings are beautiful. We say—one day's berry picking. If after one day the jiggers—but ask Mr. Cavis, our chief accountant, who says it is a great game if you don't weaken.

Ralph Lehman and Sadie McDonald were both so good last month that we will not put their names this time in the Bulletin.

Mr. and Mrs. Harry Rafe are visiting their son, D. M. Rafe, and family.

Bob Reynolds knows how to find blackberries. Equipped with two ten-gallon buckets, he sallied forth and brought back two gills of berries.

Mrs. J. R. Arthur and sons, John, Robert J. and Thomas, of Dayton are spending a few weeks' vacation with her mother and father, Mr. and Mrs. Line, and her sister, Mrs. W. J. Harnish.

Mr. A. L. Pauls has just purchased a new Buick, the door of his old car having mysteriously disappeared. The doors on his new car are securely fastened, so that thieves will be unable to make away with them.

Riddle No. 9263: Can a garage be entered without opening the door? Ask Rafe; he knows.

Chas. Howe, our popular master mechanic, after working overtime getting his car to run in good order, lost his key. What good is a car in good running order without a key?

Ask Harry Kern how it feels to be a prospective father-in-law.

ENGLEWOOD

Mrs. Wm. Heller has returned from her visit, bringing with her Miss Margaretta Royal, her charming niece. Miss Royal is contemplating a month's visit with the Hellers, during which time a series of enjoyable affairs will be given in her honor.

The school gardens are now at their best. Much credit is due the children of Englewood school for the interest and effort displayed by them toward their gardens. Three men have been selected to judge them and proclaim the winners of the various prizes offered.

O. F. Welbaum is back in the Division Office after having used up all of his accumulated vacation.

Card of Thanks

To those who so kindly sent me newspapers and clippings requested in last month's Bulletin. I am now well stocked up, thanks to readers.

NED JORDAN.

The Brownell-Stork Company, playing the season at the Victory Theatre, spent Thursday afternoon, July 29, at Englewood Dam. They were served a special dinner in the Mess Hall, which they seemed to enjoy very much. After dinner they toured the work.

Double Birthday Celebration

Ellen Ruebush was guest of honor at a birthday party, Thursday, July 1, her eighth birthday anniversary. Games were played and a dainty luncheon was served. The invited guests were Irene, Helen Edward, Paul and Chester Patrick, Grace and Blanche Green, Mary, Stanley, Wilfred

and Alfred Reeves, Miss Christine, Josie, Fred, James and William Waddell, Charley Peterson, Mary Wicks, Johnnie Rice, Mabel Wagner, William and Albert Tulley, Miss Florence and Miss Anna Tulley, Isabelle and Charles Williams, Mrs. Rice, Mrs. E. Parr, Mrs. Chas. Wagner and Mrs. Nettie Ruebush. Master Johnnie Rice celebrated his seventh birthday anniversary also with Miss Ellen. The little hostess is the popular granddaughter of Mr. and Mrs. Charles Wagner.

Mrs. Morgan and Mrs. Everdell on Auto Trip

Early on Saturday afternoon we started out on the Old National Highway through Springfield, Columbus and Zanesville, making our first camp not far from Zanesville. The second day we crossed West Virginia by way of Wheeling to Uniontown, Pennsylvania, where we left this highway for the Lincoln Highway.

This second day proved very interesting because our road took us through the oil and coal regions of Ohio, West Virginia and Pennsylvania. I told Mrs. Morgan how glad I was that we lived in Englewood Camp instead of one of these mining towns, where there are row upon row of houses alike in both structure and color. What a drab, colorless life these miners and their families must live, with hardly a tree, shrub, or plant to grace their dooryards. Here it would be easy to keep that part of the tenth commandment which says, "Thou shalt not covet thy neighbor's house."

The third day was the loveliest part of our auto trip, as it took us through the Allegheny Mountains, from Greensburg to within twelve miles of Gettysburg. Nature couldn't have lovelier pictures to show than the ones she showed that day: the beautiful, winding Juniata River, Laurel Ridge, the Roller Coaster Hill, and Mount Tuscarora, whose summit shows one a grand panorama fifty miles in diameter. The old Inns and Taverns of stage coach days add to the pictures.

The fourth and last day of our auto trip gave us historic Gettysburg, with its four hundred monuments of bronze, marble and granite to commemorate the most noted battle in American history.

Mrs. Morgan and I parted in Philadelphia to meet a week later at Cape May for the Friends' Conference. We were very proud that we had made a trip of over six hundred miles in less than three and a half days with never a mishap, not even a blowout or puncture. We had lived real gypsy lives, never seeing the inside of a house for a meal or bed, with clear weather and a full moon to make it a perfect auto trip.

Eudell D. Everdell.

TAYLORSVILLE

Mr. Jens Jensen, our faithful baker, has left for Salt Lake City, his former home.

During the past month, Mrs. W. D. Rodgers with her two sons, Clarence and Russell, spent a few days in Covington, Ky.

Mr. and Mrs. R. W. Trowbridge left July 18 for a two weeks' visit with Mr. Trowbridge's parents in Sundance, Wyoming. The mother of Mr. Trowbridge will return with them.

Mr. and Mrs. J. C. Keller were presented with a fine boy on the anniversary of the mother's birth. Mr. Keller is wearing the smile that won't come off.

Miss Melbourne Gordon, of Brandt, has been selected as teacher of the Taylorsville school for the coming term. She will be assisted by Miss Margaret McCarthy.

A Boys' Club is being organized in Taylorsville Camp. The club will be conducted along the lines of a Boy Scout Troop, and the boys have pledged themselves to direct their efforts in a beneficial way about the camp. The or-

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ganization will be directed by Mr. Sando. Let's give the boys a boost.

A very sad event of the past month was the sudden death by drowning of Stella, daughter of Mr. and Mrs. C. P. Heckman. She was in swimming in the borrow pit pool with a group of friends, when suddenly her screams attracted her companions, who on looking saw her sink out of sight. Her body was soon recovered and all efforts made to revive her, but without success. A short funeral service was conducted from the home by Rev. Zimmerman, following which services were held in Cincinnati, where burial was made.

Although only thirteen years of age, she was very popular among her friends and was a faithful worker in the Sunday School. Her sunny smile will be greatly missed about the camp.

Card of Thanks

We desire to take this means of expressing our thanks to our many friends who so kindly responded with their services and floral contributions on the occasion of the death of our daughter.

Mr. and Mrs. C. P. Heckman and Family.

LOCKINGTON

Mr. Cory Bowers and family have moved into camp, taking the cottage recently vacated by the Argenbrights.

Mrs. C. H. Shea has had as her guest her niece, Miss Marianna Remick, of Tulsa, Okla.

Word has been received from Mrs. Frank Watson that she is on the road to recovery from an operation recently performed at a Detroit hospital.

Mrs. Anna Bolmer, Miss Rachel Bolmer and Miss Emma Wagner are guests of Mrs. C. M. Gudgeon.

Mrs. L. J. McWilliams has returned from a visit in Newark, Ohio, accompanied by Miss Mary Joyce, her cousin.

HAMILTON

Rev. F. J. Rolf of Rock Island, Illinois, was a recent visitor at the home of his brother-in-law, C. H. Eiffert.

Inspector W. Z. Bovard reports that his young son is recovering nicely from injuries sustained when he was run down by an automobile in Oxford a few days ago.

Mr. and Mrs. Wilburn B. Smith of Birmingham, Ala., are the guests of Mr. and Mrs. R. B. McWhorter.

Mr. and Mrs. G. W. Schrader and daughter Jane, accompanied by Mr. and Mrs. Frank Blessing of Dayton, are enjoying their vacation by motoring to the Pacific Coast.

John Deineger, of the shop force, has invested in a bicycle and is using his every effort to learn to ride it. He has knocked a widow woman's yard fence down (and heard from her about it) and defaced a telephone post; he also defaced himself.

Mr. and Ms. C. H. Eiffert, Mr. and Mrs. R. B. McWhorter, and Mr. and Mrs. F. J. Rolf and children spent a pleasant Fourth of July at Fort Ancient.

Messrs. W. S. Conklin, Nelson Messner, Herman Klenke, Robert Hazeltine and Morris Forman visited Dayton July 30th to inspect the Conservancy work there. Coincidentally they saw Jimmy Cox and the parade. (Mr. Conklin fixed the date for this trip.)

Mrs. Charles LaLonde has returned from a visit to New York.

HUFFMAN

About twenty from Huffman entertained themselves with a dancing party at Triangle Park, Wednesday evening, July 20th.

The Misses Julia Marie and Sara Belle Darnell have just returned from a two weeks' visit to their old home town, Manchester, Ohio. From all appearances, many fattened chickens were sacrificed when the two prodigal girls arrived there. We all,—and especially certain interested parties,—are glad to see them safely returned to us.

We welcome Mr. and Mrs. Jerry Dennis, who have moved to our camp from Osborn.

The July committee of the Sunshine Circle made themselves popular with all of us who were able to attend the camp supper prepared and served by them at Hills and Dales. Ask those who were there what roads to take to find Polo View Camp and you will get as many answers as there were automobiles. Paul says that when you are driving your own machine, it may not be so bad to try every road but the right one, but there is a different feel-

ing when a taxi register is ticking in front of you. These extra rides, however, only made the delicious steak supper more appreciated. Everybody pronounced it as among the best of our many pleasant gatherings.

Mrs. B. V. Chambers is enjoying a visit from her father, mother and two brothers, who are making a short stop on their return auto trip from California to their home in eastern Ohio.

DAYTON

Mr. and Mrs. Morgan at Cape May

Mr. and Mrs. Morgan have been spending a part of their vacation at Cape May and in the vicinity of Philadelphia. Mrs. Morgan made the jaunt by automobile, accompanied by Mrs. Everdell and the children, an interesting account of the trip being given in another column, among the Englewood items, by Mrs. Everdell. A unique feature, which must have been very pleasant, was the camping at night by the wayside, a la caravan. With pleasant weather and clear full moonlight, such "gypsyng by automobile" must have been an uncommon "lark." The trip took three and a half days.

Gerard H. Matthes Goes to Tennessee

Mention is made in the editorial columns of the Bulletin of the departure of Mr. Matthes to take part in the investigation of the hydraulic resources of the Tennessee River. He started for Nashville, his new headquarters, on Monday morning, August 2. His wife, who has been Executive Secretary of the Dayton Red Cross for many months, will not go immediately, but will wait until some one has been found to take her place. She has filled the post with uncommon ability, and following the departure of Rabbi Lefkowitz, her loss will be heavily felt in the organization. As the family has broken up housekeeping, Mrs. Matthes will live, pending her departure, with her little daughter Florence, at the Young Women's League Camp on the Stillwater River. It is with great regret that the friends of the Matthes see them go. They have been members of the Conservancy family so long, and have been active in so many ways, that their places will be hard to fill.

E. W. Lane Goes to China

We have noted in another column of the Bulletin the departure of E. W. Lane on August 21, on the steamship "China," for Shanghai, to be the representative of the Morgan Engineering Company in the Far East. We are sure all who have known Mr. Lane in the work of the District, while rejoicing in the unusual opportunity which this brings to him, will regret that we are going to lose one who has been so long and capably and pleasantly identified with the project. Besides having unusual professional abilities, Mr. Lane has the larger human qualities which make those he works with become his friends. It is this combination which enables one to predict with such confidence that he is bound in the long run to make a high place for himself. With ability, energy and good will, and that natural love of his work which keeps him everlastingly at it, rain or shine, there is only one outcome. We shall hope to get a word from him now and then to give our readers.

Dog-day Song of the Hobo

Oh, comfortabler than a flea, on a sleepy ole log—that's me!

Layin' here on my back by the D. an' L. track,

In the cool o' this breezy tree,

With a pipe o' cut plug stickin' out o' my mug,

A smokin' so peacefuller.

(Fer the Lord that made work made the drone an' the shirk—

That's the hobo's philosophee!)

Oh, the sweet "hum of industree!"—I love it—fur off!—my idee

Is to never get het—if I did I might sweat—

Oh, I ain't no ant ner bee!

So I lays in the cool watchin' some farmer fool—

God bless him!—a sweatin' fer me!

(Fer the Lord that made work made the drone an' the shirk—

That's the hobo's philosophee!)

WOMAN'S CLUB

Mrs. Tanner's place during her vacation is being filled by Mrs. Frye.

Miss Jean Bruleport of the Farm Division is spending

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EDITORIAL

Board of Editors

Germantown	Miss Julia Darnell
Englewood	Albert L. Wald, George Rodgers
Lockington	C. H. Shea
Taylorville	Mr. M. H. Sando
Huffman	Mrs. C. C. Chambers
Hamilton	R. B. McWhorter
The Woman's Club, Dayton, Ohio.....	Miss Mayme McGraw
Dayton Warehouse.....	J. T. Hall

It's a Great Little District

Has it occurred to you that the Miami Conservancy District is furnishing more presidential candidates per square mile than any other political division in the United States? It is true. The editor spends a large part of his time hurrahing for Cox and Watkins. Dayton celebrated the nomination of its townsman last Friday. Germantown is staging its fireworks for Dr. Watkins on August 12. The District celebrates both. Probably most of us did not realize the Germantown timber. But why not? Is not a "dry" candidate the perfectly logical result of a flood protection project?

The Death of Stella Heckman

We record with sadness the death of Stella Heckman, since our last issue, by drowning in the borrow pit at Taylorville. She was in swimming with a few girl friends and evidently slipped into one of the deeper pockets dug in the bottom by the dragline bucket in making the excavation. Her companions heard her screams and, looking, saw her struggling in the water, but were unable to save her. The body was in the water perhaps fifteen minutes before it was recovered, and every effort was made to resuscitate her. Dr. Smalley was notified and made the trip from Dayton bringing a pulmotor, "Tobey" driving a considerable part of the distance at fifty miles per hour, but it was unavailing. We wish to extend to the parents our deep sympathy. Stella's name was familiar to us as one of our "Junior Editors," whose contributions gave us pleasure to read. We shall miss her name from the roll the coming year.

Do It Now

We refer to photographs of the work. The time to get them is just as soon after they are taken as you can, while the actual picture is fresh in your mind. Then jot down on the back a few notes, giving the date and circumstances, to help your memory when you look at the picture, months or years afterwards. Our job is unique and these pictures are a record which some day you will prize. Many men put off ordering, thinking to make up one big order at some later date. That is a mistake. Do it on the "easy payment" plan, a bit at a time, and do it while the goods are "fresh," and your memory and interest fresh.

Bound Volumes of the Bulletin

There have been repeated inquiries as to binding the back volumes of the Bulletin. For the convenience of those who wish their Bulletin in permanent form, we are making arrangements so that those who wish can get the first two volumes, now completed with the July issue, bound together as one, with an index to both volumes. This index, when completed, will be sent to all subscribers who wish it. The price, etc., of the binding, which will be inexpensive yet durable and neat, will be announced later.

her vacation with a house party in the West Virginia mountains northeast of Charleston, at the country home of ex-Senator Chilton of that state. Her place is taken by Miss Tyler.

A Dangerous Job

The job of voucher typist in the Purchasing Division has gone to a premium. Miss Mary Nealon, the incumbent not long since, is now no longer Miss Mary Nealon. The present holder of the job is scheduled to go the same road, according to announcement made soon after taking Miss Nealon's place. The Office Engineer's desk is said to be piled high with applicants for the position. Young women stop our friend Fowler Smith on the street to make inquiries.

Meantime, the same "lovely lightning" has struck just across the aisle in the Accounting Division, and appears to be playing over the heads of others in the near vicinity. It's fatal stuff, and no insurance at any price.

Shop, Warehouse and Garage

Anyone having any new silk shirts which do not fit or any silk handkerchiefs they do not like kindly, leave them in Mr. Harvey's office, as Harry Kuth objects to dusting with the usual assortment of linen rags provided by the warehouse.

Understand the water boy for the line gang of the Electrical Department does not carry water any more, but instead is carrying coal oil in order that the men can do something besides scratching jiggers.

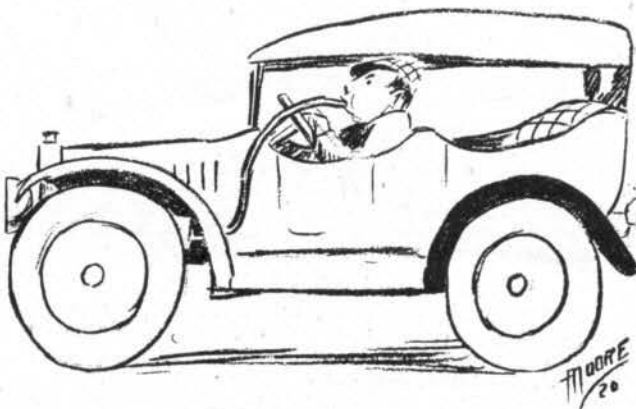
Aside from paying a great deal of attention to the mess of jiggers that he has acquired, Sam Capper found time the other day to capture a swarm of bees, which are now on Mr. Harvey's farm southeast of Dayton. Harvey is to feed and water the bees and take good care of them for one-half of their output.

Since school is out for the summer vacation, we notice that Mr. Albert does not make his regular trips to Germantown Dam on Mondays and Fridays.

Quite a coincident happened at the Germantown Dam a short time ago when one of the acetylene welders from the shop was sent there to make some repairs on their grizzly. While working he caught his leg in a certain part of the machinery and fell backward. After getting his bearings he discovered that he had broken his leg in several places. Mentioning the fact to several men who were helping him, he kept right on working as though nothing had happened. This, of course, caused a great deal of excitement and the news spread quickly. People came from near and far to see this wonderful human with so much nerve, and before long quite a crowd had gathered. Paying no attention to the crowd of onlookers he kept right on working until his leg became a hindrance, when he reached down and broke it completely off and pitched it aside. It was then that the mass of Germantown folk discovered that his leg was made of wood.

George Booher of the shop made some sensational revelations to the garage office force the other day. For particulars, see George.

Last month the Purchasing Department called on the editor for more information on a requisition calling for "3-inch Square-Faced Blacksmiths." The Warehouse is now wondering who gave them the dope as to where they could purchase "5 gross of 1 1/4-inch wooden-headed screws" which they bought on purchase order placed recently with a local concern.



NEW INVENTION

Sketch showing how Dan Daub was able to start from Toledo with ten gallons of gas in his tank and arrive in Dayton with twelve gallons. (Note tube running from Mr. Daub's mouth to the carburetor. He was full of hilarity on leaving Toledo, having had an unusually pleasant time with friends there.)

The Everhards Revisit the Conservancy

Mr. and Mrs. J. W. Everhard, of Youngstown, Ohio, are making their old friends of the Conservancy a visit of a week or so during this first week in August. Mr. Everhard is with the architectural firm of Miller & Son, of Youngstown, and very evidently is finding his work pleas-

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ant and prosperous. He has roused up the tennis sharks of the Conservancy and the Athletic Park courts will see a bitter revival of the good old feuds which enlivened the days of yore.

"Speaking About the Weather"

These are the days that get our goats; we stew and sizzle minus coats, at desk or bench or in the ditch, and cuss and fume and fret and itch. Our collars sag about our flues, the hot smoke oozes from our shoes, the while we dream of trees and bees and babbling brooks and cheaper cheese. We yearn to board an aeroplane, and high up in the skies raise Cain; or flee to Greenland's icy shores and frolic with the Polar bears. The August days are hot—then some! They almost put us on the bum. Yet though we grieve and sigh and sob, somehow we stick right on the job!

—Elldce.

Scoring John Hall

We hope to be forgiven if we throw a bouquet to our editorial colleague, John Hall, who runs our end of the Shop, Warehouse and Garage. He has the natural newspaper eye for live stuff, puts punch into his items, and can pinch-hit a two-bagger on the shortest notice of anybody on the staff, including the supposed senior.

Watch Lockington

With all the record breaking we have been publishing in the Bulletin of late, we are still warning the boys that the crowd at Lockington, as usual, are saying nothing and sawing wood. And when the recording angel foots up the score sheet, the result is not unlikely to be what it was in the days of the War Chest Drives. We have a Lockington article up our sleeve which we shall release in a month or two. Look out for it.

Threshing Season Begins

There is loud threshing of political straw these days and lots of it, with the smallest real wheat crop we ever remember to have seen.

"Peace Gardens"

We haven't heard much about the camp gardens this year, except from Englewood, where we read there is to be a distribution of prizes as last year. That's good for Englewood. The "Back to the Land" slogan is the wholesomest slogan in these feverish and spendthrift days that we know of, and the garden movement is a part of it. It should be a part of the education of every child, as much as readin', 'ritin' and 'rithmetic. It is one of the roads back to Mother Nature, mixed with exercise and a little honest sweat. It's what life ought to be—a mixture of play and work, and as such, true education. Let's keep up the peace garden movement.

"Hot Air"

Don't ever let anybody back you down by any insinuation regarding hot air—your own or anybody else's. Remember, there is hot air and hot air—mere wind, and the breath of the oxy-acetylene torch, which will saw bar steel in two. Much virtue in hot air—if it's hot enough.

Mrs. Albert Undergoes Successful Operation

The friends of Mr. and Mrs. George L. Albert will be much pleased to learn that Mrs. Albert has come successfully through a rather serious major operation and is well on the road to full health again. The operation was at Dr. Hatcher's private sanitarium on August 3.

Brownell-Stork Players Appreciative

The following little notice, taken from the Brownell-Stork Weekly, shows that the courtesy recently extended the Brownell-Stork Players by some of the people of the District, was fully appreciated:

"One of the most generous and delightful treats was afforded the Brownell-Stork Players by executive members of the Miami Conservancy District last Thursday. At 10 a. m. Mr. Ezra M. Kuhns, Mr. and Mrs. C. H. Locher, Mr. C. H. Paul and Mr. C. N. Phillips met their guests at the Gibbons Hotel and conveyed them in a number of machines to the various dams at Osborn, Taylorsville, Englewood and Germantown. At each place most interesting and educating descriptions of the work were offered by the gentlemen in charge of the party, and at Englewood the generous hosts had one of the most elaborate dinners served for their guests. Mr. and Mrs. John A. MacMillan, the latter being the chairman-general of the Hostess Committee, accompanied the party to the great enjoyment of the players. The company is deeply appreciative of the royal treat which has been extended."

We Begin Our Third Year

Do you realize that we are celebrating our second birthday? We have been waiting for somebody else to say the word, but since nobody does, we must (in the interest of truth, of course,) say it ourselves—"Some two year old!" Our new knickers fit us fine (regardless of grammar) and we expect some day to arrive at long trousers.

Chief Accountant Cavis Sports New Mitchell Six

C. L. Cavis is the latest District man, we believe, to be luxuriating in a new car—a Mitchell Six—which just now is employing a good deal of his spare time. The Mitchell folks also have Division Engineer Larsen on the string. He thinks he's safe, but they have landed Fowler Smith and Cavis, both of whom are pleased and purring over being taken in, and they will land Larsen also before the story's done. Once you get those fellows camping on your trail, you're a goner.

Death of William O. Creager

Mr. Otterbein Creager, Chief Clerk to the Farm Division, received the sad news on August 3rd of the sudden death of his father, William O. Creager, at Farmersville, about noon on that day. The death was due to rheumatism. The deceased served through the entire civil war with the Union army, and was active in G. A. R. circles. He is survived by his wife, Sarah Creager, and by three sons, N. B. and O. L. Creager of Dayton, and Charles E. Creager of Oklahoma. The Bulletin extends its sympathy to the family in their bereavement.

We are sure all who know him will be glad to see the picture of our commander-in-chief of hydraulic fill, George L. Albert, published this month in the main Bulletin. It is a good likeness, all the better that it depicts him in no stiff-starched photographic studio pose, but in his fighting togs, and on the job.

The Dayton Gravel Plant

Those of us who haven't been will do well to visit the gravel washing plant at the mouth of Wolf Creek. With its two big derricks, its dragline excavator, its mountainous piles of cleaned, assorted product, its rock crusher, and its "dock front," where scows and steam tug lie moored, or come and go,—to say nothing of the washing and screening mechanism itself, the plant presents a picturesque and busy scene, well worth anybody's time. We expect to publish an article about it in the near future.

If

(By Robert Isham Randolph, with Apologies to Rudyard Kipling)

- If you can swing an axe, or wield a brush-hook,
Or drive a stake, or drag a chain all day;
If you can scribble "figgers" in a note book,
Or shoot a range pole half a mile away.
If you can sight a transit or a level,
Or move a target up and down a rod.
If you know fear for neither man nor devil,
And know yourself and trust the living God.
- If you can wade a swamp, or swim a river,
Nor fear the deeps, nor yet the dizzy heights,
If you can stand the cold without a shiver,
And take the Higgin's ink to bed o' nights.
If you can turn a thumb screw with your fingers,
When every digit's like a frozen thumb.
If you can work as long as daylight lingers,
And not complain, nor think you're going some.
- If you can sight through tropic heat's refraction,
Or toil all day beneath a blistering sun.
If you can find a sort of satisfaction
In knowing that you've got a job well done.
If you can close a traverse without fudgin',
Or check a line of levels by a foot.
If you can set a slope stake, just by judgin',
And never kicked a tripod with your foot.
- If you can give yourself and all that's in you
And make the others give their own best, too.
If you can handle men of brawn and sinew,
And like the men and make 'em like you too.
If you can meet with triumph and disaster
And treat them without favor, nor with fear,
You'll be a man—and you'll be your own master,
But—what is more—you'll be an ENGINEER.

—The Earth Mover.

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FIG. 184—MONITOR TEARING DOWN LOCKINGTON PIT FACE. AUG. 5, 1920. SEE PAGE 20



FIG. 185—SLUICING LOOSE GRAVEL AT LOCKINGTON. AUGUST 5, 1920

This shows the short length of channel pipe receiving the discharge of the main pipe, and directing it against the base of the loose pile of gravel. The manner in which the material on the slope breaks off and comes sliding down shows plainly. See Fig. 186.



FIG. 186—GRAVEL PILE BEING SLUICED DOWN BY LOW PRESSURE WATER, AND ALSO BY A SLUICE DITCH. AUGUST 5, 1920

This is the gravel pile referred to in the caption to Fig. 185. The pipe at the left is the outlet of a low pressure pipe line carrying 8 cubic feet of water per second, the water being driven by a centrifugal pump in the pump house at the right of the dredge pump house in Fig. 188. The discharge is received in a short length of channel pipe which is manipulated so as to undermine the material at the base of the loose gravel pile to best advantage, this material being then washed into the sluice ditch at the left, by which it is brought to the main sluice ditch in the foreground. This main sluice ditch is directed by "sluice boards" (see Fig. 187), so that it also undermines the base of the gravel pile, as shown farther up the pit in the picture. This sluice ditch is thus bringing down material to the sump from three different sources—from the low pressure pipe line outlet (circulating water, see page 29) from the sluice ditch excavation of the gravel pile, and from the monitor working on the pit from at the head of the sluice ditch. The top of the boom of the dragline which does the original excavating of the gravel, is seen above the gravel pile.

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G. L. TERPLE, Assistant Engineer, EDITOR.

Hydraulic Work at Lockington

The present issue of the Bulletin is given over in large part to a description and discussion of hydraulic excavation and transportation of the earth materials in the borrow pit of the Lockington dam. Two articles are presented, the first being of a less technical character, dealing in the main with the underlying principles of the various operations, and the second giving engineering details whose chief appeal will be to members of the profession. Special attention is being given to the articles in the Bulletin on the subject of hydraulic fill dam construction. The literature on the subject seems to be scanty. The method is one which has grown up in accordance with the exigencies of practical construction, with such variations and expedients as were found of value in adapting it to varying conditions. Much of this material has apparently not found its way into print, or is widely scattered through the files of engineering periodicals, and it has never been brought together. It is the hope of those in charge that the matter in the Bulletin, while fulfilling its function as a periodical report to the public of the progress of the Conservancy work, may be a means of collecting and getting together such information on this subject as may bring it up to date; and also, while doing that, to state and illustrate the underlying principles in a manner which may make the Bulletin discussions fill a gap which up to the present appears to be unoccupied.

The work this season, at Lockington, it may be said, marks a decided advance in efficiency over that of last year, as a reading of the articles will indicate, this advance being the result of much study of the details of last year's operation. The improvement made in the work on the dam embankment itself is reserved for a future article.

Big Four Railway Now Open to Traffic on the New Line.

The first train over the relocated line of the Big Four Railway went through on September 3, thus marking another step in the completion of the Conservancy project. It will be remembered that the relocation was made necessary by the interference of the old lines, both of the Big Four and of the Erie Railway, with the construction of the Huffman dam. The two railways are to operate the relocation in conjunction as a double track road between Dayton and Enon, the total distance between the two places being 21 miles. The Erie will begin operation on the new line about October 1. The town of Osborne, a little northeast of Dayton, which later must be abandoned entirely, owing to its being within the flood limits of the Huffman Basin, will continue to be served for the present by both roads, the local trains on the Big Four still running through Osborne instead of running on the relocation, which is some distance on one side.

The total length of the relocated line is 15.2 miles. It is built with a 60 foot road bed, to accommodate eventually four tracks. Its chief feature is the ex-

ceedingly heavy cut at the east end of the Huffman dam, 120 feet in height and comprising over 600,000 cubic yards of material, over 500,000 of which was rock. This heavy work was made necessary by the fact that the ruling gradient on these railways was very flat. It being impossible to change the track levels in the Dayton yard, where the new line started, and the valley slope rising abruptly where the new line swung aside to clear the east end of the dam, this gradient cut heavily into the hillside, as the figures indicate. This gradient begins at Findlay Street, in Dayton, and will necessitate raising the railway yard a little for some distance north of this point, this work being now in progress.

The work has been done by the Walsh Construction Co., of Davenport, Iowa. The grading began about April 1, 1918, and was finished in November, 1919, the operations of track laying, ballasting, etc., having consumed the interval since that date. The total amount of material excavated has been 1,416,000 cubic yards. The same company did the tracklaying and ballasting, subletting the former to Roberts Bros., of Chicago. The gravel for the ballast was obtained in the valley floor borrow pit just above the Huffman dam. The work of supplying it has been done by the District forces, and has occupied more than half the time of the excavating equipment at this pit, delaying thus, unavoidably, the dam construction.

Two new interlocking towers, equipped with 44 levers each, of the electro-mechanical type, have been erected on the new line. One is of brick, located at Tate's Point, in the environs of Dayton, at the crossing with the Baltimore & Ohio R. R. The other is of wood on a steel under frame. It is located at Fairfield, at the crossover between the east-bound and westbound tracks. A passing track and sidetracks at Fairfield are to be completed at a later date.

Stability of Hydraulic Fill Dams

Attention is called to the double page picture on pages 24 and 25 in this issue of the Bulletin, because it presents visibly to the eye a sense of the stability of a hydraulic fill earth dam, properly designed and constructed, as it exists during its most unstable stage—that of construction. It is then, if ever, that a hydraulic fill dam will give way. The picture of the river section of the Englewood dam in its present condition, above referred to, shows clearly how little fear need be entertained on this head as regards the Conservancy dams. The great breadth of the sand and gravel slopes and beaches, enclosing the core pool, as compared with the narrow width of the latter, gives an unmistakable indication of the impossibility that the core material, deposited in the bottom of the pool as it is, should even in its earliest stage of plasticity, before the process of consolidation has become complete, ever be able to break through the enclosing masses of sand and gravel, and thus compel a reconstruction of the dam. In the case of the Conservancy dams such an occurrence is made doubly improbable, by the fact that water cannot remain behind the dam more than a few days, and that only at long intervals, when floods occur. This for the reason that the outlets through the dam embankment are never closed, and the retarding basins behind them drain immediately. The water is not retained long enough to permit any

softening effect on the embankment material sufficient to endanger its stability. After the flood, there is a rapid drying out of the embankment, due to the high porosity of the slope material, with a corresponding return to maximum stability.

It may be noted, with relation to the above mentioned picture, that the river section of the dam at Englewood is now up to a level which, with the present temporary spillway in operation, (just beyond the cross dam in the distance, as seen in the picture) makes the embankment safe against a flood equal to that of 1913. Thus another mark has been passed on the road to complete flood protection for the Miami Valley.

The Work in Dayton

The back cover page of the Bulletin is devoted this month to illustrations which were unavoidably crowded over from our last issue. The big dragline excavator in Fig. 196 has now been floated under the bridge where the picture shows it at work, and is engaged in channel excavation several hundred yards downstream. The work on the levee wall just above Main Street bridge is at present the most prominent piece of construction under way in the Dayton river improvement. This wall is of the same type as that just completed between Third and Fifth Street bridges, construction details of which were given in the Bulletin for last March. There are details, however, in which it shows interesting differences. It is hoped to present these in the next Bulletin.

The Lockington Borrow Pit. (See Page 29.)

The dredge pump house is seen at the right. The monitor pipe line is seen crossing the pit just below the pit face in the distance. The two main sluice ditches are seen running from the pit face to the dredge pump house. The pipe line at the left is the low pressure circulating water referred to in the article, page 27, as the second circulating system. (See also page 22). The dragline excavator at the left digs a gravel deposit in the west part of the borrow pit, and piles the material in the heap seen, to be washed down into the sluice ditch by the low pressure water just referred to. The roof of the pump house for this low pressure water is seen over the bushes at the left of the dredge pump house. The dragline excavation is more expensive than that by monitor, but is necessary here because the pit as a whole has a deficiency of gravel, which is supplied by digging deeper into the gravel deposit, this extra depth carrying the pit floor to an elevation below that permitting direct washing by monitor into a sluice ditch. Hence the piling into a heap at higher elevation. The stiffleg derrick at the right of the dredge pump house is used to handle repair parts of the pumps, etc., into and out of the pump house, which has a removable roof to permit this. This derrick, equipped as a dragline excavator, also excavated the original hole for the sump and pump house.

Records Again Broken

Records both at Englewood and Taylorsville have again been broken. At Taylorsville the July run of concrete in the outlet works was 8,087 cubic yards. At Englewood it is the month's record for material pumped into the dam embankment—18,552 cars.

Hydraulic Excavation and Transportation of Borrow Pit Materials

Principles Underlying These Processes as Developed in the Work at the Lockington Dam.

In last month's Bulletin the hillside borrow pit at Huffman was described, with the arrangement by which the pit face is broken down by the hydraulic monitor and the material sluiced from the pit through a pipe flume directly to the top of the dam embankment, without other pumping than that necessary to supply the monitor. At Lockington the valley slope is so flat, and the elevation of the upper hillside so little above the top of the dam, that this process is not economical. Some material could be sluiced to the dam by the method, but in amount so small that the cost of erection of the necessary plant would more than counterbalance the advantage. At Lockington, therefore, the material, after being broken down from the pit face by hydraulic monitor as at Huffman, is sluiced to a sump on the lower valley slope, adjacent to the dam, and pumped thence to the embankment by dredge pumps. (See Figs. 184 and 188.)

The general process is to tear down the pit face by the monitor jet, and to "sluice" the eroded material to the dredge pumps by means of water rushing down the slope of the pit bottom in a "sluice ditch." The sluice water is supplied partly by the spent monitor jets and partly from a ditch system on the valley slope above the pit face, directed over the tops of the pit bank, this ditch system being supplied from a reservoir or forebay, fed by a culvert pipe from the Miami and Erie Canal. (See Fig. 191). At the lowest point in the borrow pit the sluice ditch empties into a "sump," whence the water and earth are lifted by the dredge pumps and driven to the top of the dam embankment. The general arrangement is simple, but its efficient carrying out at Lockington involves several interesting details.

A hydraulic monitor works most efficiently (see Fig. 184), when placed as close as possible to the pit

face which it is excavating, because the closer it is, the solidier the issuing water jet will be, and the higher the velocity with which it strikes the material. Also, for maximum efficiency the jet must be directed against the base of the pit face, since then it works by undercutting. The bank, thus undermined, comes tumbling down from time to time in great masses, which, broken and crumbled by the fall, are then easily knocked to pieces by the jet and the loose earth washed into the sluice ditch and on to the pumps. As the bank breaks off, the face of it recedes continually from the monitor, till it gets so far away that the jet no longer does efficient work, on account of being more or less whipped into spray before it strikes. The monitor line must then be extended and the monitor reset once more close to the pit face.

With these conditions it is evident that the deeper the pit the more earth can be excavated at one setting of the monitor, and the less labor will be used in moving forward.

There are several limitations to the depth, however. One is evidently the occurrence of bed rock, or of clay or other strata too tough to be efficiently excavated by the jet.

Another is the matter of efficient dredge pumping. The deeper the pit bottom, the deeper the dredge pumps must be set, since the pit bottom must slope toward the pumps in order that the materials may be carried to the latter. But the deeper the dredge pump setting, the higher the materials must be pumped to drive them to the top of the dam where they are deposited. A point is reached where the gain in height of pit face is counterbalanced by the added cost of pumping.

Still another limit, at Lockington, was set to the pit depth by the necessity of guarding the pumps from flood in seasons of high water in Loramie

By means of the "sluice boards" set up diagonalwise to the flow of the ditch water on one side, the flow in the ditch is directed against the base of the low hill of pit floor material shown, thus undermining it, and bringing down the excavated earth to the dredge pumps. The action is precisely analogous to that seen in a river which undermines its bank on the outside of the bend where it swings round a curve. Thousands of cubic yards of material have been undermined and brought down to the pumps at Lockington in this manner.



FIG. 187—SLUICE DITCH UNDERMINING AND EXCAVATING THE BORROW PIT FLOOR. JUNE, 1920

Creek. At Lockington that was the determining factor. The pumps were set at the lowest safe elevation (895 feet above sea level, the dam crest, when finished, being at elevation 954, and the valley floor at 885). To get the sump level as far below the pumps as possible, thus lowering the borrow pit floor (since the sump water and pit floor at the sump are at practically the same level), the pump suction pipes were made as long as possible. From this lowest possible level at the pumps, the pit floor slopes gently upward in all directions at a sufficient angle to bring the excavated material down the sluice ditches to the pumps.

The degree of the slope of the pit bottom is important, because it determines the amount of material which with a given area of borrow pit can be brought down to the pumps. The flatter this slope—that is, the flatter the rise of the pit floor—the higher will be the face of the pit bank at any given distance from the pumps; and the higher the pit face, the greater the amount of material excavated. At Lockington last season, the gradient of the slope varied from about 4 to about $5\frac{1}{2}$ per cent (depending upon the pit floor materials). This season, by proper manipulation, the slopes have been flattened so that they vary from about $2\frac{1}{2}$ to about 4 per cent, a reduction of about $1\frac{1}{2}$ per cent. The increase in the quantity of materials thus made available within the present limits of the borrow pit cannot be exactly estimated, but it is between 200,000 and 300,000 cubic yards.

This flattening of the pit floor slope was accomplished by increasing the amount of water running in the sluice ditches. The water comes down these ditches at high speed. Like all swiftly moving stream water, it tends to erode its bed. But also it comes down the slope heavily loaded with material washed down from the pit face by the hydraulic monitor, varying in coarseness from fine clay to stones a foot or more in diameter. (See Fig. 193). The flowing stream tends to drop the coarsest of these materials and thus fill up its bed. If it flows at sufficient speed, it erodes its bed faster than it drops the coarser materials, and the stream slope flattens. But the flattened stream slope slows down the water's speed, and the slackened speed causes it to erode its bed less, and drop more coarse materials. Thus in time the slope arrives at a stage of equilibrium, when the ditch bed erosion is just balanced by the dropped material.

Increasing the quantity of water flowing in the ditch disturbs this equilibrium, by increasing the speed of the water, the increase being due to the fact that a smaller proportion of the water is now in contact with the rough ditch bed which impedes it. (The lower layers of water "grease" the ditch bed for the upper layers to slide over, and when the quantity of water is increased there is a greater thickness of these upper layers). The increased speed will increase the erosion, and this in turn will flatten the ditch bed slope. Conversely, diminishing the quantity of water will steepen the ditch slope. The increase in the quantity of water, just discussed, has the advantage not only of flattening the ditch slope, but of carrying a greater quantity of eroded material to the pumps by reason of the increased volume of flow.

It may also be noted that in passing over a portion of the pit bottom containing a greater proportion of coarse materials, the ditch slope will steepen, since these coarse materials will impede the flow, thus requiring a steepened slope to produce the speed of equilibrium at which, carrying a given material, the deposition and erosion balance. Conversely, when flowing over fine materials, the ditch slope flattens.

The velocity of the water is increased and the ditch slope flattened not only by increasing the quantity, but by concentrating the flow. It is clear that a broad shallow stream will be much more impeded by its rough bottom than the same stream when made narrower and deeper. At Lockington this concentration is produced by means of "sluice boards," like those shown in Fig. 186. These form artificial wooden banks, between which the water is penned to a swift arrowy stream.

The Lockington sluice ditches are set to work eroding pit material as well as carrying it to the dredge pumps. It is well known (see Bulletin for May, 1919), that the chief erosive power of a stream is exerted upon the caving bank at the outside of a curve, where the river swings round a bend. At these points the bank is undercut (just as the hydraulic monitor undercuts the pit bank), and falls in masses into the stream, to be carried away by the current. This effect is made use of at Lockington to excavate the bottom of the borrow pit. By taking away the sluice boards from one side of the ditch, and pushing those on the other side farther into the stream, the current is deflected against the exposed side, undercutting it, and carrying the material away to the pumps. By continuing the process the ditch is gradually bent aside to a totally new course, moving away the intervening pit floor as it shifts. Fig. 187 shows this process in full swing. At Lockington the undercut ditch bank has been sometimes as much as ten or fifteen feet in height, the ditch thus performing a considerable work in excavation which otherwise would devolve upon the monitor.

Another application of this process is seen in Fig. 186, which shows a bank of loose earth thrown up by a dragline excavator, against the base of which one of the sluice ditches is directed by means of the sluice boards. Such loose material is undermined with great rapidity. It is dug by the dragline from depths in the pit too low to permit direct sluicing to the pumps. Therefore the material has to be thrown first to higher elevation. Dragline excavation is more expensive than that by hydraulic monitor, but was necessary in this case because of the insufficiency of gravel in the pit as a whole to furnish the necessary thickness of porous embankment in the dam in proportion to the impervious core. The gravel in the borrow pit occurs mostly in the west part of it, and to obtain it in sufficient amount a greater depth had to be excavated.

Another method of removing the loose bank of gravel excavated by this dragline is shown in Fig. 185, where one side of the bank is being eaten away by a stream of water issuing from a fifteen-inch pipe, and washed down into one of the sluice ditches. This water is pumped at low pressure by a special pump.

The water in the sluice ditches at Lockington has a velocity of about nine feet per second. At this speed it is able to transport stones to the pumps, by rolling them along the ditch bottom, larger than can go through the pumps. A "grizzly," or grating, of iron bars spaced about six inches apart, is placed at the mouth of the ditch, where it debouches into the sump, to catch the "oversize" stones, two or three men, removing them as fast as they accumulate. At most of the dams it will be remembered, this work of separation is done by a revolving

construction and operation would make the total cost of operating it at Lockington somewhat greater than that of simple grating such as is used.

The proportion of oversize stones in the Lockington borrow pit is low, averaging about $1\frac{1}{2}$ per cent. Where these stones occur thickly, as in the gravel strata in the west part of the pit, the problem of getting them out of the way of the monitor jet is somewhat vexatious. They soon cover the pit floor, at the base of the bank which is being jetted down, to a depth such that they act like "riprap" on a river

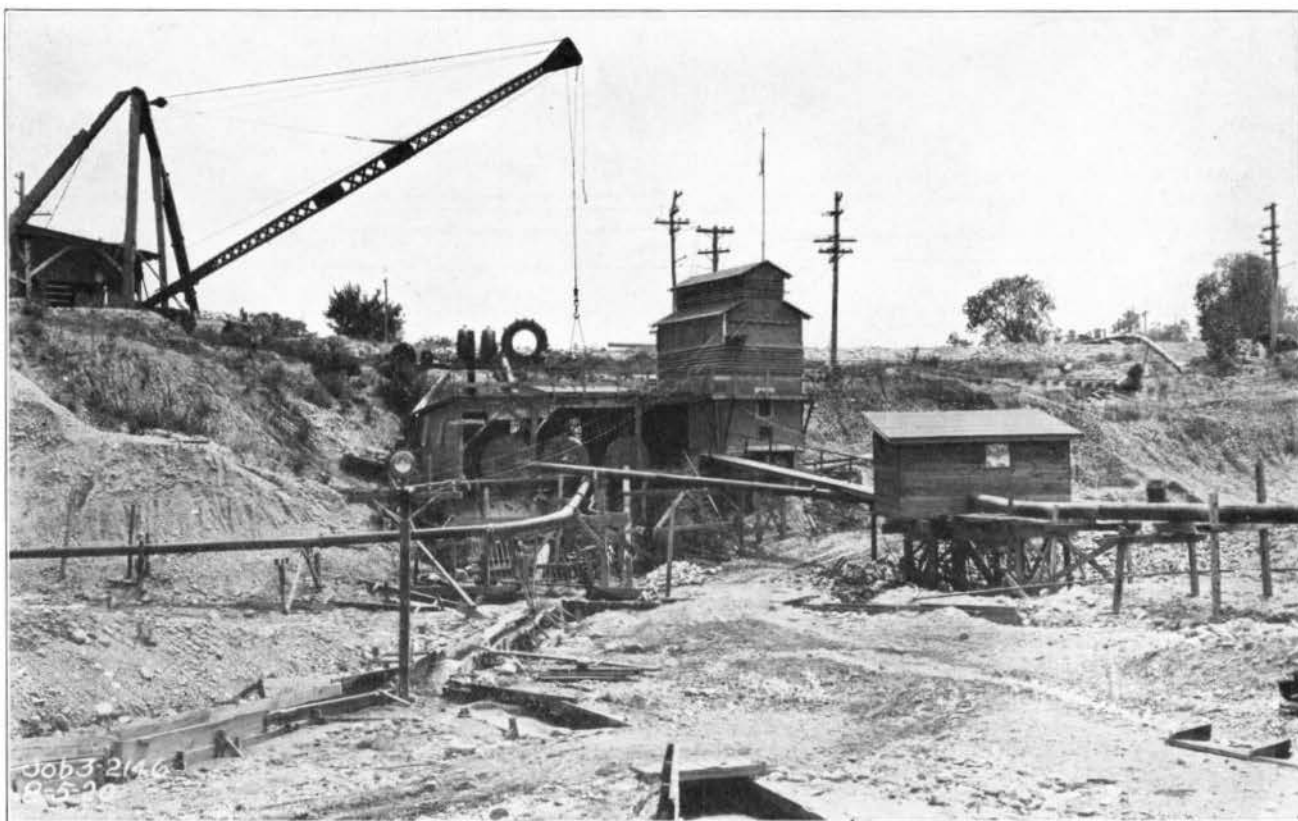


FIG. 188—PUMP HOUSES AT LOCKINGTON. AUGUST 5, 1920

The middle structure is the dredge pump house; that at the right is the house for the low pressure pump used to drive the water in the second circulating system described on page 29. The auxiliary sump there described, supplying water to the two circulation systems, is under this house. The pipe at the right is the low pressure discharge; at the left is the discharge of the first circulating system, running to the gravity ditch above the borrow pit face. The long pipe at the center, running from the left-hand pump in the dredge pump house, is the suction of this pump, which actuates the first circulating system. (See page 28). The stiff leg derrick at the left handles the machinery parts when changes must be made in the dredge pumps, etc. The junction of the two main sluice ditches coming down to the dredge pumps from the borrow pit, is seen at the left in the foreground. The dredge pipe line to the dam embankment is seen climbing the slope at the right.

grizzly, made of a long cylindrical steel shell, rotated by an electric motor, and perforated with seven-inch holes. The earth and smaller stones drop through these holes into the sump below, while the oversize stones roll on endwise through the shell (which is set on a slant), and drop into a dump car. Such a grizzly could have been used at Lockington, but would not have permitted the excavation of the borrow pit to quite so low a level (since the levels of the pumps and sump are fixed by considerations of safety against floods, as explained above, and the grizzly must be set a certain working distance above the sump water level to operate properly). Also, since the grizzly requires one or two attendants in any case, its expense of

bank, protecting the earth beneath from the impact of the jet, and seriously impeding the progress of the excavation. An expedient sometimes used in such a case is to bury the stones by boring a hole beneath them with the jet, into which they gradually sink out of sight. The process is entirely feasible, but rather expensive in time and power consumed, and when done, is only a postponement of the day of reckoning. The buried bones are sure to rise again at a later stage in the pit excavation, to stare the operator in the face and demand a further disposal.

The reason for this is that the part of the pit floor near the working face of the bank does not come at once to the flat final slope given it by the sluice ditches, because the latter, at this point, are



FIG. 189—RIVER SECTION OF THE E

The view is northwestward, endwise of the dam. The work in the middle foreground occupies the old bed of the Stillwater River, which is now running through the conduits. The walls of the conduit outlet are seen at the left, with the river beyond. The river above the conduit inlet can be seen at the extreme right, but the walls of the inlet structure are hidden by the levee topping the upstream slope of the rising dam embankment. The dragline excavator seen in the distance stands on a cross dam which it keeps building higher to retain the core pool seen in the right foreground. This dam is located on what was the old right bank of the river. The slope in the foreground, at the extreme right, is the slope of the cross dam similarly built on the old left bank, the pool being retained between these two cross dams and the upstream and downstream levees of the rising dam embankment. The gravel slopes and beaches, enclosing the core pool, show clearly the nature of dam structure, the dam core being built up by mud deposited from the water of the pool, and the material for both the core and the gravel slopes being pumped to the dam top through the pipe lines seen along the levees. The pump house in the foreground is mounted on a scow, which rises as the pool rises, the pump taking water from the top foot or so of the pool and returning it to the dredge pumps for a fresh load of embankment material. The timber tower is built on the

not fully formed. These ditches are given their swiftest, and most concentrated flow by the sluice boards, and the sluice boards do not get into effective operation until the ditch gets some distance downstream from the pit face. Near the pit face the sluice water, derived from the monitor jet after the latter has been dissipated by striking the face of the bank, and from the ditch water cascading down the pit face (see Fig. 184), is more or less scattered and ineffective for erosive purposes, and therefore leaves the pit floor near the base of the bank lying at a steeper angle. It is on this steeper slope that the stones are buried. Later, when the pit face has been pushed back by the advancing monitors, this steeper grade is mowed down by the sluice water, now gathered into one swift and powerful stream by the sluice boards. (See Fig. 184). The buried stones are thus again undermined and brought to the surface, to block the sluice ditch until they are removed. For these reasons burial by means of the jet is inadvisable.

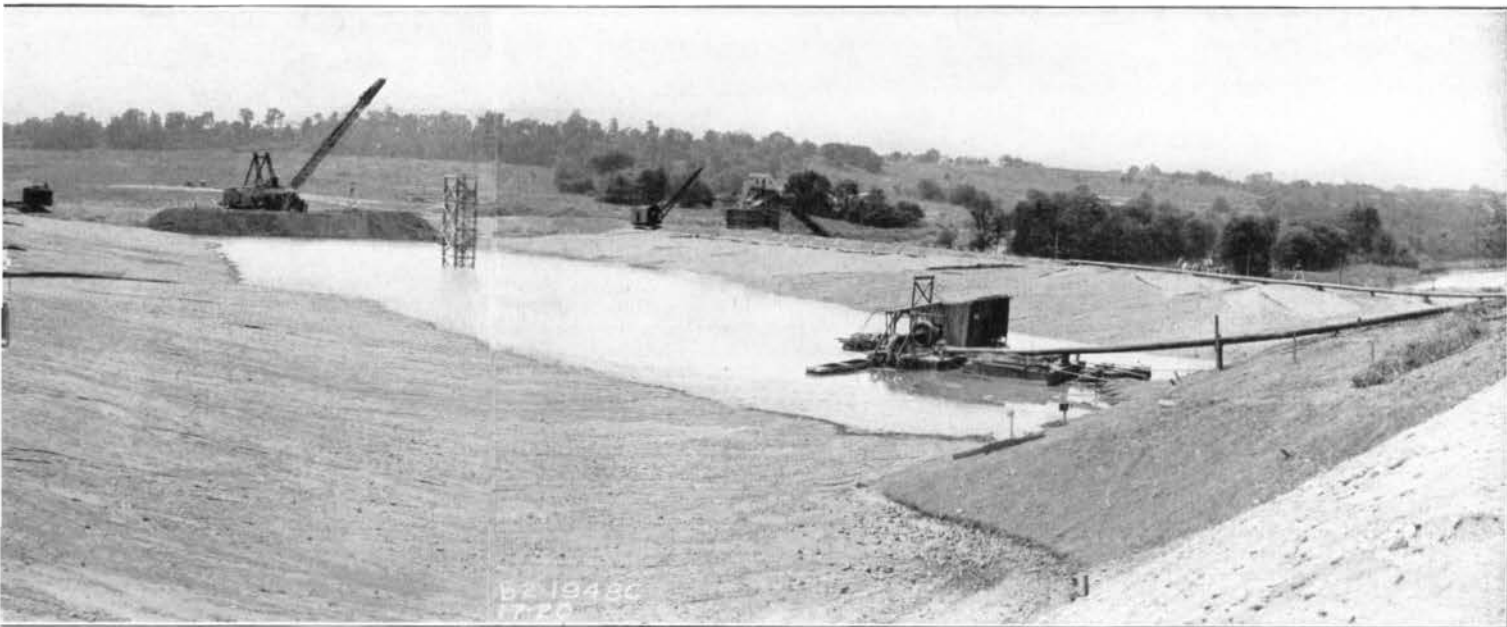
At Lockington, the practical solution of this problem is to load the oversize stone into a wagon, as soon as they gather on the pit floor thick enough to impede the monitor jet, and cart them to the dam embankment to be used as paving for the slopes. This paving, built in part also of stones carried to the beach slopes of the core pool through the dredge pipes, will give the final finish to the embankment surface, in place of the grass slopes originally planned. The finished appearance can be seen in the downstream slope of the dam, shown in Fig. 180 in the last Bulletin.

The size of the stones brought down by the sluice ditches is always a source of surprise to those who see it for the first time. The largest brought down at Lockington are shown in the picture, Fig. 193. The heaviest weighed $376\frac{1}{2}$ pounds, the other two being 275 and 205 respectively. Rock of such dimensions are not rolled continuously down a ditch bottom. They are shifted a little at a time, as the water gets a favorable "hold."

The work on the dam embankment at Lockington has only been touched upon in this article. It will be treated at length in a future issue of the Bulletin.



FIG. 190—CREST WALL TOPPING THE DAYTON LEVEE. JULY 24, 1920 (See Page 31)



ENGLEWOOD DAM. AUGUST 17, 1920

center line of the dam to support pressure cells which are imbedded in the core material below. These indicate the horizontal and lateral pressures in the core, giving thus a measure of the consolidation of the core material. (See Bulletin for April, 1920.)

The most significant feature of the view is the demonstration it presents, directly to the eye, of the stability of the hydraulic fill construction. Note the narrow width of the pool, which deposits the core material, as compared with sand and gravel slope and beach enclosing it at the left, remembering that a similar slope and beach encloses it on the right, though not so clearly seen. These slopes and beaches are of clean, solid sand and gravel, which drain perfectly to permit the escape of the entrained water of the core material, permitting the latter to consolidate as time goes on. With such broad, stable masses of sand and gravel enclosing the core the practical impossibility of the core material ever breaking through and flowing out into the valley above and below, as some have feared, is clear to the eye. It is worth pointing out that such an accident would occur during dam construction, if at all, since it is at that time that the core material is most unstable. The picture shows why the Conservancy engineers have no worries concerning such an occurrence at the Conservancy dams.

August Progress on the Work

GERMANTOWN

During the month of July 62,670 cubic yards of hydraulic embankment was pumped into place on the dam, bringing the total embankment at the end of July up to 669,700 cubic yards. This yardage makes the dam 84.7 per cent completed.

The large dragline is now preparing to cross over the old borrow pit and excavate enough material from the island formed between the creek and the borrow pit to finish the dam.

At the present writing the pumping plant is shut down, due to this program for the dragline. Advantage is being taken of the shut down to repair pumps and locomotives, to patch the floor in the hog box and to make minor repairs on the little dragline.

During the month work has been started on the drainage system for the dam. The gutters along the edge of the dam are being laid up with dry rip-rap. Good progress is being made on this work.

This month also marks the starting of work on the spillway bridge excavation. Three piers are being put down into rock. The excavation of the spillway is rapidly nearing completion. It will probably be finished by the latter part of August.

The facing of the upstream slope of the dam with dry rip-rap is continuing daily. The earth surface dressing on the downstream slope has been completed to elevation 780. Gravel is being placed on that portion of Road No. 1 from the camp to the top of the dam.

J. C. McCann is making excellent progress on Road No. 2. He expects to finish before the last of August, after which he will move his equipment to the dam, using it to spread material from the spoil banks along the outlet works, over the old creek bed, and to backfill against the concrete retaining walls of the outlet works.

Arthur L. Pauls, Division Engineer.

August 16, 1920.

ENGLEWOOD

Hydraulic fill has progressed favorably during the month. The dredge pumps handled 153,380 cubic yards, and 5,450 cubic yards were placed in the rolled embankment in Cross Dam No. 2. The total yardage to date, including all classes of embankment, is 1,600,000 or 46 per cent of the estimated quantity. The best month's record for hydraulic fill has again been broken, 18,552 cars being pumped.

The hydraulic fill in the river closure has reached an elevation of 825, a height of 57 feet above the river bed. Within a week a sufficient height will have been reached to insure safety against overtopping in case of a repetition of the 1913 flood, with the temporary spillway and enlarged conduit in service.

Cross dam No. 2, west of the river, has reached a height of 830, or 20 feet below its projected elevation. This should be completed during the coming month.

Oversize rock, rejected from the dredge pumps, has been placed on the upstream slope of the dam in the river closure. Rubble paving around the outlet conduit has been continued.

New tracks in the borrow pit have been laid and ballasted.

H. S. R. McCurdy, Division Engineer.

August 21, 1920.

LOCKINGTON

During the past month 2,770 cubic yards of material has been the daily average placed in the dam by the hydraulic fill method. The average height of the embankment west of the outlet structure is 37 feet below the finished top of the dam, and on the east side 39 feet below.

The stone surface dressing is advancing at a rate to keep it even with the earth fill and indications are that it will prove to be a very desirable finish for the dam. The stone is a by-product of the hydraulic fill operations.

Some minor repairs have been made on roads 9 and 10, and arrangements are nearing completion for resuming work to finish Road 9.

Barton M. Jones, Division Engineer.

August 20, 1920.

TAYLORSVILLE

The total quantity of concrete placed during July was 8,087 cubic yards. This is our best record for one month. The yardage for August will not be much above 6,000 cubic yards, as we are finishing on the upper end where the walls are not so thick.

The east wall, the center wall and the floor are finished. The west wall will be finished in two weeks, and by the middle of September the piers under the spillway should be up to the height at which they will be left until the earth dam is completed. This will finish the concrete in the outlet works except the spillway wier, which cannot be placed until the fall of 1921.

The sluicing is making fair progress. The Lidgerwood dragline has been started on the excavation of the inlet channel during both shifts, and casting up the material to where it is sluiced to the dredge pump. The dredge pump handles all this material during the day shift. Also an extra 3-inch nozzle under about 175 pounds pressure has been started, which will add about 1,000 to 1,200 cubic yards to the daily output of the dredge pump.

The grading on Road 12 has been finished from the east end of the dam to the top of the bluff near Station 26.

O. N. Floyd, Division Engineer.

August 23, 1920.

HUFFMAN

The rolled clay blanket has been completed under the upstream half of the dam, and material is now being pumped onto both slopes of the dam embankment, in the section left open during the past season for the flow of the river. 37,000 cubic yards of material were placed in the dam during the month of July. The entire time of the day shift and a part of the night shift have been occupied in getting out ballast gravel for the railroad work.

The small steam dragline is back on the main dam building slope levees. The downstream levee has been built up to elevation 806, from the end dam to the Erie Railroad. The dragline is now crossing to the upstream side and will build the levee on this side up to the same elevation.

The sluicing of material from the hillside at the north end of the dam has been continued very successfully during the past month.

C. C. Chambers, Division Engineer.

August 15, 1920.

DAYTON

Dragline D-16 was moved under the Third Street bridge August 2 and is now excavating between Third Street and Fifth Street, this material being carried to the gravel plant on scows. Dragline D-19, after finishing a channel for the passage of D-16 under the Third Street bridge, has returned to the 20-inch water main above Dayton View bridge and is lowering the last section of that pipe. Dragline D-15 is continuing channel excavation below Washington Street.

South Robert Boulevard river wall is complete, except for backfilling and cleaning the site. Bank Street crest wall has been completed. Good progress is being made with Stillwater Drive wall, where the mixing plant is nearly ready for operation and Finke Engineering Company has nearly completed the preliminary excavation. Some concrete has already been placed. Work on Sunset Avenue retaining wall, extending northerly from Third Street bridge, has been started.

Price Brothers have discontinued revetment work in Dayton for a short time.

To date 33,400 cubic yards have been issued from the gravel plant.

Up to August 1, channel excavation amounted to 919,500 cubic yards. The pay quantity in spoil banks and levees amounted to 588,000 cubic yards. Levee embankment amounted to 75,900 cubic yards, including 60,000 cubic yards on Contract No. 41. The total yardage handled in accomplishing this work was 1,522,000 cubic

yards. None of the foregoing figures includes excess excavation for the launching basins and scowing canals, which amounts to 95,000 cubic yards.

C. A. Bock, Division Engineer.

August 23, 1920.

HAMILTON

The electric dragline D-16-18 is loading cars on the west side of the river about midway between the Main Street bridge and the railroad bridge.

Dragline D-16-17 is proceeding with the excavation for Pier No. 4 of the Black Street bridge. Concreting of pier 3 has been completed to about low water level in the river. The cable-way towers have been erected and it is expected that the cable-way will be in operation within a few days. This cable-way is for the purpose of handling materials during the erection of the bridge. The mixing plant is being placed on the east abutment.

Dragline D-16-20 has completed the sewer work on the west side and is now grading for the next track to carry the trains for serving the electric dragline.

Price Bros. have laid 10,000 blocks in the flexible revetment, and 75 slabs of the slope revetment.

Another dragline is being installed for the completion of the Old River channel west of the B. & O. R. R.

Excavation and concreting are being continued on the Black-Clawson wall.

C. H. Eiffert, Division Engineer.

August 20, 1920.

TROY

The cut-off channel has been practically completed by Clapp, Norstrom & Riley, the opening into the old river bed having been made on August 7. All but two hundred and fifty feet of the right side of the main river channel below the B. & O. Railroad bridge has been dug to the required grade, and the levee along the right side is complete except for three hundred feet. Their total pay excavation, made up of Items 6 and 9, amounts to 104,000 cubic yards. The total levee embankment, on this section of the work amounts to 43,000 cubic yards. In making this embankment, about 2,500 cubic yards of material had to be handled twice.

The C. & C. Haulage Co. has excavated from the river channel and placed in embankment 14,000 cubic yards of material, between Market and Adams Streets. This material is practically all "top soil," being taken from a shallow cut, averaging four feet, along the overflow part of the improved channel. Their second shovel and three more Sterling trucks arrived, and were at work on August 3.

The contract for building the levees on the north and south sides of Morgan Ditch, at the north end of Troy, has been let to The Finke Engineering Co. of Dayton. Their equipment, consisting of a Thew steam shovel with a three-fourths yard dipper, and seven teams, has been at work since the last week in July. The total yardage placed in the south levee amounts to 4,000 cubic yards. The levee on the south side of the ditch, is the west end of the levee, extending all through town, on the right side of the river, and will average sixteen feet in height. The levee on the north side will be raised to the height of the present M. & E. Canal embankment, and will protect the farms from flood water up to the protection given now by the canal embankment. The height of this levee will be about ten feet above the natural field level.

R. F. Griffin, Assistant Engineer.

August 15, 1920.

LOWER RIVER WORK

Miamisburg—The work on the west side of the river in Miamisburg is rapidly nearing completion. In ten days' time the material should all be in place. At present the Sycamore Street crossing of the B. & O. R. R. is closed while the work of grading and gravelling the roads which extend over the levee to the north and west of this crossing is being completed. These roads will be opened within a few days.

Franklin—During the past month Jeffrey, Boorhem & Co. have completed the Lake Ave. approach to the levee and opened it to traffic, and have placed about 7,000 cubic yards of material in the levee between Lake Avenue and Park Avenue. They are using a narrow gauge train outfit,

consisting of one locomotive and from 7 to 9 four-yard dump cars, the cars being loaded by the dragline machine. The average haul for this section is about 900 feet.

Middletown—The material for the levee between Fifth and Sixth Streets is now all in place and the 300 foot gap at Eighth Street has been filled. The work of dressing this levee is progressing rapidly. This completes the southern section of the Middletown levee. Construction of monolithic concrete and flexible concrete block revetment to extend 900 feet southerly from a point 500 feet south of Fifth Street will be carried on as rapidly as possible. Price Bros. Company have the contract for this work and have commenced driving piles for the footing and anchor walls. Cole Bros. are preparing to haul gravel from the river bottom below Sixth Street with the train outfit, to construct a berm along the river toe of the levee on which the flexible block revetment will be laid.

F. G. Blackwell, Assistant Engineer.

August 20, 1920.

RAILWAY RELOCATION

Big Four & Erie—The Big Four ballasting will be completed so that traffic can be diverted upon the new line September 3. A temporary diversion of traffic over the passing track was made at the west end where the new line joins the old line. This is just west of Findlay Street for about 4,000 feet. All the ballast has been delivered on the Erie Railway and this line will be put in operation about the last week in September.

The signal system is all installed at Tates Point and Fairfield, except connecting up the circuits, and this is also nearly completed. The District forces, with Mr. Kramer, Assistant Division Engineer, in charge, have assisted in signal work, ditching, etc.

Ohio Electric Railway—The ballast on the Ohio Electric, west of Fairfield has all been distributed, and as soon as the Walsh Construction Company complete the Big Four and Erie they will dress and finish this line. The District forces have the pole line 70 per cent complete.

Baltimore & Ohio Railroad—The tearing up of the rail in the old line is in progress. The track material has been sold to the B. & O. Railroad.

Albert Larsen, Division Engineer.

August 20, 1920.

RIVER AND WEATHER CONDITIONS

The rainfall in the Miami Valley during the month of July varied from 3.14 inches at the Taylorsville Dam to 5.35 inches at Ingomar, on Twin Creek. At Dayton it was 3.76 inches, 0.48 inches more than normal, reducing the accumulated deficiency since January 1 to 2.43 inches.

A rise of about 8 feet occurred in the Stillwater River during the first part of the month, due to the precipitation of from one and a half to two inches which fell on July 2. Freshets of less importance also occurred in some of the other streams of the valley due to this storm. During the rest of the month the stages were comparatively low.

Observations taken at the local office of the U. S. Weather Bureau show that the mean temperature for the month was 72.2 degrees, or 3.8 degrees less than normal; that there were 17 clear days, 7 partly cloudy days, 7 cloudy days, and 10 days on which the rainfall amounted to or exceeded 0.01 of an inch; that the average wind velocity was 8.4 miles per hour; and that the maximum wind velocity for five minutes was 33 miles per hour from the northeast on the 30th.

Ivan E. Houk, District Forecaster.

August 31, 1920.

Hydraulic Equipment and Operation at the Lockington Dam

Engineering Details Showing the Layout and the Improvements Instituted During the Present Season.

Study and observation on the methods used last season in sluicing material for the Lockington dam embankment, led at the beginning of the present season to several modifications which have been of marked value in increasing the efficiency of the operations.

The present layout at Lockington is shown in plan in Fig. 191. The water consumed in the various operations is obtained from the Miami and Erie Canal, which runs conveniently a few hundred feet east of the east end of the dam. The quantity required is about 20 cubic feet per second during two ten-hour shifts. As the city of Piqua, a few miles below the dam, depends on this canal for its water supply, it was necessary, in order to insure a sufficiency for Conservancy needs, to make extensive repairs to the Sidney feeder, which brings water to the canal from the Miami River at Port Jefferson, and also to the State dam at the latter place. These repairs were accepted by the State as payment for the water to be used. In order to make certain that Piqua should never run short of a full supply, the quantity of water available from these improvements was made considerably greater than the Conservancy requirements.

Of the 20 second feet taken from the canal, one half is pumped through the monitors to tear down the pit face. The other half is led over the top of the pit face, wherever the monitor is working, to increase the flow in the sluice ditches. The total flow is picked up by the dredge pumps at the sump, and sent to the core pool on the top of the dam embankment, whence it overflows through vertical shafts in the back of the outlet walls of the dam structure, into the new channel of Loramie Creek, now flowing between these walls. Two subsidiary

circulating systems take water from the dredge pump sump, and return it again after using it for sluicing operations in the borrow pit, as explained later. The entire water system is thus comprised in four parts.

To steady the source of supply, the water is led from the canal, through a pipe culvert controlled by gates, to a small natural reservoir, or forebay, just south of the east end of the dam. The main ditch of the gravity supply takes from this forebay through gates, and is led along the valley slope in a course roughly parallel to the upper edge of the borrow pit and connecting with it by laterals which enable water to be dropped over the bank wherever a monitor may be working. This main ditch has a capacity of about 25 cubic feet per second, made necessary by the fact that besides the flow from the reservoir, it must also carry the discharge from one of the circulating pumps.

The monitor pump house is located at the west end of the forebay, and is equipped with three Allis Chalmers centrifugal pumps, direct-connected to 3-phase, 60 cycle induction motors, taking current from the Dayton Power and Light Co.'s 30,000 volt transmission line, which was extended from Piqua for Conservancy use. All pumps on the work are driven by induction motors from this line.

Two of the monitor pumps are 8-inch centrifugal pumps, driven by 100 horse power motors, and so arranged that they can be connected either in series or in parallel. Each has a capacity of 2,500 gallons per minute against 125 feet head. The third monitor pump is "a booster," a 14-inch pump with a capacity of 5,000 gallons per minute against 115 feet head, or of 2,500 gallons per minute against a 230 foot head. With the two 8-inch pumps working in parallel a

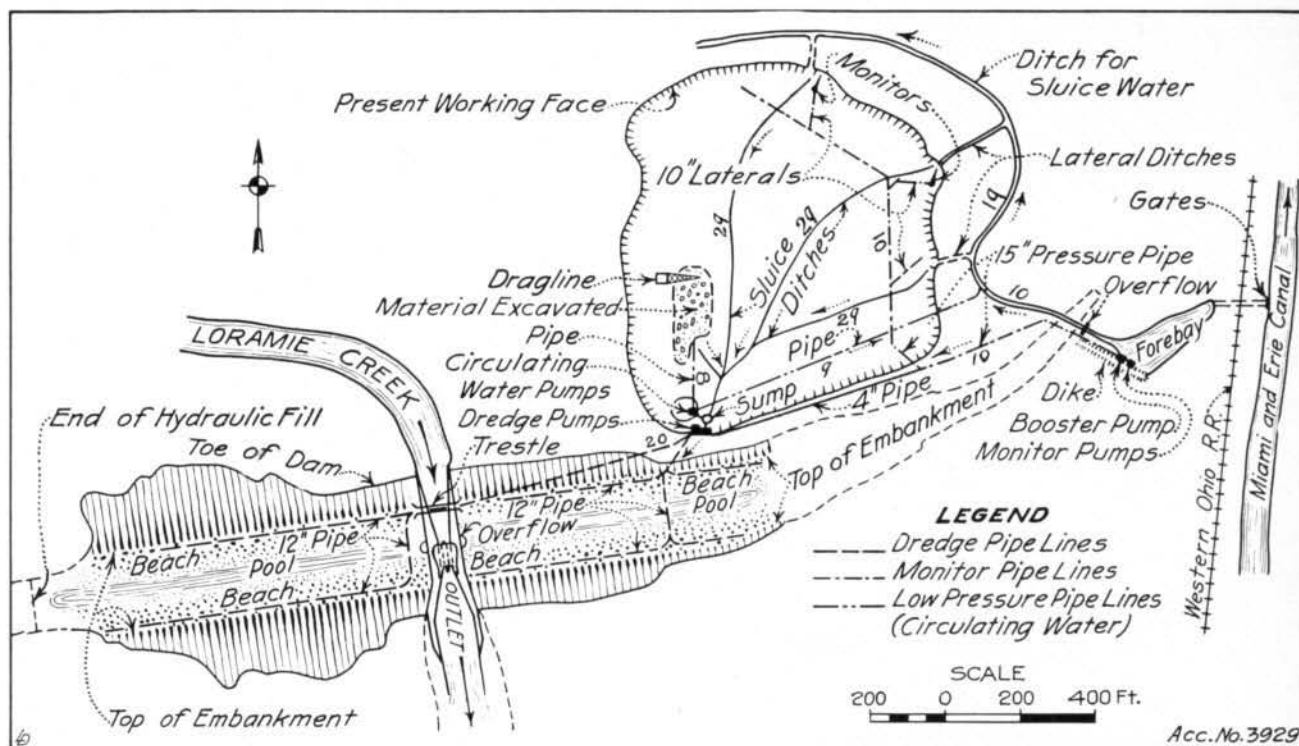


FIG. 191—BORROW PIT AND PUMPING LAYOUT AT LOCKINGTON DAM

The water used comes from the Miami and Erie Canal at the right, the flow in which was enlarged for the purpose. The water flows from the canal to the forebay or reservoir, at which the monitor pumps are located which supply the high pressure water for tearing down the face of the borrow pit, the latter being indicated by the hatched line. The "ditch for sluice water," running parallel to the pit face, draws an additional supply from the forebay by gravity, and pours it over the pit face wherever a monitor is working, to help swell the flow in the sluice ditches leading down the borrow pit from the pit face to the dredge pumps, these sluice ditches carrying the materials excavated by the monitor jet. The dredge pumps take the water and earth material from the sump and drive it through the dredge pipes to the core pool on top of the dam embankment. The overflow from the core pool drains through vertical conduits in the backs of the outlet structure walls of the dam, to the channel of Loramie Creek, now flowing between these walls.

pressure of from 40 to 70 pounds per square inch is obtained at the monitor, depending on whether a 5-inch or a 4-inch nozzle is used. The 5-inch nozzle is used to excavate the pit face where the material is softest. (A loamy gravel). On such material the large jet at low pressure is much more efficient than the same amount of water at higher pressure. For hard clay a 2½-inch jet is used at 175 pounds pressure. To obtain this all three pumps are connected in series. For intermediate materials a 3¾-inch jet is used at about 120 pounds pressure. This is obtained by connecting the two smaller pumps in parallel, and the larger pump in series with the combination. This adaptation of different pressures and nozzles for different refractoriness of the pit materials has proved very advantageous.

The main monitor pipe line runs from these pumps into the pit and along the pit floor roughly parallel with the pit face. It is of 15 inch spiral rivetted steel pipe, 12 and 14 gage. Lateral branches, leading from this main to the monitors, are of 10-inch flanged wrought iron pipe in about 20-foot lengths.* Since two or three monitor settings are often used in a single day, requiring an almost continual shifting or extending of these branches, gate

*It has been found that longer lengths (of about 30 feet), of light weight pipe would have been more desirable for these branches, on account of the large amount of shifting above noted.

valves are placed at strategic points to enable these shifts to be made at any time. The total length of the monitor supply line varies from about 800 to about 2,000 feet.

The booster pump on the monitor line, described above, was set at work early in June of the present year, as one of the improvements which last season's experience suggested. A second improvement was in taking a large flow of idle ground water, which ran out of the gravel in the west part of the borrow pit into the dredge pump sump, and setting it at work bringing down material. This ground water diluted the loaded flow from the sluice ditches by about six second feet, requiring thus nearly two-thirds of the capacity of one dredge pump just to get rid of it. The idea suggested itself to set up a third pump in the dredge pump house, which should take this idle ground water, and pump it into the gravity ditch above the borrow pit face, thus compelling it, as it came back down the sluice ditch, to bring down a load of material to the sump, and save the dilution and the waste in pumping. This idea was carried out, the added pump being run at a capacity of about nine second feet, this quantity thus circulating continually, being pumped "empty" from the sump to the gravity ditch, and returning loaded, like a conveyor belt or a train of dump cars. In order that this water might be as free from suspended material as possible, the suction of the circulation pump was led to an auxiliary sump, located

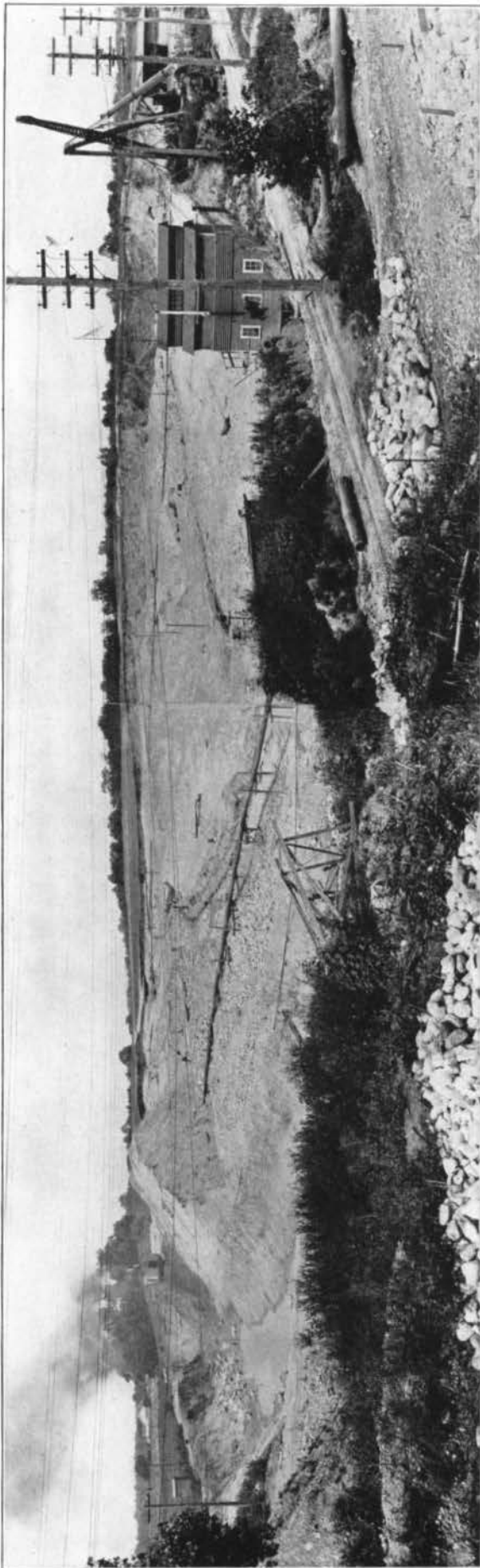


FIG. 192—THE BORROW PIT AT LOCKINGTON. AUGUST 23, 1920. SEE PAGE 20

near the main sump in a location to intercept most of the ground water flow out of the gravel belt, and connecting with the upper level of the main sump by a pipe culvert, the object of the latter being to steady the sump water level. This circulating water evidently makes no difference with the quantity of water in the sump, since whatever is taken out by the pump is immediately returned by the sluice ditch. Neither does it make any difference in the quantity passing through the dredge pumps. Its operation is simply to compel all the water passing through those pumps to take a load of material with it.

The effect of the increase in the sluice ditch flow, thus produced, in flattening the borrow pit slopes, has been noted in the preceding article. This flattening has averaged about $1\frac{1}{2}$ per cent, and has increased the quantity of available material in the borrow pit, over the present area, between 200,000 and 300,000 cubic yards. Besides doing this service, the increased flow in the sluice ditches also decreases the labor necessary to keep these ditches clear.

It was noted in the preceding article that a dragline excavator digs in the gravel bank in the west part of the pit, below the regular pit floor grade, and throws up a bank of loose sand and gravel to a higher level, to be carried to the dredge pump sump by sluice water. This dragline is a Class B Lidgerwood machine with a 75 foot boom and a $1\frac{1}{2}$ yard bucket. The sluice water is supplied by a second circulating system, like the one already described, the quantity being about 8 second feet. It is drawn from the same auxiliary sump that is used for the first system, by a centrifugal pump working at 13 pounds pressure, and is driven through a 15-inch pipe to the point of operation. A short length of channel pipe receives the stream of water as it debouches at the base of the bank, and is shifted by hand to accomplish the washing down of the loose material to the best advantage. By this second circulating system an additional 800 cubic yards of material is fed to the dredge pumps during the day shift, the pump being idle during the night. The dragline excavator, to dig this quantity, has to work during both day and night shifts.

It will be noted that with both dredge pumps running the flow in the sluice ditch is 29 second feet, of which 10 comes from the monitor, 10 from the gravity ditch, and 9 from the circulation system. When the sluice ditch receives also the flow from the second circulation system—that supplied to bring down the loose gravel bank—the flow is increased thereby to 37 second feet, the maximum ditch flow at Lockington. In either case, however, the flow through the dredge pumps is the same—20 second feet, the change being only in the load of material pumped.

It is worth noting also that the water supplied to the gravity ditch by the reservoir, and that supplied to the monitor, is in each case about 10 second feet in amount, and that this is also about the capacity of each dredge pump. This equality in capacity has advantages in operation. Thus if it is necessary to shut down one dredge pump for any reason, it is necessary also to decrease the flow coming down the sluice ditch by the same amount, or the sump will flood. This is conveniently accomplished by

shutting the gate leading to the monitor. But this stops the excavation of material, leaving 19 second feet of idle water coming down the sluice ditch. Therefore if the shutdown is prolonged, the gravity supply is decreased, and the monitor again started excavating, the regular operation being then in effect, but with one instead of two dredge pumps working.

The effect of the improvements in the Lockington borrow pit made at the beginning of the present season, may be judged by a comparison of figures taken from the record this year and last. In the best month of operation last year, 56,000 cubic yards of material were deposited in the dam. The last two working months of this year have averaged 78,000 cubic yards.

The location of the dredge pump house and sump at Lockington was determined by several considerations. One was that of safety, the pumps being placed at the lowest elevation which would leave them free from probable damage by floods. To get the pit floor—practically on a level with the sump water—as far below this as possible, so as to secure maximum pit depth, the pump suction was lengthened so that the lift varies from 12 to 15 feet, according to conditions.* With the elevation of the pit bottom at the sump thus determined, the pump

*It was feared that the long pump suction would give trouble by air leakages, necessitating frequent priming, and also by reducing the pump capacity, but by care both of these difficulties have been avoided.

house was located as far down the valley slope as possible, to get it as near as might be to the center of the dam embankment (to save pumping through long pipe lines), while at the same time it was sunk deep enough in the ground to create a sufficiently high pit face for efficient monitor excavation. This was, of course, done at the beginning of last season, before any pumping was done, the excavation for the pumps and sump being done by a derrick rigged as a dragline excavator, the same machine being used later to handle machinery and repair parts in and out of the excavation. (See Fig. 188.)

The working force at Lockington is small compared with the material moved. The average is about 19 men on each shift. Four of these are mechanics, engaged in shifting the monitor line, this force being irregular, and the figure given being an average. Four men are engaged in attending the dredge pipe line on the dam, two being at the west pool and two at the east. There are seven men attending the sluice ditches and clearing the grizzly at the dredge pump sump. Besides these, there is a monitor man, a dredge pump runner, a monitor pump runner and a foreman. About 5 teams are also employed during the day shift in removing stone from the borrow pit and in building the beach levees on the dam embankment.

The work at Lockington is in charge of B. M. Jones, Division Engineer, C. H. Shea, Assistant Division Engineer, and G. E. Warburton, Superintendent.

The largest stone weighs $376\frac{1}{2}$ pounds, the next largest, 275 pounds, and the smallest, 205 pounds. The sluice ditches are seen in action in Figs. 186 and 187. Stones of this size, of course, are not rolled over and over continuously down the ditch, but are moved little by little as the water undermines the stone and gets it off balance. Such "oversize" stones are too large to go through the dredge pumps, and are removed from the ditch and loaded into wagons to be carted to the dam embankment, where they are used to dress the dam slopes. (See Fig. 180 in the last Bulletin). The man in the picture is L. J. McWilliams, the Lockington field clerk.

The "oversize" stones that come down the sluice ditches are caught on a rectangular iron grating with an opening 6 or 7 inches square, the retained stones being removed by two or three men stationed at the grating for that purpose.



FIG. 193—LARGE STONES WHICH HAVE COME DOWN THE LOCKINGTON SLUICE DITCHES. TAKEN AUGUST 23, 1920

Description of Figure 184

The monitor is in the midst of the group of men, its barrel directed slantwise downward by the man at the left, to undermine the base of the pit bank, which comes tumbling down from time to time in great masses, which are then knocked to pieces by the jet and washed by the spent water into the sluice ditch in the foreground, the sluice ditch carrying the excavated materials to the dredge pumps. To swell the flow in the sluice ditch, the water seen cascading down the break in the pit face, behind the monitor, is brought by a ditch which is on top of the bank beyond the pit face. The pipe line at the

left of the men is the monitor line, bringing water at 175 pounds pressure (in this case), to feed the jet which here is $2\frac{1}{2}$ inches in diameter.

Description of Figure 190

This levee is on the right bank of the Miami, just below Third Street bridge. The river face of the old levee is lined with a concrete revetment, and the additional height necessary to bring the river bank up to the full requirements of flood protection is best obtained in this case by means of a concrete crest wall two to three feet high, with foundations carried two feet down into the earth of the levee.

CONSERVANCY CORN FARMS FOR SALE

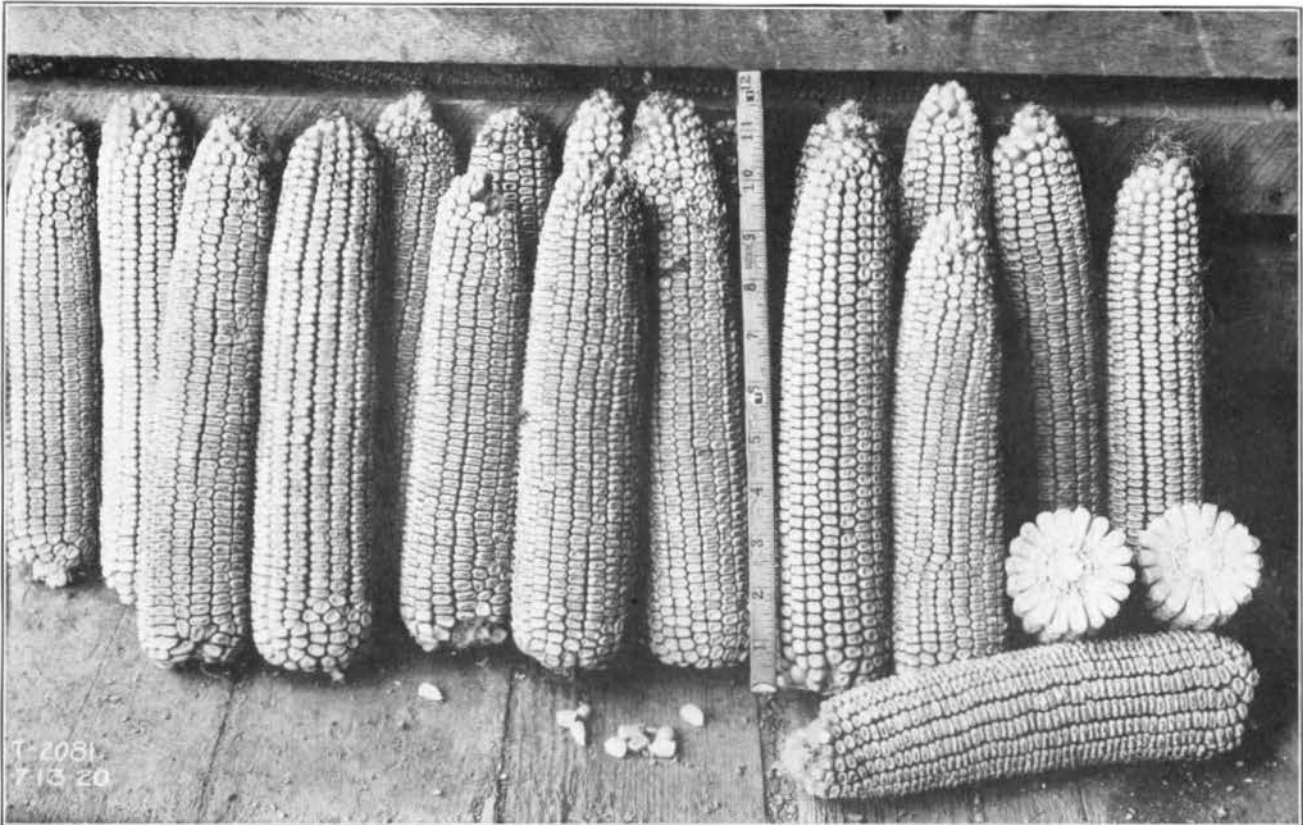


FIG. 194—MIAMI CONSERVANCY DISTRICT CORN GROWN IN THE TAYLORSVILLE BASIN LAST SEASON

The foot rule shows the size of the ears. Taken July 13, 1920

Corn is king! It is to corn that America owes her position as the foremost meat producing nation. Land which will regularly yield a sure crop of this cereal is getting relatively scarcer year by year. Conservancy land as a corn producer cannot be beaten. The fine ears shown above were grown on a Conservancy farm, with enough more to total 1,100 bushels—all on a 13-acre corn field.

Address Office "F"—Miami Conservancy District, Dayton, Ohio

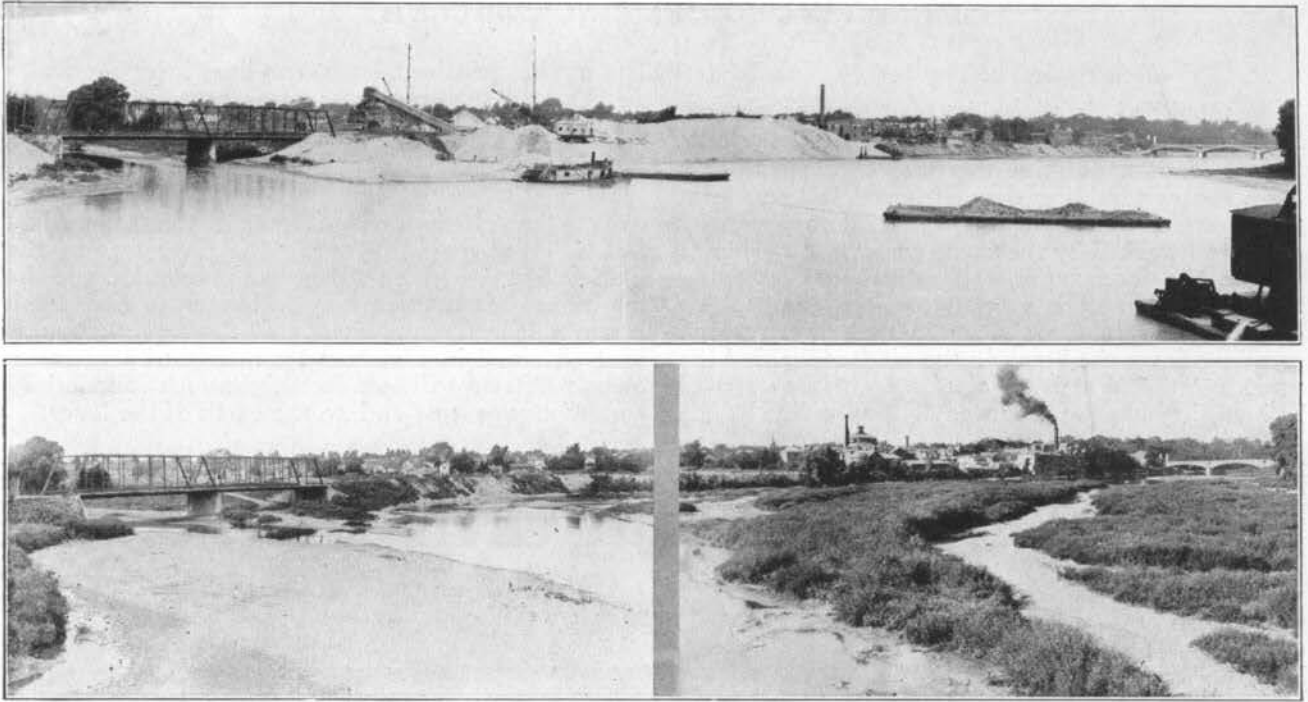


FIG. 195—EFFECT OF CONSERVANCY WORK ON THE MIAMI RIVER

The lower pair of views show the condition of the river, as seen looking upstream from Third Street bridge, September 14, 1917, the two views nearly but not quite matching, as they are taken from slightly different positions. The upper view covers the same ground, in one picture, taken July 24, 1920. The improved river channel, in the upper view, has been practically excavated to grade, and only needs finishing in a few places, which work will be done at a later date. The excavation was done by a Class 175 Bucyrus dragline excavator with 135-foot boom and $3\frac{1}{2}$ -yard bucket, mounted part of the time on a scow (the machine on its scow being shown in Fig. 196), and part of the time on trucks. This machine will soon move under Third street bridge for work on the river below. The increase in channel capacity appears plainly in the contrast between the conditions before and after the work. At the left in the upper picture the gravel washing and screening plant appears, with piles of the accumulated material, which is obtained in excellent quality from the regular river excavation. This gravel will be used later in concrete walls, revetments, etc., in connection with the levee improvement. Some of it is sold at market rates, and thus affords the District an income.



FIG. 196—EXCAVATING UNDER THE THIRD STREET BRIDGE. JULY 23, 1920

The bucket of a dragline excavator ordinarily must be dropped nearly vertically to the river bottom to get its load. Under the bridge this is impossible. Hence the scheme shown, which is to put two draglines at work, one each side of the bridge, playing a game of "see-saw" with two buckets. The two drags, (the boom of the further, projecting above the bridge, is the only part seen of the second,) are placed facing each other. The heels of the two buckets are attached to each other by means of chains or steel cable. The buckets are then hauled back and forth beneath the bridge, by the two loading cables, "clawing" the earth on the bottom out from under the structure and dropping it in the clear where it can be picked up afterwards in the regular manner. The boom of the near dragline is lowered so that it can project under the bridge to facilitate the operation.

THE MIAMI CONSERVANCY BULLETIN SUPPLEMENT

"The News Letter"

To Promote the Conservancy Spirit on the Work

September 1920

OF GENERAL INTEREST

Death of "Nicky" Westol

It is with deep regret that the Bulletin records the accidental death of "Nicky" Westol, which occurred at the Germantown dam on August 19. The accident happened just after supper, as the night shift was about to begin work. The regular operator of the monitor pumps was absent, and the monitor man went to the pump house to start the pump for the night run. Young Westol stood near the monitor, and when the water came the regular operator called to him to run to the nozzle and handle it till he could come. Westol did so, but being unfamiliar with it, and probably a little nervous, he swung the directing lever in the wrong direction—toward himself. The barrel of the monitor followed, knocking him down. He fell where the powerful water jet, under about 130 pounds pressure, and directed slantwise downward by the still revolving barrel of the monitor, struck him apparently with all its terrible force, driving him bodily, head first, against the big iron control valve of the pipe line. The impact crushed the right side of his head, dislocated his neck, and broke his left arm. The monitor meantime swung on till the counterweight struck the pipe line and stopped. The water was shut off and Dr. Travis of Germantown summoned. He arrived seven minutes after the accident, and at once took the injured man to his office in Germantown. It was impossible to save him, however, and he died in the doctor's office about half an hour after he had been hurt.

Westol was a young man of Italian blood, born in Denver, Colorado, in 1902. He had worked for the Conservancy at the Germantown dam for about two years, and was on the drilling crew in the hillside borrow pit at the time of his death. His home was in Paw Paw, Michigan, where he has a mother and two sisters living. A brother also worked at Germantown. The body was sent home to Paw Paw for burial, accompanied by the brother and by Mr. August Oddi, of Germantown Camp, who went as the representative of the Conservancy District. The affair is a very sad one, and the fellow workers of the dead man unite in extending to his family their deepest sympathy.

News From G. H. Matthes

A letter to the editor from Mr. Matthes, some days after his arrival on the scene of his new job, was very welcome, and full of interesting matter. He finds the Tennessee a bigger job than he had thought. It is "some stream," discharging into the Ohio a volume of flow equal to the latter stream, although it drains but one-fifth the area. This, of course, means rainfall. Our friend has already seen 5.15 inches in two days, and people took it as a matter of course. Mr. Matthes' address is U. S. Engineer Office, 605 Temple Court, Chattanooga, Tenn. We call special attention to it inasmuch as we announced last month that the new address was in Nashville.

Put Stop Chains on Them

The big hydraulic monitor in the Taylorsville borrow pit broke loose the other day in the style characteristic of these dangerous machines when the water is turned on, and they take the bits in their teeth with the operating lever jammed. It laid down a rotating barrage of liquid 150 millimeter shells all round the borrow pit, giving the dredge pump house a terrific side swipe at every rotation. At each swipe the pump house boarding ripped and flew, till the structure was laid flat. Finally the machine cut off its own power,—by stopping the monitor pump, as we hear the story, probably by short circuiting and blowing the motor fuse,—and the exhibition came to an end. Fortunately, nobody was hurt, and the financial loss nominal. Isn't it time something were done to stop these highly dangerous performances? They have occurred several

times. A very simple device will stop any possibility—barring human negligence—of such risks being repeated.

Ben Petty in Pittsburg

That makes a good heading, so we use it. However, he was only in the smoky burg a matter of three hours, so there is still hope. We received the news by way of a picture postcard, on which a faint fragrance of soot still lingered,—attar of roses in that steel city. We were very glad to read that our old friend had survived the ordeal. He gives his regular address as Jonesboro, Indiana, which sounds better, suggesting peace, blue skies and clean air. Congratulations on Jonesboro. We were brought up ourselves on the edge of a country town, and we thank Providence for it with increasing fervor year by year. Our best wishes to the Petties, and Jonesboro.

DAYTON

Departure of Professor Woodward

The senior editor records with unusual regret the departure of Professor S. M. Woodward for Iowa City, to resume his regular work in the University. This marks, as we understand it, the final severing of Professor Woodward's connection with the Conservancy District. He came first in 1914, at an early stage in the preliminary study of the project, on the invitation of Chief Engineer Morgan. His connection with these studies was fundamental and vital, and we believe it no more than fair to say that to him, perhaps more than to any other single man, the soundness of the foundations of the Conservancy work is due. Personally, the editor feels under very unusual obligations to Professor Woodward, for help extended on many occasions. We wish him and his family Godspeed on their journey.

WOMEN'S CLUB

Truth and Poetry

We give it that name because it is true, and also it is poetry,—prose poetry, which is sometimes more poetic than rhyme. It concerns a little two-year-old girl at one of our camps, who likes to be told stories, and who also has been fascinated by the lovely fireflies that glimmer through the air over the green lawn in the door yard. One evening her mother suggested, when story time came, that it was now the little one's turn—couldn't she this time tell a story to mother. It was growing dusk, and the little one went to the front door, which stood open, and looked out at a rose bush, where late roses were still blooming. And she began—

I went to the door, (she said,) and it was getting dark; and I looked out, I saw a little rose bud; and it was getting dark; and I said to the little rose bud—

"Little rose bud, are you out there all alone in the dark?"

And the rose bud said;

"Yes, little girl, I'm out here all alone in the dark."

And I said to the little rose bud;

"Wait a minute, little rose bud, and I'll bring you a little fire fly, and then you won't be out there all alone in the dark."

That was the end of the story. Truth and poetry, we said. Is it not so?

We spoke of the fascination which the fireflies have for this little girl. She could in fact have carried out her promise to the little rose bud. She catches the fireflies. Perhaps she thinks they are flying flowers. She will come to her father sometimes with her small hand quite full of them, carefully imprisoned. She came running to him one day weeping.

"I—I caught a little firefly," she said; "and he turned up his little tail—so!—and he stuck me with it!"

THE MIAMI CONSERVANCY BULLETIN

Personal

Mary Nealon Wilhelm will spend next week making "home-made pickles" and canning tomatoes and plums. We intend to call on her—after the good stuff is canned.

Ruby Williamson has left the District on account of her health. We all wish that her good health will soon be restored.

Miss Plance, Miss Van Horne and Miss Dubbs have all returned from their vacations.

We wonder what our "good man" Foust was doing all those days of vacation in Kentucky? It is reported that he goes about since his return humming the good old tune—"Oh, the moonshine 's bright in the old Kentucky home."

Miss Mary Cullen, our Librarian, returned not long since from a ten days' vacation in Canada, most of it spent in Sarnia, across the river from Detroit.

We note also that Miss Naomi Doudna, of the Dayton Channel Division, and Miss Jean Bruleport, of the Farm Division, have returned from their vacations. Miss Carrol, of the Accounting, is just starting away as we go to press, to enjoy hers.

Mrs. Mary Wilhelm, once Miss Mary Nealon, of the Purchasing Division, has come to the rescue of her old department recently, and is holding down her desk for a few days. The people in that Division appreciate the accommodation.

Shop, Warehouse, and Garage

We are glad to see our old friend, Chris Emrich, in the Garage again. Chris has been absent about a year.

Clem Tobias received a broken arm in the first round with a "Henry" last week. The last report of Clem, he was carrying his own board with him. Better luck next time, old top!

Has anyone seen "Kelly"? The last report of him was that he was entertaining a case of "Diphtheria." Cheer up, old boy, if it had been the Mumps, you would have had a real swell time.

Mr. Tressler of the Garage was given a surprise recently. Near Wilbur Wright Field, U. S. agents were on a "still" hunt in the neighborhood for peddlers of "snake oil", so when Harry came riding by, he was stopped and searched for the rare article. All they found was a little castor oil—for the motor, of course!

Stephen Maloney, the new Fld. Clerk at the Shop, is coming along fine with this new work. Mr. Maloney was transferred from the Accounting Division.

Dad Hall, Brown, Peggy Ames and Geo. Swinderman are still discussing the welfare of the Nations, every noon hour. Dad Hall wants us to try out in a Bush League, before going into the Major League stuff. One thing Brown can't get straight is, what Smith won at the primary, Black or White. Peggy said we should have the election in the winter, then we need not fear a shortage in the natural gas.

Henry Wangler had a very painful accident at the shop about two weeks ago. While working at a punch press, his forefinger was caught and cut off. He is doing very nicely at present and hopes to be back on the job in the near future.

The Warehouse team is still leading the Saturday Baseball League. Mr. Everhart has promised the boys a trip to Germantown if they capture the pennant, providing, of course, the presidential nominee is at home.

Ralph Stoner is looking for a good second-hand alarm clock. Last week he ran from the bridge to the warehouse to avoid being late. Ralph said he could have made it easily if he had risen a little earlier. We suspect they had another band concert in New Lebanon the night before.

After being off for two weeks with a "bad" eye, caused by a piece of transformer cable flying up and striking that member, Mr. Donley, Electrical Foreman, is again on the job.

If an S and an I and an O and a U,
With an X at the end, spell "Su,"
And an E and a Y and an E spell "I,"
Pray what is a speller to do?
If also an S and an I and a G
With an H-E-D spell "Side,"
The only thing for a speller to do,
Is to com-mit "SIOUX-EYE-SIGHED."

—T. N.

Be Ca'm

Be ca'm—I say, be ca'm.

Whether it be thy fate

To play the peasant or the king in state,

To grace a wedding gown or a sarcophagus;

Yea, though for thee the dotard Death doth wait,

With hangman's hemp to comfort thine oesophagus—

Be ca'm.

I say—Be ca'm.

Oh, emulate the clam!

He recks not—no, not one unholy d—mn!—

Come what come may!

Ah, no; behold him in his pebbled cave,

Far, far below the storm and swinging wave,

Propped on his oozy bed,

Cozy as King Pandion "lapped in lead,"

Quaffing his bitter brewage of sea-brine,

As 'twere some golden tankard of rare wine,—

Divine Tokay;

And wagging slow his weedy, wise old head

As if to say—

Ah, foolish mortal, be thou as I am—

Be ca'm.

HUFFMAN

Increase in Freight Rates Felt at Huffman

A few days ago Mr. Zull bought his wife a new oil stove in Dayton. As it was only a small one, he thought he could carry it under his arm on the platform of the Ohio Electric. But when the conductor wanted to charge 77 cents freight on it Mr. Zull found a friend with an auto who was coming here, who hauled it gratis. Now Mr. Zull's slogan is "Ship by Truck."

Wedding Bells

Miss Zella Wills of the Dining Room became the bride of Bluford Atkins of Dayton, Ohio, August 21. The men, to show their regards, made up a collection and bought them a large trunk and a beautiful set of silverware. May they be happy on their journey thru life together.

The Travelers

Mr. Clawson, T. C. Shuler, Dr. Secore, and Mr. Dubois and their families motored to Mr. Tabor Cave and Don Piat's Castle on August fifteenth. They treated themselves to bacon and eggs in real camp style, by a real camp chef. All bring back the report that Mr. Clawson can cook as well as any woman in camp. They also say that if anyone wants a nice Sunday drive it is surely a fine place to go.

Fish, Poultry and Eggs

Once upon a time someone brought to Huffman great tales of the multitudinous and mighty fish to be caught in the waters of the Stillwater. This story was heard and believed by one Mr. Gena, as a small boy believes his mother. He told it in turn to his friend Mr. Wesle of the Dayton office. So after having spent a week's salary for fishing tackle they wended their way to the great waters. After a night and a day of very assiduous angling, they returned with their long dream of game—three small fishes.

Having so much more than was necessary for their own families, they disposed of a large quantity to one Jack Cook, who, having eaten his fill, was aroused with great ambition. These self-same aspirations caused him to improve the looks of his home by mowing the growth of shrubbery around his house. But lo! as he swung his great scythe, big as old Father Time's, he struck a domineck hen which was sitting on a full dozen eggs. Jack says it was purely accidental, but Mrs. Dubois, to whom the hen belonged, says "NO",—and then the fun began.

MORAL: Help preserve our fish by catching no more than you need.

August Visitors

Mrs. Cullen has been visiting her parents in Dayton. The Misses Darnell have returned from Cincinnati where they visited their aunt at Hyde Park.

Mr. and Mrs. Gena entertained Mr. and Mrs. R. S. Howe of Mt. Jewett, Pa. for a few days.

Mrs. J. Cook and Miss Olive Cook made a trip through The N. C. R. August 23, prior to Miss Olive's leaving for her home in Oneonta, N. Y., on the 25th.

THE MIAMI CONSERVANCY BULLETIN

EDITORIAL

Board of Editors

Germantown	Miss Julia Darnell
Englewood	Albert L. Wald, George Rodgers
Lockington	C. H. Shea
Taylorville	Mr. M. H. Sando
Huffman	Mrs. J. F. Gena, W. R. Minton
Hamilton	R. B. McWhorter
The Woman's Club, Dayton, Ohio.....	Miss Mayme McGraw
Shop, Warehouse and Garage.....	Thomas F. Nealon

Editorial Changes

We welcome with this issue three new members into what used to be called the "editorial sanctum." They are Mrs. J. F. Gena and Mr. W. R. Minton, of Huffman Camp, and Mr. Thomas Nealon of the Warehouse. Mrs. Gena and Mr. Minton take the place of Mrs. C. C. Chambers, who has played a "lone hand" for Huffman in the Bulletin game for many months. We are uncommonly sorry to see Mrs. Chambers go. She has made Huffman, we think, one of the most interesting corners of our little enterprise. Every bunch of items from her pen had some characteristic touch to give it point and flavor, often humorous. It was "Huffman stuff." May her successors continue the tradition. The departure of John Hall is noted elsewhere. His place is taken by Mr. Thomas Nealon of the Warehouse, whose first work appears in this issue, and shows that John Hall in suggesting him for the job knew his man. There will be no falling off in the live wire work from that corner.

Our Shop Editor Departs

It is with much regret that we record the departure from the service of the Conservancy of Mr. John T. Hall, Field Clerk at the shop. He went on August 23, to enter the employ of the Chicago and Northwestern Railway as Chief Clerk and Traveling Representative in the Traffic Division. This is familiar work with him, he having held down a similar position with the same railway some years ago, having much to do with the Yellowstone Park tours on that line. He has been with the Conservancy two years and four months, his first place being with Mr. Stockman as Chief Clerk in the Traffic Division. He has been the Shop Editor of the Bulletin for many months, and we shall miss his work, into which he put unusual pep and humor.

Bound Bulletins

We referred in our last issue to the matter of bound volumes of the Bulletin. The work on the Index is now well along and by the next issue we expect to be able to make final announcement regarding this matter. Such an index as is needed, covering two full years, involves considerable labor if it is done right. It is in charge of Miss Frieda Kiefer of Ohio State University, who is helping also in the preparation of the next volume of the Technical Reports.

Mr. and Mrs. Dennis of Frankfort, Ohio, spent a few days recently with their son, Mr. Jerry Dennis.

Mrs. Maynard and sons visited, not long since, in New Point, Indiana.

Mrs. Bailey and daughter Isabelle were in Greensburg, Indiana, with her relatives for a couple of weeks.

Mrs. Schuler is spending some time in Greenville, Ohio, with friends and relatives.

Mrs. Madigan is visiting in Kokomo, Indiana.

Hal Milton, our old storekeeper, and wife, and Mrs. Meeks of Des Moines, Iowa, were in Camp for a day calling on old friends.

Mr. and Mrs. W. H. Gillespie of Piqua, Ohio, spent several days recently with their daughter, Mrs. W. R. Minton.

Roselle Weikert of Christiansburg has been visiting with Paul Saylor, and Garnet Drake of Troy, with Geneva Saylor.

The Misses Darnell received a caller from Germantown, Sunday the twenty-second.

Mr. C. C. Chambers and family are spending a two weeks vacation at Buckeye Lake. By the reports Cap sends home he will be giving dancing lessons next winter to all those who wish to learn.

TAYLORSVILLE

Arrangements have been completed for the opening of school on Tuesday following Labor Day.

Mr. O. N. Floyd has been called to Cleveland because of the sudden illness of Mrs. Floyd.

Mrs. H. L. Freund, with her daughter Henrietta, is spending a few weeks' vacation at Pine Lake, Mich.

Mr. O. C. Wampool, who has succeeded Jens Jensen as baker, has taken up his residence in camp.

Miss Audrey Pease has resigned as stenographer in the Taylorville office, and will enter the Miami Valley Hospital Training School. She will be succeeded by Miss Helen Stibbs.

Samples of the water in camp and from the springs in the outlet works were taken by Dr. Smalley and sent to the State Chemist for analysis. In every case the water was found entirely safe for drinking purposes.

ENGLEWOOD

Superintendent Byers on Vacation

Mr. and Mrs. Byers and daughter are on a real vacation. Leaving Aug. 7, they journeyed to Staunton, Va., which place proudly claims Mr. Byers as a resident and citizen. They spent several days there with the home folks, later going to New York City, where they took in many summer resorts of amusement and recreation. Montreal, Canada, was the next stopping place, which is Mrs. Byers' home town. At Montreal Mr. Byers rode the flyer thru the three and one-half mile Mt. Royal tunnel, which was built under his general superintendence and which holds the world's record for hard rock tunnel driving. During Mr. Byers' absence R. L. Clark is acting as Superintendent and holding the pace set by the former on Englewood Dam.

Various Camp People Leave Us

Mr. and Mrs. Wm. Heller are leaving Englewood. They are planning an extended stay at Mt. Clemens' well known health and pleasure resort. The Hellers shared with Gladys Owens and Ruth Meals at a party given in their honor in Community Hall. Miss Owens is returning to boarding school, while Miss Meals is returning to her home after spending the summer with her sister, Mrs. Knerr.

On the evening of July 10, practically all camp residents gathered in Community Hall for the purpose of bidding farewell and extending best wishes to our friends the Bjorgums and Mulherons, who are leaving in the near future. Mr. Bjorgum, who for a long time held the position of Warehouseman, was recently transferred to the carpenter gang. We all agree in saying that by their kindness and good will to their neighbors the Bjorgums won a warm place in the hearts of all Englewood, and their departure is marked with much regret. Mr. Mulheron has been Chief of Field Party since coming to Englewood. The absence of his sunny and cheerful disposition is sure to have its effect on camp social circles. Our departing friends are going to make their home in western Illinois.

Jonk! Jonk!

An alleged collector of old relics and curios tried to get away with Louie Wollenhaupt's Ford a few days ago. Said machine was discovered later by Dayton Police while it was undergoing a major operation on its pneumatic organs.

The Last Word, A la Mode

Mr. McCurdy showed evidence of having made a hurried departure from home the other morning, wearing one puttee and a puzzled expression.

"Hello! Hello!"

"Hello" says Miss Jordan into the transmitter.

"Hello" says Mr. Pei as he stepped in the door, his face showing how much he appreciated Miss Jordan's prompt greeting.

We almost forgot to mention that Mr. Pei rendered a love song in the Chinese language at a recent Community party; at least Pei says it was a love song, altho some of us still wonder and doubt.

Ned Jordan Leaves

Ned Jordan, timekeeper, has left Englewood for Harrisburg, Pa., where he is now engaged in the auto tire and accessory business. While we all regret to see Ned leave us, we are pleased to hear of his success in his new enterprise. Before leaving he qualified as an unofficial D. C., specializing in homeless Airdales and stray beagle hounds. We shall continue sending Bulletins to you, Ned, together with lots of good wishes and luck.

THE MIAMI CONSERVANCY BULLETIN

Introducing Mr. and Mrs. Thompson

Ben Thompson and wife are now Englewood storekeepers. Before coming here they had the store at Germantown. They are making friends in camp and a hearty welcome is extended to them. C. J. Spaid, former storekeeper, is making his home at Troy, Ohio.

Thanking Fowler Smith

The school girls are still talking about the good time they had camping in Fowler Smith's bungalow on the upper Stillwater. Mrs. Everdell arranged the trip and now all the girls want to take this opportunity to thank Mr. Smith for his kindness.

School Garden Prize Winners

Appreciating the senior editor's favorable comment in last month's Bulletin, we wish to publish a little more school garden news. The gardens were judged by Messrs. Horne, Jones and Wald, the following prizes being awarded:—

First Prize, Clarence Bouladier; second, Chester Patrick; third, Wm. Tully; fourth, Ed. Patrick and Christine Waddell; fifth and sixth, Isabell Williams, Albert Tully, Fred Waddell, and Clarence Mackinnon.

We feel sure that our youthful gardeners will not weigh the value and benefits derived from their efforts by the amount of prize money received, but will realize that the lesson of industry and thrift which their gardens taught them is the real object of school gardens.

Personal

Pete Haskell is still on the lookout for the party who sent him a card bearing a scripture text which Pete is unable to interpret.

The Hellers have as their guests Mr. Heller's parents, who are making a week's end visit with them. They come from Pennsylvania.

HAMILTON

Ass't Div. Engr., R. B. McWhorter, left recently for Courtland, Ala., called there by the sudden death of his mother. We all extend to Mr. McWhorter our sincere sympathy.

Stanley E. Roush, resident electrician, returned from his vacation last Monday morning, and judging from the amount of "pep" he has on tap, the trip must have been an enjoyable one.

The wife of dragline operator, Gordon Cheyne, who has been quite ill, is reported better.

Mrs. Chas. Jent, wife of our carpenter foreman, died suddenly yesterday morning. We all offer sympathy to Mr. Jent.

W. S. Conklin is laid up at his home in Middletown with a number of sties on one of his eyes. (This is the truth; nothing happened.)

Chas. LaLonde, our master mechanic, is somewhat of a genius. The other day I saw him attempt to use our local phone. Finding it out of order, he simply turned around, opened the window, leaned out, and yelled.

Office Eng., J. E. Faist and wife, have returned from a boat trip up the Ohio River to Pittsburgh.

GERMANTOWN

Some Snake

While at work one day an Italian who had been acquainted with the nature of rattlesnakes, was struck at by a little gartersnake. On seeing it strike, he turned and said, "What de hell matter? You no ring a de bell?"

For Watkins and Prohibition

Germantown also has the pleasure of having a presidential candidate in its midst—namely Aaron Watkins of the Prohibition Party, who was notified of his nomination on August 11th. Quite a number of camp people took part in the celebration, notably Supt. Albert Armstrong, who was a member of the Prohibition Finance Committee.

New Foreman

We have a new foreman on our work now who is sure on the job. It is little Alex Deski. He has a big acorn badge and is out on the dam rawhiding his dad all day long standing over him and telling him, "You got to work a little faster!"

Personal

Mr. Joe Oddi and family will move to Michigan, where Joe has purchased a farm.

Henry Fuller has gone back to dear old Georgia, and expects to attend school again this fall.

Bob Pruett has left us to return to Purdue to finish his education.

Fred Albert is going to Georgia to college this year. We wonder if his father will make his usual Monday and Friday trips to Germantown, now that his son has gone and our school starting again soon.

Miss Scott of Urbana, Ohio, is visiting her grand parents, Mr. and Mrs. George W. Kelly.

Joe Augustine was married on the 14th, and moved into Camp on the 30th. Best wishes are extended to the bride and groom.

DAYTON SPILLWAY

New Baby Arrives at the Eastmans

The Bulletin office had a welcome call, on August 19, from our old Conservancy associate, R. F. Eastman. He was in somewhat high feather over the recent arrival in his family of son and heir, Richard Payson Eastman, born on August 5 in Springfield. (We inserted that "somewhat" because this is the second baby.) We congratulated him—not too effusively, on the new arrival, remembering the high cost of bibs, teething rings, etc., in these fearsome days. But he is a bold man and an ex-soldier, who can smile even in the midst of the "salaried proletariat's" present battle for bread. He is now associated with Hall & Lethly, architects in Springfield, as a member of the firm, so that we really cannot truthfully class him any longer, we suppose, with the salaried proletariat. Anyway, here's prosperity to Eastman, the baby, the family, and the firm.

Lockington

Through some inadvertence the Lockington items fell by the wayside somewhere between that camp and the Bulletin office. The senior editor does his best with the following story, supposed to be "on" the Division Engineer. It seems that when the "movie" of the Lockington job was shot some time ago, Mr. Jones did his modest best, as usual, to keep out of the limelight. However, at one stage—it was in the borrow pit,—something went wrong with the work and he, forgetting himself, jumped in and righted it, getting back out of focus, of course, as rapidly as possible, so fast, in fact, that he supposed he had the film dodged. The next chapter takes us to New York City and into a movie show, where Mr. Jones' little niece happened to be, said little niece suddenly breaking into the film herself with the excited cry—

"Oh, mamma! There's Uncle Barton!"

Thus "Uncle Barton" breaks into the limelight yet again—this time in the "News-Letter."

Mrs. Albert Once More at Home

We are very glad to say that Mrs. George L. Albert, whose convalescence in a Dayton hospital following a serious operation was recorded in the last "News-Letter," is now so well recovered that she is once more at home, the removal occurring on August 28. It is expected that she will soon be in full health again.

Baseball and Politics

The prophetic editor—didn't he pick out the right state to emigrate to? Two fighting teams topping two fighting major baseball leagues, and three mountain peaks in the Presidential Range adorning the "United States of Ohio!" Rah! Rah! Etc.

To Elldee, on a Vacation

Our friend and associate in the Bulletin, "L. L. D.," has gone on a vacation. We don't know where; he didn't when we asked him; was waiting for "inspiration" (and maybe for his pay check). Any way, he's loafing; **real** loafing, not just marking time, but **loafing**, as only a poet and wise man can; casting a quiet hook and line along some still reach of creek or river; or lying with his hat over his eyes, listening to the breeze in the tree tops; or watching the white clouds sail by, while he weaves them, maybe, into rhyme. Loaf on, old top, loaf on! Who said—production?

Following which, and just to show that Elldee has a philosophy larger than mere hoboism, we print the following quotation from his Book of Proverbs:

Be patient. Keep everlastingly at it. Everything worth doing well takes time.

(Which is as true of loafing as of anything else.)

THE MIAMI CONSERVANCY BULLETIN

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FIG. 197—AIRPLANE VIEW OF BIG FOUR AND ERIE R. R. RELOCATION. SEPT. 17, 1920.

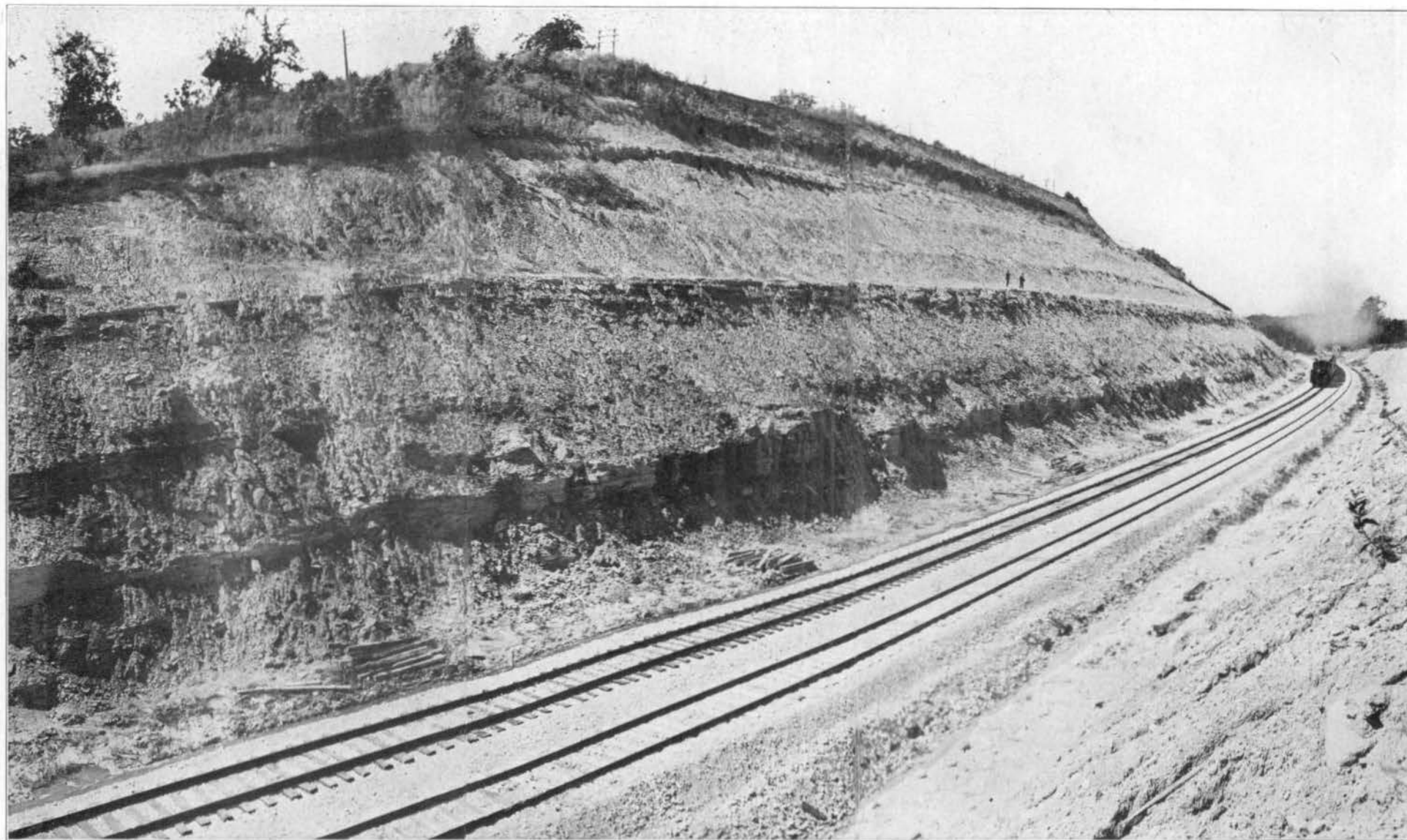


FIG. 198—THE BIG RAILWAY CUT AT HUFFMAN. SEPT. 3, 1920.

This cut is 119.8 feet in maximum height, and 4,500 feet long. It required the excavation of 657,000 cubic yards of material, of which 593,000 cubic yards was rock. The material was taken out by steam shovels and standard gauge 12-yard dump cars, the

work beginning April 15, 1918, and ending September 6, 1919. The rock was drilled and blasted, well drills and Ingersoll steam rock drills being both used. The train was the first, (a passenger over the Big Four,) to go over the new line.

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THE MIAMI CONSERVANCY BULLETIN

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DAYTON, OHIO

Volume 3

October 1920

Number 3

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

G. L. TEEPLE, Assistant Engineer, EDITOR.

New Levy Made to Finish the Conservancy Work

At a special meeting of the Board of Directors on September 28, it was voted to make an additional levy on the benefitted property of the District, estimated to be sufficient to finish the work of carrying out the Conservancy project, the sum levied being \$10,793,000. The combined benefits of the project, as calculated by the board of appraisal, was about \$76,000,000. A 36 percent levy was made on these benefits, preceding the beginning of the work in January of 1918, creating thus a fund of about \$27,000,000, the estimated cost of the project at that time being \$25,000,000. The great rise in the cost of labor and materials since the levy was voted, however, has made this fund insufficient for its purpose, about \$25,000,000 having been expended in the work to date. Hence the necessity of the new levy.

The amount of the estimate, \$10,793,000, constitutes about 14 per cent on the original estimate of benefits (\$76,000,000); and will be levied as a tax pro rata on the benefitted property of the District. It represents an increase on the original levy of a little less than 40 per cent, and will bring the completed cost of the project around \$35,000,000. In view of the general rise in all costs since the original levy was made, it is considered that the increase is entirely reasonable and in line with the original estimates. It is believed also that in view of the advanced stage of the work, the new levy is final. The construction at the Germantown and Lockington dams is nearing completion, and everywhere is progressing according to program.

The additional assessment will not be included in this year's tax duplicate, but will be added at the earliest to that of December, 1920.

Big Four and Erie New Double Track Now Operating

The relocated line of the Erie Railway through the Huffman retarding basin was put in operation on October 4. This is the west bound line of the new double track system now operating between Dayton and Enon, the Big Four being the east bound line and the two being operated as a unit. The tracks are parallel, 14 feet between centers from Dayton to about a mile east of the Huffman dam, and 60 feet between centers beyond that point. The total length of the relocated line is 15.22 miles, and the total cost of construction, including damages to the railways on account of necessarily increased cost of operation on the new lines, cost of maintenance during construction, etc., is \$3,234,094. The new Big Four track (the east bound line), was put in operation September 3. The old Erie line will be temporarily used as a west bound passing track between Dayton and Enon, pending the finishing of the new west bound passing track at the new Fairfield station. The latter will hereafter be known as Osborne.

The town of Osborne will hereafter get passenger service only from the Ohio Electric line, and freight service from occasional freight trains over the old steam lines until the latter are taken up. The Ohio Electric service to Osborne will be abandoned next spring.

Wilbur Wright Aviation Field will have a temporary connection to the new steam lines just this side of the new Osborne. This is now under construction. A special, direct, permanent steam line will connect the two places later, for freight service.

The new Erie passing track at new Osborne will be finished by October 9, and the old Erie track torn up by October 18. The work on the Huffman dam embankment, partly held up by the railway gravel requirements, will then go ahead full speed.

Walls and Outlet Structure of Taylorsville Dam Conduits Completed

The walls and piers of the Taylorsville dam concrete outlet were completed on September 25. The hydraulic jump pool and stilling pool structures at the downstream end of the outlet having been finished some time since, this completes the outlet structure, except for the spillway. In order to leave ample waterway between the walls, thus preventing possible overtopping of the earthen dam embankment during construction to its injury, the spillway will not be built until the embankment is completed. It will require about 4,000 cubic yards of concrete.

The total quantity of concrete in the walls, piers and pool structures, in the present condition of the outlet, is 45,000 cubic yards. The length of the structure is 550 feet and its extreme width is 215 feet and its height, from the bottom of the foundation 82 feet.

The outlet structure at Taylorsville is the largest of all the outlets at the Conservancy dams, providing four openings side by side, each 15 feet in width by 19 feet, 2 inches in height, to take the flood flow of the Miami River, at spillway level equal to 53,600 cubic feet per second. On account of peculiar conditions it was the last to be begun, and is consequently the last to be completed. Its completion therefore marks another distinct forward step in the carrying out of the project.

The Conservancy Farm Lands Proving Attractive

The Farm Division has recently got out an attractive illustrated circular of 20 pages, giving additional information regarding the Conservancy farm lands which are on sale. The interest shown in these lands has been widespread, inquiries being received from localities scattered from Connecticut to California and from Saskatchewan to Tampico, Honduras, and the Panama Canal Zone. Sale is proceeding steadily, and it is expected that the interest during the coming months of fall and winter will increase still more, due to the fact that possession of the sold lands will be given on March 1, 1921. The fact that these lands are highly improved properties, in a particularly prosperous and fully developed region, is making them an attractive investment.

Airplane Pictures of the Railway Relocation

The airplane pictures shown on our front cover, and in Fig. 199, we are able to present through the courtesy of the Photographic Branch of the Equipment Division, Air Service, U. S. A., McCook Field. They were taken in the course of the regular photographic flights over the Mad River valley, yet in special shots to bring out the relation of the new

railway lines to the topography of the valley, and the relocation problem which the building of the Huffman dam presented to the Conservancy engineers. The big hill at the right in the frontispiece is the south buttress of the dam and furnished the only practicable "jump off" for the dam site between Dayton and Springfield, 22 miles up the valley, the topography of the valley elsewhere being broad and flat. The building of the dam forced the railway lines 400 feet to the southward, into the hill. See also page 37.

Germantown Embankment Nears Completion

The work of building the earth embankment of the Germantown dam is rapidly nearing completion, the embankment being now less than fifteen feet from the finished crest level. The material is still being deposited by pumping, as usual, but sand and gravel from the beaches is being picked up by the small dragline excavator which builds up the core pool levees, and dropped into the pool. The latter being now very narrow by reason of the gradual encroachment of the beaches, the deposit in it of the beach gravel is practically making the upper layers of the core into an arch of "mud concrete," spanning the clay materials below, and furnishing solid foundation for the highway which will be built along the top of the dam. Observations and experiments on core materials continue to furnish evidence of a satisfactory solidification.

Black Street Bridge, Hamilton

Attention was called in a recent Bulletin to the open excavation for Pier 3 of the new Black Street bridge at Hamilton. This method was so satisfactory that it has been extended to Piers 2 and 4 adjacent, the excavations being connected so that they can all be unwatered at one setting of the pumps, the latter being located about opposite Pier 3. The pumps are now handling $4\frac{1}{4}$ million gallons per day from these excavations, an amount equal to the daily water consumption of the city of Hamilton. As soon as Piers 2, 3 and 4 are finished, the river, which now is running in a channel west of Pier 4, will be turned to run between Piers 2 and 4. The work on the piers and abutments is now half completed and will be finished by January 1, leaving only the arches for next season.

All the material for the construction—piling, concrete materials, forms, reinforcing, steel, etc.—is being handled by a cableway. This cableway, recently completed, is working smoothly and satisfactorily. An article description of the work at Black Street bridge is reserved for a future issue of the Bulletin.

New Technical Report Soon to Be Out

A new Technical Report, probably on the whole the most interesting of the series, has reached the stage of proof reading and will soon be off the press. It is by Professor Sherman M. Ward and Gerard H. Matthes and deals with the design of the retarding basins, dams and improved river channels in their relations as to reservoir capacity and flood flow. These relations, after the study of the great storms of the eastern United States as to rainfall, are of course fundamental to the entire flood prevention project and are certain to prove of unusual interest to the profession.

The Big Four and Erie Railway Relocation

New Double Track Line 15.22 Miles in Length, Requiring a Total Excavation of 1,340,000 Cubic Yards. The Huffman Cut, 4,500 Feet Long, Totaling 657,000 Cubic Yards, of Which 593,000 Was Rock, the Leading Feature.

The Big Four and Erie Railways run northeasterly out of Dayton up the Mad River Valley. (See general map, Fig. 200). About six miles from the center of the city they reach the site of the Huffman dam, the proposed building of which compelled their relocation. The valley here narrows between steep hillsides to a width of about 3,400 feet, providing what is practically the only dam site available in the 22 miles between Dayton and Springfield. Everywhere else between the two cities the valley is very broad and flat, forming a natural floor for railway location, which the old lines followed, the Erie up the north side of the river, the Big Four up the south side, the two coming together just west of Enon, and being run in conjunction between Dayton and Enon as a double track system. They struck the Huffman dam site at about elevation 790. The top of the proposed dam was 60 feet higher. (See Fig. 203 and Fig. 204). The maximum permissible gradient on both roads is 0.3 per cent. Starting from the railroad yard in Dayton, the elevation of which could not be changed, this gradient, carried to the dam site, falls 35 feet below the proposed crest elevation. Under such circumstances the prob-

lem of relocation presented by the dam was exceedingly serious. It involved throwing both roads—treated here as one four-track system, to provide for future traffic expansion—some 400 feet south of the south end of the dam, and into the steep hillside, a large percentage of which was rock. Once across the dam site, the new roadbed would find itself within the Huffman retarding basin, 20 feet below the maximum flow line (spillway level), necessitating protection of the tracks by levees on each side for about a mile and a half above the dam, until the continued 0.3% gradient could reach the flow line. The remainder of the relocation is practically one long tangent till the old line at Enon is reached, the work on this portion being most of it light.

The total length of the relocated lines is 15.22 miles. This is an increase over the old length of the Big Four of about 3,540 feet and over the old length of the Erie of about 4,350 feet. Together, the new lines also show an increase over the old in curvature of about 93 degrees. Both of these changes, as well as the increase in length of gradient, involve a permanent increase in operating expense. This increase, capitalized in accordance with the Interstate

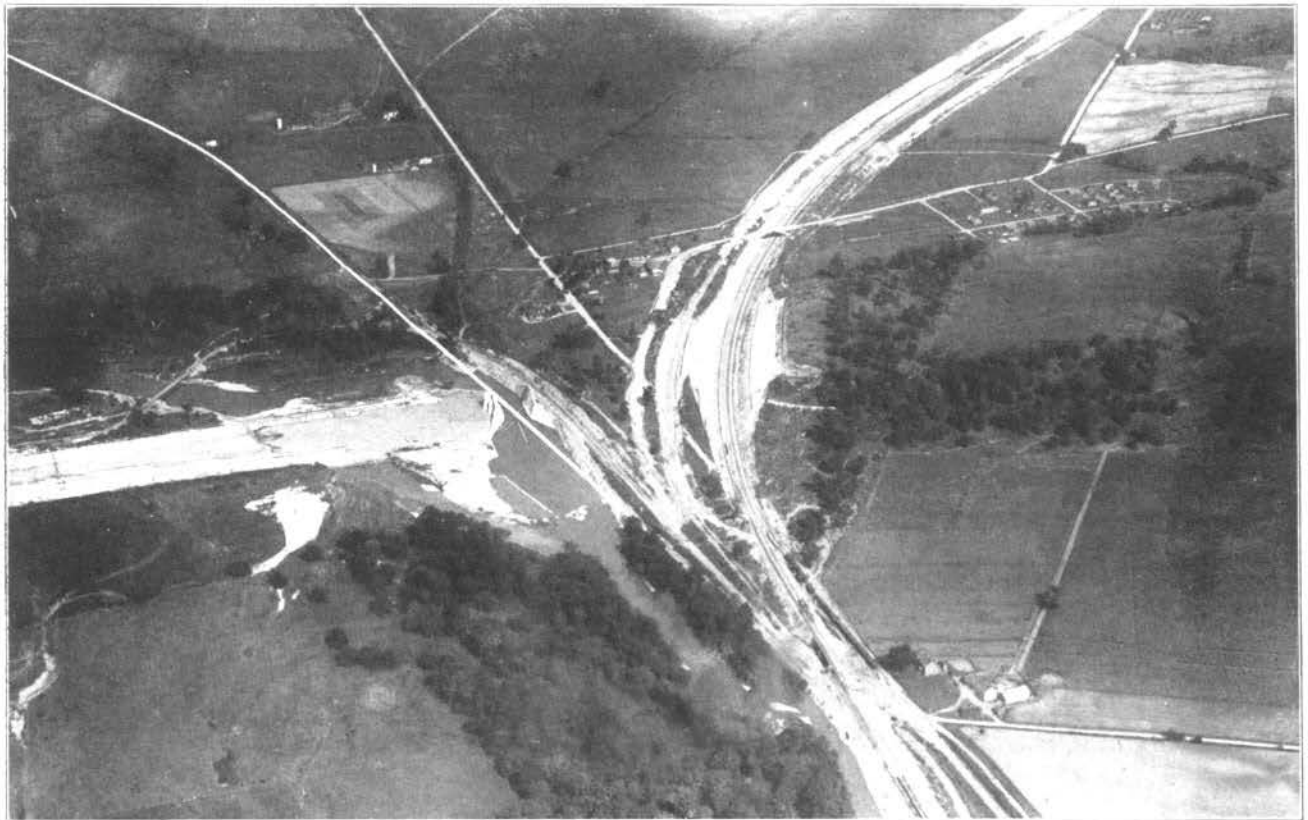


FIG. 199—AIRPLANE VIEW OF HUFFMAN DAM AND RAILWAY RELOCATION. SEPT. 17, 1920.

This view is east, and shows with especial clearness the relation between the old and new locations of the Big Four R. R. at Huffman dam. The old location is shown by the left hand white line. The new one is seen swinging to the right through the big cut and on along the edge of Mad River valley beyond, between the two levees. The middle white line is the old location of the Springfield Pike. The old line of the Big Four is seen to pass directly between the walls of the Huffman dam outlet structure, to the left of the big cut, the uncompleted earth embankment of the dam being the light area running to the left from the walls. Mad River is seen as the darker area coming from the left and running between the walls toward the observer into the foreground. The temporary Big Four location is seen just to the right of the walls.

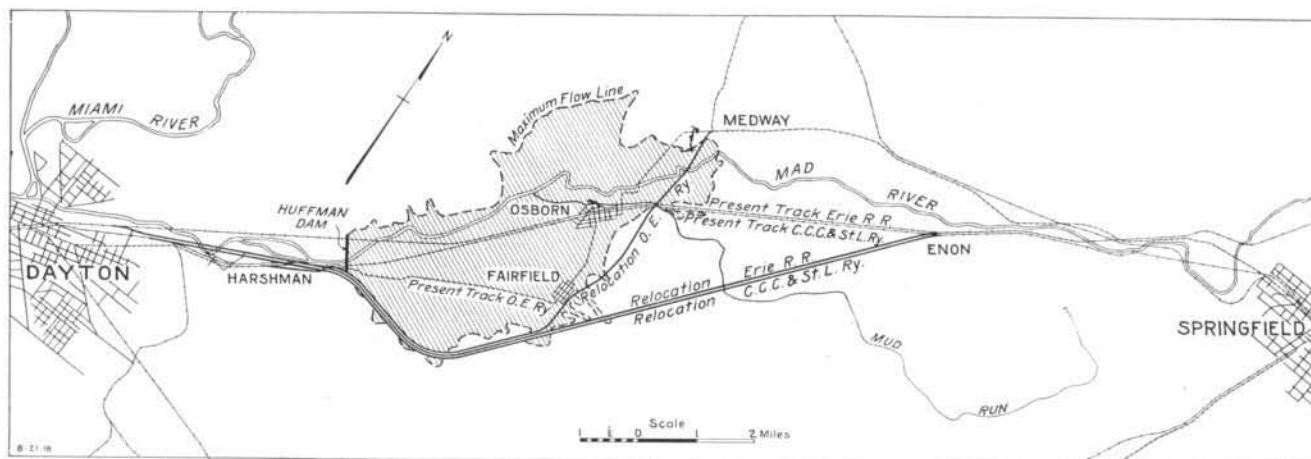


FIG. 200—GENERAL MAP OF THE BIG FOUR AND ERIE RELOCATION.

Commerce Commission's classification, amounts to about \$400,000, which will be paid to the roads by the District as part of the expense of the relocation.

Through the big cut, the roadbed has a width of 72 feet, sufficient to accommodate four tracks on 14-foot centers. Between the levees the cuts are of like width, while the fills are extended from levee to levee, the levees being 200 feet apart on centers, with the drainage between them running back to the mouth of the big cut, since no openings can be permitted into the valley above the dam on account of their admitting flood water. The remainder of the roadbed has 34 ft. width in fill and 44 ft. in cut, to accommodate two tracks.

The old line of the Big Four, indicated by the left white line in Fig. 199, ran directly through the proposed outlet structure of the Huffman dam. It being necessary to begin construction of this outlet at the earliest possible date, a temporary relocation of the Big Four was necessary, since the regular relocation would require over two years to complete.

The temporary relocation is shown in the same figure running just to the right of the outlet works. It was about a mile and a third in length, and required 46,000 cubic yards of excavation, of which 33,800 was rock. It was put in operation in October, 1918.

The total amount of excavation required to grade the new lines is about 1,420,000 cubic yards, of which about 657,000 was in the big cut at Huffman, about 593,000 of this being rock. The latter condition made it uneconomical to balance cut and fill, embankment exceeding excavation, as the work was carried out, by 400,000 cubic yards. The excess was partly obtained by widening the cuts, except the big cut, the rock making the latter too expensive.

Between Dayton and the dam the most interesting features are the two channel changes in Mad River, by which double river crossings are avoided. The excavation on these amounted to 44,000 cubic yards, of which 34,000 was overcast by a clamshell and the rest moved by teams. Another feature is

The view is northwest, the inner (north) levee being at the right. The two levees are 200 feet between center lines, and have a maximum height of 35 feet. They are necessary because the maximum permissible gradient on the Big Four and Erie on this division is only 0.3 per cent, which carried east out of Dayton, (where the track levels could not be changed,) would only lift the relocated lines to an elevation 25 feet below the crest of the Huffman dam. East of the dam, therefore, the tracks would be within the retarding basin and subject to overflow in times of

(Continued below.)



FIG. 201—LOOKING NORTHWEST BETWEEN THE TWO RAILWAY LEVEES. SEPT. 20, 1920.

unusual flood. They are, therefore, enclosed on each side by the levees for a distance of a mile and a half east of the dam. Culverts 275 feet in length carry the drainage water from the hills to the south, under both tracks and both levees.



FIG. 202—ON THE OHIO ELECTRIC R. R. TRACK AT HUFFMAN, JUST EAST OF THE BIG CUT.
SEPT. 20, 1920.

The two views were taken from the same place on the inner (north) levee, the upper looking west, the lower east, to show the nature of the relocation problem. The hill at the left, above, is the one requiring the 120-foot cut, just at the south end of the Huffman dam. The lower view shows Mad River valley bottom at the left, and the valley side sloping down to meet it at the right, with the steam lines occupying the cut between the two levees in the right foreground. The top of the levee here is ten feet above spillway level, and five feet below the dam crest.

the abolition from the new Big Four and Erie lines of "Dead Man's Crossing" in the outer limits of Dayton, to be completed when the Baltimore and Ohio carries out its contemplated grade separation. All the grading between Dayton and Huffman is embankment, steadily rising across the valley flat to the big cut at the dam. It totals 390,000 cubic yards, of which 106,000 came from a borrow pit at Harshman and 90,000 from the dam outlet excavation; the remainder from the big cut.

Beyond the big cut, the chief features are the twin levees, 200 feet apart, 35 feet in maximum height, and a mile and a half long, the inner one carrying the Ohio Electric Railway relocation. These two

tractor.

The east three miles of the line was in wet, miry material, obtained from side borrow by elevating grader, and built into a narrow embankment, widened later by side dump from the cuts west, using steam shovel and dump cars. This was done by George W. Condon, by Condon and Kolterman, and by Condon and Ward.

The big cut in the hillside at Huffman was by far the dominating feature in the work of construction, the topography elsewhere being mostly broad, flat valley. On the high side the cut reaches a maximum depth of 119.8 feet. Its total length is 4,500 feet. The underlying rock in many places reaches to the

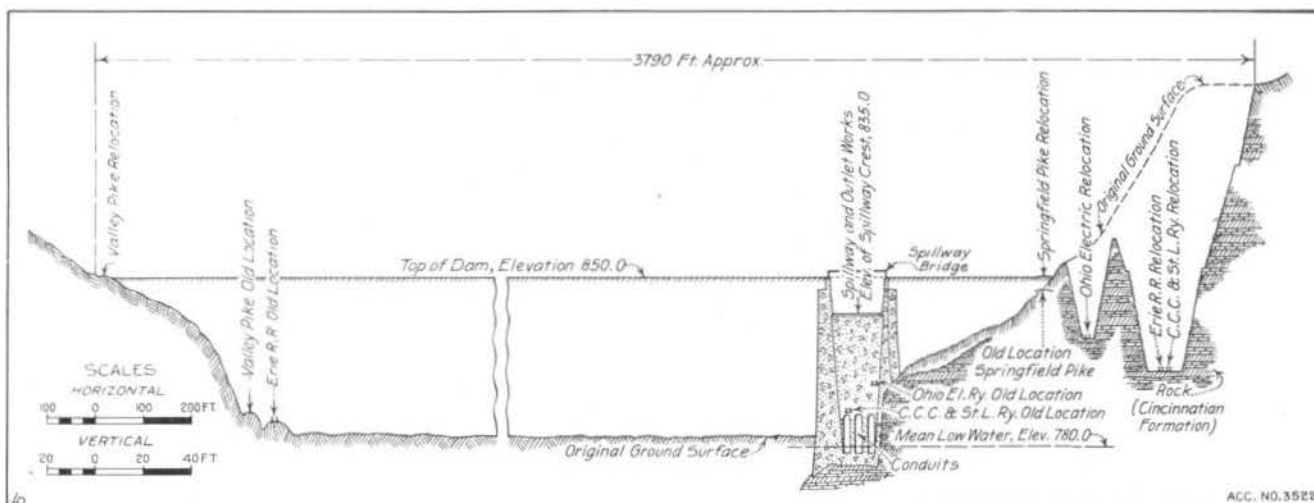


FIG. 203—CROSS SECTION OF MAD RIVER VALLEY ALONG CENTER LINE OF HUFFMAN DAM.

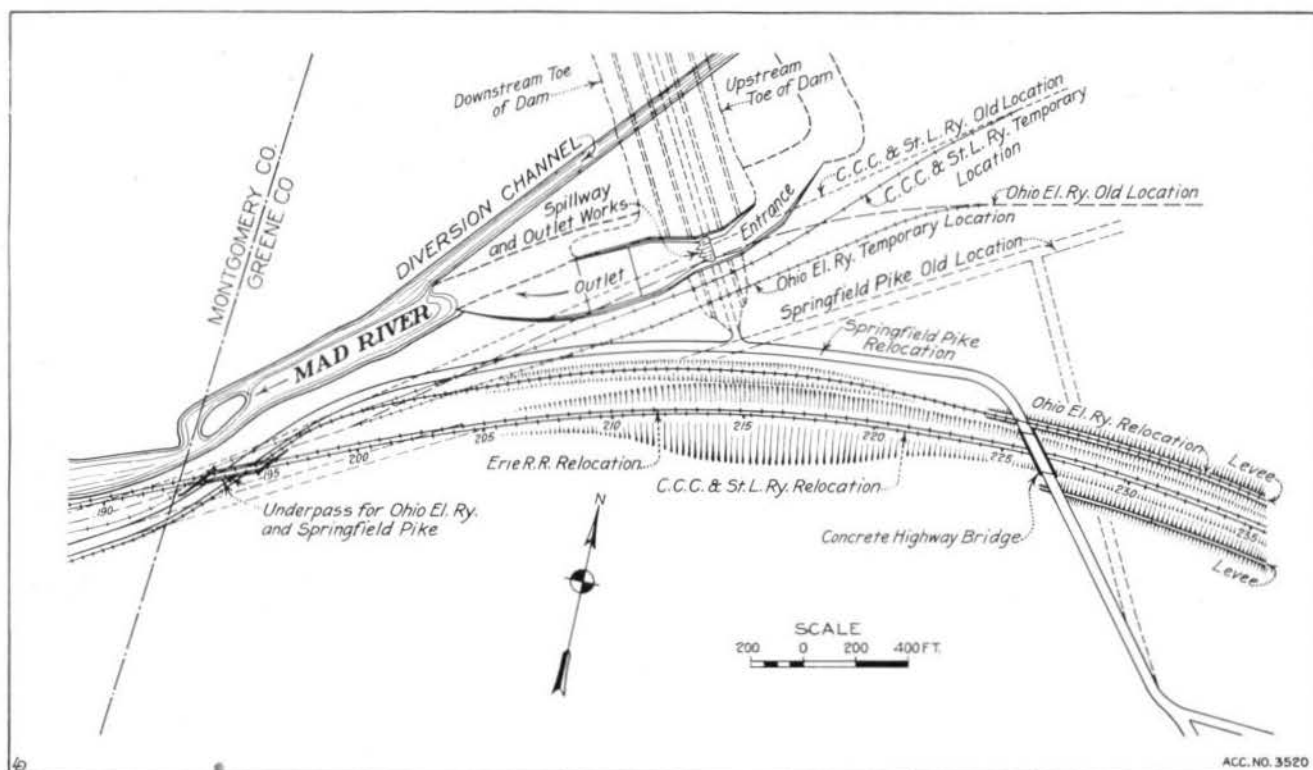


FIG. 204—MAP OF RAILWAY RELOCATION AT HUFFMAN

grass roots. The excavation totalled 657,000 cubic yards, of which 593,000 was rock. Its finished appearance is shown in Fig. 198 and various features of the work in Fig. 210.

The rock is of three formations, the Brassfield, the upper, about 35 feet thick, of the Silurian group, with the Elkhorn, about 44 feet thick, and the Cincinnati, about 41 feet thick, in order below, the two latter of the Ordovician group. The Brassfield is a fairly solid limestone, and was excavated on a one-to-one slope, with an 8-foot berm at its foot. The Elkhorn is a much softer stone, somewhat greasy in texture, so that it had to be given a $1\frac{1}{2}$ -to-1 slope, with a four-foot berm at its foot. It was possible to excavate it by steam shovel without blasting, but its toughness made this so uneconomical that blasting was resorted to in fact. The Cincinnati consisted of limestone layers inter-laminated with shale, making a formation which on first exposure was quite hard, but softened and sloughed rapidly on exposure to the weather, so that in a month it could be kicked to pieces with the foot. It was stable enough to stand on a 1-to-1 slope, which was used.

All the rock required drilling and blasting, mostly done in 8 or 16-foot lifts, the latter height being used when the steam shovel stood on a level with the cars it was loading, the former when the cars stood on the shelf above. Forty per cent dynamite (DuPont or Aetna), was used, in charges of 100 to 250 pounds, the holes being mostly (ninety per cent) sprung for the charge. Ammonia dynamite was used at first, but the occurrence of many springs of water compelled recourse to gelatine dynamite for most of the work. Holes were spaced about 7 feet for the 8-foot lifts and about 13 feet for the 16-foot lifts. The bottom 28 to 30 feet of the rock was shot in one lift, 2,500 feet in length. Five Ingersoll E-44 steam

drills and four well drills were used, with two jack hammers for lighter work. The well drills made 40 to 50 feet in a ten-hour shift; the rock drills from 60 to 65 feet, the holes being $3\frac{1}{4}$ to $3\frac{1}{2}$ inches in size. The lower left picture in Fig. 210 shows especially well the thorough disintegration produced by the blasting, in this case in the 28 ft. layer, the material being just lifted and left in a loose windrow which the steam shovel handled readily.

The shovel used for most of the work was the 70-C (about 70 ton) Bucyrus, a type especially fitted for rock excavation. Two of these machines were used for the first three months of the work on one 10-hour shift. One shovel was then substituted, working day and night. The machine removed about 4,000 cubic yards per 10-hour shift, and averaged about 34,000 cubic yards per month. A small Erie shovel assisted on the rock for the Springfield Pike fill and the levee embankments. The entire material was transported in standard gage 12-yard dump cars (Western), hauled by locomotives, and was used in making the embankments east and west, and the two levees. The work was done by the Walsh Construction Co., of Davenport, Iowa, general contractors for the grading, track work and ballasting on both the Erie and Big Four, under the general superintendence of Mr. W. A. Durkin. It is noteworthy that not a man was seriously injured in the entire course of the job. The grading was begun April 15, 1918, and finished September 6, 1919.

The track laying was done by Roberts Brothers of Chicago, who took the contract for this feature under the Walsh Construction Co., following similar work on the Baltimore and Ohio relocation. This work on the Big Four and Erie was begun in Oct., 1919, and completed March, 1920. A picture and de-

scription of the Roberts tracklaying machine was given in the issue of September, 1919.

The new track on both the Big Four and Erie includes 15.22 miles of main line, with 1.51 miles of side tracks on the Erie and 1.36 miles of the same on the Big Four, in the new yard at Fairfield. The rail on both roads is 90 pound A. S. C. E. open hearth steel, with the side tracks of 90 pound repair steel, the latter being obtained from the old yards at Osborne. The ties on the Big Four are creosoted, 8' 6" long, and averaging 7"x8", laid 20 to the 33 foot rail, with suspended joints, the two ties at the joint being 14" center to center. On the Erie they are 8' 6" long and at least 7"x8", untreated, spaced 18 to the 33 foot rail. Standard tie plates are used on all curves on both roads. On the Big Four anti-rail-creepers were placed on all rails, of the P. and M type, four to the rail. The angle bars are standard 24", 4-hole, on the Big Four of the continuous type, and on the Erie of the Erie standard; the track bolts with square heads and rolled threads.

The ballast is gravel, obtained from the valley borrow pit supplying material to the Huffman dam. A minimum of 12" was required below the bottom of the tie, equivalent to 3,490 cubic yards per mile of single track. The work of supplying it took all the time of the day shift in the borrow pit and part of that of the night shift, and was the cause of some delay in the building of the dam embankment. The excavation was done by the District's own forces, the transportation and placing by the Walsh Construction Co. under its contract.

The total cost of construction of these two relocated railways is about \$2,717,120. This includes grading, tracks and tracklaying, ballasting, concrete structures, fencing, telegraph lines, and interlocking plants. To this must be added damages to the railway companies on account of increased cost of operation over the new lines, extraordinary maintenance during construction, etc., amounting to \$579,974, totalling with the construction cost, \$3,237,094.

This does not include the cost of the right of way, amounting to 345 acres. Estimate of this it is not possible to present at this time, much of it being purchased along with the farms bought by the District in the Huffman retarding basin.

The railways and the Conservancy District being all three vitally interested in the relocation, all had engineers overseeing the work. For the Big Four, the representatives were G. P. Smith, Consulting Engineer, and W. B. Hodge, Resident Engineer. The interests of the Erie were looked after by C. H. Splitstone, Superintendent of Construction, and by Messrs. C. B. Miese and C. J. McCabe, successive resident engineers. For the Conservancy District the work was at first in charge of E. N. Floyd as Division Engineer, succeeded in November, 1918, by Albert Larsen, the assistant engineers being successively William Yount and W. D. Kramer, with Olaf Froseth as Office Engineer.

Features of the relocation especially concerning the Ohio Electric Railway and the valley highways will be treated at a later date.

August Progress on the Work

GERMANTOWN

During the month of August, 31,680 yards of hydraulic embankment were pumped into place on the dam. This yardage is made up of eight days' pumping from dragline excavation, and 17 days from hill sluicing alone. The total yardage up to the end of August was 701,420 cubic yards, making the dam 88.9 per cent complete.

Both the upstream and downstream slopes of the dam have reached elevation 810, which is just 20 feet below the top of the dam. The small dragline is now throwing up a 5-foot lift on the 2:1 slope of the upstream slope.

The large dragline is excavating material for the dam from the new borrow pit opened up on the island, getting a good run of gravel.

Concreting of the spillway bridge was started during the month. Piers 2, 3, 4 and 5 have been poured up to the caps. A portion of the cut-off trenches in the spillway channel has also been concreted.

The spillway excavation is now complete, Daniels moving the last of his equipment August 28th. Mr. J. C. McCann has also finished the grading on Road No. 2 and moved his equipment into camp August 30th, for leveling off spoil banks adjacent to the outlet works.

A. L. Pauls, Division Engineer.

September 20, 1920.

ENGLEWOOD

During the month ending August 25, 154,000 cubic yards of embankment were pumped into the hydraulic fill. The rolled embankment in the cross dam amounted to 7,000 cubic yards, making a total for the month of 161,000 cubic yards of earth placed in the dam. The total at the estimate date, August 25, including all classes of embankment, aggregated 1,765,000 cubic yards, or 50.4 per cent of the completed dam.

The embankment in the river closure has reached elevation 839, 71 feet above the river bed. With the temporary spillway and conduit in service this amply insures safety against overtopping even in the event of a repetition of the 1913 flood.

Cross dam No. 2, on the right bank of the river, has reached elevation 844, six feet below its projected height.

A few weeks will see the completion of this piece of work.

Dry rubble paving at the entrance to the outlet conduits has been started.

The embankment in the river closure has reached nearly to the elevation of the portion of the dam constructed last year and preparations are in progress for including that section in the filling operations during the remainder of the season. When this shall be done 3,000 lineal feet of embankment will be in progress at the same time, utilizing in sequence both pumping plants.

H. S. R. McCurdy, Division Engineer.

September 15, 1920.

LOCKINGTON

There were 62,000 cubic yards placed in the dam by hydraulic pumping during August. The truss bridge over the outlet structure for carrying the dredge pipe to the west part of the dam was raised on September 13. Clay material of a very hard character has been encountered in different parts of the borrow pit.

The stone surface dressing or rip rap on the slopes of the dam is progressing satisfactorily.

Some work is being done on Roads 8, 9 and 10 by Contractor Ryan pending commencement of the large fill on Road 9. The work consists mostly of reshaping the surface and regrading the fills after a season's settlement. A relocation of Road 11 has been approved by the commissioners of Shelby county.

Barton M. Jones, Division Engineer.

September 25, 1920.

TAYLORSVILLE

The concrete outlet works were completed on September 25, with the exception of the spillway. The west wall was finished on August 30, the east wall proper on August 14, an extension of this wall on September 25, and the three piers, containing about 2,000 cubic yards, on September 24. The latter were carried up to the springing line of the conduit arches, about 18 feet above the conduit floor.

Over 2,000 cubic yards of concrete were placed during the month, bringing the total to about 45,000 cubic yards. The spillway will add about 10,000 cubic yards to this.

The Lidgerwood Class M dragline has finished the excavation of the inlet channel to the conduits to station 3, a distance of 300 feet in all.

The building up of the earthen cross dike enclosing the hydraulic fill pool on the east, was again started on Sept. 23. This dike will now be carried up to its full height, at elevation 820 (the dam crest being at 837). The material is being transported from the inlet excavation in 12-yard dump cars, and placed in the dike by a locomotive crane rigged with a clamshell bucket.

The hydraulic fill is progressing at about the same rate as last month, the work being on the section between the cross dike (on the west bank of the Miami) and the west valley slope.

Mr. Crampton has completed the grading of Road Number 12 to station 59

W. J. Smith, Assistant Engineer.

September 26, 1920.

HUFFMAN

During the month of August 40,000 cubic yards of material were placed in the dam, 12,000 cubic yards of this being sluiced directly into the dam from the hillside at the north end of the dam. The balance was pumped through the main pumps by the night shift. A part of the night shift, as well as all of the day shift, has been engaged in getting out material for the railroad work.

The 1½-yard steam dragline has completed building the upstream levee up to elevation 806 in the section north of the old diversion channel and up to the 800-foot berm in the river closure section. It has also sloped up the north bank of the entrance channel to the outlet works in preparation for covering it with rip rap.

The new location of the Springfield Pike west of the dam has been graded sufficiently to allow light traffic to pass through. It cannot be entirely completed so as to open it to the general public until after the Ohio Electric has been shifted to its final location.

C. C. Chambers, Division Engineer.

September 24, 1920.

DAYTON

Dragline D-15 is excavating a trench for the Beach Avenue river wall foundation. D-16 is excavating from the channel and placing the material as backfill at South Robert Boulevard wall and as embankment for the proposed revision of the street grades between Fourth and Fifth Streets. D-19 is finishing the channel excavation west of Main Street along the north bank of the river. The material is being used for enlarging the Lehman Street levee. A considerable portion of the levee embankment will be moved with cars.

Good progress has been made on Sunset Avenue retaining wall, 272 cubic yards of concrete having been placed. At Stillwater Drive river wall 745 cubic yards of concrete have been poured.

Finke Engineering Company is cleaning up the channel excavation and levee embankment at the old launching basin near Herman Avenue.

Price Brothers have started driving piles for revetment on the north bank of the river east of Dayton View bridge.

To date 38,800 cubic yards have been issued from the gravel pit.

Summary of Excavation and Embankment

	Previous to Aug. 1 cu. yds.	During August cu. yds.	Total to Date cu. yds.
Pay quantity in levees and spoil banks	588,000	17,000	605,000
Levee embankment (In- cludes Contract No. 41).....	75,900	100	76,000
Total yardage handled.....	1,522,000	78,000	1,600,000

None of the figures includes 105,000 cubic yards of excess excavation for launching basins and scowling canals.

C. A. Bock, Division Engineer.

September 20, 1920.

HAMILTON

The total of Item 9, channel excavation, to September 1st, was 740,000 cubic yards.

The electric dragline, D-16-18, is at present loading cars on the west side of the river, between the Columbia bridge and the railroad bridge.

Excavation and pile driving for Pier 4, Black Street bridge, have been completed by Dragline D-16-17, and the excavation for Pier 2 is 75 per cent completed. The cableway was placed in operation on September 13th and has been used for concreting part of Pier 3 and the footing for Pier 4. The excavation for Piers 2, 3 and 4 is being done by the dragline in such a way that all the piers are enclosed by one coffer dam and are being pumped out from one setting of the pumps. The pumps are handling about 4½ million gallons daily, or the equivalent of the daily consumption of the city of Hamilton.

Work has been started on the excavation for lowering the 24-inch water main across Old River, west of the B. & O. bridge.

Excavating and concreting are being continued on the Black-Clawson wall.

Price Bros. have turned out 105,000 blocks at their block plant. The work of laying the blocks and the slope revetment on the east bank between the railroad and the Main Street bridge is nearing completion.

C. H. Eiffert, Division Engineer.

September 20, 1920.

LOWER RIVER WORK

Miamisburg.—Jeffrey, Boorhem & Co. have practically completed their contract for construction of local protection works on the west side of the river. A few days' work will be required to finish dressing and seeding levee and road slopes and surfacing roads. The work on the west side of the river consists of 3,500 lineal feet of levee averaging about 14 feet in height, and 2,400 lineal feet of gravel surface roads. It was also necessary to raise a spur railroad track over a distance of 700 feet a maximum of 10 feet at the center. The work was begun about a year ago.

Cole Bros. are erecting their dragline machine on the east side of the river and will be ready to throw dirt in a week or ten days. They will start about at the north corporation line, just west of the C. & D. traction embankment, and work down the river. They have the contract for all the dragline work on the east side.

Franklin.—Jeffrey, Boorhem & Co. have placed about 8,000 cubic yards of material in levee embankment between Park Avenue and Pine Street during the past month.

Middletown.—Cole Bros. have moved their equipment to Miamisburg, having completed their work here with the exception of a small amount of dressing and seeding.

Price Bros. have finished the pile driving for the revetment and have laid about one-third of the concrete blocks, of which 6,400 will be required for the flexible revetment.

F. G. Blackwell, Assistant Engineer.

September 25, 1920.

TROY

Clapp, Norstrom & Riley completed their part of the work on August 21. Their total pay excavation amounted to 106,000 cubic yards and their pay embankment to 44,000 cubic yards. Practically all their equipment was purchased by the District, and will be used here and at other points, as needed.

The remaining dragline work has been let to Mr. Donald Jeffrey on a percentage basis, and he started to work September 2. The levee embankment below the B. & O. railway bridge, on the right bank, has been completed, and the machine is now starting a fill for crossing the river channel. The deep water channel from the B. & O. bridge to the head of the cut-off channel will then be completed, after which the dragline will cross over the B. & O. railway fill at the north end of the river bridge, and commence excavating the deep water channel between the B. & O. bridge and North Market Street.

The total yardage excavated from the river channel, between Market and Adams Streets, by the C. & C. Haulage Co., is 27,000 cubic yards. This material has all been placed in the embankment between Market and Adams Streets, except for 850 cubic yards, which has been placed in levee embankment on the west side of the B. & O. railway fill, to form a grade for the dragline crossing.

The Finke Engineering Co. has placed 10,500 cubic yards of material in the south levee along Morgan Ditch. The first 800 feet of this levee is practically complete, except for top soil and shaping the slopes.

The contract for the Pearson Levee has been let to Wm. Oberer of Dayton. This is a low levee, averaging five feet in height, crossing the southwest corner of the Pearson

farm, just east of the Bradford bridge. The new levee will be the same height as the original levee along that side of the river, but is located some distance east of the original levee to make a wider opening for flood water at that point. The contractor started work with a four team outfit on August 21 and has completed 900 feet of levee, or placed 2,500 cubic yards of embankment to date.

A. F. Griffin, Assistant Engineer.

September 15, 1920.

RAILROAD RELOCATION

Big Four and Erie.—All eastbound trains of the Big Four and Erie have been operating over the new line with the exception of three local passenger trains which operate over the Erie against the regular current of traffic to Osborn and then over the old Big Four line to Enon. All westbound trains of these two railroads, and the three eastbound trains, will be diverted to the new line October 1, 1920. The ballast is complete with the exception of the yard tracks at Fairfield. The old side track material at Osborn is being used for the new side tracks at Fairfield. The District forces are removing these tracks at Osborn. The Big Four side tracks at Fairfield are laid and the passing track will be ballasted by the 1st of October.

The gap in the line at Huffman, where temporary timber structure was built at the underpass for the temporary main track, is completely filled, and the temporary Big Four main track is almost all removed. The removal of the Big Four temporary main track made it possible to begin construction of the new Springfield Pike at Huffman, and Mr. Connelly's team outfit started grading on the 16th of the month and it is now passable for vehicles. The Springfield Pike had been closed for more than a year.

The Big Four yard tracks just east of Findlay street, are also being raised and nearly all the ballast has been hauled for the yard.

The signal systems at Fairfield and Tate's Point are practically complete and are in operation.

Baltimore & Ohio Railroad.—The track south of Taylorsville dam has been removed, the railroad taking all of

the rails, angle bars, and tie plates, and the best of the ties. The remainder of the ties are being sent to Englewood for the temporary spillway and to other features for construction tracks.

Ohio Electric Railroad.—Work on the electric line has been practically suspended during the month, the contractors' forces working on the steam railroads, and the District's trolley line forces on other District work. Work is being resumed and it is expected to complete for operation the Ohio Electric from Huffman to Fairfield by November 1.

Albert Larsen, Division Engineer.

September 27, 1920.

RIVER AND WEATHER CONDITIONS

The rainfall in the Miami Valley during the month of August varied from 2.18 inches at Fort Loramie to 5.08 inches at Ingomar. At Dayton it amounted to 2.64 inches, or 0.37 inches less than normal, bringing the accumulated deficiency since January 1 up to 2.80 inches.

Unusually heavy precipitation occurred at Hamilton and just north of Springfield during the evening of the 21st. At Hamilton $4\frac{1}{2}$ inches of rainfall was reported. At Springfield, the total amounted to 2.75 inches, causing a rise of about 10 feet in Mad River. Owing to the comparatively small area on which the heavy rainfall occurred at Hamilton, the Miami at that place only rose about four feet.

Observations taken at the local office of the U. S. Weather Bureau, show that the mean temperature for the month was 71.1 degrees, or 2.3 degrees less than normal; that there were seven clear days, seventeen partly cloudy days, seven cloudy days, and thirteen days on which the precipitation amounted to or exceeded 0.01 of an inch; that the average wind velocity was 7.3 miles per hour, the prevailing direction being from the northwest; and that the maximum wind velocity for five minutes was twenty-six miles per hour from the northwest on the 31st.

Ivan E. Houk, District Forecaster.

September 25, 1920.

Evidences of Sea Life at the Huffman Dam

The coral whose photograph is presented here was found seven miles east of Dayton, in the deepest part of the excavation for the jump pool on the down-stream side of the Huffman dam. The figures are only one-third as large in diameter as the actual specimen. The right-hand figure shows the exterior surface; the left-hand figure shows the interior structure of the same specimen.

The level at which the coral was found is 107 feet above the base of the Monument, opposite Steele High School on Main street. Since the latter is 750 feet above sea level, this coral was found about 857 feet above present sea level.

Corals evidently are sea animals, hence their occurrence far above present sea level and at great distances from the ocean requires explanation.

As a matter of fact, evidences of sea life are common in the rocks around Dayton. It is evidences of land animals and land plants which are absent here, no traces of land animals or plants ever being found in rocks nearer than 75 miles from Dayton in any direction. However, the remains of sea life occur frequently in the rocks even at the highest elevations around Dayton. Many have been described and figured from the abandoned quarry at the Soldiers' Home and from still higher elevations.

Geologists find abundant evidence that all of Ohio and of the neighboring states repeatedly was covered by oceanic waters for long periods of time. During those periods oceanic waters must have been of greater depth or the continental masses must have had much lower elevations so that their lower parts

were below sea level. Among geologists the second theory finds most favor, although there may have been a combination of both causes operative in bringing Ohio below sea level.

The coral here figured was found by T. C. Shuler, of the engineering force at the Huffman Dam. The same kind of coral has been found at numerous localities in southwestern Ohio, but it is much more

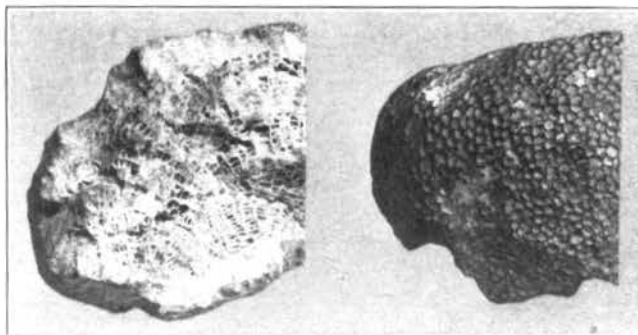


FIG. 205—FOSSIL CORAL FROM HUFFMAN DAM EXCAVATION.

abundant near Madison, Indiana, on the Ohio river, and from that point southward for a distance of fifty miles. There it occurs in such great quantities in the rocks that geologists refer to this region as an area of coral reefs. Many million years have passed since Ohio was below sea level.

August F. Foerste.



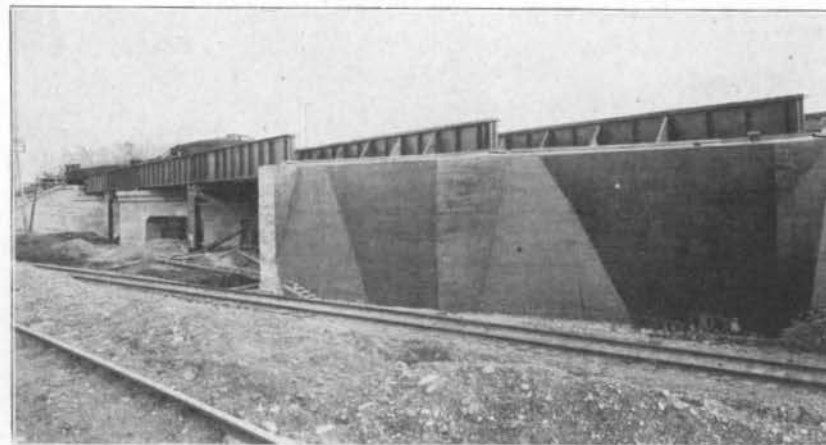
1



2



3



4

FIG. 206—NEW BRIDGES ON THE BIG FOUR AND ERIE RAILWAY RELOCATION.

Number 1 is the new double bridge at Mud Run, really two separate structures, one for each railway, which here are 60 feet apart. The center arch is 40-foot span, the side arches 25-foot span. Both bridges are 20 feet wide. Picture taken September 20, 1920.

Number 2 is the triple box culvert at Tates Point at the northeast city limit of Dayton. The culvert openings are of 12-foot span. Picture taken September 20, 1920.

Number 3 is the highway bridge spanning the eastern entrance to the big cut at Huffman dam. It was fully described in the Bulletin for August, 1920. It is a three-hinged arch, the two arch ribs being entirely cut in two transversely at the two abutments and at the top of the rise, with a pin and ring joint inserted at each of the cuts. The entire thrust of the arch is thus borne by two bronze pins $2\frac{1}{4}$ inches in diameter and 28 inches long, at these cuts. By this design temperature stresses in

the arch, which frequently crack the ordinary type of barrel arch, are avoided. The roadway is 18 feet wide and carries the relocated Springfield Pike. Picture taken June 26, 1920.

Number 4 is the underpass just west of the big cut at Huffman dam, which carries the relocated Springfield Pike and the Ohio Electric Railway under the relocated Big Four and Erie lines. The center concrete pier separates the highway and the electric line. Two spans of steel "through girders," each 45 feet long, and 6 feet in height, extend over the highway, supported at the highway center line by steel "bents." Two similar spans, 38 feet long, and similarly supported between the two tracks, carry the bridge over the electric line. Picture taken February 18, 1919.

The three-hinged arch was designed in the offices of the District; the other bridges in the offices of the Big Four Railway.

The New Big Four and Erie Railway Bridges

The most striking bridge on these lines is the hinged arch highway bridge spanning the big cut at Huffman, described in the Bulletin for August, 1920. The other more important structures are described below. Like all the railway bridges, they are built to carry Cooper's Class E-70 loading, with the impact allowances of the 1917 New York Central Specifications. They were designed in the offices of the Big Four Railway, subject to the approval of the Conservancy engineers. They are illustrated in Fig. 206.

The Huffman Underpass. This was provided to carry the Springfield Pike and the Ohio Electric R. R. under the grade of the Big Four and Erie. Inspection of the cross section and map in figures 203 and 204 will make clear the necessities of highway relocation in the case, to provide grade separation, and lift the Pike out of the Huffman retarding basin on reasonable grades. The underpass is the only bridge on the relocated railways having a steel structure, a design introduced here for economy. The location is just west of the big cut, the Big Four and Erie being here on tangent, rising toward the cut on a three-tenths grade. The bridge is of the through girder type, with four spans of three girders each, built on a skew of 65 degrees from the normal. Two 45-foot spans go over the highway, and two 38-foot spans over the Ohio Electric line, the highway and the O. E. tracks being separated by the large central concrete pier, while the quarter points, located on the center line of the highway and of the electric railway tracks respectively, are supported by steel bents, thus minimizing the obstruction to the under traffic, while securing the rigidity given by the massive pier. The heavy abutments are of gravity section, with wing walls and expansion plates.

The longitudinal girders are on 14-foot centers, with 20-inch cross floor beams resting on their lower flanges, spaced on about 30-inch centers. The main girders are cross braced by knees about 8 feet apart, extending up from the floor beams.

A reinforced concrete slab, about 6 inches thick, covers the floor beams, its finished surface where it meets the knee braces, extending up the slope of the latter to the girders, covering the knees about an inch thick. To reduce the weight of concrete in the triangular spaces between these slopes and the girders, this space is partly filled with hollow tile. The floor slab is covered with a water-proofing of coal tar and paper, applied according to Barrett's specifications, the waterproofing in turn covered by a two-inch concrete coat partly reinforced with wire mesh. The floor slab drains into tile drains running down the sides of the roadway to the ends of the bridge. The base of the rail is about two feet above the top of the floor slab, the space between filled with gravel, so that the track can be ballasted, raised or re-lined like any other part of the road bed, thus assuring continuity of track structure and reducing impact and jarring effects from passing trains.

Bridges Over Mud Run. The Erie and Big Four are here on 60-foot centers, each road being carried by a separate concrete bridge, of three spans, the middle one a 40-foot three-centered arch, and the others 25-foot circular arches. Both bridges are of

the standard 20-foot width over all, with the base of rail at the same elevation as the top of the filled spandrel walls. The arches are designed to carry the dead and live loads without reinforcement, but with a liberal allowance of additional steel reinforcement to provide for temperature stresses.

While the bridges are independent structures, the wing walls between them are built as a unit, poured as a continuous section, with an expansion joint where they join the abutments. Heavy pilasters reinforce the ends of each pier, tied together by steel across the bridge, to help carry the thrust of the earth filling under the track structure. The spandrel walls themselves are reinforced, so that the earth pressure is largely resisted by cantilever action.

The masonry rests on a gravel formation containing some clay and sand. Into this piles were driven sufficient to carry the entire load of the structure. Thus the creek bed may suffer considerable scour without danger to the stability of the bridges.

Long Culverts Under Levees. As explained elsewhere, the Big Four and Erie pass the south end of the Huffman Dam in a cut 35 feet below the dam crest, and enter the retarding basin at a corresponding distance below the maximum flow line, requiring thus to be protected against flood by levees on each side. These levees (see Fig. 201), are 200 feet apart and have a maximum height of 35 feet. To carry the surface drainage into Mad River valley from the hills to the south, long culverts are provided passing under both tracks and both levees.

A typical culvert is that designated as Bridge 154. This is a standard 12-foot circular concrete arch, with a length between head walls of about 275 feet. In times of extreme flood, the water in the retarding basin will back up the valley slopes through these culverts to a considerable height above track level. To prevent the water seeping under the side walls into the road bed, the culvert is floored with concrete. Longitudinal seepage is checked by cut-off walls over the top of the arch under each levee.

Triple Box Culvert at Tate's Point. The railways at this point cross a creek on a structure consisting of three 12-foot reinforced box culverts built as a unit. This structure has a skew of 20 degrees, with the normal. The roof slabs of the culverts are designed as simple beams, the haunches being neglected in the calculation. Sufficient steel is provided over the piers to take care of negative bending moments. The haunches are added to afford additional resistance against tractive forces.

In the design of these culverts, stresses of 16,000 pounds were allowed in the steel and of 700 pounds in the concrete. The abutments were required to carry the load from a 7-foot surcharge. Both the abutments and the wing walls have a gravity section, and are separated from each other by joints.

Third Report of the Board of Directors Now Being Printed

The Third Report of the Board of Directors of the District to the Conservancy Court is in the hands of the printers. It will no doubt be delivered to the judges before the next issue of the Bulletin, and we shall therefore hope to present the gist of it to our readers at that time.

The New Big Four and Erie Interlocking Plants

Interesting features of the railway relocation are the two interlocking systems. One of these protects its intersection with the cut-off connecting the Baltimore and Ohio Railway main line (Dayton-Toledo) with the Welston Division of that road, at Tate's Point, just outside the city limits of Dayton. The other is at Fairfield, to take the place of the old interlocking plant at Osborne, serving the Big Four and Erie. The first is primarily and mainly for safety; the second is also for convenience in switching and crossing over between the two last named roads, there being no railway intersection at this point. Both are block stations; that is, both indicate to locomotive enginemen clearance or occupancy of an entire block of the railway, east or west of the tower as the case may be. The operation is in part automatic (the signals set electrically by the train), and in part manual, by means of tower operators, the latter being also in telephonic and telegraphic communication with Division headquarters, and reporting the movement of all trains to the dispatchers, as at any regular railway station.

The fundamental point in the design of any interlocking plant is safety, and this has been carried to a remarkable efficiency. Such a plant is in fact "fool-proof" in this regard. A green operator cannot set switches and signals which will permit trains to collide; at the worst he can only "ball things up" by "clearing" tracks which are not wanted, and blocking tracks which need to be "cleared."



FIG. 207—INTERLOCKING PLANT AT TATES POINT. SEPT. 20, 1920.

The view is toward Dayton. The right track is the westbound, the Erie. The left is the eastbound, the Big Four. The transverse track is the cut-off from the Baltimore & Ohio main line to the Wellston Division (at the left) of the same road. Thirty-four levers in the tower operate all the switches, derails and signals in the system, the transmission being mechanical (by jointed pipes,) for switches and derails, and electrical or mechanical for the signals.

This desideratum is secured by means of the interlocking machine, that used at Tate's Point and Fairfield being the Saxby and Farmer design, made by the Union Switch and Signal Co. The operating levers of all the switches, derails and signals in the system are brought to this machine and set side by side. (See Fig. 209). By an ingenious mechanism, these operating levers are interconnected, so that any lever can be made to lock or unlock any other in the system. With all the levers thrown back (to

the left in Fig. 209), every signal in the system is set to "stop," and every switch and derail is thrown open, so that no train can approach the tower from any direction without first being warned off, and then, if it disregards the warning, derailed. To open any route through the system (as the B. & O. cut-off east, described under Fig. 209), the levers can be thrown only in a predetermined order, each lever as it is thrown unlocking the next, switches and derails first, then the signals, thus opening a clear route before signalling the train to come on. In addition, the first lever thrown locks the levers of all conflicting routes (these being already in the "stop" position), so that they cannot be opened until the route in use is again closed by throwing all its operating levers back again, in reverse order.

Study of what has just been said will make it clear that such a system is by its nature "fool-proof," as above indicated. No route can be opened until all conflicting routes are closed; and no signal to proceed set until the track is first cleared.

This universal interlocking is obtained by means of two sets of horizontal bars, the bars of a set laid "side by each," one set at right angles to the other and just above it. Each set has a bar for the operating lever of every switch, derail and signal in the system, the bar being connected to its lever by mechanism so as to slide a short distance endwise as the lever is thrown. Projecting bolts or "dogs" on one set of the bars slide in and out of corres-



FIG. 208—THE INTERLOCKING PLANT AT FAIRFIELD. SEPT. 20, 1920.

The tower is of structural steel, carrying a frame building of wood above. At Tate's Point the entire structure is brick. The double cross-over appears just beyond the cross pipes in the foreground. These pipes lead back to the tower, where they are worked by the levers shown in Fig. 209. The two cross pipes work, one the switch and the other the switch lock, belonging to the switch at the left in the foreground.

ponding notches cut in the other set, if the notched bars are in proper position. But if a notch is slid along by the motion of the bar carrying it, the corresponding dog is no longer in line, and strikes the bar instead, thus preventing motion. In this way any lever can be "locked" until the interfering bar is again slid back, once more permitting free motion.

At either of the new towers on the Big Four and Erie railway relocation there are 44 of these levers and bars, of which only about 34 are now operated,

The levers, several of which are shown thrown to the right, operate the mechanism, there being a lever for each switch, derail, lock and signal in the system, and also for every switch and derail lock. (See Fig. 208.) The levers at the right are thrown for an out-bound train (from Dayton) from the B. & O. main line over the cut-off to the Wellston Division. The first two throw and lock the switch from the cut-off to the Wellston Division. The next two close and lock the derail protecting the Big Four and Erie from out-bound trains on the cut-off. (The switch first thrown

(Continued below)

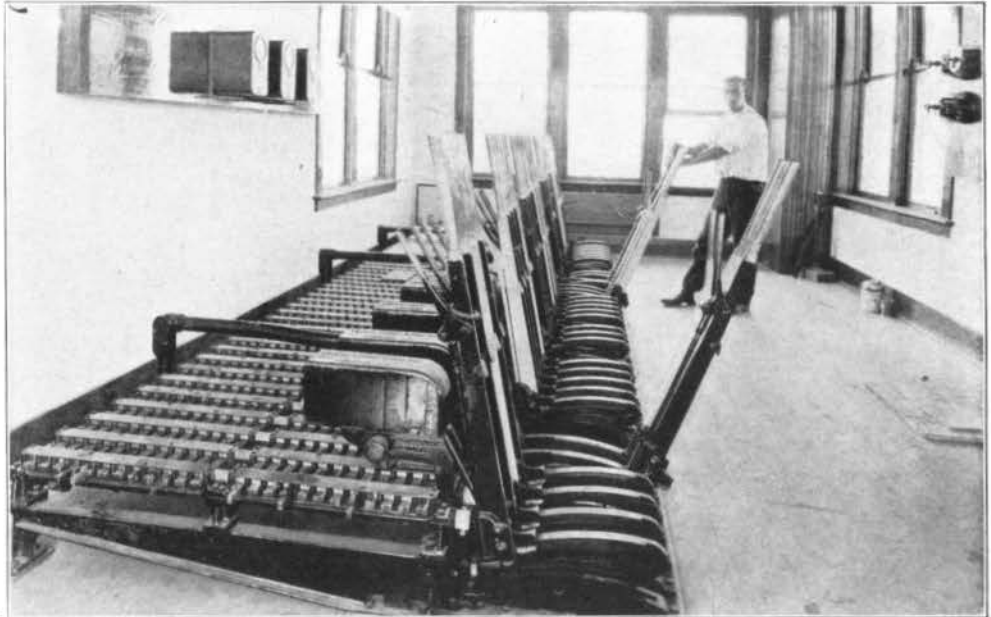


FIG. 209—INTERIOR OF INTERLOCKING TOWER AT TATES POINT. SEPT. 23, 1920.

normally acting as a derail for trains on the cut-off bound in.) The next sets an "advance" signal to "stop" for trains coming in over the Wellston Division which might be around the hill to the east. The next sets a signal beside the thrown derail to the position "proceed," and the next sets a distant signal, several thousand feet down the cut-off to the west, to the same "proceed" position, both these signals telling the engineer of the oncoming train on the cut-off that the track is clear for him. Thus the switches and derails are set first, and the signals last; and the levers are so interconnected that it is impossible to reverse this order. The row of boxes to the left of the levers cover electric switches which operate the distant signals, these switches being connected each to its proper operating lever by mechanism. The two sets of rectangular bars which constitute the interlocking mechanism between the levers, (see page 46,) is seen at the left of the levers and below the switch covers.

the remainder being in reserve for future track additions. Thus at Fairfield there are 35 working levers, which operate the switches and derails on two passing tracks, two team tracks, and two cross-overs, and also the mechanism of 23 signals.

It will be noted that besides the safety feature in this system, there is also a factor of convenience, due to the fact that every switch and signal lever is brought to the central tower. One man thus does all the switching in the "yard" from the one point, saving time and labor of switchmen running about on foot.

In the towers here described, an additional factor of safety is introduced, in addition to that mentioned. Suppose the signal set to "clear" on the east bound track for an approaching Big Four train at Tate's Point. As soon as the train reaches the signal, the semaphore arm drops to the "stop" position, indicating to a following train that the block is occupied. This is accomplished electrically, by means of a little electric motor on the signal mast, connected to a primary battery in the interlock tower, the circuit being automatically closed by an electromagnet on the locomotive as it passes the signal mast. The same electric current locks the levers in the tower also, so that the operator there cannot if he would, open a switch or clear a signal on any conflicting track.

A further word as to the signals. They are carried on two semaphore masts, placed in line at right angles to the tracks, one for each track. (The Big Four and Erie being operated in conjunction between Dayton and Enon as one double track system). Three signals, placed one above the other, are on each mast. The upper signals, set to "clear,"

mean "high speed ahead." The middle signals mean "caution"—reduced speed ahead and be on the lookout. The lower signals mean "low speed ahead and expect a train on the block, a broken rail or other obstruction." If any arm is dropped to the horizontal position, it means "stop." If it is vertical, it means "track clear."

The old system reversed these latter indications. A dropped arm meant "track clear, go ahead." The reason for the change is important. If there were a break in the mechanism, or if sleet froze on the arm perhaps, on the old system the arm dropped to "clear" of its own weight, when the track ahead might in fact be occupied. Now, in a similar case, it drops to "stop," and trains are held up till the mechanism is put right again.

Another feature is that whether needed or not, there are always three signals on each mast. Thus there are three signals on each mast at Tate's Point, although the middle set, meaning "reduced speed," is never used there under the conditions. It is always cleared for "high speed," or "low speed." The installation of three sets of signals where only two are used is on the principle of uniformity of appearance. The engineer, always seeing the same number of signals on a mast, all changes of appearance mean action, either go ahead, or stop. No unnecessary changes in appearance distract his attention.

Both interlocking plants were placed in operation on September 3, when the diversion of traffic on the Big Four was made. The installation was made under the direction of Mr. C. F. Stoltz, Signal Engineer of the Big Four R. R., the work being done by that railway's signal forces, under the direct supervision of General Signal Foreman J. P. McGill.



FIG. 210—WORKING IN THE BIG ROCK CUT AT HUFFMAN.

Number 1 shows the softness of the Elkhorn layer of rock, the marks of the steam shovel dipper being plainly visible in the face of the cut all along the excavation. This rock could have been taken out without blasting, but at an excessive cost.

Number 2 shows how the rock was blasted in a long windrow ahead of the steam shovel, the latter then following and loading the shattered material into the cars.

Number 3 is a close-up of the shovel, a 70-C Bucyrus, which did the major part of the rock excavation. This type is especially well fitted for this class of work.

Number 4 shows the full scope of the work of excavation, with two well drills in operation nearest the observer, and the steam shovel, dump car train and Ingersoll rock drills at work further down, with finished cut at left and above.

THE MIAMI CONSERVANCY BULLETIN

NOVEMBER, 1920

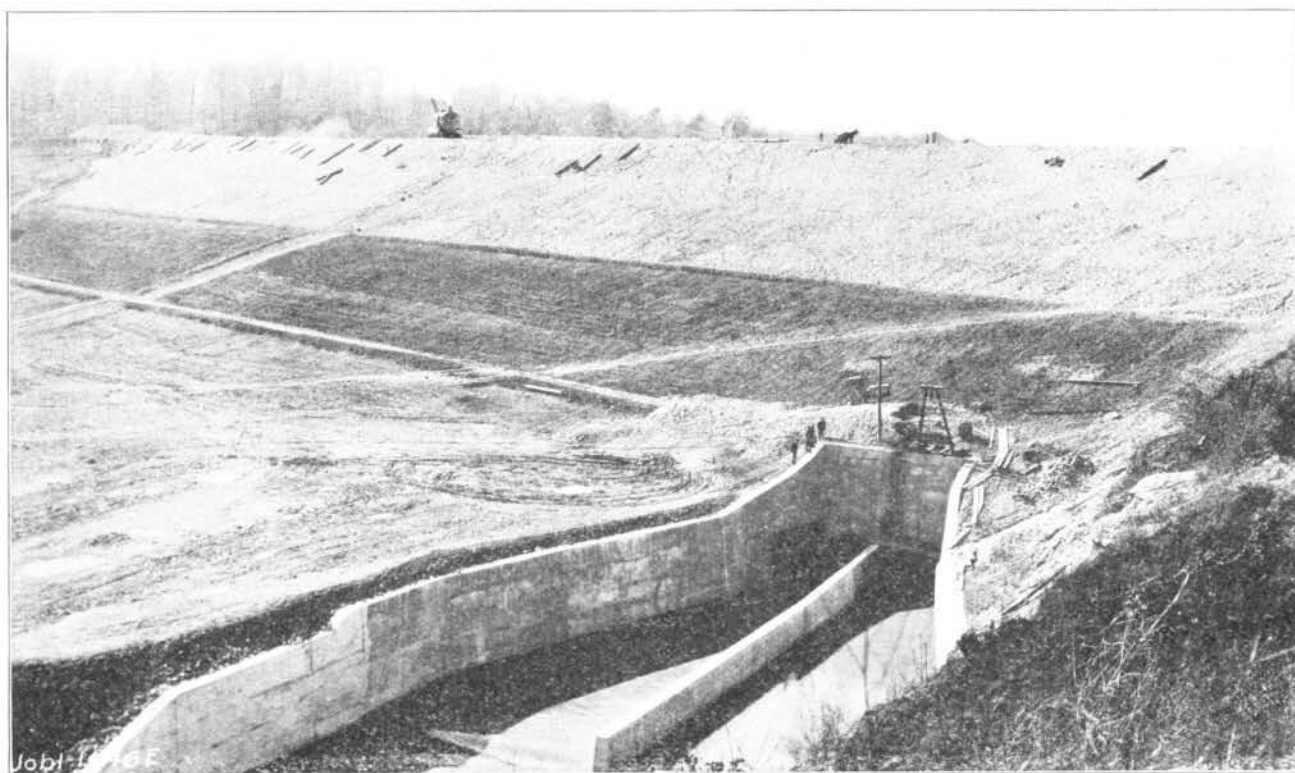
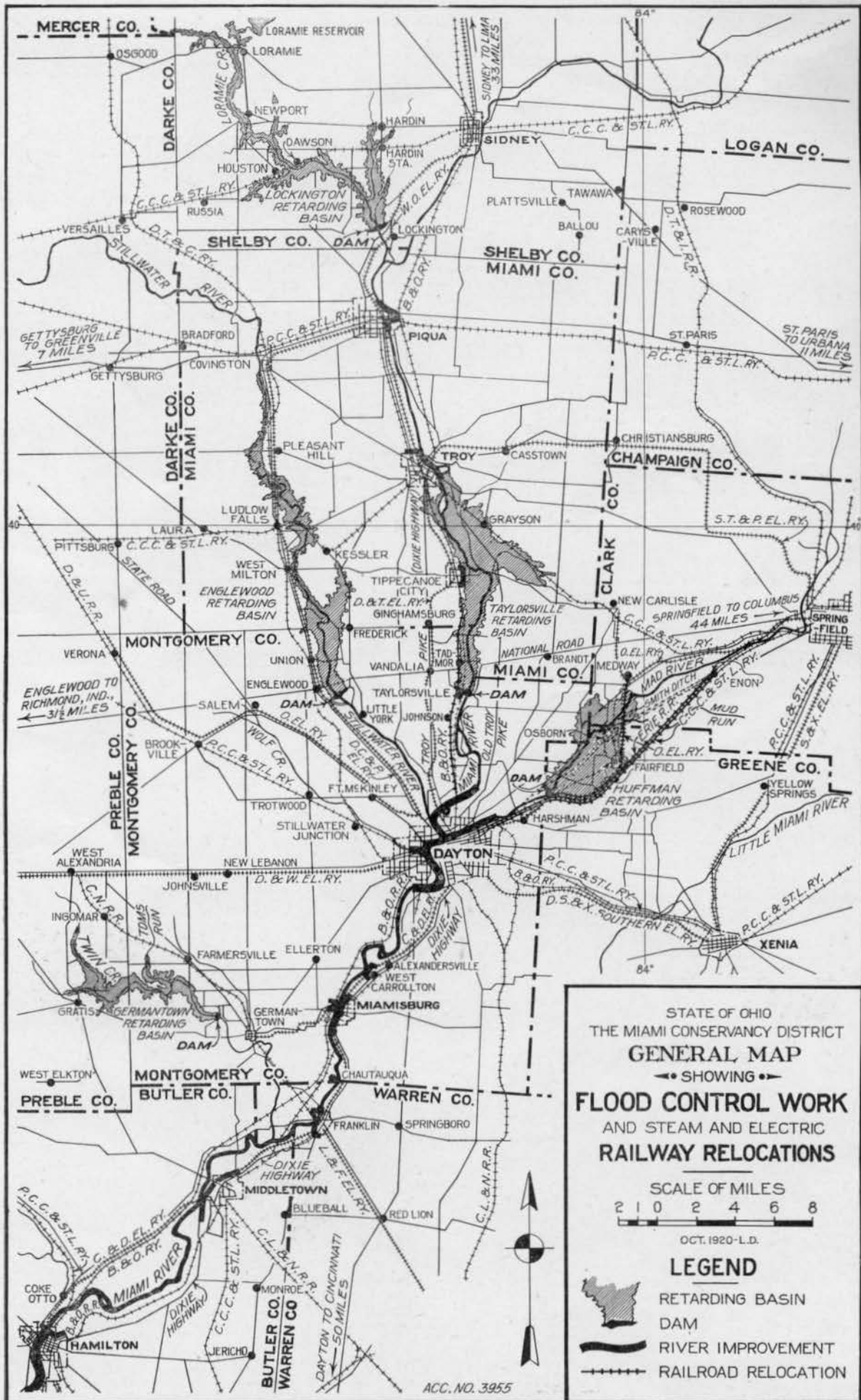


FIG. 211—GERMANTOWN DAM EMBANKMENT UP TO FULL HEIGHT, NOV. 4, 1920



BOARD OF DIRECTORS
Edward A. Deeds, President
Henry M. Allen
Gordon S. Rentschler
Ezra M. Kuhns, Secretary

Arthur E. Morgan, Chief Engineer
Chas. H. Paul, Asst. Chief Engineer
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THE MIAMI CONSERVANCY BULLETIN

PUBLISHED BY THE MIAMI CONSERVANCY DISTRICT
DAYTON, OHIO

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November 1920

Number 4

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

G. L. TEEPLE, Assistant Engineer, EDITOR.

Germantown Dam Embankment Now Up To Full Height

The pumping of material into the Germantown Dam Embankment was completed on November 4, a total of 796,000 cubic yards having been placed.

The placing of gravel to fill up the lower half of the conduits, this to be topped with the finished concrete floor, has already begun, the material being pumped into place like embankment material, but of course without admixture of any "fines." One conduit is closed against Twin Creek for this operation while the other carries the creek water. It is expected that this final work on the conduits will be done before cold weather, as also the last of the work on the spillway, the latter being practically completed now. Thus a spring flood will find the Germantown Dam affording complete protection.

Bound Volumes of the Bulletin

The index to the first two volumes of the Bulletin is being sent as a supplement with all copies of the present issue. If those desiring their Bulletins bound will kindly send us back the Index, with the issues, August, 1918, to July, 1919, inclusive, we shall be glad to attend to the matter for them. We have been able to arrange a price of \$1.50 for this service, which is better than we had expected. Some missing issues can also be supplied at the regular price, but not all.

Map of the Conservancy Work

Attention is called to the map on the inside front cover page, showing the location and nature of the

entire work of the District, as revised to date, including road changes. This map has been prepared with great care, and is practically a final map.

Third Report of the Board of Directors

The third annual report of the Board of Directors to the Conservancy Court has been made since our last issue. In general it shows that the work has gone forward at an excellent rate of progress, with a probability that it will be completed somewhat ahead of the anticipated date. The statement of financial conditions, showing receipts and disbursements brought up to June 30, 1920, is reproduced in summary on page 52. It shows an expenditure to June 30 of \$26,637,491.76, and a balance on hand at the same time of \$2,783,152.29. The special levy of \$10,793,231.17, noted in our last issue, made necessary by the great increase in the cost of labor and materials since the original estimate was made, is expected to be sufficient to carry the project through to completion. Gratification is expressed at the excellent response of the taxpayers to the assessments, the delinquency on a total levy of \$3,300,994.22 net during 1918 and 1919 being only \$20,363.27, or six-tenths of one per cent. The favorable course of litigation is also noted. Appeals regarding benefits are now closed in five of the nine counties of the District, and no other litigation of importance is in prospect.

The report of Chief Engineer Morgan, appended to the report of the Board, gives the progress on the various construction features, brought up to Sept. 1,

Flood Control Works Proper

	To Oct. 1, 1918	To Oct. 1, 1919	To Sept. 1, 1920
Earth removed from cut-off trenches, outlet works, spillways and structures	274,680 cu. yds.	682,312 cu. yds.	877,010 cu. yds.
Loose rock, hard pan and solid rock removed from cut-off trenches, outlet works, spillways and structures	64,535 " "	357,412 " "	442,567 " "
Earth placed in dams	87,900 " "	1,504,012 " "	3,978,490 " "
Earth placed in levees	55,800 " "	374,209 " "	721,246 " "
Earth removed from river channels	47,190 " "	1,096,700 " "	1,467,327 " "
Earth moved in soil stripping and in dressing slopes with earth	100,127 " "	158,437 " "	181,276 " "
Earth moved in permanent road building	7,840 " "	41,437 " "	93,409 " "
Earth moved in sewer and drainage construction	2,360 " "	18,720 " "	25,242 " "
Concrete placed	11,680 " "	104,945 " "	144,734 " "
Clearing and grubbing	21 acres	80 acres	104 acres
Steel reinforcing and steel piling placed	0 pounds	535,607 pounds	1,446,245 pounds
Riprap placed	0 cu. yds.	0 cu. yds.	5,233 cu. yds.

Public Service Relocations

	To Oct. 1, 1918	To Oct. 1, 1919	To Sept. 1, 1920
Earth excavation	193,500 cu. yds.	1,560,770 cu. yds.	1,785,250 cu. yds.
Loose and solid rock excavation	270,500 " "	726,120 " "	* 713,207 " "
Concrete placed in structures	8,500 " "	30,620 " "	32,698 " "
Gravel placed on relocated roads	0 sq. yds.	21,900 sq. yds.	26,882 sq. yds.
Steel reinforcing placed	0 pounds	638,000 pounds	811,179 pounds
Track laid	0 miles	13.5 miles	47.98 miles
Track ballast placed	0 cu. yds.	6,000 cu. yds.	214,000 cu. yds.
Wire lines relocated	0 miles	0 miles	23.6 miles

* Small decrease due to change in classification.

1920. A summary of the volume of work done is reprinted on this page. The total force at work during the last winter was reduced to an average of 1,000 daily, with 1,200 on the payroll, the number being gradually increased with the advancing season to upwards of 1,700 on the payroll, with upwards of 1,600 at work each day. The contentment of the labor forces is noted, as well as the marked improvement in the efficiency of the average employee.

The state of the program at the several features is given as follows: The Railway Relocations are

practically completed, permitting full speed at Taylorsville and Huffman. The Germantown Dam is also practically completed, as noted elsewhere, and affords full protection. The Englewood Dam is about half completed, and a little ahead of schedule, with the temporary spillway now built and protecting the construction against even a 1913 flood. The Taylorsville outlet is completed, except the spillway, so that the river closure can be made in the spring of 1920. Closure of Mad River at the Huffman Dam

(Continued on page 54)

Condensed Summary of Net Cash Receipts and Disbursements, August 12, 1915, to June 30, 1920.

	Aug. 12, 1915 to Dec. 31, 1919	Jan. 1, 1920 to June 30, 1920	Totals Aug. 15, 1915 to June 30, 1920
Net Cash Receipts			
Sale of Bonds (Net)	\$19,594,900.00	\$4,482,752.42	\$24,077,652.42
Taxes	1,777,254.42	777,474.35	2,554,728.77
Assessments Paid in Advance	765,262.45	20,698.02	785,960.47
Interest Earned	357,565.08	95,906.26	453,471.34
Sale of Real Estate	115,094.36	15.00	115,109.36
Sale of Farms	53,619.16	310,729.70	364,348.86
Real Estate Operation Receipts	391,431.61	165,214.37	556,645.98
Engineering Department Receipts	135,279.92	52,349.76	187,629.68
Miscellaneous Receipts	129,698.96	12,641.91	142,340.87
Accounts and Notes Receivable	175,229.07	7,527.23	182,756.30
Total Net Cash Receipts	\$23,495,335.03	\$5,925,309.02	\$29,420,644.05
Net Cash Disbursements			
Interest on Bonds	\$ 1,925,000.00	\$ 669,368.99	\$ 2,594,368.99
Interest on Loans	40,241.00		40,241.00
Temporary Building	17,091.87		17,091.87
Osborn Items	128,035.00	5,889.93	133,924.93
Miscellaneous Items	9,545.10	1,495.00	11,040.10
Administrative Department	202,747.03	43,112.70	245,859.73
Legal Department	345,139.48	40,192.18	385,331.66
Taxation Department	219,975.72	17,163.72	237,139.44
Real Estate Investments	7,465,960.86	203,216.19	7,669,177.05
Land Operations	203,437.79	69,863.01	273,300.80
Crop Operations	43,540.82	3,361.98	46,902.80
Miscellaneous Land Items	5,328.45	38.19	5,366.64
General Expense	147,558.72	46,779.82	194,338.54
Engineering and Construction	12,539,948.63	2,243,459.58	14,783,408.21
Total Net Cash Disbursements	\$23,493,550.47	\$3,143,947.29	\$26,637,497.76
Balance on Hand, June 30, 1920			\$ 2,783,152.29

The Borrow Pit at Englewood

A Tract, 3,000 Feet in Length and Breadth, From Which 3,500,000 Cubic Yards of Material Is Being Excavated to Make the Dam Embankment.

By H. S. R. McCurdy, Division Engineer.

Broadly speaking, a hydraulic fill dam is composed of two general classes of material, namely, the fine-grained impervious central core and the coarse, porous outer portions. The function of the central core is to render the dam a water-tight barrier against leakage of impounded water in the reservoir. To insure this result the material forming the core should be extremely finely graded. It must settle in the water of the pool and form a compact, impervious mass, but this stiffening action should not be so slow that the core fails to resist encroachment from the gravel constituting the outer portions of the dam. For this reason a core composed of too fine grains is undesirable owing to the length of time required for it to expel its excess water and reach a condition of solidification.

The outer portions of the dam serve to confine the central core which, as sluiced into place, would otherwise flow to very flat slopes. Obviously the material forming the outer portions must be heavy and porous, heavy to resist displacement by the thrust of the semi-liquid core and porous to enable it to drain freely and to stand at the required slopes. In the Conservancy dams the core resembles a sticky, unctuous mud, while the outer portions are of sand and gravel. The combination of materials acts as a unit in forming a structure capable of resisting the thrust of impounded water.

With the foregoing rather exacting requirements

in mind the borrow pits were selected. Fortunately Nature had dealt kindly with the Miami Valley in this respect; otherwise the dams would not have been built as they are.

At Englewood, as at the other dams, vast deposits of alluvial material were left by the ice "sheet" during the Glacial Epoch, and worked over by the torrents from its melting. These deposits are composed of sand and gravel in various proportions, overlaid with from two to four feet of fertile dark brown soil. The sands and gravels are ideal for the outer portions of the dam and, in addition, contribute a small amount of "fines" to the central core. The greater portion of the core, however, comes from the top soil.

The borrow pit at Englewood lies upstream from the dam, extending northerly to the National Road, a distance of about 3,000 feet, and will have an east and west width of approximately the same amount. It will cover roughly 200 acres. The depth of excavation averages about 15 to 20 feet.

Lying as it does in the river valley, the borrow pit affords no opportunity to sluice material into the dam by gravity. Several means of conveyance were feasible, but for economic reasons trains of side-dump cars were selected. The cars are of 12 cubic yards nominal capacity. Five cars constitute a train, which is hauled by a 40-ton locomotive. All track is standard gage.



FIG. 213—CIRCULATION PUMP, ENGLEWOOD CORE POOL, RIVER SECTION, JUNE 8, 1920

Shown also at the left edge of pool in Fig. 214. Water came to the pool from the dredge pumps through the left-hand pipe in that figure, bringing materials for the dam embankment. These materials being dropped to the bottom of the pool, the cleaner water near the pool surface, emptied of its load of earth, was returned to the dredge pumps for a fresh load by the pump here seen. The pump was carried on a scow floating on the pool, and rose as the water in the pool rose with the growing dam embankment.



FIG. 214—BEGINNING HYDRAULIC FILL OF THE RIVER SECTION, ENGLEWOOD DAM, APRIL 5, 1920

Compare with Fig. 215, which shows one month's progress on the embankment. The bank at the left in both pictures is the cross dam built on the old river bank to retain the core pool of the east section of the dam, this section being still farther at the left, out of the picture. A similar cross dam is out of sight at the right, on the old west bank of the river, to retain the west end of the river section core pool, the latter occupying the center of the picture. The entrance to the completed dam conduits, carrying the water of the river (in the foreground), is seen at the right. The old bed of the river is seen at the left of the conduits, cleaned of all silty material down to bed rock. The upstream toe of the dam embankment is just being formed by the material coming out of the pipe at the left, reaching across to meet the conduit entrance.

The material for the dam is excavated and loaded into the cars by two 115-ton draglines, one steam and one electric, fitted with 85-foot booms and equipped with $4\frac{1}{2}$ -yard buckets. Another smaller steam dragline is located in the borrow pit excavating material for concrete aggregates, gravel for ballast and a limited amount of fill for the dam.

The tracks are laid running north and south through the borrow pit, connecting at the dam with the pumping plants where are located the 15-inch dredge pumps which handle the material into the dam.

The cuts run north and south in the pit, the successive cuts progressing from west to east. The first cut was taken out near the river, the draglines loading onto a track to the east. While this was in progress a second track was laid down for use upon the completion of Cut No. 1. Progressively, across the borrow pit, tracks were laid, 150 feet on centers, as the succeeding cuts were made.

The draglines travel up one cut and down the next, being spaced about 1,500 feet apart along the cut. In this manner one reaches the middle of the pit as the other reaches the end and each moves to the new cut at about the same time. In each cut the dragline excavates the area between the face of the previous cut and the loading track, backing along as it works.

The method of operating the trains is as follows: One train stands at each dragline. As the train at the northerly dragline is loading its next to the last

car the engine runner blows his whistle. At this signal the train at the southerly dragline proceeds to the northerly dragline. The time of loading the last car at the latter allows time for this move so that as the loaded train moves out its place is immediately taken by the other and the dragline is not delayed. There are six trains in service and the empties proceed directly from the pumps to the southerly dragline, waiting there for the trains to be loaded and move ahead. Should it happen that a train at the southerly dragline is fully loaded before a signal comes from the northerly dragline it moves directly to the pumps by means of a cross-over from the loading track. As the empty trains return from the pumps they pass the coaling and watering station and take on fuel as required.

While the dragline buckets are classed as of $4\frac{1}{2}$ cubic yards capacity, experience with over two million yards has shown that each bucketfull builds 3 cubic yards of finished dam. To date the best dragline performance has been to load 274 cars, or 2,470 cubic yards, in a 10-hour shift. At three bucketfulls to a car this involves 822 scoops and swings. The average monthly output for each dragline, working two shifts, is a little over 75,000 cubic yards.

Report of the Board of Directors

(Continued from page 52)

is affected, and construction safety against a 1913 flood expected by winter. The channel improvement through the cities is progressing in general accordance with the schedule.



FIG. 215—RIVER SECTION, ENGLEWOOD DAM EMBANKMENT, JUNE 8, 1920

Picture taken one month and three days after that in Fig. 214, showing progress. The scale is given by the men beside the conduit entrance in Fig. 214. The small dragline excavator above is building the upstream levee which bounds the top of the beach slope of the core pool, which is unseen, beyond the embankment slope. The wood tower in the pool in Fig. 214 carries the pressure cells which give a measure of the stability reached at various depths in the dam core.

September Progress on the Work

GERMANTOWN

The entire length of the upstream slope and about half the downstream slope of the dam is now up to elevation 824. Thus only six more feet are needed to bring the dam to its final elevation.

During September 49,770 cubic yards of hydraulic embankment were pumped into the dam, making the total yardage pumped up to the end of September, 751,190 cubic yards. This is approximately 95 per cent of the completed structure.

Concreting of the spillway is being pushed to good advantage. The slope revetments, cut-off trenches and wiers in the spillway channel are completed. All piers of the bridge except the north abutment and the three central spans have been completed. Carpenters are building forms for the south approach span and for the parapet walls on the central span.

The installation of plant and equipment for putting in the permanent floor in the conduits is being rushed to completion as fast as possible.

J. C. McCann has completed his work with the steam shovel in the spoil banks near the outlet works, and removed the shovel from camp September 12. He is now grading and levelling by teams, which is only a few days work.

Arthur L. Pauls, Division Engineer.

October 19, 1920.

ENGLEWOOD

During the month ending September 25, all previous records for pumping hydraulic fill were broken, 162,000 cubic yards being placed. This month saw the portion of the dam across the old river channel carried up to an elevation of 10 feet higher than the section east of the river, of which the most had been built during the season of 1919. During the month, also, the two-millionth cubic yard was placed in the dam. On October 5 the depositing

of material into the river closure was temporarily discontinued and preparations made for resuming fill in the section of embankment east of the Stillwater River. On October 11 this work was begun from Sump No. 3 and continued until October 14, when operations were transferred to Sump No. 2. The two sections of embankment now being continuous the fill will be carried up as a unit, over a length of 3,000 feet, using Sumps Nos. 2 and 3 in sequence. A fact perhaps worthy of mention in this connection is that the embankment in the river closure was carried up to a height of 82 feet in a few days more than 5 months, involving the handling of 750,000 cubic yards of material.

Cross Dam No. 2 was finished during the month and the electric dragline completed excavating the entrance to the temporary spillway.

Work was continued on the crib for the protection of the levee at the outlet of the temporary spillway.

A small amount of dry rubble paving was laid at the entrance to the outlet conduits. A granite tablet admonishing coming generations from utilizing the retarding basins for either storage or power purposes was set in the head-wall at the outlet of the conduits.

A booster pump, for assisting in passing material to the extreme easterly end of the dam from Sump No. 2 was set.

H. S. R. McCurdy, Division Engineer.

October 15, 1920.

LOCKINGTON

During the last six weeks the hydraulic fill has been placed in the dam at an average rate of 57,200 cubic yards per month. The dykes on the dam, around the pool have reached a height averaging 27 feet from the finished top of dam. Extremely hard clay such as runs in the eastern part of the borrow pit, and at Taylorsville, has been encountered also in the northern part.



FIG. 216—PANORAMA OF BORROW PIT, ENGLEWOOD

The stone surface dressing and paving on the dam is progressing satisfactorily and a part of it that was left unfinished last year is being completed.

An 8-foot concrete arch culvert 40 feet long was built on Road 9 preparatory to placing the fill of 4,500 cubic yards at Fox Creek, adjacent to the Western Ohio R. R. track. The fill will be made under contract with G. H. Heffner & Son. They are now moving a steam shovel to the work.

Gravel is being placed on Roads 9 and 10, to increase the original allowance for surfacing, which proved insufficient. Some bids have been received for the work on Road 11, known locally as the Bunker Hill Road.

Barton M. Jones, Division Engineer.

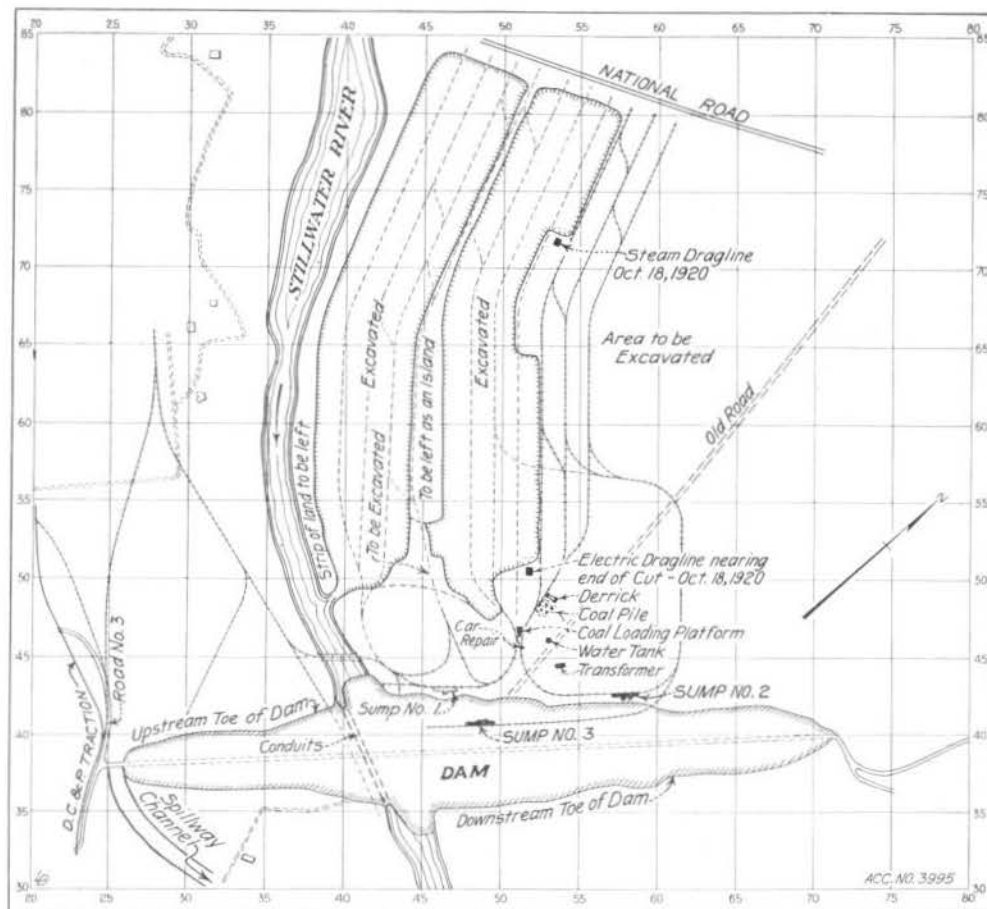
October 5, 1920.

TAYLORSVILLE

The Lidgerwood dragline has finished the excavation of the inlet channel to Station 4+50, which leaves about 250 feet more to be finished before moving down to the outlet channel.

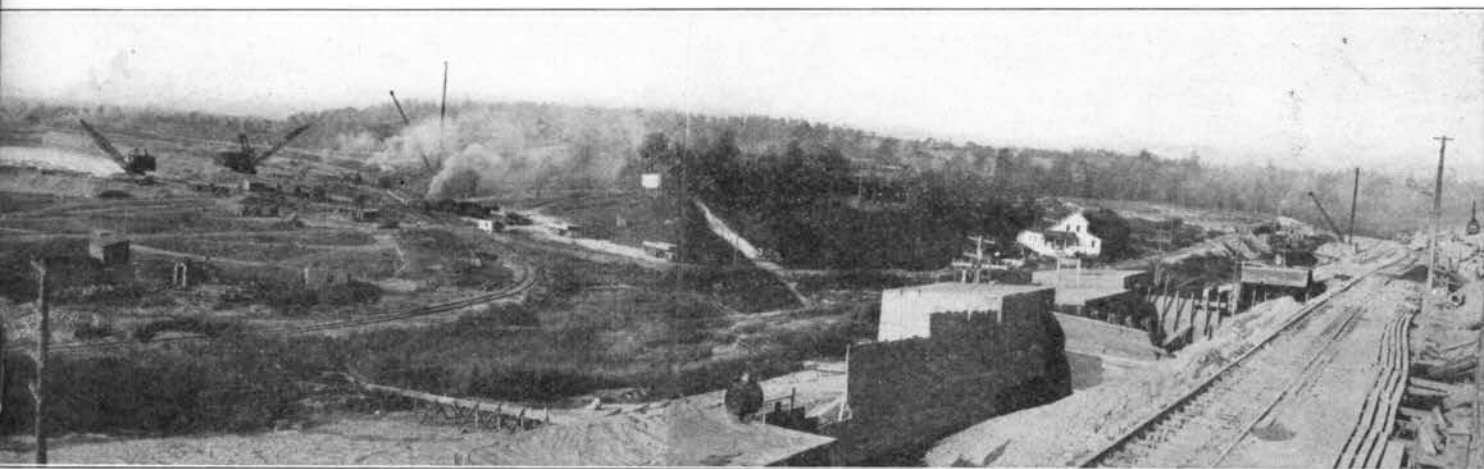
The sluicing at present is taking only the output of the dragline, which averages about 1,600 cubic yards per day, the sluicing being done in one shift, while the dragline runs two.

The concrete derricks have been dismantled and removed from the work; also the trestles and concrete tracks have been removed. The gravel plant has been dismantled except the bins and concrete mixer, these being left to mix the concrete for about 150 cubic yards of



This plan should be studied in connection with the panorama shown in Fig. 216, which gives a view of the borrow pit looking northwest from a point on the dam embankment just to the left of "Sump No. 3" in the plan. In the picture Sump No. 3 is seen in the immediate right foreground, Sump No. 2 beyond and to right of Sump No. 3, beside the derrick. The borrow pit extends about 3,000 feet from the dam to the National Road, which is just beyond the water occupying the excavated pit in the center distance. The two nearest dragline excavators and the third in the distance beyond, in right center, have done all the excavating, the one at the right (electric), and the one in the distance (steam), doing 98 per cent of it. The derrick for unloading coal for the locomotives (at right of the dragline), the water tank, transformer sub-station, etc., can be picked out by comparing the picture with the plan.

FIG. 217—PLAN OF ENGLEWOOD BORROW PIT



DAM, OCTOBER 22, 1920. SEE CAPTION OF FIG. 217

paving on the upstream toe of the dam near the inlet channel.

The Bucyrus dragline has been moved from the gravel pit to excavate and backfill for the concrete paving mentioned above. A part of this paving is below water and it is important to get it in before the big dragline completes the inlet channel.

Mr. Crampton has finished the grading on Road No. 12 to Station 80+00.

O. N. Floyd, Division Engineer.

October 26, 1920.

HUFFMAN

The last of the ballast gravel for the railroad relocation work was delivered on October 18, and the placing of material upon the dam was begun again by both the day and night shifts.

Twenty-eight thousand yards of material were placed in the dam embankment during the month of September.

The old Erie tracks have been taken up across the location of the dam, and the right-of-way is being cleaned off in preparation for building up the short section of the dam left out as a gap for the railway until the latter could be moved to its new location. The filling of this gap will tie the north end of the dam to the hill. The dam will now be carried up over the entire distance from the outlet works at the south end to the hill at the north end.

Stone is being gathered up along the old Erie Railroad bed and from the old stone bridge abutments, and is being placed as rip-rap along the sides of the entrance channel to the outlet works.

C. C. Chambers, Division Engineer.

October 23, 1920.

DAYTON

Dragline D-15 is working down stream on the right bank of the river between Washington Street and Stewart Avenue, cleaning up channel excavation and building the levee. This machine also built the ramp for a track to be used later in hauling the material from channel excavation between Fifth Street and Washington Street. D-16 has completed the fill back of South Robert Boulevard Wall and is excavating in the channel opposite, the material being scowed to the gravel plant. D-8 is unloading excavated materials at the gravel plant. D-19 is excavating in the channel west of Main Street.

Sunset Avenue wall has been completed and the derrick has been moved upstream and started excavating for First Street wall. Excavation for Beach Avenue wall has been nearly completed and two 16-foot sections of footing have been poured. Good progress is being made with Stillwater wall. A total of 1700 cubic yards of concrete has been placed, the wall being 46 per cent completed.

Finke Engineering Company is still working at the old launching basin, some of the material being hauled by teams to enlarge the levee between Helena Street and the Dayton Canoe Club house.

Price Brothers are placing revetment on the north bank of the river east of Dayton View bridge and driving piles for revetment on the east bank at Herman Avenue.

To date 42,900 cubic yards of sand and gravel have been issued from the gravel plant.

Summary of Excavation and Embankment

	Previous Cu. Yd.	During Sept. Cu. Yd.	To Date Total Cu. Yd.
Channel Excavation			
Item 9.....	605,000	20,000	625,000
Levee Embankment			
(Incl. Cont. No. 41.....)	76,000	5,600	81,600
Total yardage handled.....	1,600,000	65,800	1,665,800

These figures do not include 105,000 cubic yards of excess excavation for the launching basin and scowing canals.

C. A. Bock, Division Engineer.

October 18, 1920.

HAMILTON

The electric dragline, D-16-18, has again passed under the railroad bridge, going north, and has started to excavate the last cut on the west side of the river, between Main Street and the railroad.

The total amount of channel excavation, item 9, to October 1, was 761,500 cubic yards.

Excavation and pile driving for pier No. 2, Black Street bridge, have been completed, and pier No. 2 has also been concreted to low water level. The Bucyrus steam dragline, D-16-17, has diverted the river to a new channel between piers 3 and 4, and has crossed the river to the west bank where it is excavating for piers 5 and 6. It is the intention to surround these two piers with one coffer dam.

The 24-inch water main across Old River has been lowered so as to pass below the bottom of the Ford tail-race. A second line of pipe is now being laid to take care of a future increased water supply. This work will be completed in a few days. It is expected that the Ford power plant will be in operation, and water turned into the tail-race, by November 1.

Excavation and concreting are being continued at the Black-Clawson wall.

The total number of concrete blocks manufactured to date at Price Bros' block plant is 135,000. The concrete revetment on the east side of the river, between Main Street and the railroad bridge, was completed on September 30.

C. H. Eiffert, Division Engineer.

October 20, 1920.

TROY

The dragline on the Jeffrey contract completed its river crossing and B. & O. Railroad crossing by October 5 and started excavating from the river channel below Market Street on October 9. To date it has excavated about 5,000 cubic yards from this section. The material is being placed on the left side of the channel cut and will be hauled away to spoil banks by the C. & C. Haulage Co.

The C. & C. Haulage Co. has excavated 19,000 cubic yards, Item 9, since the last report, bringing their total to 46,000 cubic yards. This excavation is between the Market and Adams Street bridges.

The Finke Engineering Co. has placed 18,500 cubic yards of material in the levees along Morgan Ditch. The first 1,100 feet of the south levee has been completed by the addition of top soil and seeding, and 500 feet of the north levee is practically ready for seeding. The material for the balance of the levees is being obtained from a borrow pit east of the M. & E. Canal and south of th Morgan Ditch.

The Pearson Levee has been completed by Wm. Oberer. This levee was made from side borrow and consists of 6,300 cubic yards over a length of 2,070 feet.

The surfacing and seeding of the levee made by McGillicuddy & Co., has been started and will be completed in the near future.

A. F. Griffin, Assistant Engineer.

October 20, 1920.

LOWER RIVER WORK

Miamisburg—Levee construction on the west side of the river has been completed and the contractors, Jeffrey, Boorhem & Co., have shipped out their equipment with the exception of the dragline machine and boarding cars.

Cole Bros. have constructed about 200 lineal feet of levee on the east side. Their dragline machine has been undergoing repairs since the middle of October, which accounts for the small amount of work done.

The Thos. & John S. Daniel Co. have commenced work on the elevation of Main Street and the construction of the section of levee which crosses this street at right angles just south of the north corporation line. They are using six "three-up" teams and 1½-yard bottom-dump wagons, loading with a small steam shovel.

Franklin—Jeffrey, Boorhem & Co. are nearly through with their train outfit on the west side levee construction. They are now placing top soil on the levee below Lake Avenue. As soon as this is done the dragline machine will move eastward through the gap in the levee just north of Lake avenue and close this opening. This will complete the west side levee except for dressing and seeding. Protection for the west side will not be complete, however, until the Miami Avenue wall is built.

The Thos. and John S. Daniel Co. are ready to commence work on the levee which is to extend eastward from the Dixie Highway opposite the Chautauqua dam, to the foot of the hill on the east bank of the canal.

Middletown—Work on concrete revetment between Fifth and Sixth streets is progressing fairly rapidly. The Price Bros. Co. is using two concrete mixers and an average of 25 men on this job. The work is about 40 per cent complete and at the present rate of progress should be finished in a little less than three weeks.

F. G. Blackwell, Assistant Engineer.

October 25, 1920.

RAILWAY RELOCATION

Fig Four and Erie—All of the trains of the Big Four and Erie are now operating over the new line, the Erie having been transferred to its new location October 4.

The team tracks of the Erie at New Osborne have not been constructed. They will be started as soon as their location has been definitely determined. All of the Big Four and Erie construction is therefore complete with the exception of the team tracks mentioned, the new station, and other miscellaneous items of lesser importance.

The Springfield pike at Huffman is now open for public use, but is not complete, the finishing depending upon the removal of a temporary construction track now connecting the new railway line with Huffman Dam. This temporary track serves for the delivery of freight to the dam.

The signal system at Fairfield is complete, but the Tates Point signal system is not entirely so, because of delay in shipment of wire for the electric circuits.

Mr. M. K. Frank of Pittsburgh is dismantling the old Erie Railroad, he having purchased the rail and bridges, except the two truss bridges crossing the Mad River at Kneisly and Huffman.

Baltimore & Ohio Railroad—Mr. J. C. McCann has been awarded the contract for the widening of the embankment at the Narrows, and should complete this work, totaling about 7,000 cubic yards, during the month of November.

All of the rail in the old line has been taken up, as well as the bridges. The old ties also have been taken up, and are being shipped to other district work for construction purposes. The Baltimore & Ohio Railroad secured about 8,000 of these ties.

Ohio Electric Railroad—The Walsh Construction Company finished their contract on the electric line on the 29th of October. The track, trolley and pole line construction is thus practically complete from Dayton to Fairfield. There only remains to be done, between Fairfield and Huffman, the track connections to the old line, and also the two passing tracks. Beyond Fairfield, the new line will be built next season.

Albert Larsen, Division Engineer.

October 25, 1920.

RIVER AND WEATHER CONDITIONS

The rainfall in the Miami Valley during the month of September varied from 0.92 inches at the Lockington Dam to 2.85 inches at Fort Loramie. At Dayton it amounted to 2.62 inches or to 0.12 inches more than normal, reducing the accumulated deficiency since January 1 to 2.68 inches. The rivers were low during the entire month.

Observations taken by the local office of the U. S. Weather Bureau show that the mean temperature for the month was 67.9 degrees, or 0.9 of a degree more than normal; that there were 16 clear days, 10 partly cloudy days, 4 cloudy days, and 8 days on which the precipitation amounted to or exceeded 0.01 of an inch; that the average wind velocity was 7.6 miles per hour, the prevailing direction being from the southwest; and that the maximum wind velocity for five minutes was 26 miles per hour from the southwest on the 15th.

Ivan E. Houk, District Forecaster.

October 25, 1920.

The nearest railway to the Germantown dam being about 2½ miles away, this dump car, needed for the river work at Hamilton, had to be transported from the dam to the railway over country roads. It was loaded on a special broad-wheeled truck, and hauled by two traction engines, coupled tandem. One of these dump cars weighs 25,500 pounds.

All of the dams but Germantown are located close to railways, so that expedients like that shown do not have to be resorted to usually in shipping equipment.

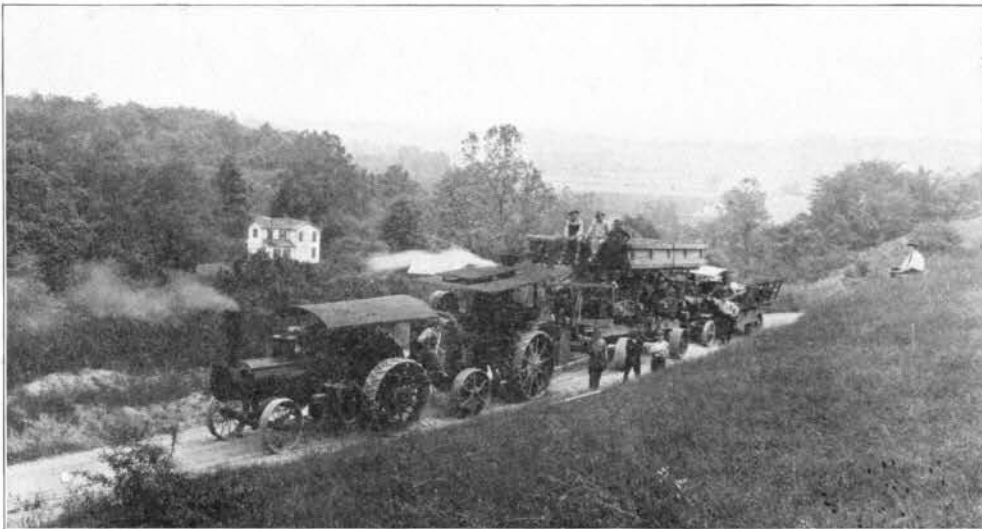


FIG. 218—HAULING A 12-YARD DUMP CAR OVER COUNTRY ROADS FOR SHIPMENT, JUNE 6, 1920

The Stillwater Drive Retaining Wall

Concrete Structure 920 Feet in Length, and 20 Feet Above Slope of River Bed, Replaces Levee.

By E. L. Chandler, Assistant Division Engineer.

Stillwater Drive Wall, now in progress of construction on the north bank of the Miami River in Dayton, just east of Main Street bridge, is similar in its principal features to eight of the walls to be built as part of the channel improvement. The river being narrow at this point, a wall is required instead of the usual levee, in order to secure the necessary additional cross section area in the channel to carry the assumed maximum flood flow, with minimum encroachment on the valuable property next the river. The wall will also facilitate the flow of the water under the northerly spans of Main Street bridge. The Miami bends so sharply opposite Stillwater Avenue that the direction of flow at Main Street is nearly at right angles to that at Herman Avenue, and the momentum of the water naturally tends to throw it to the outside of the curve, through the southerly spans of Main Street bridge, lessening the flow through the northerly spans. The new wall will not only enlarge the channel, but by an improved alignment provide a regular and easy approach to this bridge, and thus tend to equalize the flow through the spans. The total length of the structure will be 920 feet, extending from the wing wall of Main Street bridge to a point near the east end of Emmet Street. (See Fig. 220). For a

distance of 672 feet, to the point where it meets the top of the new levee, the wall is 20.3 feet high above the finished channel slope. From this point upstream it gradually diminishes in height, continuing on an easy curve down the levee slope to the foot of the latter, where it stops, the channel width beyond being sufficient to permit the use of the ordinary grass-covered earth slope.

Two types of design are employed, the "gravity" section where the wall is below ten feet in effective height (at the upstream end), and the "semi-reinforced" section for the remainder. See Fig. 221. In the gravity wall no steel is used, the weight of the massive concrete being sufficient to support the thrust of the earth behind the wall. In the higher "semi-reinforced" parts, the introduction of the reinforcing steel to take part of the stress induced by thrust saves expense. The wall is built in 16-foot sections, the intervening joints being keyed and thoroughly coated with asphalt. The footing is poured in one operation, the shaft (from top of footing to bottom of coping), in a second, and the coping section in still a third. See Fig. 223.

The accessibility of the work and a consequent speeding up of progress, were much facilitated by a preliminary earth excavation, removing the material

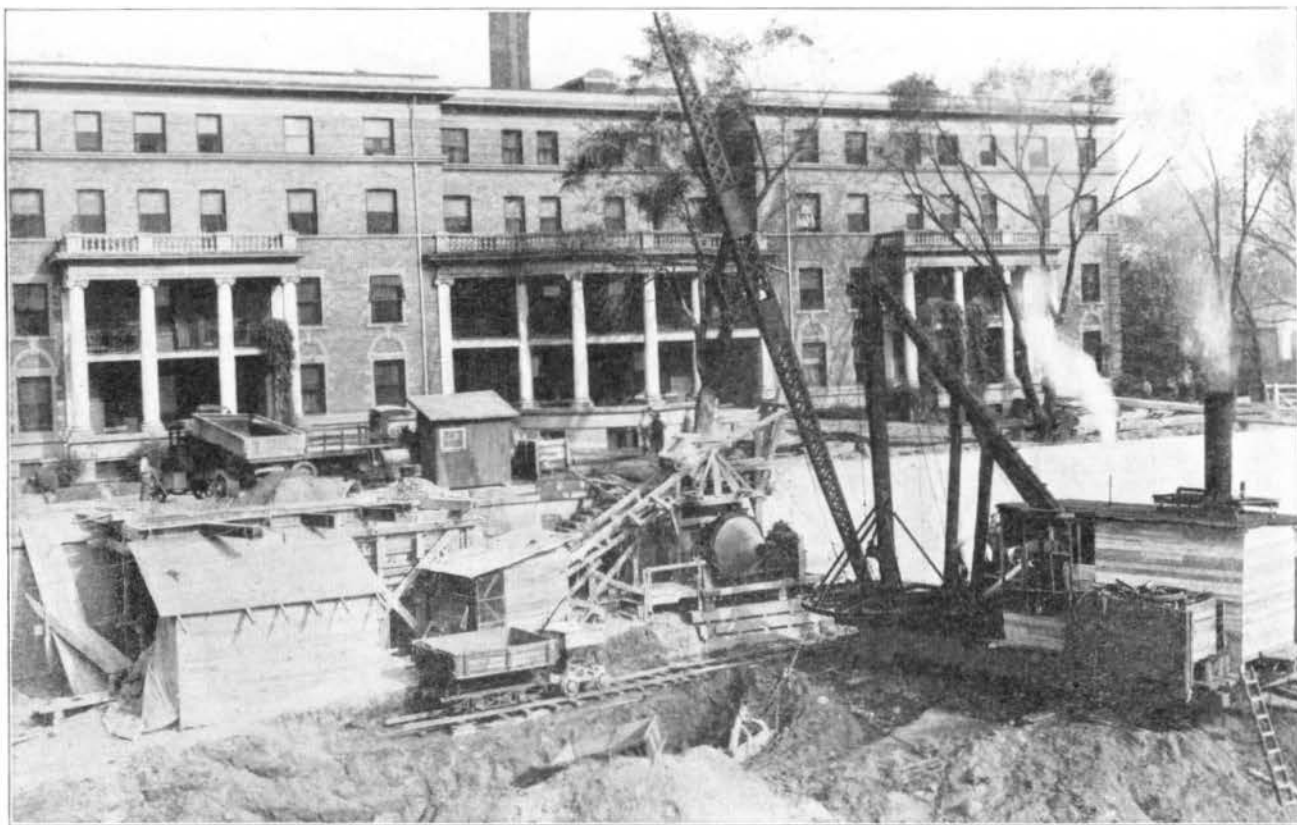


FIG. 219—CONCRETING PLANT, STILLWATER DRIVE RETAINING WALL, DAYTON, OCT. 23, 1920

The truck at the left brings sand and gravel from the District's plant at Sunrise Avenue, and dumps it into bins as seen, their tops level with the roadway. From the bins these materials pass through measuring boxes to a small car below, which when loaded is hauled up the incline by an electric motor, to the bin seen above the concrete mixer (the conical drum of which is seen under the derrick boom). From this bin it passes by gravity into the mixer, and from that into cars which carry it to the concrete forms. See also Fig. 223.

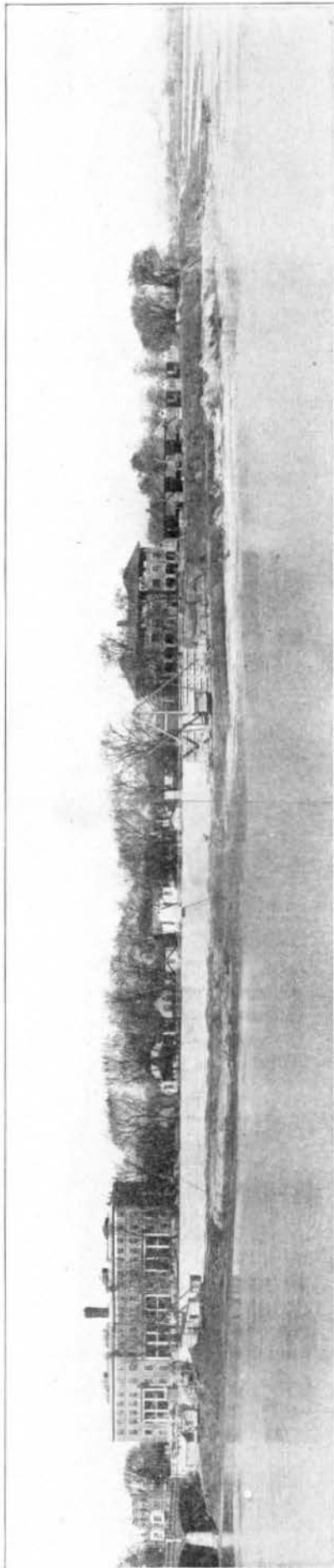


FIG. 220—STILLWATER DRIVE RETAINING WALL, DAYTON, OCTOBER 30, 1920

This wall, now a little more than half completed, is shown in its entire extent as it appears from the opposite (south) bank of the river. It begins at the east end of the north wing wall of Main Street bridge (at the left in the picture), and extends eastwardly for a distance of 920 feet, ending at the foot of the new levee, now under construction, at the end of Stillwater Avenue. It improves the general alignment of the river by cutting off the sharp corner of the bend in the river between the latter street and Linwood Avenue, and adds to the channel capacity of the river by cutting off part of the old levee which it replaces, and also by cutting off the wide

river slope of this levee, substituting for this slope its own vertical face, twenty feet in height above the upper toe of the slope of the improved river channel, and twenty-eight feet above the level bottom at the middle of the stream. It meets the top of the new levee 672 feet east of the Main Street wall, and follows thence down the face of levee, gradually diminishing in height, to its extremity at the foot of the embankment slope. Cross sections of the wall, which is of concrete, are shown in Figs. 221, the left-hand section (reinforced with steel), being used where the wall face is more than ten feet in height, and the left ("gravity") section (not reinforced) where the face is of height less than this.

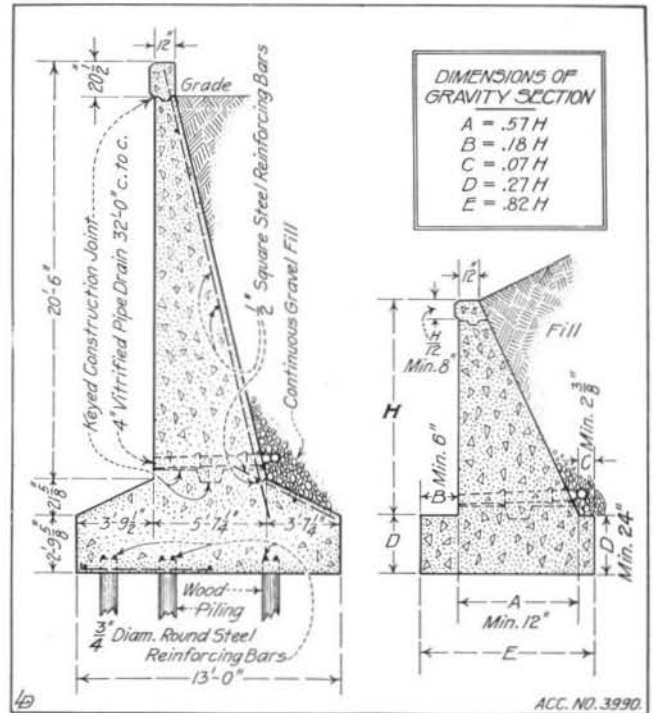


FIG. 221—SECTIONS, STILLWATER DRIVE WALL

down to the level of the top of the footing, not only that necessary for the wall construction, but that between the wall and the river. This work was well done by a "Type O," Thew steam shovel operating a $\frac{3}{4}$ -yard bucket. The material was transported in wagons, the greater part being dumped on the big spoil bank (some day to be a park), between Emmet Street and Herman Avenue. A part was used to build a drive along the river from Linwood Avenue to this park area. To make room for the drive, three two-story brick buildings at the east end of Emmet Street had to be removed. See Fig. 220. The preliminary earth work referred to was done under contract by the Finke Engineering Co.; all other work by the District itself.

Following this excavation, the trench for the wall footing was dug by a stiff-leg steam derrick, equipped with 22-foot wood mast, 62-foot steel boom, 60 H. P. boiler and a Lawson and Morrison triple drum engine operating a one-yard clamshell bucket. To preserve the fine elms along the levee, which grow close to the wall location, 24-foot steel sheet piling was driven next the trench, to keep the earth in place about the tree bases, the piles extending up to the top of the old levee.

Upon excavating to the proposed level for the wall footings, it was found that the underlying material was fine sand and muck, too unstable to support the heavy wall, and that to secure solid foundation, 16-foot wood piles must be driven down through about 10 feet of the sand and muck into the underlying gravel. The lateral spacing of the piles under the higher sections is shown in Fig. 221. Longitudinally, the spacing is four feet between centers. They are designed to carry the entire weight of the wall, each pile being equally loaded. They were driven by a No. 2 Vulcan steam hammer operated by the derrick described.

According to the original scheme, all of the work of excavating, moving forms, placing concrete, and

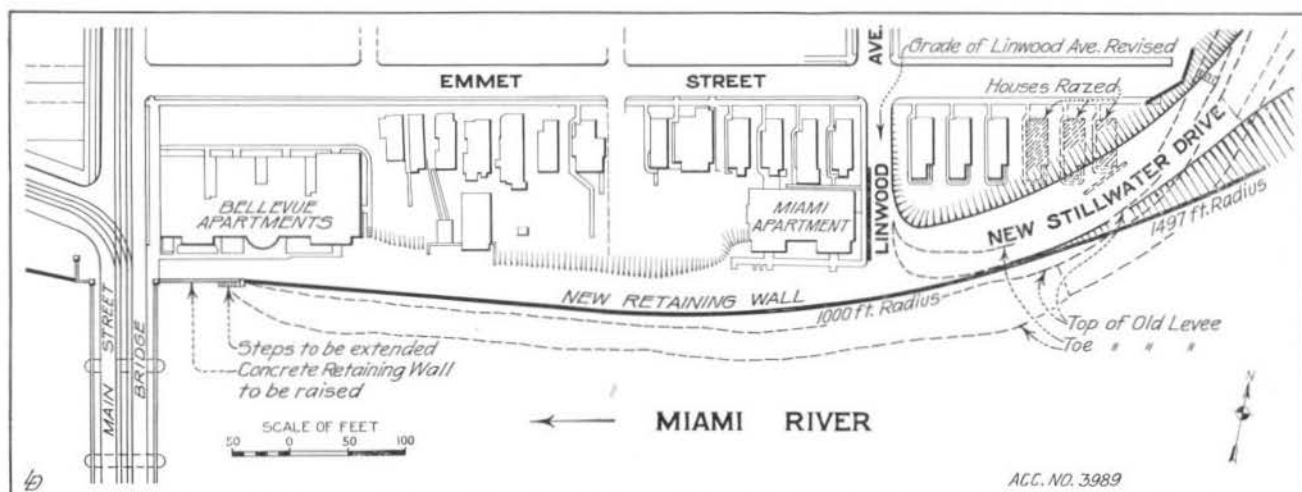


FIG. 222—PLAN, STILLWATER DRIVE RIVER WALL, DAYTON

backfilling after the completion of the wall, would have been performed by one derrick, but in view of the complications mentioned, it was necessary to install a second one to handle forms and place concrete in the shaft of the wall. Accordingly an electrically operated, stiff-leg derrick was assembled. It is of wood, with a 39-foot mast and a 56-foot boom, fitted with a Thomas double-drum hoist and a 40 H. P. motor.

Sand and gravel for use in the concrete are obtained from the District's plant on Sunrise Avenue. Bins for the aggregate are located near Main Street, the top of the bins being at street level. Dump trucks coming from the gravel plant discharge directly into the bins, from which the material is fed by gravity into a "charging" car of 24 cubic feet capacity. The loaded car is hauled up an incline by a hoist operated by a 15 H. P. electric motor, and automatically dumps into a 1 cubic yard Smith concrete mixer. The concrete is chuted into a narrow-

gage car and hauled to the forms by a 3-ton Plymouth gasoline locomotive, running on a track built on a trestle somewhat higher than the top of the footing. For pouring footings, a radial gate, side dump car is used, the concrete being chuted directly into the forms. For the shaft, concrete is hauled in a bottom dump bucket seated on a flat car, to the derrick, which picks the bucket up and lifts it to the top of the form to discharge its load. The various features mentioned are to be seen in Fig. 219 and Fig. 223.

Three grades of aggregate are used in the concrete; sand less than $\frac{1}{4}$ of an inch in diameter; fine gravel between $\frac{1}{4}$ of an inch and $1\frac{1}{2}$ inch in diameter; and coarse gravel between $1\frac{1}{2}$ inch and 3 inches in diameter. For the footings the mixture is 3 cubic feet of cement to about 7.5 cubic feet of each grade of aggregate, while for the neat work, an extra $\frac{1}{2}$ cubic foot of cement is used. The proportions are subject to change, depending upon variation of the aggregate.

The bucket is seen suspended over the form from the boom of the derrick, and about to dump its load. An empty bucket is seen on the small car in the foreground, with the locomotive (three foot gage, gasoline) beyond it. See also Fig. 219. These buckets are "bottom dump," the dumping being done by mechanism operated by the derrick. Another type of bucket, used in pouring the wall footings, is seen standing near the derrick. This is a "side dump" bucket, dumped by hand. The forms are 16 feet long and 18 feet, 6 inches high, the front and back "panels" weighing about two tons, being lifted into place by the derrick.

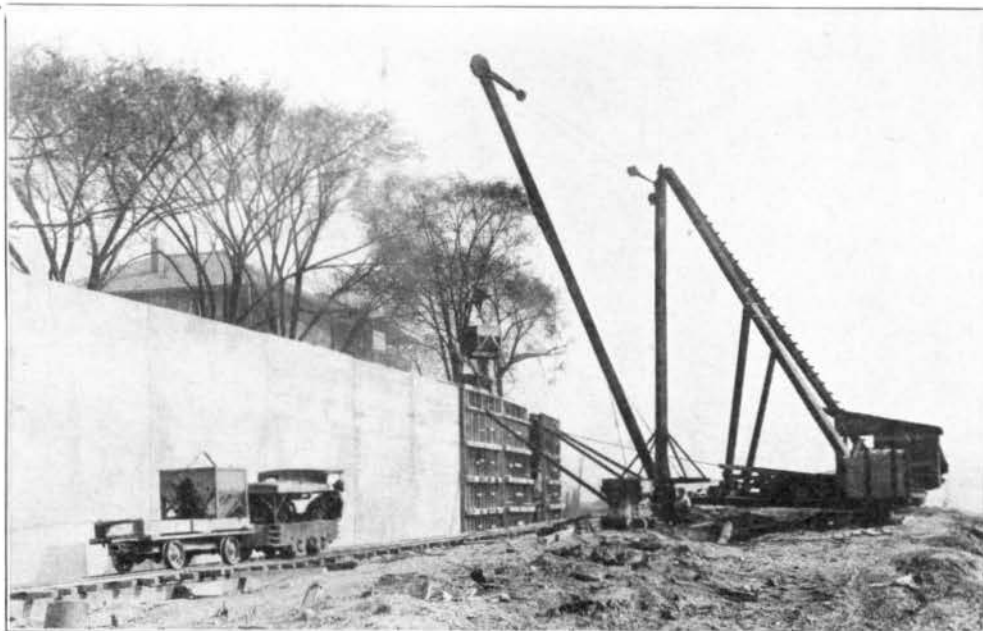


FIG. 223—POURING THE CONCRETE, STILLWATER DRIVE RIVER WALL, DAYTON, OCT. 23, 1920

Forms for the upstream end of the wall, where the dimensions vary, must be built in place and wrecked after pouring the concrete. For the greater part of the work, movable forms have been constructed in such a manner that they may be used repeatedly. Each 16-foot section of shaft requires but one panel for the front and one for the back. The dimensions of a front panel are 16' x 18'-6", being built of a 2-inch lagging with 4" x 6" studs and 6" x 8" and 8" x 8" wales. Each panel weighs about 2 tons, but with the aid of the derrick there is no difficulty in moving them as required. Three complete sets of forms are in use, making it possible to pour four or five sections in a week. The total height, approximately 18 feet, is filled at one pouring. The minimum time for pouring a complete section has been about 2 hours, the average being 3 hours.

In spite of the rapidity of the operation no serious injury to the forms has resulted. The front and back panels for each section are held securely in place by twenty-five 8-inch bolts passing transversely through the forms. The bolts are encased in tin tubes one inch in diameter, and after the forms are removed, the bolts are punched out of their tin casings and are ready for use again. More serious than the holding together of the forms, is the problem of external bracing. If the walls were being built in a trench, it would be a simple matter to brace against the trench walls. Under the existing conditions, with the river channel excavation practically com-

pleted, there is nothing on the river side of the wall higher than the top of the footing, and it is necessary to resort to long, sloping struts as shown in Fig. 223. The fact that the earth is of a loose, sandy texture, adds to the difficulty. By continued care, the greatest variation from true alignment at the top has been kept within $\frac{3}{8}$ of an inch. When the coping section is constructed, it will be possible to tie the coping forms to the already built concrete of the wall shaft, and thus obtain an accurate alignment which will eliminate from the ultimate appearance of the wall the slight irregularities mentioned. In conjunction with the coping construction, an iron pipe fence will be placed on the top between Main Street and Linwood Avenue.

At present writing, the steam derrick has completed its work of excavation and pile driving, and has moved back to a position near Main Street. It will again travel the length of the job, pulling the steel sheet piling and placing the required earth fill back of the wall.

At some future date, in the course of the development of the city's park and boulevard system, it is anticipated that a drive will lead from Main Street along the wall to the riverside park between Linwood and Herman Avenues.

The work is being done under the direction of C. A. Bock, Division Engineer, E. L. Chandler, Assistant Division Engineer, and H. A. Hanson, Superintendent of Construction, with David Wright and John Rosite in immediate charge.

Building the Revetment

Special Devices Used in Building the Flexible Revetment to Speed Up the Work.

Following the account of the successful practical test of the flexible revetment, in the Bulletin for June, 1920, an account of the method of laying it may be of interest.

The general order of the work is first to drive the piling, both of wood and steel; then to lay the flexible mattress; then to cast the slabs on the slope, including the low concrete wall at its foot; (see Fig. 225), and finally to cast the concrete cross walls capping the steel piling, together with the row of heavy blocks forming the river edge of the mattress.

The most interesting feature, because the most unusual, is the laying of the flexible mattress. The operation is shown in Fig. 224. It is very simple, yet the evolving of it is an excellent example of the application of ingenuity to the neat and easy performance of a job which, dealing with a refractory material like stiff steel guy cable, to be used in weaving together a continuous "rug" composed of hundred-and-twenty-pound concrete blocks, is not so easy as it might look.

The cable is of rather hard drawn, double-galvanized, half-inch steel, twisted of seven strands, and having a good deal of spring. The fabric of blocks must if possible be laid in place on the ground since if laid on a timber floor, the process of sliding it off into place involves a good deal of added expense, although, the edge of the river channel being dry except during floods, the expense of laying the revetment in water is obviated. Two holes are cast in each block, running squarely across the block, a foot apart and six inches from each end. Laid breaking joints, this brings the holes in line across

the entire width of the revetment, to receive the cables—provided the blocks are laid accurately and the ground is evenly graded, the permissible play being only $\frac{1}{4}$ inch, the holes being $\frac{3}{4}$ inch and the cable $\frac{1}{2}$ inch. If the holes are not in line the cable binds in passing through. A grand total of 400,000 blocks requiring to be woven, calling for a total cable length of 900,000 feet, the necessity of easy weave becomes apparent, if excessive cost is to be avoided.

Several "kinks" had to be learned regarding the wire. One was the ease with which curves or bends in it slow up the weave, by binding in the holes. The cable naturally keeps the curve of the circular reels on which it is shipped, and this has to be taken out by running it through a set of three grooved wheels, set staggering, which give it just sufficient reverse bend to take out this curvature. It needs watching subsequently to keep accidental bends out, this proving to be a small but important detail.

So simple an operation as cutting it into lengths led into trouble. If the cutting were done with ordinary heavy metal shears, the stiff ends of the cut strands splayed out in a seven branched point which refused to thread the holes. Melting the wire in two with the oxy-acetylene torch was tried, but this ran into time and cost at a rate to make it prohibitive. Finally a pair of small circular arcs were ground in the shear jaws, apposite each other, one in each jaw, between which the cable is gripped and then sheared. This draws the strands together instead of splaying them out, and gives a bluntly rounded point which takes the holes readily.

The blocks are 12 in. by 24 in. by 5 in. thick, laid breaking joints as seen. The $\frac{1}{2}$ inch double galvanized steel cable is threaded through the holes in the blocks across the entire width of the revetment. The two holes in each block are threaded on the two cable ends as the men holding the block slip it into place, the cables being steered by the third man, who sits in front of them, as shown.

The tongs used to handle the blocks are simple, the horizontal handle carrying a vertical bar, to which the two tongs proper are hinged, biting the block with a powerful grip.



FIG. 224—LAYING FLEXIBLE CONCRETE REVETMENT, OCT. 30, 1920

The detail of the weaving was worked out, after considerable study, to a point of great simplicity, as Fig. 224 shows. The blocks are laid a row at a time, parallel to the levee slope and beginning at its foot. The cable is cut into lengths such that when doubled, they will thread through two adjacent holes at a time across the entire width of the revetment, with sufficient overplus to anchor into the slope slabs at one edge, and into the row of heavy blocks at the other.

The row next the levee is laid first, the free ends of a loop of cable being passed through the adjacent holes of adjacent blocks, loop after loop, down the row, the ends being pushed through a foot or two into the clear. The blocks of the second row are then laid, one by one, each being slipped over two adjacent projecting ends of cable, as seen in the picture, two men handling the block with a pair of special tongs, and a third man steering the cable ends into the holes. A fourth man follows, and

pushes or pulls the cable through the holes till the ends are free to take the blocks for the next row. The four men constitute the gang. They do fifty lineal feet of revetment per day, on a weekly schedule, including all "stops for wood and water."

The general arrangement for casting the slabs on the levee slope is shown in Fig. 225. The forms are of steel, the sloping sides being of six-inch channel bars, the top a six-inch plate, and the bottom an angle bar resting on the edge of the upper row of blocks in the flexible mattress. Wider brace plates at the lower corners stiffen the forms. The corner connections are made by tenons on the ends of the upper and lower members, piercing mortises in the side pieces, the joints being locked by steel wedges driven through slots in the tenons. The mixer runs along the top of the levee and discharges into the forms through a chute. The gang doing the work consists of nine men. The same outfit pours the walls and heavy edge blocks referred to in the be-

This operation follows the laying of the flexible mattress. The forms are of steel; the top a 6 in. plate bar, the sides 6 in. channels, and the bottom a $2\frac{1}{2}$ in. angle bar. The channels are connected to the bottom piece by curved pieces to give a rounded corner at the foot of the slope. The pieces are joined at the four corners by mortise and tenon joints, locked by steel wedges driven through slots in the tenons. The two lower corners are braced by triangular plate pieces to keep the angle bar true.



FIG. 225—CASTING THE CONCRETE REVETMENT SLABS, JUNE 2, 1920

This operation was at first done by hand, but the labor was so great, due to the binding of the cable in the holes (the blocks being difficult to keep in true line and grade on the hand surfaced gravel slope), that the device seen was invented. A 2-inch plank rests against the long edge of the block, carrying the lever seen in the man's hands hinged at its outer end. The two chains attached to the lever run to the handles of a pair of tongs which bite upon the cable, pulling it through the holes in the row of blocks as the man pulls on the lever handle. The device is simple and does its work well.



FIG. 226—PULLING THE STEEL CABLES THROUGH THE REVETMENT BLOCKS, OCT. 30, 1920

ginning. Alternate slabs are first cast with the forms, and then the intermediate ones in the usual manner. It is planned later to run the mixer on the flexible mattress, thus bringing it nearer the center of the work.

The work is being done by Price Brothers, Contractors, under a special arrangement. The details are due to Mr. Harry Price, senior member of the firm. The work is being done under the direct superintendence of Mr. H. S. Knight.

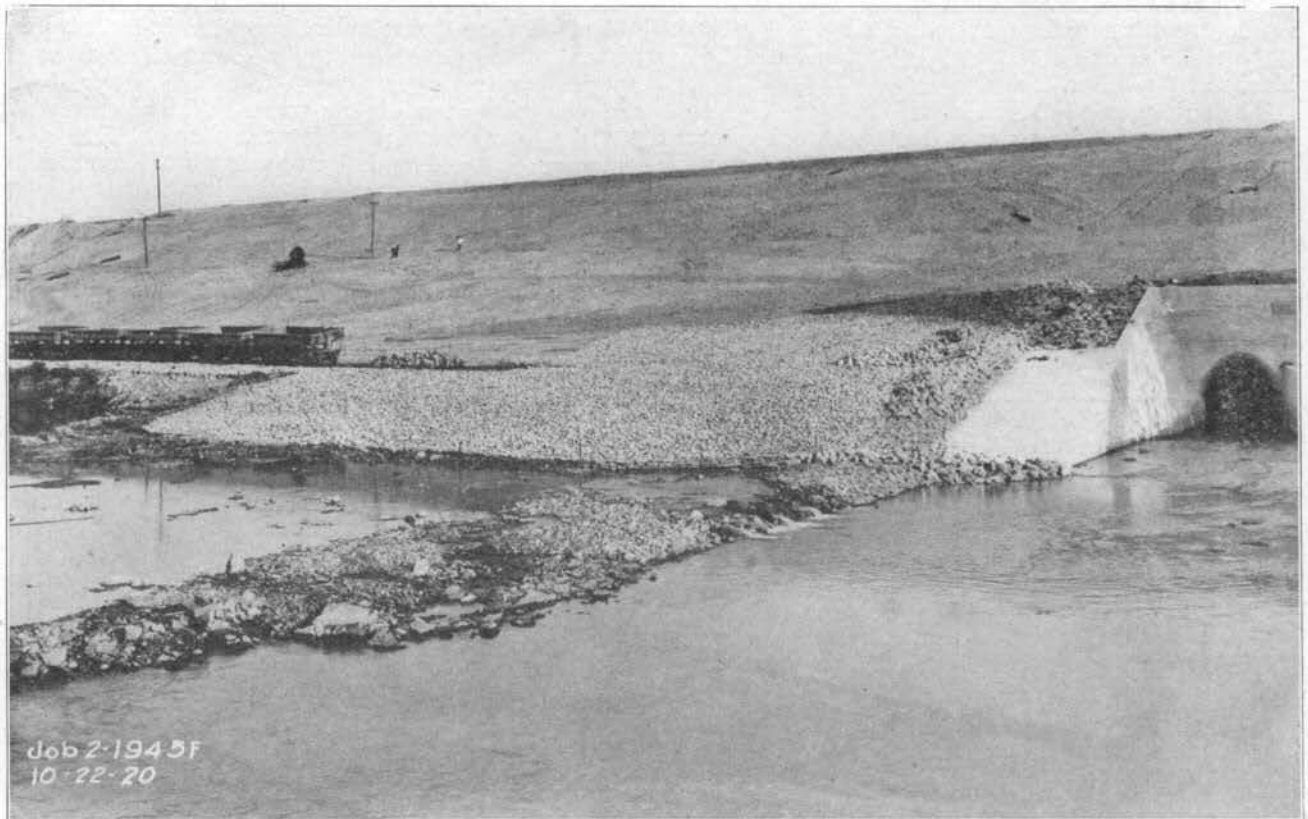


FIG. 227—RIVER SECTION, ENGLEWOOD DAM, OCT. 5, 1920.

This is shown for comparison with Figs. 214 and 215, to show the rapid rate at which this section of the dam embankment has been pumped. Pumping was begun May 6, one day before the date of Fig. 214. The section was brought to its present stage on Oct. 5, when work on it was temporarily stopped in order to bring the easterly section of the dam up to a corresponding level, after which the two sections will be united and the work carried up as one. During the month ending Sept. 25, all records of pumping were broken in the work on this section, 162,000 cubic yards of material being put in place. The total material pumped during the five months was 750,000 cubic yards.

THE MIAMI CONSERVANCY BULLETIN SUPPLEMENT

"The News Letter"

To Promote the Conservancy Spirit on the Work

November 1920

Honor to "Daddy" Lumby

Hats off to "Daddy" Lumby!—the Senior of the Conservancy shop—eighty-six years old and still on the active list, live steam in the boiler, his eye undimmed, still going ahead, not back.

His full name is Thomas Lane Lumby. He was born in 1834, in the town of London, in the province of Ontario, Canada, and at sixteen entered the machine shop of Frazer & Ashfell in that place, as an apprentice. In those days an apprentice was an apprentice. You served seven years before you were graduated, three and a half in the pattern shop and three and a half in the machine shop. Our young upstarts today serve four years at paper and theory and call themselves "engineers." Daddy served seven on the real wood and iron—seven for his "sheepskin"—and sixty-three since—seventy in all to date—and still going.

He came to this country long since. For many years he worked in the Cincinnati, Hamilton and Dayton Railway shops at Delphos. For seven years he was on the Panama Canal. He was at different times all over that big and famous job—at Cristobal, Empire, Gorgona, Balboa, Porto Bello, (where he saw the old tavern where the celebrated buccaneer, Morgan, escaped capture by prompt use of his flint-lock pistol—but that was two hundred years ago and more—old stuff.) He worked on locomotives, on the twelve-yard steel dump cars, and on the big steam shovels—most of them with six and seven-yard buckets, the biggest with a bucket of thirteen yards,—that threw dirt in the Culebra Cut. He saw something of Colonel Goethals, and speaks of him with much respect, and even with a kind of affection. To the editor it was the finest tribute he has yet heard to Colonel Goethals—the way that Daddy Lumby spoke of him.

And now he is with the Conservancy District. He came on February 4, 1919, and has been with us ever since. In the year and three-quarters he has lost just ten days, and that was when he was laid up with rheumatism. Most men, laid up with rheumatism at eighty-six, would go into dry dock for a long vacation. Not so Daddy. He fought it off (he "was always great to fight things," he says, modestly and quaintly,) and so he fought it off—"with cream of tartar and sulphur." And then he got right back on the job. (Don't forget that "cream of tartar and sulphur." The doctors have nothing on Daddy.)

Daddy says he "feels as good today as he did at thirty." Clean living did it. He "never laid around a saloon," he says; and he "has yet the first house to go into" where the red lights tell the story that Daddy was too clean to learn.

He works at a lathe. Go into the machine shop, and there next to Superintendent Walter Strong's office you will see him. There we found him; and there, amid the bang of hammers on boiler shells and the quick rat-tat of the air riveters, we cornered him for his story. He is one of the best men in the shop. His eyes are clear, but age has lengthened their focus as age will, so that he uses glasses and doesn't see quite as he once did. But that doesn't stop Daddy. He just shifts to "mike work"—where the micrometer caliper permits the sense of touch to help out beyond the limits of vision. With the micrometer caliper—a crutch for his eyes like the glasses—Daddy goes on, at eighty-six, doing a man's job, and asking no odds of anybody.

We hope he will pardon our setting him up on this little "pedestal of publicity," for the rest of us to look at. He is a modest man, who doesn't naturally seek the limelight. But we think it will do us all good to get acquainted with him; so here he is.

Such men are the backbone of a job, whether it is a Panama Canal or a Conservancy Dam. They form the foundation on which the whole project is built.

Hats off to Daddy Lumby!

Tree Seeds for the Conservancy Basins

A lively interest has been created during the past month among the school children of the District, and including also their mates all over Montgomery county, in the gathering of shrub and tree seeds for the plantings to be made in the valleys above the Conservancy dams, and on the slopes of the embankments. The object of the plantings is to check the wash of waves on the earth slopes during floods, when the waters will form a lake in each basin above the dam site. Such wash, unless checked, would tend to eat into the embankments and require mending to restore the original slopes. A thicket of hardy native shrubs will break up the waves as they break and greatly reduce this undesirable action. Also in the valleys above, a forest of trees will prevent destructive waves forming and check their onward sweep.

The seeds will be first sown in a nursery at Taylorsville, in charge of W. B. Flory. Later the young trees and shrubs will be planted where needed. Market prices were paid for the seed, some of which we quote, with the quantity obtained:

Hard Maple	3 pounds @	50c
Red Oak	3 " @	8c
White Oak	@	15c
Chestnut Oak	38 pounds @	15c
Burr Oak	295 " @	5c

(Burr Oak acorns are big and heavy)

Walnuts	500 bushels @	\$3.00
Hawthorns	31 " @	\$7.00
Red Bud	@	50c
Dogwood	66 pounds @	50c
Wild Rose	89 " @	50c

Coffeenut, 4 pounds; Paw-Paw, 6 pounds; Crab Apple, 8 pounds; Buckeye, 2 bushels.

It will be noted that the report on quantity, published in one of the local dailies, was off by several thousand bushels.

The school children were enthusiastic collectors and the crowd of them that came to the Conservancy Office door bringing seed at the appointed times, was an interesting sight. A few loads were brought in from the schools on Conservancy trucks. The job was handled by Messrs. Hauck, Moyer and Patitz, with the collaboration of Professor Werthner of the Steele High School.

W. M. Caye Goes to Louisville

We regret to announce the departure of W. M. Caye, Assistant Engineer in Mr. Kimball's office, who has gone to Louisville, Ky., to take a position as Designing Engineer on the \$2,000,000.00 sewer extension project which has recently been authorized there. This is an extension of the \$4,000,000.00 job from which Mr. Kimball was called to assume the position of Construction Engineer for the District, and on which Mr. Caye was also engaged for a time, so that the new call comes not only as a promotion for Mr. Caye, but as a recognition of his earlier work on the job he goes to. The consulting engineer on the job is Harrison P. Eddy, one of the foremost American authorities on the subject of sewerage, on which fact Mr. Caye can also be congratulated in the opportunity it gives him.

Mr. Caye came to the Conservancy in the summer of 1915, and left it to enter the army in 1916, serving on the Mexican border and later overseas. He was in France five months, returning to the Conservancy in May of 1919. His family goes with him at once to Louisville.

The best wishes of all his colleagues will follow him.

Trucking a Dinkie Locomotive

A little job worth noting, as showing how our garage men take things all in the day's work, was the recent

THE MIAMI CONSERVANCY BULLETIN

freighting down from Lockington of the Vulcan dinkie locomotive used on the work there, by motor truck, in 3 hours and 50 minutes, negotiating two skittish bridges on the way. The driver was Albert Jolly. He was proud of the job, as he had a right to be.

A Hint for the Camp Youngsters

Our friend Elldee told us a wondrous yarn recently—he didn't dare vouch for it—he reported it as told to him, he said—about an Eldorado in mink and muskrat skins, along our Miami Valley streams. One man, he was told, trapped during last winter \$3,200.00 worth of these little fur-bearing creatures along the Stillwater River. Probably a bit stretched; still, some of our enterprising camp youngsters might find a little investment in steel traps worth while.

W. J. Smith's Dive Into the Mud

Our readers cannot have forgotten the picture we published in the supplement some time ago, showing our friend "Smith of Lockington," (now of Taylorsville) high-diving off a sixty-foot timber into the core mud of Lockington pool. To say nothing of the high dive feature, no doubt some who saw the feat feared that they might have to dig the diver out of sixty feet or less of core mud. They didn't know the stuff. Mr. Smith did, and related further experiences with it to the editor some time ago, which our own more recent study of this interesting material enables us to understand. He had dove into the stuff before, trying to get a "specimen" from the "bottom," and found he couldn't. The stuff behaved like the water in Great Salt Lake. You couldn't sink in it. You bobbed up like a cork. It was a heavy fluid, too thin (near the surface) to be sticky, and too dense to permit sinking. To get anywhere at all, he had to get a hundred-pound anchor stone hitched to a rope, throw it overboard and drag himself down the rope, hand over hand, with a little tin pail slung to his wrist for the "specimen." Many of us have gone up a rope hand over hand; we think none but our friend Smith has gone down one in that manner. At the end of the rope—about 15 feet down—he found the stone, imbedded in the "mud," and had to hang onto the rope hard with one hand, (while he scooped up his specimen with the other,) to prevent being shot back up to the surface by the buoyant material. So, when he jumped off the sixty-foot timber, he knew what he was jumping into,— "stuff that couldn't be hired to drown you."

Bound Volumes of the Bulletin

We repeat here, for the benefit of members of the Conservancy family who might miss it elsewhere, the notice regarding bound volumes of the Bulletin. Arrangements have been made to bind the first two years' issues—August, 1918, to July, 1920, inclusive, in substantial brown buckram, in one volume. The buckram is a linen cloth, of better quality than the ordinary cloth binding. The price will be \$1.50, plus postage. The latter item can be cut out for our Conservancy people by delivering the issues you wish bound to the local Division Office, whence they will be forwarded to Headquarters to the Bulletin address. Mark your name and address plainly on your package of Bulletins before delivering them. Don't forget, also, to put in your package the Index to the first two years' issues, which is inclosed as a Supplement in this issue of the Bulletin. A good deal of care has been spent on the Index, to make it complete and accurate, and it should prove of value. It covers illustrations as well as articles. In case your set of Bulletins is not complete, the missing issues can be supplied, to a limited number, from this office, if you will write us stating the issues wanted. The issues, however, of September, 1918, April, 1919, June, 1919, and February, 1920, cannot be had, as the heavy demand for them has exhausted our supply. Some of the other issues are running low, also, and it will behoove you to send in promptly if you wish your order filled. The cost of such extra numbers will be 5 cents per copy, this amount being added to the bill. The bound volumes will be returned in packages to the several Division Offices, and may be had there on payment of the bill, which will accompany the bound volumes. It will not be necessary to send the cash with the order.

W. A. Kramer Injured

W. A. Kramer, Assistant Engineer on the Railway Re-location, who suffered a painful fracture and sprain of the ankle some time since at Huffman, is still obliged to carry crutches, but is much better, and expects to go it alone again soon, without the "dot and carry-one."

DAYTON

Marriage of Miss Zula Eberly

Friends of Miss Zula Eberly, in the Headquarters Office, had the pleasure of personally congratulating her on Tuesday, the 16th, when she passed through Dayton on her wedding trip. She was married on October 29th at her home in Bowling Green, to Mr. Uri Bruning of Pemberville, Ohio. Mr. Bruning is a graduate of the Ohio State University, and—a fact which we celebrate elsewhere—he intends to follow that "most ancient and honorable of callings," that of a farmer. He has recently purchased a fine homestead of about a hundred acres, running up to the little town of Woodville, 16 miles from Toledo, in the edge of which is the home, provided with all the modern conveniences which electricity can furnish. We congratulate the young couple, not only on their marriage but on the life work ahead of them.

John Hall Calls on His Old Friends

The Bulletin acknowledges a pleasant call from our former colleague, John T. Hall, on election day. His work with the Chicago and Northwestern Railway agrees with him, and he exhibits all the evidences of health and prosperity. Our best wishes go with him.

Another Ford Astray

If you see a Ford running about suspiciously loose, take notice of it. It may belong to Mr. McWilliams, Field Clerk at Lockington, who had the misfortune to lose his car not long since, it having been boldly stolen from the shed by a person who was seen to be taking it, but who was mistaken, in the dusk of the evening, for its owner. We hope he will have as good fortune recovering it as did Mr. Clawson at Huffman.

Salute Lawrence Alfred Booher

The Bulletin extends congratulations to Mr. and Mrs. George Booher on the new son, named as above, born to them at the Miami Valley Hospital on October 22, 1920, the young man's weight being 5 pounds 14 ounces. Mr. Booher is main prop in the office of Superintendent Strong at the Conservancy Shop. We take unusual pleasure in offering congratulations in this case, in view of the uniform courtesy and efficiency with which Mr. Booher has extended help to us recently. We hope the young man will follow in the footsteps of his father.

Conservancy Bowling League

The Bowling League ended its preliminary round on October 22, and has started off on the second with fresh speed, and a livelier, all-round interest than has ever before been exhibited. The result of the first round, noted in the table below, has enabled some shifting to be made, with the object of evening up the teams and making a closer and more interesting contest. This result has been achieved, as comparison of the table with that for November 5, after the teams had been revised, will show. The changes were made in the Calculators and the Hustlers, each of these being a "select" bunch, made up from several divisions of the work. New men are being steadily drawn in, and more are in prospect, among these being Messrs. Chas. H. Paul, Cavis, and C. A. Bock, all of whom have expressed intention of coming in. Prominent among the River Imps is Contractor Price. The teams meet on Friday evenings—"Conservancy Night"—at the Royal Alleys on West Fifth street. By expanding the teams a few more men can be accommodated. Join early and avoid the rush. The bowling is from 5:30 to 7:15 p. m.

Standings of the Teams At End of Preliminary Round

Teams	Won	Lost	Pct.
Hustlers	14	1	.933
Slide Rules	9	6	.600
River Imps	9	6	.600
Calculators	6	8	.428
Pencil Pushers	3	11	.214
Tripods	3	12	.200

On November 5, 1920

Teams	Won	Lost	Pct.
River Imps	4	2	.667
Tripods	4	2	.667
Calculators	4	2	.667
Hustlers	3	3	.500
Slide Rules	3	3	.500
Pencil Pushers	1	5	.166

THE MIAMI CONSERVANCY BULLETIN

EDITORIAL

Board of Editors

Germantown	Miss Julia Darnell
Englewood	Albert L. Wald
Lockington	C. H. Shea
Taylorville	Mr. M. H. Sando
Huffman	Mrs. J. F. Gena, W. R. Minton
Hamilton	R. B. McWhorter
The Woman's Club, Dayton, Ohio.....	Miss Mayme McGraw
Shop, Warehouse and Garage.....	Thomas F. Nealon

Reducing the Coal Cost

By making a proper charge to cover "overhead," the District organization has been able to do a real service to Conservancy employees in reducing coal cost, advantage being taken of the low price at the mine of \$5.50 per ton. A few notes on the items may be of interest. Freight charges, Monte, West Virginia, to Dayton, Ohio, were \$2.38 per ton; overhead, \$1.18 per ton; unloading at the Conservancy Shop, which was done by derrick and clam-shell, \$0.25 per ton; trucking (in 4½-ton lots), \$1.03 per ton; making a total of \$10.34 per ton of coal delivered at the curb. Coal at the time was selling for \$14.00 per ton in the market. Four carloads were purchased, totalling 204 tons. In two-ton lots the cost was a trifle higher—\$10.50 per ton. The prices are for Dayton. For the camps circumstances enabled a slightly better figure than for Dayton. It was interesting to observe the swift and enthusiastic response by employees to the proffered service. It was an excellent lesson in the advantages of organized buying.

SHOP, WAREHOUSE AND GARAGE

Whitey Tangerman is still explaining how a fellow can be going very swiftly and not notice it. One night recently Whitey was riding down Main street in his gas wagon, when the speed agent stopped him and explained that Judge Budroe wanted to see him badly. Whitey didn't believe it until the next morning, when the Judge told him to leave thirty bucks at the office and hurry back to work.

"Red" Enjoys Moonlight Evenings

The fellows in the Garage are wondering what has happened to Red Jordan lately. "Red" has the most happy light in his eyes, especially on the morning when he has an engagement to call on a certain young lady. "Red" says you couldn't find lovelier moonlight evenings in California than the Ohio variety he has been recently enjoying.

Political Stuff

Bill Lester, the Shop Boss Carpenter, is now putting in all his spare time on a new boat. Bill is almost ready to take the usual trip up Salt Creek with his crew of near Political Forecasters. On his previous trip Bill had plenty of grape juice for the consolation prize, but no such luck this year. The wet stuff will be a tear. Never mind, Bill, 1924 is coming!

The Warehouse office was recently surprised by seeing a new form of order received from the Electrical Department. It had a very refreshing look to the tired, hard-working clerks. Thanks for the suggestion!

Anyone knowing of a good correspondence school where instructions can be had on "How to Dope Out a Ball Game," please notify Steve Maloney at the Shop. It never occurred to Steve just how little he knew about this sport until he backed his knowledge with money. Now he is willing to study more, if he can raise the price of kerosene to burn during the long winter evenings.

Harry R. Walks

Modern transportation made it difficult for Harry Rosenkrantz to find relief from distress. Harry was embarrassed when he discovered his cash was very low and the distance between Celina and Dayton was between him and his dinner, so he decided to walk, and while he enjoyed the view of growing things on the way his feet grew too big for his shoes. However, Harry is wearing the same size shoes, but a little smaller hat.

OUR JUNIOR EDITORS

A Ghost

One dark night as I was passing a cemetery, I heard a bell ring, and looking over in the cemetery I saw a white object rise out of a grave. I was rooted to the ground.

When I could move I went down the road like a streak. Someone passing by asked me, "What is the matter?" I told him and he just laughed, but he said he would go with me to the cemetery.

When we arrived we saw the white thing rise out of the grave, and that was enough for him and he too took for the road.

So I went back and tried to get some one to go with me; they all laughed, but no one cared to go with me, so I went back myself. As soon as I was there I heard the bell; my blood grew cold, but I kept on going nearer to the grave.

What do you think I saw? Not a ghost, but a little lamb, with a bell tied on its neck with a bit of ribbon.

Elbert Tannereuther, Taylorville, 7th Grade.

A Jaunt

One Thursday afternoon, after school, my teacher, one of my chums and myself started out for a walk on the new road. We had walked for about ten minutes when we decided to go over and see the spillway bridge. We found the work very interesting and watched for quite a while and saw upon a hill some walnuts and thought we would go after them. After we had gathered the walnuts we started on, but we didn't know where we were going. Finally we found ourselves up on the top of the hill above the conduits. After we had rested we started on home down the steepest hill we could find; part of the time we were sliding and part of the time falling. After much struggling we got back home. We were sure stiff the next day.

Elizabeth Stewart, Germantown, 7th Grade.

The Walnut Hunt

The boys of the M. C. D. of Germantown camp school heard that the M. C. D. wanted walnuts, so there was a scramble for the trees.

Not a boy had thought of gathering walnuts yet until the teacher told us we could get three dollars a bushel for them. The trees for half a mile around were all cleared.

Henry Wehrly, Germantown, 6th Grade.

Our Secret Place

Oral Composition

Our Secret Place is down by the river. Rex found it yesterday. He hid some shells in the weeds. We are going to use them for boats. The boats will sail far away across the river. They will come back filled with stones to build us a little dam.

Rex Gibson, Englewood, Age 7.

Maybe They Were Lemons

People in the vicinity of Englewood were amused recently by what they thought was an Indian War Dance. Investigation proved that nothing so serious was going on. Tom Lahey and Carl Frische had discovered a walnut tree with about 25 bushels of nuts lying on the ground. They didn't say whether they were hulled or not, but from the description of the tree, we suppose it was not an ordinary one. They claim the walnuts absolutely did not stain one's hands.

Frank Kuboski, Baseball Dope Artist

All the wizards in mathematics were a little uneasy when Frank Koboski began to figure out a system to beat the World Series. Frank wore out a number of pencils and used miles of paper before he had reached the solution. No one could deny his not having the correct dope, only the two clubs did not play as Frank figured they would.

Frank Sheets was explaining to the boys in the garage why Fords can be purchased cheaper than other cars. After much discussion—from Frank, of course,—they all agreed that if tin wagons can be manufactured cheaper, then Frank should get rid of his Prehistoric Gasoline Can. Every time it sniffs gas it sneezes so loud that the boys can't tell whether it's the horn or the motor blowing. How about it, Frank?

As forecast in last month's Bulletin, the Warehouse boys won the pennant in the Saturday Afternoon League. The last game was interesting.

THE MIAMI CONSERVANCY BULLETIN

New Baby at the Howes

The Bulletin extends congratulations to Mr. and Mrs. C. W. Howe on the new baby girl, born recently at the Miami Valley Hospital. Mr. Howe is Assistant Engineer on the Railway Relocation. We regret being unable to give the important details as to name, date, and weight, etc., details which we endeavor to supply, but cannot always.

ENGLEWOOD

Wedding Bells

Wedding bells have had their opportunity to announce the glad tidings on two different occasions during the past month. Paul Alpers and bride were first in line of march, coming into camp early in the month. They were received with the usual ceremony, namely, a lot of noise, then a ride on the old spring wagon to Community Hall.

Lester Wagner joined the benedict ranks later in the month. Anna Tully, also a camp resident, is Lester's happy bride. A wedding supper was served in Community Hall, which featured the Wagner-Tully union. We all wish these young people a happy and prosperous life together.

Hallowe'en Celebration

Hallowe'en was appropriately celebrated in camp. A mask party and dance was held in the Hall. There were numerous games and contests for the children, in which apples and pumpkin pies played their role. The older folks danced and partook of the various eats on hand.

Introducing Mr. Elwood

Mr. John B. Elwood will be welcomed as our new Division Warehouseman. Mr. Elwood comes from Bridgeport, Conn. At the present writing he is traveling through the Middle West in the interest of Cornell University, which latter mission he will leave to come to Englewood.

Welbaums to Florida

Mr. O. F. Welbaum and family were seen on the road recently following a flock of wild geese toward Florida. All of the Welbaums in Englewood are going south for the winter equipped to camp at attractive places along the road and bent on having the time of their lives. C. A. Schroufe has taken Welbaum's position in the Division Office.

Mrs. Everdell Entertains

Mrs. Everdell entertained the school children and their parents at a house party given in the camp school building. Hallowe'en games and decorations were prominent also at this affair.

Personal

Florence Tully has returned from her extended visit to her aunt, Anna Tully, in New York City. Miss Mary E. Tully, a cousin, accompanied Florence on her return to Englewood and will make her home with Joseph Tully and family in camp.

TAYLORSVILLE

W. J. Smith in Minnesota

Mr. W. J. Smith, Assistant Engineer, is at present visiting various points through Minnesota making investigations for the Morgan Engineering Company. He is expected back on the job at Taylorsville in about one month.

Social Features

Two social features have been staged in Community Hall during the past month. Plenty of "jazz" and dancing until a late hour were events of the first party, which was enjoyed by everyone. Quite a few visitors were present from out of camp. The other, a masquerade dance, proved a delightful success. A large crowd attended this event, many of them displaying very unique costumes. Following the dance, refreshments in keeping with the Hallowe'en spirit were served.

Mrs. R. W. Trowbridge is at present visiting relatives at Phoebus, Va.

Political discussions about the Taylorsville office have displayed considerable enthusiasm recently. Mr. Shively still insists that "Jimmie" will carry the election, much to the chagrin of some of his friends.

Mrs. A. F. McCarthy was taken to Miami Valley hospital recently for an operation. Reports from the hospital are to the effect that her condition is very satisfactory.

Death of Robert Rogers

Taylorsville was unfortunate in having its first fatal accident on the work. It occurred during this month to Robert Rogers while he was assisting in the construction of a trestle for the pipe line relocation near the north entrance to the flumes. A brace to which he was holding sprang outward, causing him to fall about 30 feet to the concrete floor below. The impact was sufficient to fracture his skull badly. He was rushed to the Miami Valley Hospital and every effort made to save his life, but his death occurred three days later without his regaining consciousness. The funeral was held from the Chapel at Covington, Ky., and burial was made in the Covington Cemetery. Mrs. Rogers desires to express her thanks and appreciation through the columns of the Bulletin for the many kindnesses during her recent bereavement and for the beautiful floral contributions.

GERMANTOWN

Mr. and Mrs. Limes are visiting relatives in Iowa.

Mrs. Harnish has been visiting in Dayton several days. Quite a large number from camp attended the Hallowe'en dance in Germantown October 31st.

Mr. and Mrs. Crissmar and little daughter Wilberta are visiting in Columbus this week.

Mrs. Foehr spent a few days with her parents in Cincinnati last week.

Miss Dorothy Somers is expecting to go to the hospital in Dayton this week to have her tonsils removed. We hope she will get along nicely and be able to enter school again very soon.

Mr. and Mrs. Johnson and children were the guests of Mr. and Mrs. Allen this week-end.

HUFFMAN

New Club in Prospect?

The ladies of the "Sunshine Club" met twice during October, at Mrs. Bailey's on the 16th, and at Mrs. Burns' on the 20th. As we had no reporter at either of these occasions nothing can be told except that there was a good attendance, and surely something to eat, or they would not be so enthusiastic in continuing their meetings. Some of the men are considering organizing an auxiliary, changing the "Sun" to "Moon."

Personal

Ask Mr. Poock why he didn't get his feet wet the night he went for minnows in Mud Run?

Mrs. T. C. Shuler visited in Arcanum, Ohio, the week of October 11th.

Mr. Clawson's mother has returned to Boise, Idaho.

Mr. and Mrs. Maynard spent a week recently in Indiana visiting relatives. Mr. Maynard's parents accompanied them home and spent several days at Huffman.

Mr. and Mrs. Louis Zull and family visited for a week with their folks at Portsmouth, Ohio.

Mrs. Gena and daughter have returned from a visit in Pennsylvania, where she had been visiting with friends and relatives for a month.

Pool Hall Changes Hands

Albert Schoonover purchased the equipment and stock in the club house and is now operating an up-to-date pool hall and ice cream parlor.

Headed Toward Manchester

Mr. L. E. Paul spent the week-end of October 23rd in Manchester, Ohio. It will be unnecessary to publish similar items in later issues, as he makes this trip regularly each month.

Death of Vernon Blackwell

On the night of October 13th, Vernon Blackwell met his death by accident on one of the trains. He was a fireman, and they had just placed a car on a switch and were taking the engine on the track when the car, which was placed on an incline, crashed into the engine, crushing Mr. Blackwell between the boiler and the car. Death followed shortly after. His body was shipped next day to his home in Kentucky.

Reorganizing Sunday School

The Huffman Sunday School held an election of officers on Sunday, October 17, electing F. D. Secore Superintendent, Mrs. Burns Secretary, and Mrs. Saylor Pianist. There seems to be a good live interest in it with the approach of cool weather, and we hope to have an A-1 Sunday school this winter.

Election day brought out many voters from here.

THE MIAMI CONSERVANCY BULLETIN

DECEMBER, 1920



FIG. 228—TOPPING OUT THE GERMANTOWN DAM, NOVEMBER 3, 1920

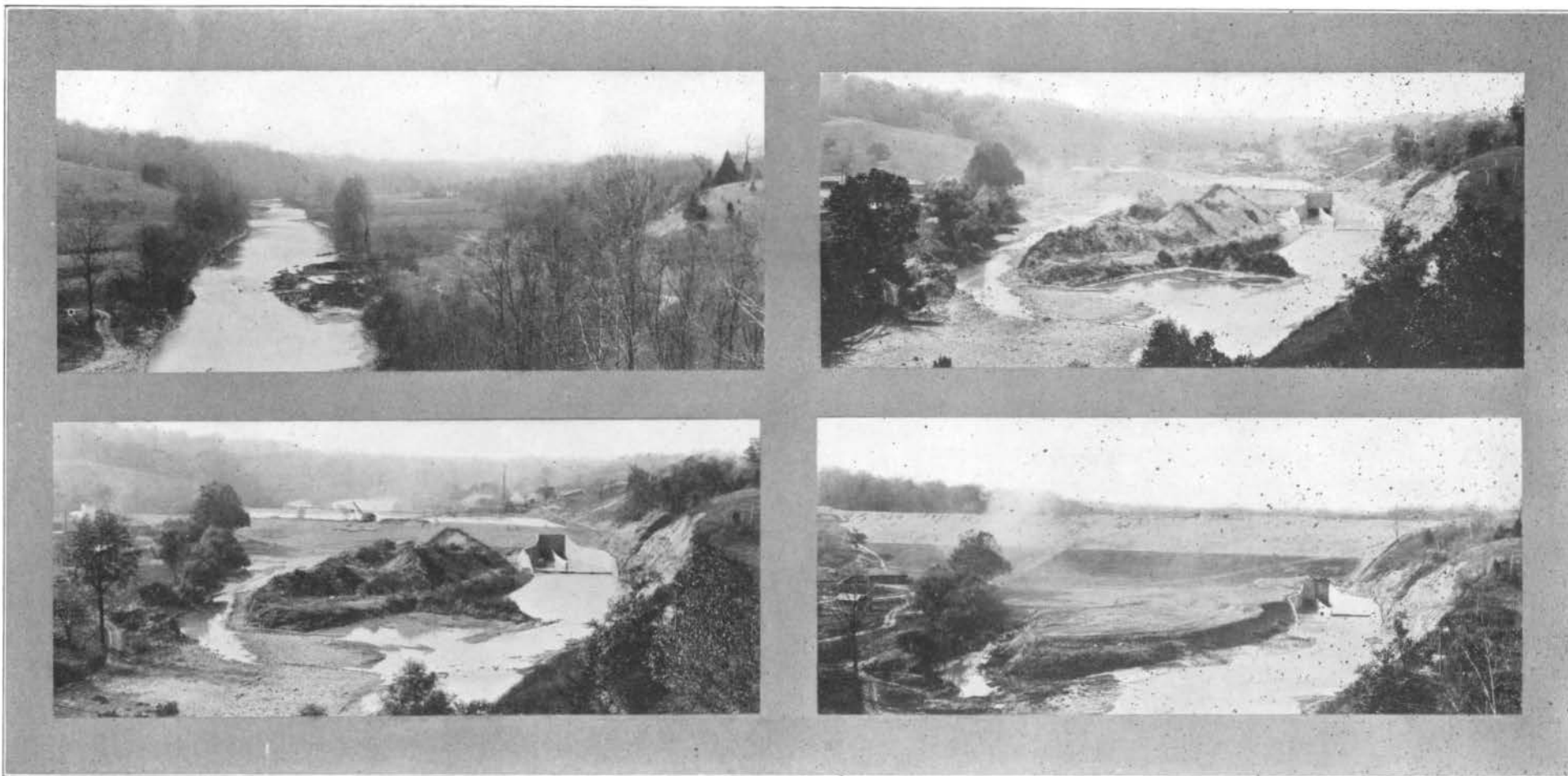


FIG. 229—PROGRESS PICTURES OF THE GERMANTOWN DAM CONSTRUCTION

These views were all taken from the same point, looking westerly up the Twin Creek valley. The upper left shows the conditions before any work was done, on March 20, 1918. The upper right shows the progress to August 6, 1919. Part of the camp can be seen at the left on the right bank of the old creek bed, over which can be seen the cable suspension bridge still in use, although the water of the stream is now flowing through the conduits. The conduit outlets appear at the right, the conduits being complete in their temporary form, giving double capacity of flow to prevent possible flood overtopping the unfinished dam during construction. Above and to the left of the conduits appears the core pool, occupying the top of the low dam embankment, the building of the latter having been started on June 30 preceding. The pool occupies as yet only the part of the valley floor north of the stream bed, being separated from

the latter by a low cross dam thrown up by a dragline excavator.

At the lower left the conditions are shown as they were on October 20 following. The core pool and dam embankment now extend across the entire valley, effecting "closure." The dredge pump station can be seen at the right above the pool, with its tall derrick mast for handling machinery in and out of the "hogbox" and pump house. The earth materials composing the dam embankment are brought to this point from the valley floor above by dump car trains, and pumped thence, mixed with water, to the pool on the dam. The dragline excavator on the dam embankment is building up the retaining levees of the pool.

The lower right picture shows the completed dam embankment, 110 feet high above the old stream bed.

BOARD OF DIRECTORS
Edward A. Deeds, President
Henry M. Allen
Gordon S. Rentschler
Ezra M. Kuhns, Secretary

Arthur E. Morgan, Chief Engineer
Chas. H. Paul, Asst. Chief Engineer
C. H. Locher, Construction Manager
Oren Britt Brown, Attorney

THE MIAMI CONSERVANCY BULLETIN

PUBLISHED BY THE MIAMI CONSERVANCY DISTRICT
DAYTON, OHIO

Volume 3

December 1920

Number 5

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

G. L. TEEPLE, Assistant Engineer, EDITOR.

A Germantown Bulletin

The present number of the Bulletin, as will be noted, is devoted to various aspects of the work at the Germantown dam connected with the finishing features of the construction, or suggested by them. To properly present these it has been necessary to encroach on our usual editorial space, and to crowd out a number of interesting matters. The dam embankment is complete, except for the surfacing of the upper part of the slopes. The conduits are complete, or will be by the end of the month and year. The cleaning and trimming, the disposal of the construction camp and the dismantling of the working plant still remain (although the last item is well advanced). For practical purposes, therefore, the Germantown dam is finished. Any future flood coming down Twin Creek valley to swell the rising waters of the Miami, will find in its path a wall solid as the enclosing hills on each side, and as high, rising 110 feet above the old stream bed. Only through the outlet conduits, built of solid concrete locked into the bed rock, will the waters be able to find their way. At the lower end of the conduits they will emerge—robbed of their destructive energy in the “hydraulic jump pool,” created by the engineers to receive and quench it—and pass on harmlessly down the valley.

It is worth while to pause at this so significant stage of the flood prevention project, and consider what it means. After all the doubts and fears, after the months and years of study and preparation and after nearly three years more devoted to the actual work of construction, that which was only dream

and desire has become a fact. The first of the Conservancy dams stands completed. And it has not only become a fact, but it has become a tried fact. It has been through a flood—a very considerable flood—that of April of the present year—and it stood the test. The embankment, the conduits and the conduit outlet works, all performed their function. They performed it according to design. No weakness developed. Nothing had to be revised. The work of construction went on to completion—successful completion. The work of the hydraulic fill especially, it is to be noted, which was the object of doubt and criticism on the part of some, was carried on without developing a sign of failure or weakness. There has been neither undue settlement, nor slippage, nor breakage, in the dam embankment as it rose to completion, nor any sign of these such as might cause worry or fear. The Germantown dam stands completed, and in such manner that it will continue to stand, for centuries, for all time that men may need it, between the people of the Miami Valley below, and the threatenings of flood.

It is worth while, we repeat, to pause and consider these things. They are just cause, we think, for especial satisfaction, to the originators of the project, to its directors, to the engineers who designed and supervised the work, to the workers who carried it out, to the people of the Miami Valley—to the people of Middletown and Hamilton especially, who can all feel in what has been done not only satisfaction for the past performance, but an augury for the future, when the entire project shall stand, as Germantown now stands, in full completion.

Finishing the Germantown Conduits

The North Conduit, the First to be Completed on the Conservancy Project,
Finished November 27, 1920.

It has been heretofore noted that the conduits which carry the streams under the Conservancy dams are so designed as to give them during the period of construction a capacity much greater than normal. The object of this is to preclude the danger of a flood overtopping the partly completed embankment. To insure this, the conduits are given temporarily an excessive depth, permitting a stream flow about double the final figure.

The Germantown dam embankment, as noted elsewhere, having now been completed to its full elevation, this special temporary feature is no longer necessary. The north conduit has already been given its final form, and work is now in progress on the other. Fig. 230 shows the north conduit just completed and undergoing inspection by the officials of the District a few moments before the water of Twin Creek was finally turned into it.

The work of this final stage of the conduit construction brings vividly into view the reason for providing two (or more) conduits at each of the Conservancy dams. The valley being entirely blocked by the dam embankment, one conduit must carry the creek water while the other is being given

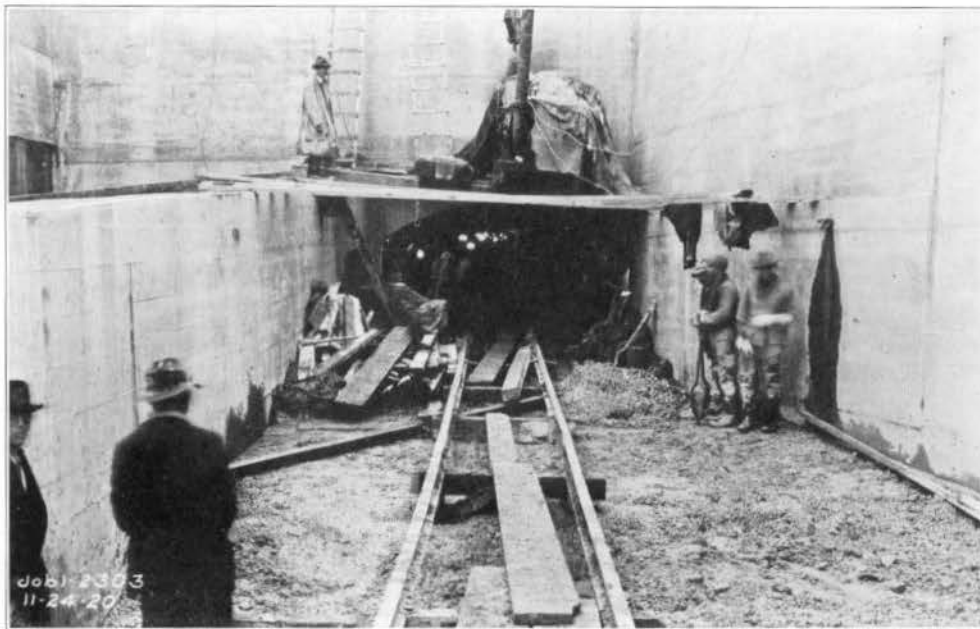
its final form; the stream must then be turned into the completed conduit and the process repeated on the second one, the mouths of each opening in turn being blocked against the creek water, to keep the conduit dry while the work is being done upon it.

Provision had been made for these coffer dams in building the entrance channel walls, vertical grooves having been cast in the concrete of the two side walls and the center partition wall, opposite each other, to receive the ends of timbers to be laid horizontally across the entrance. Four such timbers were used, 8" by 16", spaced closer together toward the bottom because the water pressure, whose total force these timbers must resist, is greatest there. Vertical planks were then set up against these timbers, and the planks faced with vertical matched flooring to close the cracks, a few subsequent leaks being calked with oakum, and the flooring being chisel edged and driven till it "broomed" against the conduit bottom to shut off any leaks there. At the exit end of the conduit bags of mixed earth and gravel were laid about 3½ feet deep along the top of the wall or "weir" at the lower end of the pool chamber, making the wall also into a "coffer dam."



FIG. 230—CONSERVANCY OFFICIALS INSPECTING THE COMPLETED OUTLET CONDUIT AT GERMANTOWN, NOVEMBER 29, 1920.

This is the first conduit to be completed on the Conservancy project. The officers are as follows, beginning at the left: Arthur E. Morgan, Chief Engineer; Ezra M. Kuhns, Secretary, Board of Directors; E. A. Deeds, President, Board of Directors; Arthur H. Pauls, Division Engineer, Germantown Dam; Albert Armstrong, Superintendent, Germantown Dam; Chas. H. Paul, Assistant Chief Engineer; Oren Britt Brown, Attorney for the District; Henry M. Allen, Board of Directors; Gordon S. Rentschler, Board of Directors; C. H. Locher, Construction Manager. For description of conduit, see pages 68 and 69.



The conduits were originally built with a height to give them ample capacity to carry flood water during the work of construction, and thus prevent flood overtopping the unfinished dam embankment during the work of construction. After the embankment was completed, the lower part of the conduit was filled with sand and gravel, over which was laid a floor of concrete averaging about three feet thick. The narrow gage railway track in the picture carries a little car and gasoline locomotive which bring the concrete from the mixer at the other end of the conduit.

FIG. 231—FINISHING THE CONDUIT FLOOR, GERMANTOWN DAM, NOVEMBER 24, 1920

This made the conduit into a great tank or cistern, about 700 feet long and ten feet wide, with about twelve feet of water in it. It held in fact about 700,000 gallons, and was pumped dry by a six-inch "centrifugal pump," harnessed to an electric motor, in about 12 hours. (A little less than a thousand gallons a minute.)

The lower half of the conduit was now ready to be filled in. The material used for most of this was sand and gravel, the lower part of the fill being of these materials, topped with the final floor of the conduit, which is of concrete. The conduit floor has no very great pressure to withstand except at the entrance. Hence it need not be thick, and the sand and gravel deposited below it are amply solid to support whatever slight pressure the floor slab transmits to them. The floor slab, in fact, is arched below, although flat above, and is really supported by the massive side walls of the conduit. Its shape is shown in Fig. 232, which is a section of the Englewood conduits (almost a replica of those at Germantown). The floor slab occupies the space between the two dotted lines crossing the left conduit; the sand and gravel occupy the space below; the space above shows the final conduit opening.

At the entrance, however, provision for the heavy possible pressures when the water backs up behind the dam under flood is very important, and to meet them a solid concrete "bulkhead" was built ten feet thick, filling the entire space between the permanent floor and the solid bedrock beneath, notching into the latter and into the walls on each side. The main function of this bulkhead is to act as a "plug" for the tunnel occupied by the sand and gravel, protecting it from the powerful thrust of the flood water, which if it got in would be likely to break up through the conduit floor. The conduit is indeed full of water, which might be expected to balance this thrust, but in fact conduit water at such times is rushing toward the outlet at high velocity, up to over 50 feet a second at maximum flood, and the powerful pressure at the entrance has been lost in

giving it this high speed. (Just as the force in a halfback's foot vanishes in the drive of the football toward the goal.)

In the open roofed chamber just in front of the conduit entrance, this plug or bulkhead is again replaced by gravel and sand, to which water is admitted by holes purposely cast in the concrete floor, thus equalizing the pressure above and below the latter, by the well known law that in water the pressure in every direction is the same.

A similar but much shorter bulkhead (5 feet long), was put in under the conduit exit, more as a reinforcement to the opening than to act as a plug, since the heavy pressures noted do not appear here.

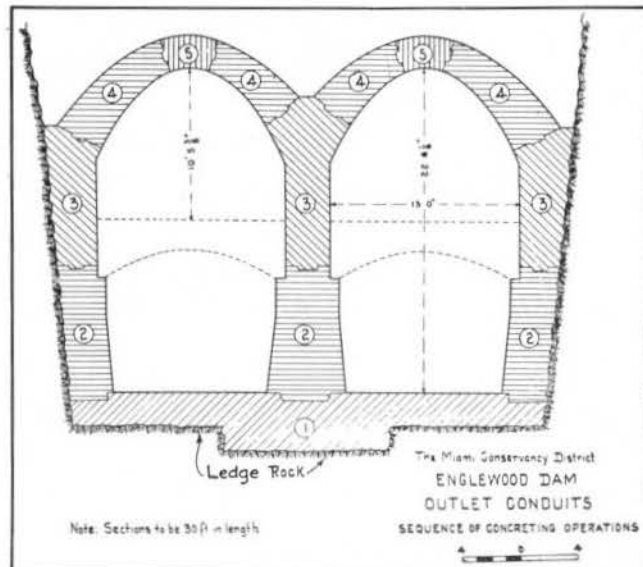


FIG. 232—CROSS SECTION OF CONDUITS

Shows the temporary section, giving approximately double height and double carrying capacity. They are brought to the final shape by filling the lower half, below the curved dotted line, with sand and gravel. This material is then floored over with concrete to the horizontal dotted line. This floor is 4 feet thick at the sides and 2 feet thick at the center. See page 69.

The gravel was washed and screened at the time the conduits were built in their temporary form, and stored in these stock piles until needed in order to permit the gravel plant to be taken to Dayton for work there. The small dragline excavator travels along the bank from pile to pile, loading the several sizes as they are needed. The narrow gage cars and little gasoline locomotive take the materials to the concrete mixer at the mouth of the conduit, where they are dumped into

(Continued below)



FIG. 233—LOADING CARS WITH CONCRETE "AGGREGATE," NOVEMBER 24, 1920.

hopper bins from which they are "chuted" into the concrete mixer through measuring boxes to secure the correct proportions.

The sand and gravel filling, which followed the building of the plugs, was transported and placed in a manner similar to the filling up of the "ditch" on the dam shown in Fig. 228, the dredge pipe line being carried down the center of the conduit, and the material being pumped through it as in ordinary hydraulic fill.

The last step, the placing of the concrete floor, is shown in its main features in Fig. 230, heretofore referred to, and in Fig. 231, which shows the conduit exit finished, with the track which carried the little gasoline locomotive and rocking hopper car by which the concrete was transported and dumped. The rails for the track were laid on blocks on the deposited gravel fill. This filling was

given an arch shape on its upper surface, and the mixed concrete deposited on this surface and leveled on top to correspond with the shape shown in Fig. 232. The depth of the concrete was two feet at the center of its width, and four feet at its edges; the top foot being a "rich mix," similar to that used in the conduit arches. The gravel for the concrete was washed and screened into sizes at the time the main work on the conduits was done (to permit the gravel washer to be dismantled for other work in Dayton), and the materials stored in stock piles until wanted. Fig. 233 shows a small dragline excavator loading the gravel from these piles into small cars drawn by another gasoline locomotive to the bins, whence it was chuted through measuring boxes to the mixer below as wanted.

Topping Out the Germantown Dam Embankment

A Mixture of All Borrow Pit Materials, Deposited Together in a Narrow Center Pool by the Hydraulic Method, Builds the Upper Layers.

A hydraulic fill dam consists essentially of a central impervious core "sandwiched in" between two sand and gravel embankments which provide drainage for the core during construction and give the dam stability. The core is deposited as clay mud on the bottom of the core pool which is carried at the summit of the growing dam embankment, along its center line. The sand and gravel are deposited on the sloping beaches of the pool by the water as it flows down these slopes from the dredge pipes which bring the mixed earth and water from the pumps. Between the true core and the enclosing sand and gravel embankments there is a "transition zone" of mingled sand, gravel and mud, of variable thickness according to circumstances.

All of these features have been described in earlier issues of the Bulletin (see especially page 105 of the Bulletin for February, 1920), and are shown in the cross section of the Germantown dam exhibited in Fig. 235 of the present issue. In this figure P represents the pool, BB the beaches, LL the levees,

and DD the dredge pipes bringing the water and suspended solids, at the stage when the dam had been built up to about elevation 815, 15 feet below the dam crest. The transition zone is marked as such.

The actual appearance of the dam at about this stage is shown in Fig. 234, taken from the south end of the dam, looking northward along its center line, October 13, 1920. This is a late stage in the dam building (15 feet from the top in a total height of about 106 feet). The pool by this time is so narrow, therefore (about fifteen feet in width) that the transition zone unavoidably encroaches on the true core zone, as is evident from the mixed clay and gravel in the nearest part of the pool. But the pool surface at this stage being about at the level of the assumed maximum flood in Twin Creek Valley, (spillway level) the encroachment is not harmful, the mixture of coarser materials with the clay producing a "mud concrete" which is practically impervious under the low head of water which it will ever be called upon to resist.

This was begun at an elevation about 15 feet below the dam summit. The dragline excavator seen scooped the materials out of the bottom of the core pool and used them to build up the side levees, giving the section shown by the line AAA in Fig. 235. The main object of this deep digging out was to break up possible sand and gravel strata which might build out from the two beaches of the pool and permit leakage.



FIG. 234—FIRST STAGE OF TOPPING OUT THE GERMANTOWN DAM. OCTOBER 13, 1920.

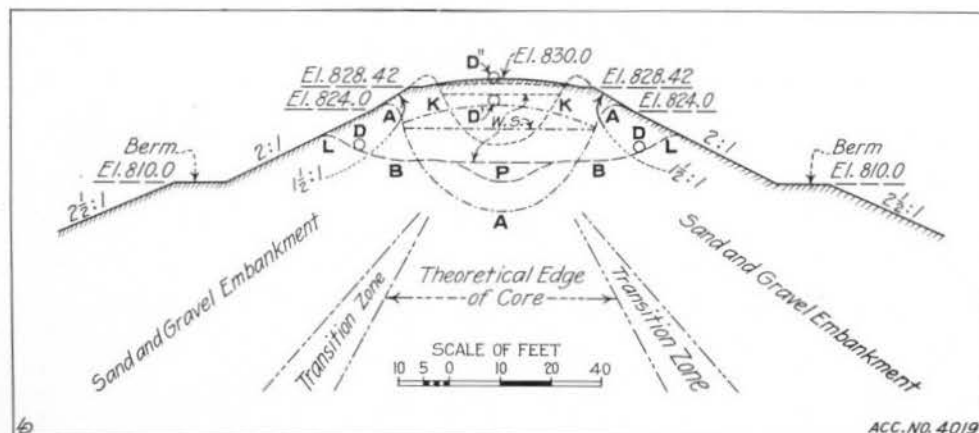
In fact, in the upper layers of the dam embankment, at the elevation shown in the picture and above, the deposition of a true core is abandoned as unnecessary, and "mud concrete" is substituted. This has the advantage of providing also an immediate solid foundation for the roadway which is to be carried along the summit of the dam, connecting the roads on the north and south sides of Twin Creek Valley. This is the more desirable, inasmuch as the upper layers of mud, many feet in thickness, as deposited in the bottom of the core pool, are quite soft, and remain so for a considerable period.

The first stage, preparatory to the changed procedure, was to excavate the bottom of the core pool to a considerable depth along the entire length of the dam. The small dragline excavator seen in Fig. 234 is engaged in this operation, the materials "fished out" of the pool bottom being used to build up the two levees topping the side slopes of the dam. The levees at GERMANTOWN were thus carried approximately to elevation 825, about 5 feet from the final dam summit, the pool bottom being lowered to about the depth indicated by the line AAA in Fig. 235. The object here was not so much to deposit the impervious mud concrete in the levees, as to mix the materials in the pool bottom, and break up any possible strata of pervious sand and gravel which might extend across the core, due to its narrowness at this elevation, and thus permit possible leakage through the dam.

Deposition of the mud concrete in the pool was then started, the materials being the same as those used to build the lower layers of the dam, and being pumped through a dredge pipe line in a similar manner, but with the use of one pipe line only. This pipe was carried nearly down the center line of the dam, discharging into one end of the pool, filling it up with the mud concrete to about the level of the line KK. The position of the dredge pipe during this process is indicated by the small circle D'.

The small dragline excavator followed the working dredge pipe along the dam embankment, digging out the central portion of the just deposited material, and casting it up on the two levees as before, carrying them thus to an elevation about two feet above the ultimate dam summit. It dug in fact, a ditch, shown in Fig. 236, of which the two levees formed the upper sides, the object of this ditch being to retain the pool on the narrow summit of the dam for the deposition by the hydraulic process of the final batch of mud concrete necessary to top out the dam.

This final operation is shown in Fig. 228, the direction of view being the same as in Fig. 236. The working dredge pipe is seen just to the left of and below the small dragline, discharging into the "ditch" just mentioned, filling it up with the mixed sand, clay and gravel. The dragline excavator follows just behind it, scooping out with its bucket such material as is necessary, and depositing it in



LL are the levees; BB the beaches; P the pool at the stage when the embankment reached an elevation 15 feet below the top. The pool bottom was then scooped out and built into the levees, giving the section AAA. Hydraulic fill was then deposited to the line KK. A repetition of these operations brought the dam to its final elevation.

FIG. 235—SECTION THROUGH UPPER PART OF GERMANTOWN DAM EMBANKMENT

Following the first stage shown in Fig. 234, the pool was nearly filled up with the earth materials brought by the dredge pipe. It was then dug out down the center line again, by the dragline excavator, creating the deep trench seen in the picture, the excavated materials being used to build up the sides of the trench still higher. This trench is then filled up as after the first stage, the dragline excavator following along just behind the discharge of the dredge pipe, and bringing the new surface to proper level by picking up with its bucket material from the pool, and depositing it where needed.



FIG. 236—RESULT OF THIRD STAGE OF TOPPING OUT GERMANTOWN DAM. NOVEMBER 3, 1920

front of and behind the machine, wherever needed to bring the dam embankment to the proper level.

The result is shown in Fig. 237, which is taken from a position just behind the dragline, and looking in the same direction as in Fig. 228. The tops of the two levees built by the dragline in its preceding operation are seen at the sides projecting above the general level, these portions being thus built a little high to provide material for the final hand finishing of the dam crest and upper slopes to the proper section, as indicated by the top full line of the drawing in Fig. 235. The dotted line in this figure indicates the top of the material deposited by the dredge pipe, the position of the latter being indicated by the small circle D".

The surface shown in Fig. 237, it will be clear, is

the unfinished subgrade of the highway to be built along the crest of the dam, referred to above. It may perhaps give reassurance to some who have had certain misgivings as regards the application of the method of hydraulic fill to the construction of the Conservancy dams, to observe in Fig. 228 the 40-ton dragline excavator (a No. 36 Marion machine) traveling along the surface of the dam summit and of the proposed highway, directly above the hydraulic fill core material which occupies the embankment interior below. Under this heavy mass the material showed no signs whatever of weakness or settlement. Levels taken on the finishing stakes on the dam summit two weeks after the completion of the embankment showed also no measurable settlement during this period.



This shows the result of the operation seen in the front cover picture, Fig. 228. The dredge pipe which brings the materials to the dam summit from the pump and hogbox in the valley below, is seen on the dam center line. The view is in the same direction as in Fig. 228, but behind the dragline excavator there seen. The ridges of sand and gravel at the edges are excess material to be used in the final bringing of the dam crest to exact grade. The dam crest, 25 feet wide, will be used as a highway connecting the roads on the north and south sides of the valley.

FIG. 237—GERMANTOWN DAM SUMMIT AFTER LAST DEPOSIT OF MATERIALS. NOV. 3, 1920

October Progress on the Work

GERMANTOWN

The last of the hydraulic embankment was placed November 6, 1920. During the month of October and first six days of November 44,724 cubic yards of hydraulic embankment were pumped in place, completing the hydraulic embankment of the dam with a total of 795,907 cubic yards of material placed.

This month also marks the completion of the spillway bridge. All false work is removed and all trimming and finishing of rough concrete completed.

The north conduit has been closed and the creek flow is now being carried by the south conduit. Gravel has been pumped into the north conduit. The plugs at the inlet and outlet ends of the conduit are concrete; also the floor in the inlet entrance and in section 1, 3, 5, 6, 7, 8, 9, 10, 11, 13, 15 and 17 of the conduit.

Mr. Conley is graveling Road No. 1 between the State Road and the dam, this portion being under contract; also that portion of Road No. 1 between the dam and the spillway, this section being done by day rate.

Dismantling of equipment is under way. So far the dredge pipe line on the dam, the 15-inch booster dredge pump, the 8-inch primary monitor pump, the 8-inch booster monitor pump and all pipe line in the sluice borrow pit have been removed.

A. L. Pauls, Division Engineer.

November 23, 1920.

ENGLEWOOD

The hydraulic fill for October shows a decrease in the monthly rate of progress, due to the fact that pumping operations were suspended for a week incidental to including in the fill that portion of the dam which had been run the preceding year. From May 6 to October 11 pumping operations were confined exclusively to building that portion of the dam occupying the old river bed. Early in October, however, the river closure had reached the elevation of the section formerly placed and steps were taken to run the two sections as a unit. During the month, ending October 25, 108,000 cubic yards of hydraulic fill were placed. During this time also 1,200 cubic yards of rolled fill were estimated. The total embankment on estimate date was 2,041,000 cubic yards, or 57 per cent of the finished dam.

The large electric dragline, formerly working on Cross Dam No. 2, moved into position and began excavating for the temporary spillway, digging cut-off trench as it progressed.

Work was continued on the crib for protecting the spur levee at the outlet of the temporary spillway.

H. S. R. McCurdy, Division Engineer.

November 15, 1920.

LOCKINGTON

During the last six weeks an average of 11,083 cubic yards of earth have been pumped into the dam embankment. The rate, however, is dropping, due to the approach of the freezing weather. There are about 200,000 cubic yards still required to complete this part of the work.

Heffner & Son, the contractors making the fill on Road 9, have suspended work till the ground freezes, due to the muddy condition of the material being moved. Some progress is being made on Road 11.

The telephone line of the Tidewater Pipe Co. is being rebuilt along the relocation, taking it out of the Lockington retarding basin.

Barton M. Jones, Division Engineer.

November 25, 1920.

TAYLORSVILLE

The work on the inlet channel has been slowed down considerably during the last month, due to the fact that as the channel has neared completion the dumping space for the dragline has become very limited, so much so that for the last two weeks the night shift has been taken off. About December 1, the giants will be moved back to the borrow pit in the hill, and the dragline will cast the little that remains in the inlet channel over into the toe of the dam to the west.

The concrete paving on the upstream toe of the dam near the inlet channel has been finished and the Bucyrus dragline has been moved down to excavate for the paving on the lower toe of the dam adjoining the west edge of

the outlet channel. A part of this paving is now being placed and all of that part below ordinary water level will be finished in a few days, so that the river can be turned into the concrete works from the inlet channel as soon as the Lidgerwood dragline finishes its work at this point.

Mr. Crampton has finished all the grading on Road 12 except a few of the ditches and culverts.

O. N. Floyd, Division Engineer.

November 25, 1920.

HUFFMAN

The upstream slope of the dam has been built up to elevation 806, in that part of the dam across the diversion channel. The gap across the old Erie Railroad and the old Valley Pike has also been built up to this same elevation. The upstream slope of the main part of the dam is at elevation 810.

47,000 cubic yards of material were placed in the dam during the month of October. The day shift was engaged in railroad work until the 18th. No more material can be placed in the main part of the dam until the closure of the gap at the old Erie Railroad has been entirely completed, which will allow the raising of the water in the center pool. For this reason the sluicing plant on the hill at the north end of the dam has been idle during the past month.

That part of the oversize rock rejected by the revolving screen at the pumping plant, smaller than 15 inches in diameter, is being placed as paving on the upstream slope of the dam. About 400 lineal feet of the dam have been covered with this rock up to the first berm. The boulders over 15 inches are being placed as rip-rap on the north slope of the entrance channel to the outlet works.

C. C. Chambers, Division Engineer.

November 20, 1920.

DAYTON

Channel excavation has been continued during the past month by dragline D-15, placing the material into levee and spoil bank fill along the right bank above Stewart Street. This machine will make the excavation for a new 16-inch water main to be laid across the river above Stewart Street bridge before crossing to the south side of Stewart Street. D-16 is working upstream between Third and Fifth Streets. D-8 has continued to unload material from scows at the gravel plant. D-19 performed the necessary excavation for lowering the 10-inch cast iron sewer pipe crossing under the river between Floral Avenue and Wilkinson Street and is now cleaning up the levee and channel slopes along the right bank below Main Street.

Favorable progress is being made on river wall work. Stillwater Drive wall is 89 per cent complete, 3,320 cubic yards of concrete having been placed. Beach Avenue wall is 26 per cent complete, 860 cubic yards having been placed. In the First Street wall 315 cubic yards, or 18 per cent of the total have been placed.

Revetment on the right bank, upstream from Dayton View bridge, has been completed. Price Brothers are constructing revetment on the left bank at Herman Avenue and driving steel sheet piling to finished grade across the channel below the bridge.

An agreement has been made with J. C. McCann for doing the excavation and embankment work on Mad River.

To date 53,900 cubic yards of sand and gravel have been issued from the gravel plant.

Previous to November 1, 776,300 cubic yards of channel excavation (Item 9), had been removed and 128,500 cubic yards of levee embankment placed. The total yardage handled in accomplishing that work amounted to 1,755,600 cubic yards.

These figures do not include 105,000 cubic yards of excess excavation for the launching basin and scowing canals.

C. A. Bock, Division Engineer.

November 23, 1920.

HAMILTON

Dragline D-16-18 has started south on the west side of the river below Main Street, finishing up the levee and channel slopes.

The total amount of channel excavation, item 9, to November 1st, was 791,300 cubic yards.

At the Black Street bridge concreting of pier No. 2 has been completed up to the beginning of the arch reinforcement. The Bucyrus steam dragline D-16-17 has completed the coffer dam for piers 5 and 6 and has driven the piling for the footing of pier No. 5.

A line of steel sheet piling has been driven by Price Brothers across the river near the north end of the channel improvement. Price Brothers have also finished driving the trestle over Old River at North Third Street.

All work on the pipe lines across Old River has been completed and the Marion steam shovel dismantled for shipment. The Ford power plant has been placed in operation.

Price Brothers' concrete block plant was closed for the winter on November 13. The total number of blocks manufactured to date at Hamilton is 147,000. About 90,000 more are to be cast next year.

C. H. Eiffert, Division Engineer.

November 23, 1920.

UPPER RIVER WORK

Troy—Since the last report, the dragline working on the Jeffrey contract has completed its first trip between Market Street and the B. & O. R. R., has excavated for the deep channel under the B. & O. R. R. bridge, and is now better than half way on its second trip between the two bridges. This second trip will complete the channel excavation to be made by the dragline in this section of the work. In doing this work about 18,000 cubic yards of Item 9 has been handled.

The C. & C. Haulage Company divided its forces on October 24, bringing one shovel into the gravel cast over by the dragline below Market Street. Due to the bad weather conditions, this part of their work has progressed much better than above Market Street. The material excavated below Market Street has all been placed along the west side of North Market Street, forming the new house lots. The total yardage of the Haulage Company to date amounts to 55,000 cubic yards.

The Finke Engineering Company has placed 4,300 cubic yards in the south levee during the last month, and about 800 cubic yards in the south approach of North Harrison Street to Morgan Ditch crossing. The levee on the north side of Morgan Ditch has been completed and seeded. This leaves only 750 feet of the south levee to build, besides the raising of Harrison, Atlantic and Elm Streets. The total yardage of the Finke Company to date is 24,500 cubic yards.

The North Harrison Street bridge, over Morgan Ditch, has been raised to meet the grade of the street raising,

and the additions to the abutments have been made. This work was done by District forces.

Piqua—The first indications of construction work at Piqua appeared in the form of parts of a derrick. This derrick will be set up near the freight depot of the Ohio Western R. R. at the northwest end of town and will be used to unload the dragline at the same place. The place of unloading is within one hundred feet of the beginning of the new levee, which extends along the town side of the Miami River, filling up the M. & E. Canal to a point below the North Main Street bridge. The dragline is expected to arrive in Piqua about the first of the new year.

A. F. Griffin, Assistant Engineer.

November 20, 1920.

TROY

The report for Troy will be found with that for the upper river work, under which head all reports of work at Troy will hereafter be placed.

LOWER RIVER WORK

Miamisburg—Since our last report Cole Brothers have constructed 900 linear feet of levee—about 17,000 cubic yards—extending southerly along the east bank of the river, commencing at the C. & D. Traction line a short distance south of the north corporation line.

Thomas Daniel & Son have two or three days' work for their team outfit to complete the fill for the Main Street elevation. This fill will be crowned and used as a gravel road over winter, in order to give it a chance to settle before the pavement is re-laid. However, as the material in the fill is nearly all gravel and is being constructed with a team and wagon outfit, not very much settlement is anticipated, and for the same reason not much difficulty is looked for in carrying the heavy traffic which passes over this road. Guard rail material is on the ground and will be erected as soon as the fill is completed.

Franklin—Jeffrey, Boorhem & Company have completed the dragline work on the west levee and now have a force of men dressing the top and slopes.

Work on the Chautauqua levee is progressing satisfactorily, considering the wet weather. Four or five days' work should complete the fill.

Middletown—Revetment construction was within four or five days' work of completion on November 24 and consequently no serious damage resulted from the high water which occurred on that date. When this work is done the levee south of Third Street will be complete, with the exception of a little dressing and seeding.

F. G. Blackwell, Assistant Engineer.

November 27, 1920.

The excavation cuts through the "saddle," shown in Fig. 241, and may be seen just beyond and to the left of the small steam shovel: the view here being about at right angles to that in Fig. 241. The steam shovel did the heaviest of the digging, the dirt being hauled away in dump wagons, and "wasted." The small buildings are the cement house and the hoist engine house, seen also at the left in Fig. 242, the view in which is from the same direction as here, but closer up. See also Fig. 244. The total excavation for the spillway was 18,300 cubic yards.



FIG. 238—EXCAVATING FOR THE GERMANTOWN SPILLWAY, AUGUST 20, 1920

RAILWAY RELOCATION

Big Four & Erie—These railroads are practically completed with the exception of the station buildings, Erie team tracks and miscellaneous items. Mr. M. K. Frank is dismantling the Erie old line and has about 30 per cent of material taken up.

Baltimore & Ohio Railroad—Mr. J. C. McCann has almost completed his contract for the grading on the Narrows. All other work has been completed.

Ohio Electric Railroad—This railroad from Huffman to Fairfield is almost complete for operation, there remaining to be done the ballasting of the passing tracks, constructing the connections at both ends and the bonding of the rails.

Albert Larsen, Division Engineer.

November 20, 1920.

RIVER AND WEATHER CONDITIONS

The month of October was comparatively dry, no rain whatever occurring during the first three weeks. The to-

tal precipitation for the month occurred during the storm beginning on the 25th and ending on the 28th, the amounts varying from 1.48 inches at the Huffman Dam to 2.73 inches at Pleasant Hill. At Dayton the total amounted to 1.61 inches or 0.79 inches less than normal, raising the accumulated deficiency since January 1 to 3.47 inches. The rivers were comparatively low during the entire month, no rises of any consequence resulting from the storm of the 25th to the 28th.

At the Dayton Weather Bureau Office, the mean temperature for the month was 60.7 degrees, or 6.6 degrees greater than normal; there were 19 clear days, 5 partly cloudy, 7 cloudy and 4 on which the precipitation amounted to 0.01 of an inch; the average wind velocity was 8.4 miles per hour, the prevailing direction being from the southwest; and the maximum wind velocity for five minutes, was 50 miles per hour from the south on the 26th.

Ivan E. Houk, District Forecaster.

December 2, 1920.

Building the Germantown Spillway

Ideal Natural Spillway Site, 800 Feet North of the Dam, Permits a Very Inexpensive Separate Concrete Structure.

The "spillway" of a dam is in the nature of a safety valve, its function being to provide a broad and ample opening through which, in flood seasons, excess waters gathering behind the structure may be carried safely away to a point in the valley below, before they have an opportunity to rise to the dam crest. In the Conservancy dams they are short, broad, open-topped channels of concrete, with flat bottoms and sloping sides, notched into the top of the dam embankment, or into the valley slope at one side, with the bottom 15 to 16 feet below the dam crest. At Lockington, Taylorsville and Huffman the spillway is notched into the top of the dam, and in these cases it is built in one concrete structure with the conduits which carry the river flow beneath. At Germantown and Englewood the spillway is a separate structure. The type chosen in each case, whether separate or combined, is that which gives the least expensive construction. (See the Bulletin for August, 1919.)

The location for the spillway at Germantown was provided by nature, and approaches almost as near to the ideal for its purpose as if the ice sheet of the Glacial Epoch, and the subsequent waters, had eroded the valley to order. The site is shown in reference to the dam in Fig. 244. Inspection of this map will show a dry run proceeding from the spillway site down the valley slope and debouching above the dam site. Its direction, rather unusual, is diagonally upstream. Just across a narrow saddle at the spillway site, another dry run proceeds down the valley slope and debouches below the dam. It only needed to cut a few feet through the saddle and line the cut with concrete, and the spillway was complete, the two dry runs furnishing the inlet and exit channels of a by-pass, through which, and over the spillway summit, the excess flood waters can find their way around the dam. The spillway floor is fifteen feet below the level of the dam crest, and as it will take a flood 40 per cent greater than that of 1913 to reach even this floor level, the chances of water ever actually passing through the spillway are exceedingly remote. To reach the crest itself, it may be said in passing, will require a flood more than twice as great as that of 1913, a contingency which is beyond all probability of occurrence.

A further fortunate circumstance was that bed rock occurred along the saddle, jutting just above

the proposed spillway floor (815 above sea level), and requiring to be peeled off to a depth of only two to four feet to provide an excellent natural floor for the structure, without going to the expense of laying concrete. The latter material had been originally provided for in the plans, but showed it to be unnecessary. Two "cut-off" walls, sunk 4 feet into the rock, extending across the channel width, with their tops flush with the floor, provide level "weirs" defining and limiting the floor of the water and guarding against any possibility of undercutting the rock floor as it weathers. The sides of the spillway are cut on a slope, and lined with concrete to guard against possible wash by flood water, these slopes being partly in earth. The principal object of the "slope revetment" of concrete is to protect the earth approaches to the spillway bridge, described later. These features are shown in Fig. 239 and Fig. 240.

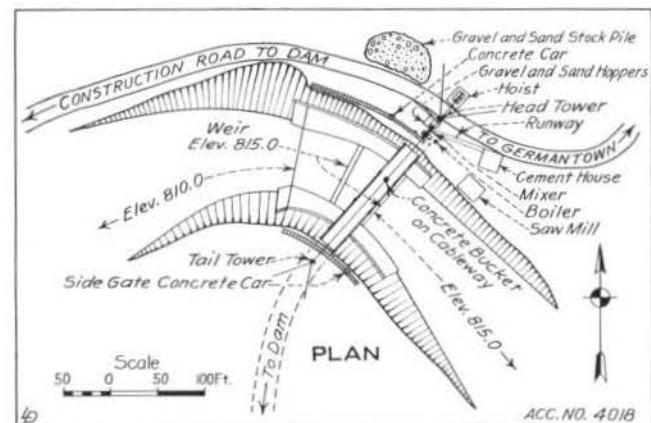
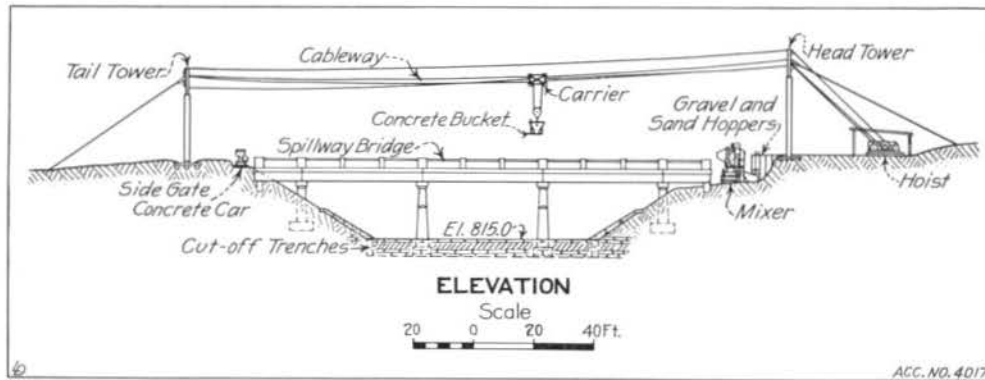


FIG. 239—PLAN OF SPILLWAY CONSTRUCTION LAYOUT

Compare Fig. 240, which shows an elevation of the same layout, and Fig. 244, which shows location relative to the dam. The sand and gravel were wheeled from the stock piles shown, and dumped into a Smith measuring hopper, and thence into the $\frac{1}{2}$ cubic yard Smith concrete mixer. For the north slope revetment and cut-off wall the concrete was discharged directly to the forms through chutes, except at the west end, which was served by a small hopper car on a light railway. The south slope and cut-off wall were served similarly by a hopper car, filled by the bucket of the cableway, shown in Figs. 240 and 242.



The concrete is distributed to the bridge forms by a bucket hung from a travelling carriage running on a trolley wire (the middle wire), anchored to the two towers. The hoist engine raises and lowers the bucket and hauls the carriage back and forth as described on page 77. Timbers, concrete forms, etc., are similarly handled.

FIG. 240—ELEVATION OF SPILLWAY BRIDGE CONCRETING LAYOUT AND CABLEWAY.

A point of interest to engineers is the substitution of the two flat-topped weirs referred to, for an "ogee weir" provided for originally in the plans. The ogee weir has a somewhat greater carrying capacity for water over a flat-topped weir (in the ratio of 3.8 to 3.18), but would have required more concrete and more rock excavation. By widening the spillway in the same ratio, the excavation was as it were transferred from rock to earth, making the structure less expensive to build. This point also, like that referred to in the preceding paragraph, shows the care used in Conservancy designs to provide the least expensive construction which will be adequate to the purpose in view.

As is evident from Figs. 240 and 242, the spillway structure is crossed by a concrete bridge, which carries the road leading across the top of the dam, to meet the highway leading along the north side of Twin Creek valley. It was desirable to lead this road from the dam across the spillway at the level of the dam summit, so that the road may be used even if water is running over the spillway; hence the building of the bridge.

It is a concrete structure of two short "approach spans," and three 40-foot main spans, 18 feet wide

between the curbs, the supporting members of each span being a center and two side beams or girders, each 6 feet deep and 20 inches wide. The floor is carried on the same level as the tops of the girders, making the bridge of the so-called "deck-girder" type, favored because it leaves no part of the main structure above the highway level, thus conducing to safety. The two central piers supporting the girders are solid, carried up from the bed rock. The end piers consist each of two broad twin posts, connected across at the top by a heavy cross beam, and with a "spread footing"—that is, a broadened rectangular base at the bottom of each post—to secure a firmer bearing below. The railings are solid, anchored to the floor by reinforcing steel. The concrete of the girders, cross beams and floor are also strengthened with heavy steel reinforcement. Cross joints in the structure are introduced at each pier, to permit temperature expansion and contraction without cracking the concrete, the ends of the girders sliding slightly on smooth steel supporting plates at the piers to facilitate the end movement. The floors are concrete slabs reinforced with steel, 9 inches thick (the width of the bridge), and 18 feet

The view is nearly north (compare plan of dam and spillway, Fig. 244). The dry run at the left leads down the valley slope and diagonally upstream, debouching just above the dam conduit entrance. The dry run at the right leads down the slope and debouches just below the conduit outlet. The saddle between needed but a few feet notched out of it to connect the two runs and provide a by-pass for the flood water should it ever rise to a point threatening to overtop the dam embankment. Bed rock provided a natural floor for this "spillway." So nearly ideal a spillway location is rare.



FIG. 241—GERMANTOWN SPILLWAY LOCATION BEFORE GROUND WAS BROKEN. APRIL 18, 1918.



FIG. 242—BUILDING THE GERMANTOWN SPILLWAY BRIDGE, OCTOBER 13, 1920

wide, of a length to reach from pier to pier. They are cast in one piece with the three girders.

The main features of the construction of the spillway and bridge may be gathered from the plan and elevation, Figs. 239 and 240, with the aid of the pictures.

The excavation was done by wheel scrapers, or steam shovel and wagons, as best fitted the several parts of the work, and the excavated earth being "wasted" in to "spoil bank" near by. This work was done under contract by T. Daniel and Sons.

The most striking feature of the bridge construction work was the "cableway" used to convey the materials to their place. It is shown in "elevation" in Fig. 240, and in the construction picture, Fig. 242. This device is to construction work what the traveling crane is to the modern machine shop, and the trolley cash carrier is to the department store, and is especially applicable to work like that on a bridge, where the materials to be distributed lie within short distances of a long center line (at German-town the bridge center line). A wire cable (the middle wire of Fig. 240) is stretched between two towers, one at each end of the work, and a trolley

or wheeled carrier, is drawn back and forth along this wire by means of two wire ropes which wind and unwind around the "drum" of a hoist engine. A hook hangs from the carrier by another wire rope passing over the pulleys on the carrier and thence over another pulley on the "head tower" to another drum of the sand engine, enabling the hook to be raised and lowered. From the hook a concrete bucket is hung, or a chain or rope which is passed around the timbers or reinforcing steel or concrete form to be placed. Thus practically all the materials to be used in the construction can be very conveniently handled. At Huffman a "slack line cableway" was similarly used in building the arch ring bridge over the relocated railways. This required only two drum wires, the hook being raised and lowered by slacking or tautening the trolley wire itself; hence the term, "slack line cableway." At Hamilton still another variant of this device is in use on the new Black Street bridge. In each case the objective is economy in construction.

The time schedule of the bridge and spillway construction will be found in another column in this issue.

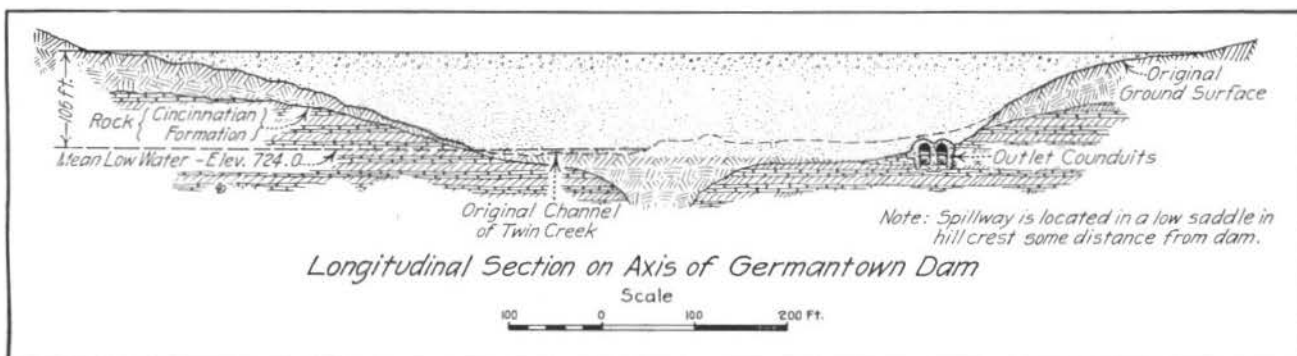


FIG. 243—LONGITUDINAL SECTION ALONG THE AXIS OF THE GERMANTOWN DAM

The dam is 1210 feet long and 110 feet above the old stream bed. Note the outlet conduits at the right, bedded in rock to the arch tops, for stability. A fence of interlocking steel sheet piling was driven to rock, or 50 feet into the subsoil, to cut off seepage beneath the dam.

Review of Construction Progress at the Germantown Dam

An Earth Dam 1,210 Feet Long and 110 Feet Above Old Stream Bed, Begun in March, 1918, and Completed in December, 1920.

The practical completion of the Germantown dam makes fitting at this time a general review of the progress of the work of construction.

The first work necessarily was the building of the camp which was to furnish the living quarters of the men. It was begun in April, 1918, and finished, practically, in June of that year, accommodating an average camp population of about 180. It included the building of 23 cottages, 12 bunkhouses, messhall, store, warehouse, first aid hospital and garage.

A sad feature of this stage of the work was the drowning of Alfred B. Mayhew, Division Engineer in charge of the dam, while directing emergency work during the flood of May 12. His place was taken by Arthur L. Pauls, then Assistant Division Engineer, under whose direction, with the assistance of Albert Armstrong, Superintendent, and C. O. Shively and W. Harnish, successive Office Engineers, the work has been carried steadily forward to a successful completion.

Along with the camp construction went forward the work of installing the plant to be used in building the concrete conduits, the latter being the first main division of the work to be undertaken. The main equipment items for this part of the work were a Lidgerwood Class K electric dragline excavator with 100 foot boom and 2½ yard bucket; a Marion Model 36 caterpillar dragline excavator with 40 foot boom and 1½ yard bucket; a Dull gravel washing and screening plant to furnish materials for the concrete, a one cubic yard Smith concrete mixer, and cars and locomotives, both standard and narrow gage, steam and gasoline, for the transportation of concrete materials and of the excavated earth. As a source of power the high tension transmission line of the Dayton Light and Power Company was extended several miles to the dam and a transformer sub-station installed.

Following the preliminary clearing and grubbing, the actual work on the conduit excavation was started by the Lidgerwood dragline on June 30, 1918, beginning at the outlet end. It was followed up, as soon as might be, by the concreting, the two processes then continuing at the same time. The pouring of the concrete began on October 5, most of the interval being accounted for by the heavy excavation required by the broad and deep outlet pools. The total conduit excavation was 105,000 cubic yards, of which about 40,000 cubic yards was rock.

The erection of the gravel washing plant began in the summer. It was completed in September, and started in at once filling its bins with the washed and screened concrete aggregates. The materials came from the gravel bed in the river bank just above the dam site, the top soil being first stripped and cast aside. The material was excellent and made a first-class quality of concrete. It was dug by the small Marion dragline excavator above referred to, and transported to the gravel washer in standard gage air dump cars drawn by saddle tank dinkie locomotives.

The conduits at Germantown are separate from the spillway structure, as noted elsewhere in this issue. They are virtually twin tunnels side by side, and as they were located next the foot of the north valley slope, it was possible to chute all the concrete by gravity into the forms from cars on a three-foot gage railway notched into the hillside. The chutes were suspended from travelling trusses spanning the conduit excavation, the trusses being carried by A-frames running on rails. The trusses were also used to shift the movable forms.

The concreting, beginning October 5, was carried on through the winter of 1918-19 with the loss of only one day, due to cold weather. This remarkably fortunate record was, of course, only made possible by the unusually mild winter. The conduits proper were finished March 17, and the conduit entrance on May 10 following, the entire work being thus finished in 7 months and 5 days. The total concrete placed was 15,368 cubic yards, a satisfactory record, considering the comparative thinness of the walls, the difficult arch forms, and the necessity for unusual care to secure the most thorough workmanship in these vital structures.

Meanwhile the large dragline excavator had dug the centerline cut-off trench for the embankment of the dam and had excavated the inlet and outlet channels connecting the conduits with the river above and below. It had also started a cross dam along the north bank of the river preparatory to building the first section of the dam embankment. This cross dam was successfully placed, using the method of "plastic fill" described in the Bulletin for February, 1920. In February, March and April also the steel sheet piling was driven in the bottom of the cut-off trench (to a maximum of 35 feet below the trench bottom). Meanwhile also the hogbox, sump and dredge pumps were being made ready for pumping the hydraulic fill into the dam embankment, this work having been begun in January.

These last preparations required until June 30, when the actual pumping began, the flow of the river having been turned through the conduits five days earlier. The north part of the embankment was started first (see the upper right picture, Fig. 229), the core pool being enclosed next the river by the cross dam along the north bank, mentioned above. To insure against seepage along the conduits the earth cast aside in excavating for them had been previously replaced as a puddle over the tops and sides of the arches. Likewise a clay blanket three feet thick had been placed, and rolled by a steam roller, over the entire area between the centerline cut-off trench and the upstream toe of the dam, to prevent seepage under the hydraulic fill. The material for the hydraulic fill was obtained by excavating the valley bottom just above the dam-site with the large dragline, transportation to the hogbox being by 12-yard standard gage dump cars and steam dinkies.

It was soon found that the valley bottom material contained insufficient fines, and it was therefore supplemented by the top layers from the valley slope just north of the hogbox, opposite the up-

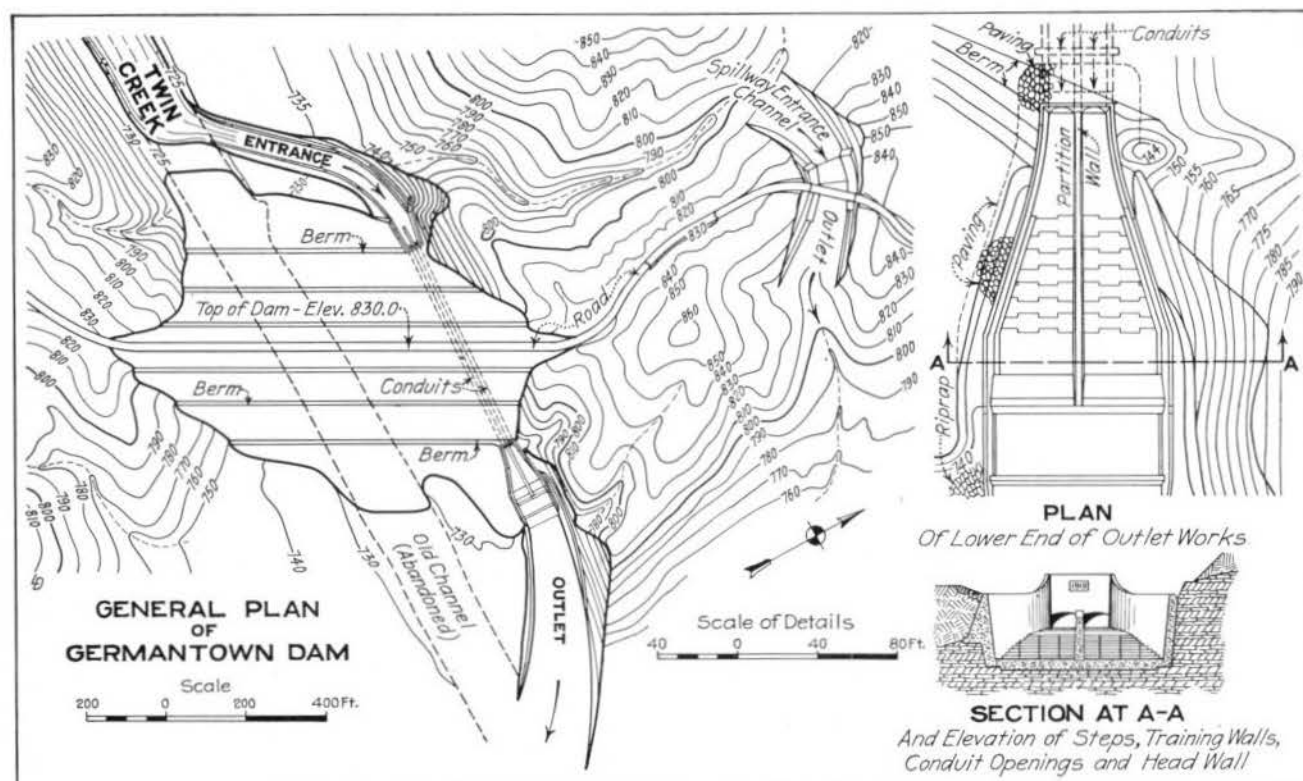


FIG. 244—PLAN OF GERMANTOWN DAM AND PLAN AND SECTION OF OUTLET WORKS.

stream toe. This excavation was by hydraulic monitor, the material being sluiced down the hillslope by gravity directly into the sump. The addition of this material cured the difficulty as to fines in the fill, and added to the quantity of material placed in the dam without any addition to the cost of pumping, the added fines acting as a "grease" to the interior dredge pipe surfaces, reducing the friction loss due to the sharp particles of sand and gravel. Incidentally this reduced friction also reduced wear on the pipes.

The rate of pumping rapidly increased as the equipment was adjusted to the conditions encountered, the quantity placed being 35,000 cubic yards in July, 50,600 in August, 58,200 in September, and 91,500 in October. It dropped again, unavoidably, with the advent of colder weather, and early in February, 1920, was stopped while the equipment was put in shape for the spring's resumption of work. The embankment placed up to that time was 412,400 cubic yards, approximately 52 per cent of the total requirement. The elevation reached was that of the second berm, 60 feet above the river bed, and 50 feet below the top of the dam. This carried it to a level sufficient to hold a flood equal to that of 1913, this mark having been set to provide ample insurance against a possible flood overtopping the unfinished embankment.

Among the devices which proved efficacious in speeding up the rate of pumping of the materials, as noted, were the substitution of manganese steel dredge pump runners for cast iron, eliminating breakages; the enlarging of the runner shoe, increasing thereby the pump capacity; the introduction of a revolving screen to eliminate the oversize rock at the hogbox; and the hydraulicking of the hillside

material already mentioned, increasing the solids pumped without increasing the pumping cost.

Early in the pumping, in August, 1919, the old bed of the river had been cleaned of all mud and silt and rubbish, and a clay blanket spread over it, following which the embankment was extended across the entire width of the valley, effecting closure. It should also be noted that the materials were deposited on the upstream and downstream sides of the embankment alternately, the levees being carried up at the slope summits by the small caterpillar dragline casting up material from the pool beaches. This procedure saved time out for shifting pipe line crew and dragline excavator back and forth across the pool and beaches.

During the winter shutdown, besides the refluing of the dinkies, and repairs to the dragline excavators, the hogbox, etc., a booster pump was installed on the second berm of the dam, 50 feet below the summit, to help lift the remaining material into place.

Pumping was resumed on March 22, 1920. About the same time the surfacing of the dam slopes was started. On the upstream slope, up to the second berm, the surfacing was of oversize rock from the nearby hogbox, a considerable stock having accumulated, and this being an economical disposition to make of it while providing a good finishing material for the embankment. On the downstream slope, up to the same level, the surfacing material is top soil from the damsite stripping, reserved for the purpose. The best surface treatment to provide for the upper levels remaining is a matter still under consideration.

On April 20 the first real test of the dam was encountered in the shape of a flood which rose at the

conduit entrance to within a foot of the top of the head wall. Special interest centered in the conduit outlet works, designed to create a hydraulic jump as an absorbent for the destructive energy of the issuing water. The design, embodying the solution of one of the most important and difficult problems which the Conservancy engineers had to face, operated in a thoroughly satisfactory manner, quite up to what had been expected of it. A decided jump was developed, about seven feet in height. The flood did only a small amount of damage to the plant, although the lower pumping plant was submerged for a number of hours. The pumping was shut down for only five days.

From this time the work of placing the earth materials in the dam embankment went steadily forward with only minor delays. In March (beginning on the 22nd), 29,600 cubic yards were placed; in April, 57,150; in May, 63,580; in June, 44,000; in July, 62,670; in August, 31,680 (made up of 8 days' pumping from dragline excavation and 17 days from the hillside sluicing alone). This carried the dam to the third berm, 90 feet above the old river bed and only 20 feet from the top, and made it 90 per cent complete, with a total earth placed amounting to 701,420 cubic yards.

It was just above this point, at about 15 feet below the dam summit, that the changed procedure in the work of the hydraulic fill was made, described elsewhere in this issue (see page 71), the deposition of a distinct core being abandoned as no longer necessary. The hydraulic method was still used, but the earth materials were mixed, fine and coarse together, in the dam embankment, producing what has been called "mud concrete." (Not implying, however, any analogous hardening). Using this modified procedure, in September, 49,770 cubic yards of material were built into the dam; and in

October and the first six days in November, 44,724 cubic yards, carrying the embankment to completion on November 6, with a total of 797,907 cubic yards of earth material placed.

The spillway (see page 73) was begun in June of 1919, excavation being started on that date, and continued as fitted with the exigencies of other work, till its completion in August, 1920, the total quantity being 18,300 cubic yards. The concreting plant was erected during July, 1920, and the excavation for bridge piers begun. Placing the concrete was started early in August, and the pouring of piers 2, 3, 4 and 5 completed by the end of the month. The slope revetments, cut-off trenches and wiers were finished during September; and the remainder of the work, both on the spillway and spillway bridge, were completed during October, including removal of falsework and trimming and finishing of the concrete. Evidence of the remarkable adaptation of the spillway site to its purpose is seen in the fact that the total concrete in both bridge and spillway was only 952 cubic yards.

The bringing of the outlet conduits to their final form, which was the next stage in the work, is described elsewhere in these columns. It will be finished during the present month (December, 1920). There will then remain only the dismantling of the construction plant, the disposition of the camp, and the final trimming and cleaning up.

Under the surveillance of the Conservancy physician, Dr. W. M. Smalley, the health of the camp was maintained at a high level throughout the work. The influenza epidemic was kept under control, with no deaths resulting. There was one death on the work from pneumonia, and two from accident. No doubt the excellent water and sewerage systems installed at the camp had much to do with the high health level.



FIG. 245—THE DOWNSTREAM SLOPE OF THE GERMANTOWN DAM

The view shows especially the flat sand and gravel slopes of the dam embankment, these growing flatter at each "berm" (or horizontal shelf), to give the dam a broad base, and ample stability. The upstream slope is similar.

THE MIAMI CONSERVANCY BULLETIN SUPPLEMENT

"The News Letter"

To Promote the Conservancy Spirit on the Work

December 1920

OF GENERAL INTEREST

Mr. G. L. Albert To Go To Venezuela

The many friends of Mr. G. L. Albert, Superintendent of Hydraulic Fill work for the District, will be interested to learn that he is to sail on Jan. 5 for Venezuela, to be gone for about two months on a furlough which has been granted him by the District. Mr. Albert has made a favorable arrangement by which he will become at a later date hydraulic engineer in charge of the building of a large dam on the headwaters of the Orinoco for "La Electricidad de Caracas," an electrical concern of Venezuela, in connection with a water power development. The proposed dam is about 200 miles from Caracas, and will call for an embankment of about 2,500,000 cubic yards of earth, to be constructed by the hydraulic fill method. Mr. Oscar Zuloaga, who was in this country some time since in the interests of the development, visited the Conservancy dams at that time in company with Mr. Allen Hazen, and it was then that Mr. Albert met him. The arrangement with Mr. Albert is the result of the visit. The present trip to Venezuela is for the purpose of reconnaissance and preliminary examination of the proposed site.

Mr. Albert will be accompanied by his wife. They will sail via the "Red D" line from New York to La Guaira, whence a railway will take them to Caracas. There Mrs. Albert will remain, while Mr. Albert goes on up the Orinoco River by steamboat, and then by a train of pack mules up into the mountains to the dam site. Something of the ruggedness of the country he is going into may be judged by the fact that the expected head of water for the power development is about 3,000 feet. For the hydraulicking of the embankment materials a head of about 400 feet will be available. The distribution of the materials on the dam will be by Mr. Albert's own patented method by means of open flumes. The Bulletin feels sure that it is voicing a universal feeling in wishing Mr. and Mrs. Albert, for all of us, a most pleasant and prosperous voyage, and a safe return.

Letter from E. W. Lane

E. L. Chandler received a letter some days ago from our friend and former colleague, E. W. Lane, dated Nantungchow, Kiangsu, China, Oct. 30. Mr. Chandler has kindly permitted us to publish an extract, which we are sure the Conservancy family will be interested in. It will be remembered that Mr. Lane sailed for China from San Francisco on Aug. 30 as a representative of the Morgan Engineering Co. The letter shows that he is outdoors on the job, beside the big Yangtze River, one of the most important streams in China. Kiangsu province, we learn from Mr. Pei of the Channel Division, is between Peking and the coast, and is probably from the western point of view the most progressive region in China.

The extract from Mr. Lane's letter follows:

"Everything is going O. K. here. I reached Shanghai on September 14 and came here a few days later. I don't remember when I wrote you last, so I may repeat. This is the model city of China and lives up to its name. It is growing very rapidly and has a big future. I was up to Yang Chow for about ten days. That is on the Grand Canal just above the Yangtze River. It is a real Chinese city, not very much waked up yet.

"Of course, I have only been here about six weeks, and the novelty has not worn off yet, but this certainly is an interesting country. I am reminded of Mr. Sidney B. Reave's description of the conditions before the factory system was introduced, everything made in the home and sold by the maker.

"There are thousands of interesting things to see and learn. There was a total eclipse of the moon the other

evening. The Chinese believe that a huge dog is attacking the moon and tries to swallow it. Sometimes he does not get it clear down, but this time he did. They beat on pans and fire cracklers, and otherwise make all the noise they can to frighten the dog away and make him "cough up" the moon.

"My work here is very interesting. It is in connection with the protection of the bend of the Yangtze from erosion. Where not protected, the river is cutting in 300 to 500 feet per year. Spur dikes have been used and have been only partially successful. The materials available here are so different from those in the United States that it makes an interesting problem. I live at a little village on the river bank about five miles from town. My cook can talk some English and one of the men also, but otherwise nothing but Chinese. I have gone ten days without seeing a foreigner. There are a number of missionaries in town, however, and I get to see them quite often."

Visit of Young Chinese Engineer

In connection with the letter from E. W. Lane, published elsewhere in this issue, it is pleasant to record the recent visit here of the Chinese engineer, Mr. C. P. Hsueh. (Pronounced without the first "H"; the rest as spelled.) Mr. Hsueh is a friend and classmate of Mr. I. H. Pei, (pronounced Pay,) formerly of Englewood and now of the Dayton Channel Division, whom many of us have met. Both the young men graduated as classmates at the Tangshan Engineering College, the foremost technical college in China, situated in the city of the same name, in Kiangsu province. Mr. Hsueh is on his way to his own country, where he expects to take part in the Hua River Improvement Project, the same on which he aided Mr. John R. Freeman in making an engineering report. In China he will call on Mr. Lane, the Hua River project being also in Kiangsu province, not far from where Mr. Lane is at work. Before leaving for China he is making a tour of inspection of some of the leading engineering projects in this country, including the Catskill Water Supply for New York City, the New York Barge Canal, the filtration plant at Washington, D. C., and others. It was this tour which brought him to the Conservancy District, the more so that he could also see here once more his old friend and classmate, Mr. Pei, the two being not only classmates, but both coming from the same town in their native country. Mr. Hsueh was one of two Chinese who graduated at the Massachusetts Institute of Technology at the head of their class. The reputation of M. I. T. being what it is, this must be reckoned a high honor. On the Hua River project Mr. Hsueh will be under the direction of Mr. Chang Chien, one of the great industrial leaders of modern China. The Bulletin wishes Mr. Hsueh every success in his future work.

J. W. Calland Returns to Conservancy

We are glad to be able to publish the good news of the return to the Conservancy of J. W. Calland, who left his work as head of the Forestry branch of the Farm Division, some time since to enter the sales and advertising department of the Kilbourn & Jacobs Co., of Columbus, manufacturers of contractors' equipment. Mr. Calland's family will follow him very soon. He will be stationed at Taylorsville, and his first work will be in connection with the reforestation of the Conservancy basins in accordance with the plans noted in a recent Bulletin in an account of tree and shrub seed collecting by the Montgomery county school children.

Mrs. Everdell Publishes Article on Conservancy Schools

The National School Digest, an educational journal published at Minneapolis, Minn., had an excellent illustrated article recently by Mrs. Eudell D. Everdell, who is in charge of the Englewood school, on the schools of the

THE MIAMI CONSERVANCY BULLETIN

Conservancy District. One needs to read such an article, in such a journal, to realize the good fortune of the children of our workers, in the unusual quality of the education they are receiving. Comparatively few city schools, we believe, offer their children such service.

DAYTON

Superintendent G. L. Albert, who has been suffering at home for some little time as a result of an accidental fall at Taylorsville, is now much better and is getting about again.

The vacationers we envy most of any we have noted in many months are Mr. and Mrs. H. L. Rogers, who departed a few days ago for a few weeks in the edge of the Georgia woods, in the little village of Brooklet, where Mr. Rogers' old home is and where his parents still reside. A week's camp in the forest is part of the program.

Apropos of hunting, we were interested in a Lockington yarn about a rabbit escaping from men in the borrow pit by a swift swim down one of the sluice ditches. Maybe Mr. Shea can tell us about that next time. It sounds interesting. For our own part, our sympathies in recent years are rather with the game than with the hunters. The only firearm we would think of raising against our furred and feathered friends of the woods and fields would be the camera.

Friends of Walter M. Smith will be interested in a recent announcement that the contract has been let for the first of the six locks which Mr. Smith is designing for the \$20,000,000 Illinois Canal Link Project.

Division Engineer Larsen of the Railway Relocation received a postcard recently from Superintendent Sutherland of the Roberts Bros.' outfit, dated Santa Ana, Cal. Mr. Sutherland announced himself as "just now very busy eating and sleeping," to the extent that he found it difficult to give proper attention to his correspondence. Evidently our friend gives as energetic and unremitting attention to his vacation job as he did to tracklaying.

SHOP, WAREHOUSE AND GARAGE

Helps the High Prices Down

A certain young man at the Warehouse is continuing his boycott of the high price clothing stores by wearing with some dignity a suit that shines like a looking glass. Not so long ago he was making a change, and it was noticed how carefully he was handling his clothes. When questioned for the reason, he explained that he did not want to drop them on the floor for fear they would break, and he would have seven years' bad luck.

Anyone in the District knowing where there is a stray maltese colored hat, (a rather devilish looking one,) please notify Harry Kuth of the Electric Division. Harry prided himself on this creation that covered his knob very much, but some other dude, whose taste ran the same way as Harry's, picked it off the rack in a barber shop. Now Harry is sporting a cap that is running Sousa's Band quite a race.

Another Conservancy Dam

Charley Gleason received his razor from Chicago, but the crop that Charley wore used up the edge before he could rake off his upper lip. Charley looks like the beavers had started to build a dam under his nose.

Earl Maltby, of the Purchasing Division, called at the Warehouse for a few tools to make some adjustments on his ancient Tin Horse. After borrowing a 15-Ton Jack, 18" Screw-driver, a few Cold-cuts, 16-lb. Hammer, 36" End Wrench, and a One-Yard Stick, he had borrowed everything he did not need. What he really wanted was a Can Opener and a Box of Snuff.

The boys at the Warehouse are anxious to know if Charley Winch will land the job as flagman at the new crossing on Kiser street. Charley said all crossings are dangerous, and he thinks the job ought to go to a fellow with great courage and endurance. We are satisfied that Charley could easily stop any bread wagon that may come up Kiser street.

Shriver and Ames Off to Kentucky

Bill Shriver, of the Garage, like many of our great statesmen, packed up his bag and gun and departed for the mountains of Kentucky to pick up some game. It was reported at the same time that Bill was going to stop off at Cincinnati to get a hair-cut, if the price was anyways reasonable.

A few of the boys are going to look into the matter and send the barbers a Christmas present.

The Shop Committee has prepared to escort Peggy Ames to the depot when he starts for his holiday trip to old Kentucky. Peggy says it is the Christmas "Spirit" that is prompting him to make the trip at this time. We agree that the Christmas spirit is a wonder this year.

ENGLEWOOD

Pig Roast and Dance

The above named event took place at Englewood Dam on Thanksgiving evening. Two hundred and fifty persons enjoyed the supper in the Mess Hall. This was followed by a dance. Old-fashioned dances were mingled with those more modern. We believe this to have been the most largely attended affair which was ever staged at the local dam. Credit for its success is due largely to the efforts and assistance of the Mess Hall people, also the committee in charge, consisting of Messrs. Parr, Moorehead, O. Werts, Wardell and Van Alst.

A pie social and dance was held December 4. Pies sold at fancy prices and the event was pronounced a success.

Birthday Party to Mr. Gerber

Mrs. Herbert Gerber gave a party one Saturday evening recently in honor of Mr. Gerber's birthday anniversary. We are in a position to testify that this little house party was a rip-roaring good time for those who attended, and we are glad to recommend Mrs. Gerber as an able hostess. Even vaudeville acts were on the program, including impersonations of Al. Jolson, Harry Lauder, etc. Fortunately, Herb's sister-in-law acknowledges a birthday this month which gives promise of another party.

Advertising Mr. Macbeth

Anyone in Camp wishing to put up a heating stove and not understanding just how to do it, will find able assistance in the person of J. L. Macbeth, dragline runner and stove expert. Macbeths have had as their guest Miss Barbara Alexander of Pittsburg, who remained over the Thanksgiving festivities.

New Baby at the Donovans

In the last issue of the Bulletin we forgot to announce the arrival of a baby girl at the home of Mr. and Mrs. Chas. Donovan. She has already established a reputation in Camp as being amongst our prize winning babies.

Mrs. John B. Elwood has arrived in Camp. She is now the guest of Mrs. Byers.

HAMILTON

Joe Hecht, carpenter foreman at the Black Street bridge, was married a few days ago. Congratulations to Mr. Hecht and welcome to his better half.

Nelson E. Messner, formerly transitman on the Hamilton field party and now employed as chief-of-party on blast furnace construction at Warren, Ohio, paid us a visit Thanksgiving. We were glad to see him and to learn that he is well pleased with his new work.

Division Engineer C. H. Eiffert and family spent the day in Cincinnati December 1.

Inspector W. Z. Bovard's young son has been dangerously ill with pneumonia, but according to latest report is somewhat improved.

Harry Tycht, foreman on the south spoil bank, is in Mercy Hospital due to injuries sustained recently when struck by the spreader.

Mr. and Mrs. G. W. Schrader and family spent Thanksgiving at Saylor Park.

Rivalry between the bowling teams of the office and the shop is getting keen. Captain Charlie LaLonde's team never loses more than three games in one night. Captain LaLonde was ill one day this week and it is the general impression that the result of last week's games didn't go any too well with him.

Draftsman Morris Forman left the employ of the District November 11th, to accept a position on engineering work at Forest City, Iowa.

Mr. and Mrs. R. B. McWhorter have had as their guest this month Mrs. R. H. Tweedy of Courtland, Alabama.

Supt. W. A. Roush was confronted by an increase in house rent recently, whereupon he informed his landlady that he would move if she did not reduce his rent \$3 a month. His rent was immediately reduced. (That's the way Bill told it, but Johnny Faist doesn't believe it.)

THE MIAMI CONSERVANCY BULLETIN

EDITORIAL

Board of Editors

Germantown	Miss Julia Darnell
Englewood	Albert L. Wald
Lockington	C. H. Shea
Taylorville	Mr. M. H. Sando
Huffman	Mrs. J. F. Gena, W. R. Minton
Hamilton	R. B. McWhorter
The Woman's Club, Dayton, Ohio.....	Miss Mayme McGraw
Shop, Warehouse and Garage.....	Thomas F. Nealon

OUR JUNIOR EDITORS

Charley

Charley, as we will call him, and that is his name, had three brothers and one sister.

Their names were Speedy, Bobby, Buck and Lizzie; thus a happy family is composed.

They had a very comfortable home under the shed in a backyard in the state of Ohio.

Charley liked to be petted and played with by everyone; Speedy lived up to his reputation and name by being wild and fast; Bobby liked to stay in the house in his master's room; Buck was a very sober, slow-going but mischievous fellow, and Lizzie had a tendency to find the highest place in the neighborhood to sleep and rest.

One day she climbed up on our pantry window and slept up on top of it all night.

Charley was the funniest cat and most mischievous one of the whole cat family. He was in every fight or excitement in the whole neighborhood.

The whole family is still living and they are happy.

I wonder who is candidate for the cat presidency. Do you know?

Albert L. Proteau, Grade 7, Taylorville.

In the Conduit

They placed a pump in the conduits and have pumped the water out and then concreted it in places. Sunday afternoon some of my playmates and I went through the conduits. We had to be very careful so we wouldn't fall in the mud. The first time we did not go so fast, but the next we ran. Bud was working at the east end and he told us to be careful. After that we went through about five times. We had a good time that Sunday.

Clyde Allen, Grade 6, Germantown.

LOCKINGTON

A Baby at the Gudgeons

Mr. and Mrs. C. M. Gudgeon are receiving congratulations upon the arrival of a baby girl at their home on November 29. The little one has been christened Fanny Rayanna.

Kicking Fords Pursue the Agenbroads

Jim Agenbroad had the misfortune to break his right thumb while cranking a Ford several days ago. This is the second accident in the Agenbroad family from the same cause, Jim's younger brother having broken his arm several months ago when a flivver kicked.

Death of Mrs. Harry Lines

Mrs. Harry Lines, wife of our master mechanic, died November 3, after an illness of several years. Everyone extends sincerest sympathy to Mr. Lines and the children.

Mac's Ford Still at Large

To date no trace has been found of the Ford stolen from L. J. McWilliams. A number of clues have been unearthed, but so far the guilty parties have been able to keep out of the hands of the law.

Camp Fire-Fighting Equipment Makes First Run

What might have been a serious fire in J. E. Applegett's cottage was narrowly averted on November 3. Upon Mrs. Applegett's return from the store she found fire making great headway in the kitchen. Prompt arrival of neighbors with the hose reel confined the damage to the walls and ceiling of the kitchen. The house furnishings were unharmed. Lockington has been fortunate in the matter of

fires. This is the first time that it has been necessary to turn water on to any of the camp buildings.

The ladies of the Camp are having sewing parties every two weeks. Mrs. Barton M. Jones was hostess on December 2.

Mrs. Perle Beckett is recovering from an attack of the grip.

Game Scarce

As a hunting ground, this locality did not live up to its reputation this year. Pheasants were scarce and very few of the hunters were able to bag the lawful quota of rabbits.

Best wishes for a Merry Christmas and a Happy and Prosperous 1921.

TAYLORSVILLE

Ho Ye Bachelors

The poet says: "Once to every man and nation comes the moment to decide." This rare opportunity will be offered all eligible men on December 17, in Taylorville. The fair and charming members of our community have arranged a Leap Year dance for this night and are even willing to furnish the entertainment free of charge as a special inducement. Kindly book your reservation early and avoid the rush.

Efficiency of Bucket Brigade

A rather unusual story was told us recently regarding a supposed illicit still which has been in operation in some undefined location near the Taylorville Camp. This distiller, who it is reported has been doing a thriving business, became tremendously excited when fire threatened to destroy his home and other interesting personal effects about him. Neighbors who heard his cries of alarm responded with the customary generosity, and a bucket brigade which was soon formed proceeded to extinguish the fire. Excitement naturally prevails on such occasions and one of the brigade on seeing a tub of "water" nearby seized it and heroically poured it on the flames. This "water" proved to be "moonshine," and the owner has not yet been able to determine whether a visit from a fire brigade is a blessing or a calamity.

Another Ford Yarn

We have all made ourselves more or less acquainted with the reputation of the Ford. Those of us who have owned or operated one of these "jolt wagons" have discovered sooner or later that this reputation does not necessarily mean that they will run without gasoline.

Mr. Shiveley, however, who has recently purchased a new sedan, has just gone through this trying ordeal. After exhausting the battery and the "Armstrong" starter, he was about to lose courage, when Mr. Sherwood kindly consented to tow him. After this had continued for some ten or fifteen miles at a speed of 30 miles per hour, there were no visible results, except the failure of the car to start and a complete collapse of the Ford reputation. His friends have been occasionally reminding him that gasoline is necessary to start even a Ford.

Things Which We Miss Around Taylorville

1. The suppressed, yet ever present joy of Andrew George.
2. Hair on the dog's back which was washed with Climlene.
3. Our faithful janitor, George Parshall.
4. A chicken belonging to C. Z. Miller, intended for Thanksgiving.

Personal

Mr. J. A. Watson is confined to his home at present on account of illness.

Mr. and Mrs. Alvin Dunn have returned to their home in Carrollton, Ky.

Mr. W. D. Rogers has returned from a business trip to Georgetown, Ky.

Miss Marie Maute is succeeding Miss Helen Stibbs as stenographer in the Taylorville office.

Miss Audry Pease has been acting in the capacity of assistant teacher in the school since the resignation of Miss McCarthy.

Mrs. Theo. O'Neal, who has been ill for some time, has been taken to the Miami Valley Hospital, where an operation was performed. Her early recovery is expected.

THE MIAMI CONSERVANCY BULLETIN

Thanksgiving Donation

Friends of Mrs. Wolverton, who formerly lived at Taylorsville Camp, very kindly remembered her at Thanksgiving. It will be recalled that Mr. Wolverton died about one year ago in the Taylorsville Camp.

Troy Rotary Visits Taylorsville

About fifty members of the Troy Rotary Club visited the works during the month. After making a tour of inspection they were served a luncheon in the Mess Hall. Following the luncheon, various points of interest on the Conservancy work were visited.

HUFFMAN

Social

The Sunshine Club was entertained on November 3rd by Mrs. B. V. Chambers, and again on November 18th by Mrs. J. W. Cullen. All reports indicate that the usual good time was provided in both instances.

(The members of the "Moonshine" Club entertained one another November 18th at the home of Dr. Saylor. Ask any of those present as to who furnished the greater part of the "entertainment".)

Dubois-Hodge-Madigan Farewell

On November 6 a dinner dance was held at the Community Hall, honoring Mr. and Mrs. E. S. DuBois, Mr. and Mrs. B. F. Hodge, and Mr. and Mrs. Thos. Madigan. The occasion was in the nature of a farewell as the three families named are leaving our village, Mr. and Mrs. DuBois going to St. Louis, Mo., Mr. and Mrs. Hodge to Springfield, Ohio, and Mr. and Mrs. Madigan to Mt. Carmel, Ill. We all join in extending our best wishes to our friends in their new fields of endeavor.

Prize Gumdrop Expert

A party of Huffmanites spent an enjoyable evening recently with Mr. and Mrs. R. A. Herbruck at their home on Mays Road. Many novel and varied forms of amusement were provided, chief among these being a demonstration of the magic art by Prof. Friers of Dayton. It is persistently rumored, however, that even the Professor was eclipsed by a well known gentleman who won the prize for eating gumdrops suspended by a string.

Correction

That no false impressions may exist, we wish to modify a statement appearing in last month's issue. To the best of our knowledge no tickets to Manchester have been purchased during the month of November.

Mysterious Visitation

The presence of a strange young man in our village was noted on a recent Sunday evening. For particulars as to the young man's identity, inquire of the school teacher at Germantown.

Mrs. Weaver's father, G. W. Priestly, also her sister, Miss May Priestly, are visiting at the Weaver home.

Everybody's Column

Dear Editor:

Any information on how to distinguish between a beef bone and a dressed goose will be greatly appreciated by Messrs. Wade and Childs. This request is being made in order that the mess hall dog may never again fall under suspicion. (Signed) X. Y. Z.

Thanksgiving Personals

Miss Isabel Hamilton and Miss Lillian Hamilton of Greensburg, Ind., were week-end visitors with I. R. Bailey and family.

Mr. and Mrs. I. Maynard of Hamilton, Ohio, spent Thanksgiving with Mr. and Mrs. O. L. Maynard.

Mr. and Mrs. C. C. Chambers entertained the former's brother, Fred Chambers, of Earlham College.

Miss Sadie MacDonald, who has been an employee at the Germantown office, has been transferred to Huffman, where she is proving to be a valuable addition to our office force.

Mr. Bert Lindsey and wife of Dayton have recently moved to Huffman.

We extend the hand of greeting to the above named newcomers.

Curtis Patterson of Ohio State University was the guest of his sister, Mrs. B. V. Chambers.

Mr. C. L. Zull journeyed to Portsmouth, Ohio, for Thanksgiving dinner, returning home Monday, accompanied by Mrs. Zull and children, who have been making an extended visit there.

Dr. Saylor and family spent the holiday at Taylorsville.

Mr. and Mrs. Clawson were Thanksgiving guests of Mr. and Mrs. A. L. Pauls at Germantown.

The Shuler family spent Thanksgiving with Mr. and Mrs. Perry Niswonger at New Madison, Ohio.

Mr. Fenton Secore and family motored to the southern part of the state recently for a week's vacation. Mr. Secore reports the hunting as being very good, especially as one is never fooled by track jacks in that part of the country.

Mr. and Mrs. R. W. Minton spent Thanksgiving at the Gillespie home in Piqua, Ohio.

Mr. and Mrs. A. H. Burns journeyed to Franklin for a short Thanksgiving visit.

The Misses Wyncoap and Gillespie were recent visitors at the home of R. W. Minton.

GERMANTOWN

Mr. and Mrs. C. H. Sandeford and son Howard moved to Troy, Ohio, last week. We will surely miss them.

Miss McDonald Goes to Huffman

Miss Sadie McDonald, our popular telephone operator, has left us, being transferred to Huffman, where our good wishes follow her.

Mr. and Mrs. Verne Clawson spent Thanksgiving with Mr. and Mrs. A. L. Pauls.

Mr. and Mrs. Albert Armstrong were guests of Mr. and Mrs. W. E. Somers on Thanksgiving.

Mrs. Aug. Espel of Hyde Park has been visiting Mr. and Mrs. Chris Foehr for the last three weeks.

The New Steno

Miss Becker, who succeeded Miss McDonald, came in with a rush and we are having a time to keep a certain young man away from her desk. Huffman is right; put them in a glass cage and they will be easier to tame.

The store closed on November 30th. Storekeeper Philip Waite has returned to Muncie, Ind.

Has Anyone Seen Kelly?

Anyone who has ever visited Germantown Dam and inspected the blacksmith shop is sure to remember G. W. Kelly. Almost everybody knows Kelly, but how many of us know him as a foreman, carpenter, or orator, as well as a blacksmith? The following verses referring to him are said to describe an actual occurrence at Piqua during the 1913 flood:

"Has anyone seen Kelly?"—

'Twas spoke in foreign tongue,
By anxious pale-faced workmen,
The jostling crowd among.

'Twas when the rushing waters
Our city did divide,
And many fled for safety
Toward the eastern side.

And Kelly, their good foreman,
Was perching with the rest
Upon the high ground eastward,
While they stayed on the west.

Unable to determine
What had become of him,
They grieved, for they were certain
That he could never swim.

At length a bridge was builded,
And people came across;
Among the first was Kelly,
The foreign workmen's boss.

At first they were not certain,
If he were flesh and blood,
Or an apparition ghastly,
That rose up from the flood.

But when convinced that Kelly
Was hearty, strong and well,
In good Italian language
They gave a mighty yell.

THE MIAMI CONSERVANCY BULLETIN

JANUARY, 1921

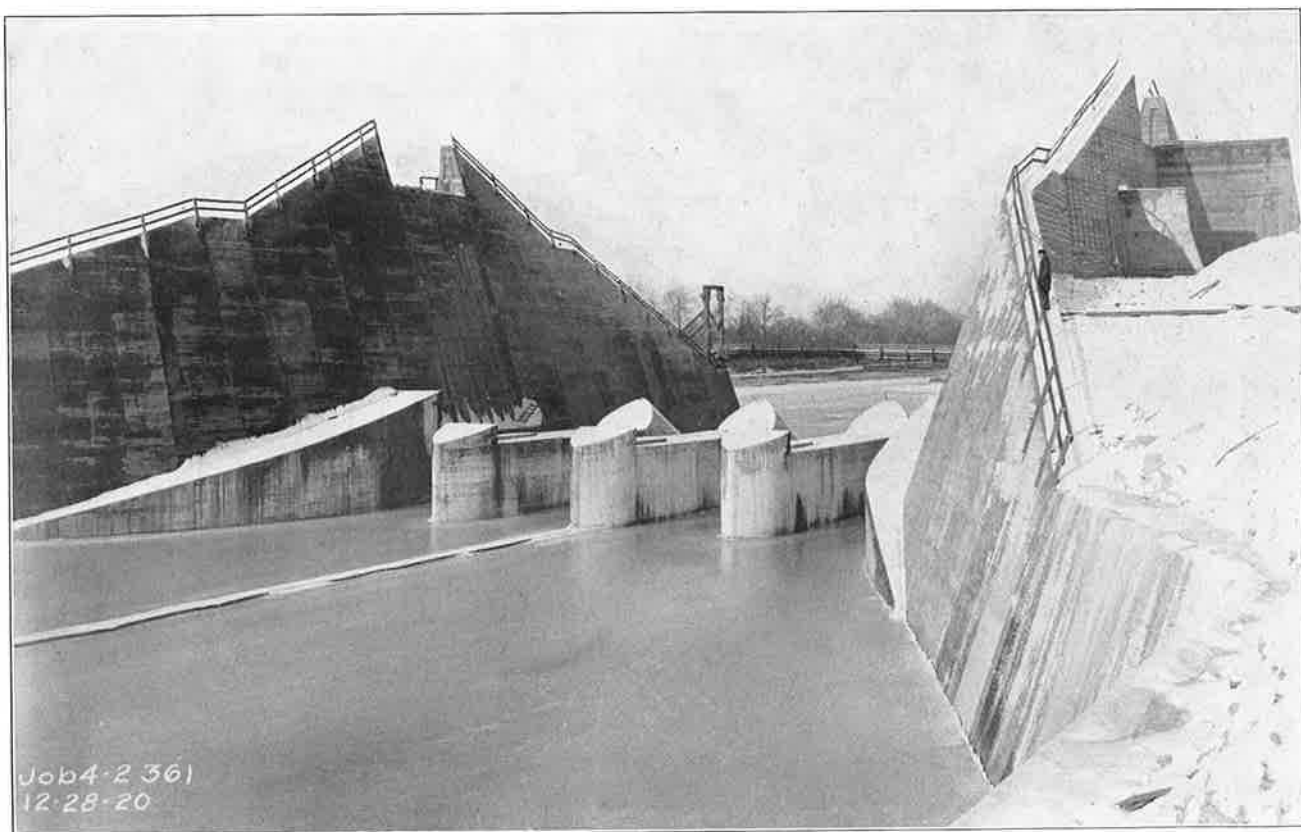


FIG. 246—CONCRETE OUTLET STRUCTURE AT THE TAYLORSVILLE DAM, DEC. 28, 1920.

Erratum

The following should be pasted over the table giving distribution of labor costs on the Taylorsville concreting on page 87.

Distribution of Labor Costs

Laying Tracks (in borrowpit).....	\$.129
Excavating Gravel	.333
Screening and Washing Gravel.....	.195
Mixing and Placing.....	.540
Building Forms	.944
Trestle and Concrete Tracks.....	.210
Repairs	.067
Placing Reinforcement	.011
Unloading Cement	.047
Cleaning Up	.032
General and Miscell. (including heating).....	.437
Storing Aggregate (extra labor only).....	.067
Dismantling and General Cleaning Up.....	.500
Total	\$3.51

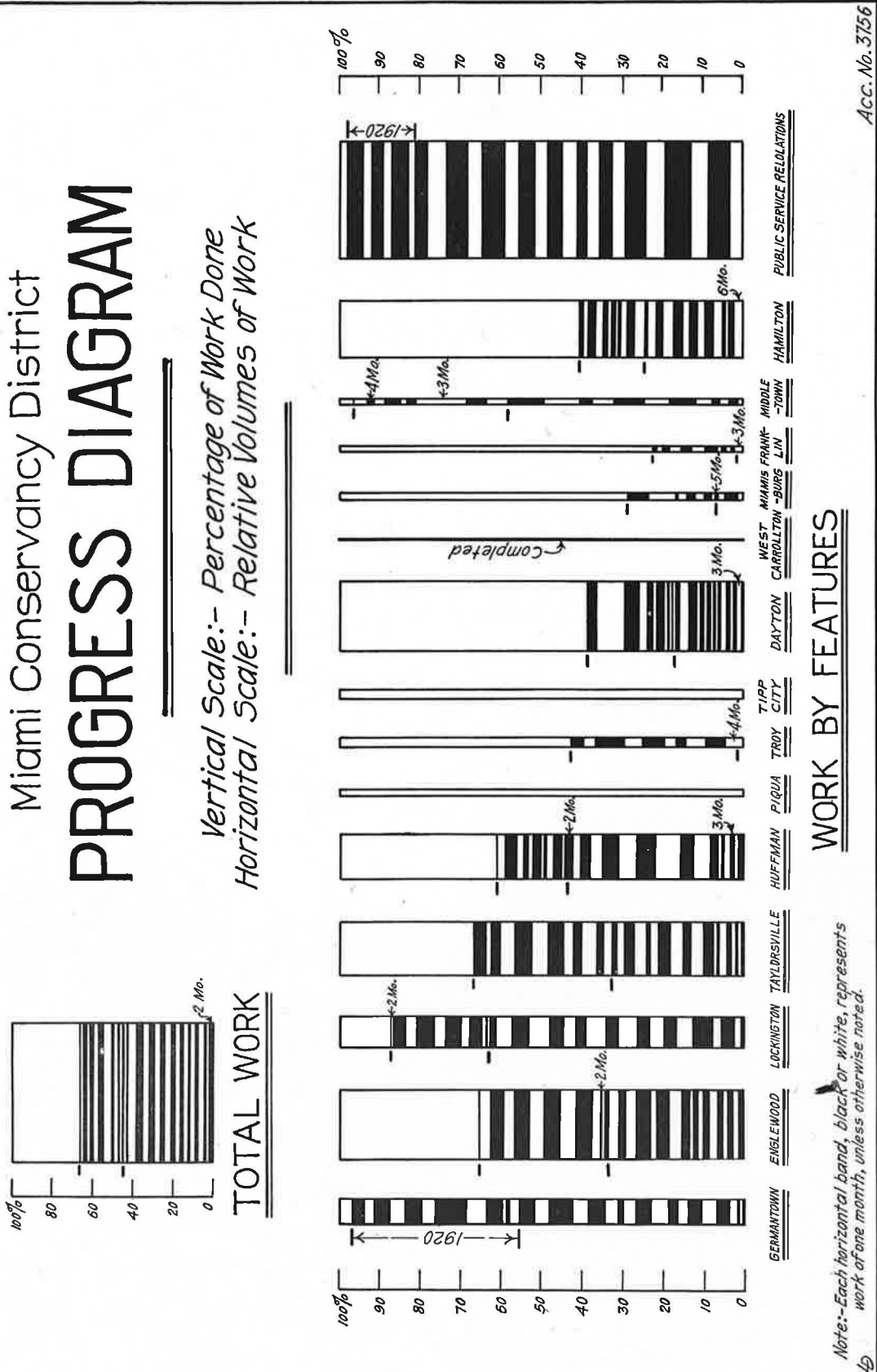


FIG. 247.—PROGRESS DIAGRAM OF CONSERVANCY WORK, TO JANUARY 1, 1921.

BOARD OF DIRECTORS
Edward A. Deeds, President
Henry M. Allen
Gordon S. Rentschler
Ezra M. Kuhns, Secretary

Arthur E. Morgan, Chief Engineer
Chas. H. Paul, Asst. Chief Engineer
C. H. Locher, Construction Manager
Oren Britt Brown, Attorney

THE MIAMI CONSERVANCY BULLETIN

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DAYTON, OHIO

Volume 3

January 1921

Number 6

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

G. L. TEEPLE, Assistant Engineer, EDITOR.

In Memoriam—Adam Schantz

The following resolution was passed at a special meeting of the Board of Directors Jan. 14:

The Board of Directors of the Miami Conservancy District has learned with deep regret of the death of Mr. Adam Schantz, which occurred at St. Augustine, Fla., where he was sojourning in search of health, on Monday, January 10, 1921. As a token of high regard in which the deceased was held by the members of this Board, the officers and employees of the District, it has been deemed appropriate and fitting to pay this humble tribute as a memorial to this and future generations of Mr. Schantz's valuable contributions to the cause of flood prevention.

The deceased was one of the originators of the flood prevention idea in its wider aspects and relationships. He had both witnessed and experienced the devastating flood of March, 1913, and with its memories and experiences deeply impressed in his soul, quickly shared in the conception of a bigger and broader program of protection. Not only did he give generously of his time, thought, service and treasure to the rehabilitation of the devastated areas, but he threw himself with his whole heart into the new plans for securing to the whole valley for all time to come, the fullest measure of protection from a recurrence of floods.

In this work, his generous and unselfish nature shone forth to the utmost degree. Many of the important steps, both before and after the organization of the District, were formulated and taken as a result of his friendly counsel. His judgment in many respects was so accurate that the officers of the District, including the members of this Board, relied upon it with complete confidence.

Mr. Schantz was a mold of public opinion and a leader in public enterprise, both in his native city and the beautiful Miami valley. This Board always found him ready to assist in solving its problems, particularly those relating to the valuation and acquiring of property, and his counsel, service and effort were always cheerfully and freely contributed, as his share in this enterprise of so much moment and importance to every man, woman and child in the valley.

The Board therefore, feels a keen sense of loss in the departure of its friend, and hereby expresses its appreciation of his noble self-sacrifice in the many and varied affairs pertaining to its work, particularly his fine spirit of devotion and unselfish co-operation.

It is accordingly ordered that all work be suspended during the final obsequies of the deceased, that this resolution be entered in the minutes of the Board of Directors, copies furnished to the public press and a copy supplied to the bereaved family.

Ezra M. Kuhns,
Secretary.

Edward A. Deeds,
Henry M. Allen,
Gordon S. Rentschler,
Board of Directors.



FIG. 248—REPAIRING DRAGLINE EXCAVATOR BOOM IN CONSERVANCY SHOP, NOV. 24, 1920.

A Chart of Conservancy Progress

The Bulletin takes pleasure in presenting again the diagram of construction progress on the project, brought up to date and marking the end of the third season. (See page 82). It gives in the upper left corner the percentage completed on the entire project; below appears a row of similar rectangles showing the state of each individual job. Each black or white band represents one month's work. Vertical scales at each end of the lower row, and beside the upper rectangle, give means of measurement of the percentage completed. The widths of the lower row of rectangles is made proportional to the magnitude of each job, measured by its total cost when complete. The short horizontal marks beside each rectangle show the fraction completed during the season of 1920, the lower mark showing the percentage at the beginning, and the upper one at the end, of the season. The work as a whole is seen to be about 63 per cent done, and is ahead of the calculated time schedule. The chart indicates that unless quite unforeseen conditions intervene, the work will be completed at the date set—the end of 1922, a condition on which the people of the Miami Valley may well look with deep satisfaction.

A Vital Link in the Conservancy Project

It is doubtful if many of us realize what a vital part of the work is embodied in the Conservancy shop. If the diagram shown on page 82 indicates so satisfactory a state of progress—ahead of schedule in spite of unusual difficulties—it is no less true that the picture on this page, Fig. 248, tells one of the best reasons why so good a record can be shown. No one who visits any part of the work of construc-

tion, whether at the dams or on the river, can fail to be struck at the part played by the powerful machinery in doing what in former days would have required the service of thousands of men and horses. At the heart of this system of machinery stands the shop. Machinery on engineering construction, as is well known, is unavoidably and peculiarly subject to grilling usage and heavy strain. The Conservancy machines are in service as a rule twenty hours a day, week in, week out, month in, month out, through the season. Unavoidably pieces wear out or break down. A daily procession of motor trucks brings these wounded members to the Dayton shop, to be mended or replaced. A similar procession takes the fresh pieces back to the job warehouses to replace there the depleted stock, so that the crippled machines will not be held up. Now and then a bigger break occurs, necessitating a stop for a "major operation," such as is shown in the case of the broken dragline boom, exhibited in the picture. Considering these things, let us not forget, in looking back with satisfaction over the past year's work, as we have a right to do, to give due credit to Master Mechanic McIntosh and his assistants, for the large share they have had in the good record.

New Technical Report Out

Part VII of the Technical Reports of the District, which covers the hydraulic design of the flood control, has just been published. Copies of it will be sent postage prepaid to any one on receipt of the price, which has been set at one dollar per copy. It is hoped to present an abstract of the early chapters in the next Bulletin. It is by Prof. S. M. Woodward, Consulting Engineer of the District.

The Completion of the Taylorsville Outlet Works

Concrete Structure 241 Feet Wide, 111 Feet High and 628 Feet Long, Containing 45,000 Cubic Yards of Concrete, Completed In Its Temporary Form.

The massiveness and magnitude of the outlets in their temporary form, make them the most interesting, as they are the largest, of any on the Conservancy project. The entire flood flow of the Miami River, equal at spillway level to 53,600 cubic feet of water per second, must here pass through the four openings indicated in the illustrations. The size of these openings is perhaps best indicated in Fig. 253, which shows one of the three concrete piers which separate the openings, as it appeared when just completed, with half of the form in which the pier nose was cast still suspended in the air as it was being removed. Comparing this with Figs. 246 and 258, where all the piers are shown, will give one an idea of the magnitude of the work. The massive left-hand wall in these last figures, at the base, is 50 feet in thickness, exclusive of the projecting "cut-off wall." The man on the wall in Fig. 246 and the men near the machine at the left in Fig. 258 will also give some indication of the scale of this work. The extreme width of the structure is 241 feet, its length 628 feet, and its height 111 feet. In its present form it contains about 45,000 cubic yards of

concrete, more than half of which, it may be of interest to state, is out of sight below the water level in the pictures just referred to.

As seen in these pictures the structure is not in its final form. When complete a massive concrete cross dam, containing about 10,000 cubic yards of concrete, will extend from wall to wall, resting on the three piers and the side shelves, and roofing the four openings, through which the river will then pass, the rest of the space being blocked, up to a point a little below the notches which appear at the wall summits. These notches are the abutments of a concrete bridge which will span the opening between the walls, carrying the highway (the National Road in its new location), which will cross the valley on the summit of the dam. The floor of this bridge will be on a level with the top of the walls as seen (not the bottoms of the notches), and the space beneath the bridge and between the walls will be the "spillway channel," which will carry the excess water of any extreme flood which might top the concrete cross dam. However, as a flood 40 per cent greater than that of 1913 (giving the maximum

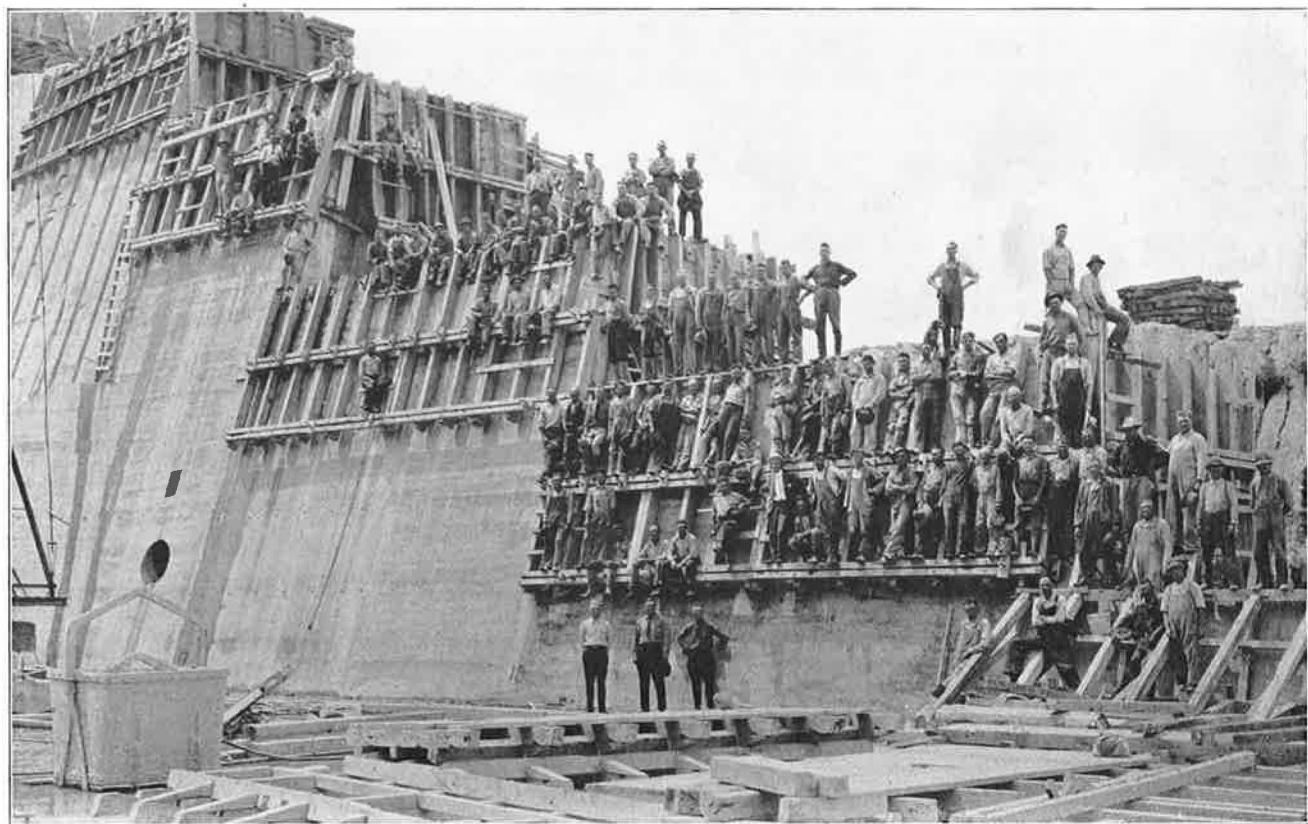


FIG. 249—THE BUILDERS OF THE TAYLORSVILLE OUTLET, AUG. 11, 1920.

The number of workers on the job seems to be large, but actual count totals "95 men and a dog," which for a piece of work of this magnitude, if one stops to consider it, is small. These men built into the outlet structure, on July 29, 568 cubic yards of concrete in the regular working day of ten hours. The same week they placed 2,408 cubic yards, or 401 yards per day; and in 27 consecutive working days they placed 9,280 cubic yards, or 343.7 per day. The quantities may be made more vivid, perhaps, if we remember that a cubic yard is just about an old-fashioned "dump-board" wagon-load. Nothing but the aid of powerful machinery could ever enable so small a force to handle that amount of heavy material. The water of the Miami River now occupies the place where the men in the foreground stand. The space beyond the wall will be occupied by the earth embankment of the dam, which will follow the general slope as seen, (the big "steps" being temporary features). The massive thickness of the wall, (50 feet at the base,) is to withstand the side pressure of this earth, tending to overturn it.

Horizontal distances represent time, the vertical lines being ten days apart, and the years, months and days marked below. Vertical distances represent concrete placed, the space between two consecutive horizontal lines representing 3,000 cubic yards. The heavy line represents the actual progress of the concreting. Thus on June 2, 1920, the heavy line is about $7\frac{1}{3}$ divisions above the base, indicating about 22,000 cubic yards of concrete in place on that date. The broken shows the progress as planned.

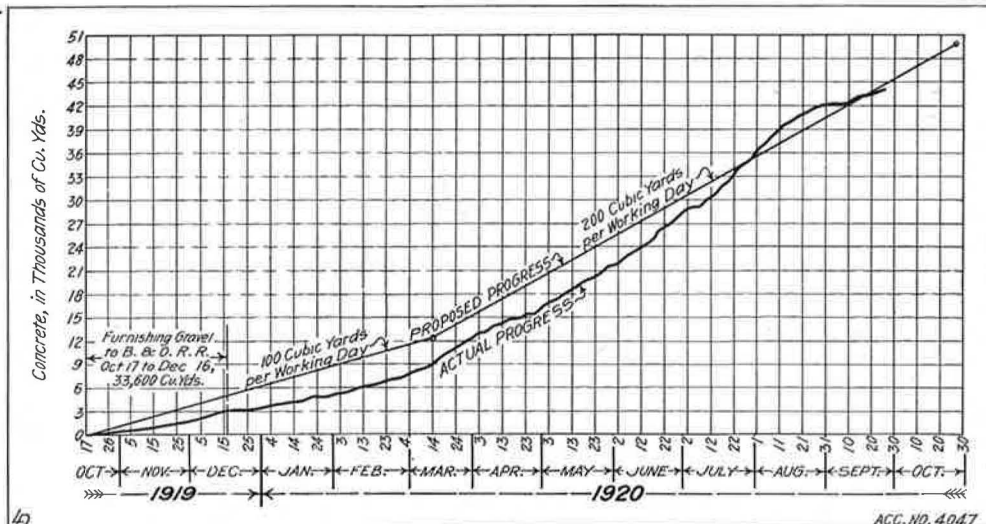


FIG. 250—PROGRESS CHART OF THE CONCRETING, TAYLORSVILLE OUTLET.

which it is thought can ever be reached in the Miami valley), will still fall more than 17 feet short of reaching the crest of the dam*, the likelihood that water will ever go over the spillway, to say nothing of overtopping the dam, is seen to be extremely remote. To top the dam itself will take a flood more than double that of 1913.

The flood discharge of the Miami at Taylorsville in 1913 was 127,300 cubic feet per second, which the new outlet works would reduce to 51,300. These figures should be compared with the two next highest 1913 discharges in the valley, 78,300 at Huffman, on Mad River, reduced to 32,600, and 85,400 on the Stillwater at Englewood, reduced to 11,000. The reduction in flood flow at Taylorsville could have been easily made considerably more by constricting the conduits, but for the cities of Troy and

Tippecanoe on the edge of the retarding basin, where a raising of the dam height would have required an objectionable raising of the levees.

As it is, the discharge of a spillway level flood through the Taylorsville outlets, if one should ever occur, which is unlikely, will be an imposing spectacle, 53,600 cubic feet of water, equal to 1,675 tons, or about the mass of a twenty-five car freight train, rushing through the conduits every second at a speed of 33 miles per hour and dashing itself into a "standing wave" of lathering foam, twenty feet or more in height, in the massive concrete basin prepared to receive it at the outlet end. It is this massive basin, 200 feet in width, which appears in the foreground in Fig. 258. By it the speed of the water will be checked to a harmless rate of six or seven feet per second, as it issues into the valley below.

The Progress of the Taylorsville Concreting

Conservancy Daily, Weekly and Monthly Records Broken in Doing This Work.

One of the most satisfactory things about the Taylorsville outlet construction was the excellent rate of progress on the work. This is shown in the progress chart in Fig. 250. Horizontal distances on this chart represent time, the years, months and days being marked. Each vertical division represents 3,000 cubic yards of concrete placed in the walls and floors. The heavy line shows the actual progress of the placing. Thus on June 2, 1920, the heavy line is about seven and a third divisions above the base, indicating about 22,000 cubic yards of concrete deposited in place up to that date. The broken straight line just above the heavy line shows the schedule of proposed progress set by the engineers at the beginning of the work, the rate being 100 cubic yards per day from the beginning (on October 17, 1919), up to March 15, 1920, and 200 cubic yards per day after that date.

Several interesting things are brought out on this chart. One is that at the beginning the curve of actual progress dropped distinctly below the 100 yard per day set. The reason for this was the lack of sufficient gravel to keep up the pace, and this in

*The top of the concrete cross dam, or "spillway weir," will be 19 feet below the dam crest.

turn was due to the necessities of the Baltimore and Ohio Railway relocation. The Taylorsville borrow pit was in fact furnishing gravel ballast for the new tracks, and this continued from the beginning up to December 16, the total furnished for this purpose during this period being 33,000 cubic yards, a fact noted on the chart. The equipment was not of sufficient capacity to keep both the railway and the outlet work going at full speed. The railway work was in fact delayed beyond the date originally estimated; hence the interference.

It will be noted that the rate of actual progress did not at once pick up much, following the completion of the ballasting, and this was due to the winter weather. The season was rather severe, and this held the work back, a matter commented on later. From March 15 on, however, the rate accelerates at once as an average, to the standard 200 cubic yards per day set, and so continues till the middle of June, when it again speeds up and about July 25 reached and crossed the line of the proposed progress. It dropped again as the work approached its end, unavoidably, as most concrete work slows up in the "puttering" details of finishing the job. The last concrete was poured on September 25.

The rate of placing during July and August exceeded considerably, in fact, the expectation, and broke all previous records on Conservancy work. This might perhaps be expected, the work being considerably more massive than any other Conservancy job, and therefore permitting the development of more efficient "quantity production." Nevertheless, much credit must be given to those in charge, the chart showing that the work was finished about one month ahead of the expected date.

The record day's work at Taylorsville was 568 cubic yards of concrete in place, made on Monday, July 29, the high record at any other dam being 374 cubic yards. This was in one ten-hour shift. The high week included the record day and ended July 24, with 2,408 yards placed, or at the rate of 401 yards per 10-hour shift. In 27 consecutive working days 9,280 cubic yards were placed, or at the rate of 343.7 yards per day. The day's work was always in one 10-hour shift.

The men in charge of the work at Taylorsville have been O. N. Floyd, Division Engineer; H. L. Freund, Assistant Engineer; Ben. H. Petty, and C. O. Shively, successive Office Engineers, and H. M. Sherwood, Superintendent of Construction. Those in direct charge of the concreting were H. R. Daubenspeck, Assistant Engineer, inspector of mixing; W. J. Smith, Jr., Assistant Engineer, inspector of placing; W. D. Rogers, General Foreman at the forms; and C. P. Heckman, Foreman at the screening and mixing plant.

The Cost of the Concreting

The favorable rate of progress, indicated by the chart, is of course connected with the question of cost. The original estimate of this was \$9.47 per cubic yard of concrete, as an average for the several classes of the material placed, the classes depending upon the amount of cement required, the difficulty of placing (as requiring pumping when below water level, for instance), and other factors. The \$9.47 was divided into \$2.87 for the cement (1¼ barrels at \$2.30 per barrel), and \$6.60 per cubic yard for the remaining items (shown in the table below). The actual cost has been \$10.00 per cubic yard. The estimate was made in 1917. In consideration

of the general conditions confronting construction work during the period when the work was being done, the showing is a very creditable one for the engineers and workers on the job. It represents in dollars and cents the careful attention to details pointed out in another paragraph.

The division of the cost per cubic yard, just referred to, is given in the following table. It is based on "pay yardage," computed to the "neat line" of the masonry, this quantity being 42,243 cubic yards.

Distribution of Concreting Costs

Item	Cost Per Cubic Yard	Per Cent of Total
Labor	\$ 3.51	35.1
Supplies (cement, lumber, repair parts, etc.).....	3.02	30.2
Power (coal, electricity, gasoline)	0.37	3.7
Plant (erection, depreciation, camp)	2.43	24.3
Industrial Insurance (2.45 cent of payroll).....	0.67	6.7
Job Overhead (20 per cent of payroll)		
Total	\$10.00	100.0

The items under labor may be of interest. The figures give the cost per cubic yard of the several divisions.

Distribution of Labor Costs

Laying Tracks (in borrowpit).....	\$1.29
Excavating Gravel	3.33
Screening and Washing Gravel.....	1.95
Mixing and Placing.....	5.40
Building Forms	9.44
Trestle and Concrete Tracks	3.10
Repairs	0.67
Placing Reinforcement	0.11
Unloading Cement	0.47
Cleaning Up	0.32
General and Miscell. (including heating).....	4.37
Storing Aggregate (extra labor only).....	0.67
Dismantling and General Cleaning Up.....	0.50
Total	\$3.51

Compare Fig. 253, showing the form being removed from the nose of a just finished pier, (the nearest pier in the picture here shown). The plan of these piers is shown in Fig. 254 in its relation to the structure. The three piers, with the two abutment shelves in the walls on each side, will support the concrete cross dam to be later built blocking the space between the walls. (See front and back cover pictures.) The men at work on the second pier give the scale. The derrick handled the forms and concrete buckets.

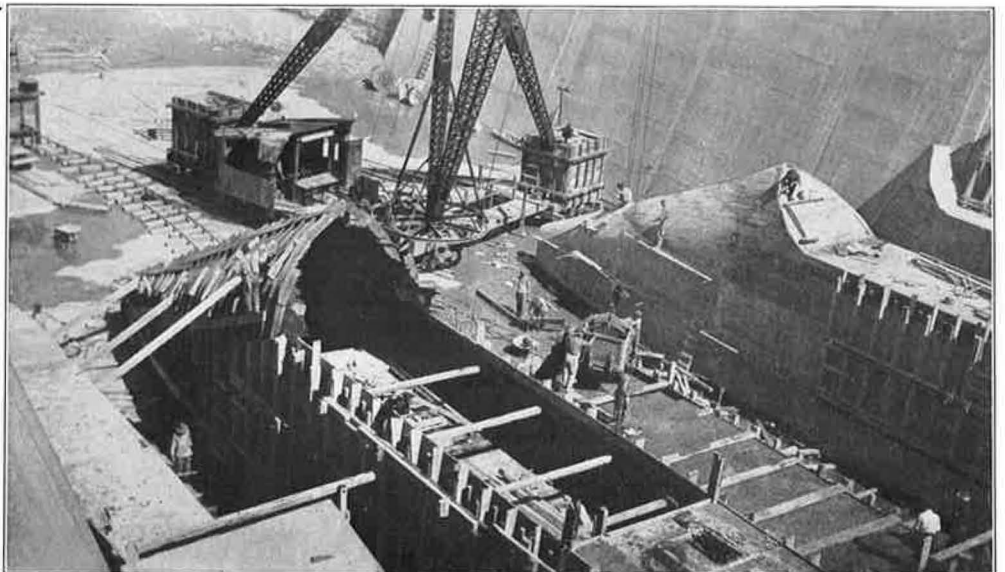


FIG. 251—OUTLET PIERS UNDER CONSTRUCTION, TAYLORSVILLE DAM, SEPT. 16, 1920.



FIG. 252—PROGRESS ON THE CONSTRUCTION

The view in each case is toward the southwest, with the gravel washing and screening plant in the distance, (except in lower right picture.) The upper left shows the rock excavation at an early stage, (Aug. 28, 1920.) concreting not being as yet begun. The upper middle, taken June 11, 1920, shows the rock excavation complete, the pool basins complete and the walls well along. The upper right, taken Aug. 11, 1920, shows the east (left) wall up to full height, the west one nearly so, and the upstream half of both walls well along. The lower left, taken Sept. 16, 1920, shows both walls complete and the piers under construction. The lower right and middle, (lower right picture) shows the structure complete in its temporary condition, as it was on Dec. 28, 1920. The boom of the dragline excavator in this picture will furnish a good scale, it being just 100 feet in length. The entire structure is 241 feet in total width, (not including the "cut-off" walls seen projecting at right angles to the main walls,) and 628 feet in extreme length, with a total height of 111 feet from the base to the top of the walls.

November Progress on the Work

GERMANTOWN

The principal work this month was putting in the permanent floor in the conduits. The work on the north conduit was completed November 24, 1920, and the creek turned through November 29, 1920. The south conduit was completed December 21, 1920, and the creek turned through December 27, 1920. This marks the completion of the dam from the flood retarding standpoint. However, there is considerable cleaning up, trimming and dismantling to do.

Work was started on the guard rail across the top of the dam this month.

Another work of importance is the placing of slope re-
vetment along the south bank of the outlet channel and immediately adjacent to the outlet works.

The new sloping concrete nose on the inlet partition wall was placed this month.

The dismantling of the monitor pump house, the primary dredge pump house and the hog box, and the removing of the local warehouse stock, have been completed. The dismantling of the large Lidgerwood dragline was started also. The small Marion dragline has been moved into Germantown, where it will act as a derrick for loading equipment on cars at the railroad yards.

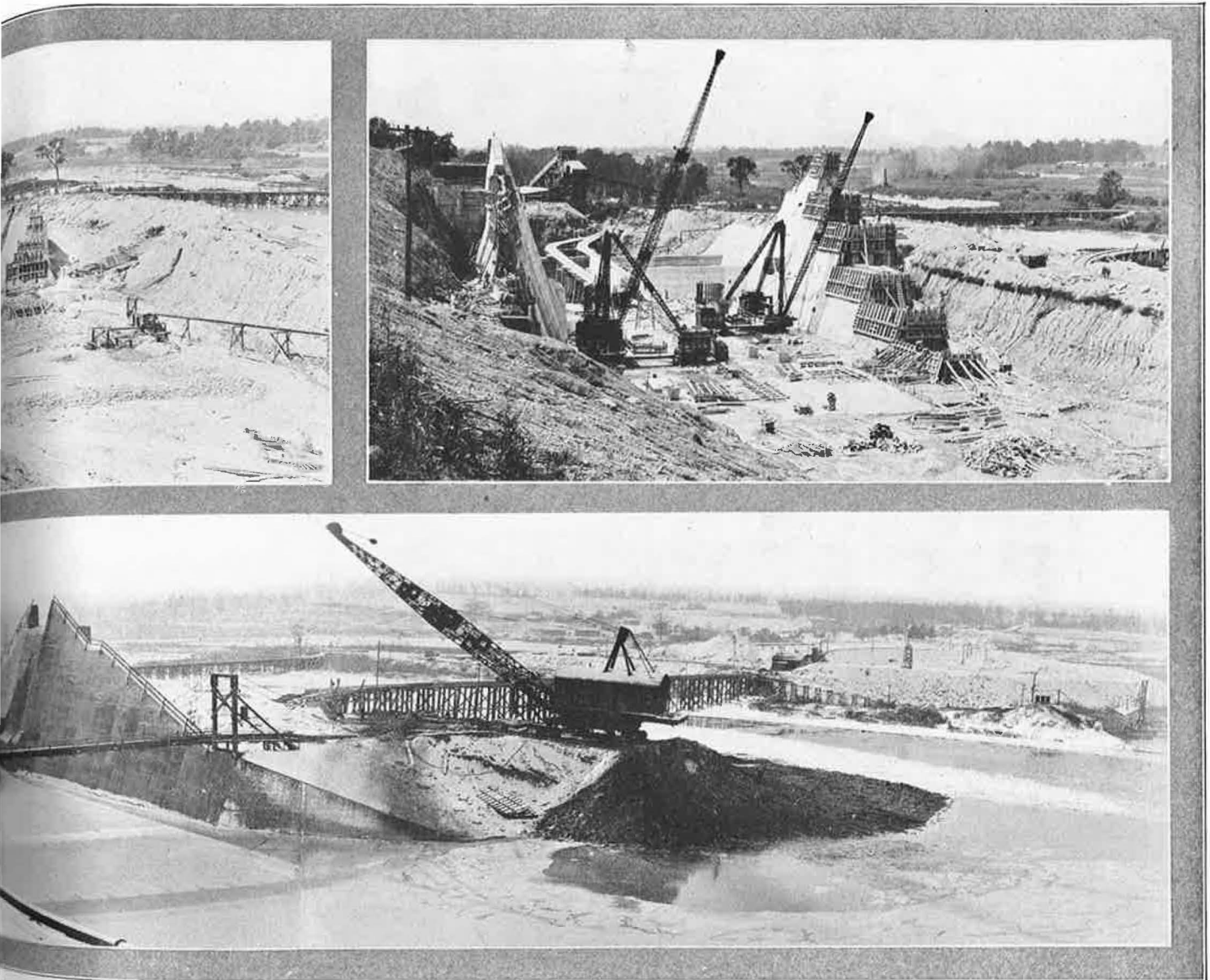
A. L. Pauls, Division Engineer.

December 30, 1920.

ENGLEWOOD

The major operations in connection with the construction of this dam during the past month have consisted of pumping hydraulic fill and of excavating for the permanent spillway.

During the estimate month ending November 25, 143,000 cubic yards were pumped into the hydraulic fill, using



THE TAYLORSVILLE OUTLET WORKS.

top of walls to base of foundation. It contains in its present condition about 45,000 cubic yards of concrete, (more than half of which will not be seen in the picture, being out of sight below the water surface,) and with the concrete cross dam and spillway apron to be built will contain, in final form, 55,000 cubic yards. The west wall, at the right, is 50 feet thick at the base, to withstand the great pressure, (equal to many thousands of tons.) of the earth embankment of the dam during construction. This embankment will rest against the further face of this wall, and be flush with the wall slopes, extending thence across the river to the far side of the valley. The Miami River is seen just beyond the dragline machine, flowing in its old channel still. Its waters now occupy, however, the new channel as far as the far end of the concrete structure, beyond which they are still blocked, the downstream (far) end of the channel not having as yet been excavated. This excavation will be completed this winter and the river turned through.

Sumps Nos. 2 and 3 in rotation. The total embankment on this date was 2,186,000 cubic yards, or 61 per cent of the completed dam.

The large electric dragline excavated 11,000 cubic yards for the permanent spillway, placing the material into a temporary spoil pile from which it will be rehandled into a levee paralleling the spillway outlet channel.

Carpenters worked intermittently on the cribwork protection for the spur levee at the outlet of the temporary spillway.

H. S. R. McCurdy, Division Engineer.

December 15, 1920.

LOCKINGTON

Practically all work at Lockington Dam was stopped December 23rd for the winter. Nothing would be gained by working to disadvantage under freezing conditions, as all features are safe against flood and the date of the completion of the dam is controlled by the duration of the

concrete work, which could not be commenced before spring. The mess hall and the store have been closed until work is resumed.

The levees around the core pool on the dam are at most places up to the top berm, 20 feet from the top. Stone slope dressing has been keeping pace with the fill and the drain ditches have been commenced.

Drilling of well holes from 20 to 40 feet deep will be done under contract this winter for blasting the blue clay which constitutes the major portion of the borrow pit to be worked next year. The intention is to blast the ground so that it may soften by "weathering" before it is sluiced.

The camp is now being supplied with 2300 volt power from Piqua over the 33,000 volt line. The change was made in order to disconnect the high voltage transformers at Lockington and thus save the core losses which would cost, for power, about \$800 during the winter.

Barton M. Jones, Division Engineer.

December 24, 1920.

TAYLORSVILLE

The Lidgerwood dragline has finished the excavation on the inlet channel and is about ready to start tracking down to begin the excavation in the outlet channel. Two well drills have been making good progress drilling the rock in the outlet channel so that this can be shot by the time the dragline arrives to start digging.

The gravel plant is about all torn down, and this and other buildings, together with rubbish, are being removed from the area to be excavated.

The sluicing was shut down on the 23rd for the winter, and the dredge pumps are being repaired and the pipe lines relaid and renewed where needed.

The stone paving at the west edge of the outlet channel has been completed up to elevation 782, (18 feet above mean low water,) and the Bucyrus dragline is being overhauled and dismantled to send to the Franklin job.

Nothing has been done on Road 12 this month except laying some pipe culverts.

O. N. Floyd, Division Engineer.

December 30, 1920.

HUFFMAN

During the month of November, 59,000 cubic yards of material were pumped into the dam. The total embankment December 1st was 507,000 cubic yards.

The gaps left for the Erie Railroad at the north end of the dam and for the diversion channel near the south end, have been entirely closed, and the dam from the outlet works to the hill at the north end, a total length of 2700 feet, is being carried up as a unit.

The steam dragline is now building the levee slope on the downstream side of the dam. After completing the lift it is now on, it will be used to finish up some excavation in the river channel below the outlet works.

A three-quarter yard dragline bucket has been put on the American Ditcher, used on the railroad work, and this machine is now building levee slope on the upstream side of the dam.

The placing of heavy rip-rap on the north bank of the entrance channel to the outlet works has been completed. The south bank is in a rock cut and will not require any rip-rap.

Oversize rock rejected by the screen at the pumping plant is being hauled away and placed as surface paving on the upstream slope of the dam.

C. C. Chambers, Division Engineer.

December 24, 1920.

DAYTON

Dragline D-16-15 is completing its work in connection with the laying of a 16" water main upstream from Stewart street bridge. D-16-16 has crossed the river below Third street and will now complete the channel excavation on the right side of the channel between Third and Fifth streets. D-16-8 is undergoing repairs at the gravel plant. D-16-19 is nearly through with its work on the levee at McKinley Park and will soon cross the river to perform the remaining channel excavation near Dayton View bridge, throwing the material back into a spoil bank opposite.

Stillwater Drive wall is complete except for the coping section, 3730 cubic yards of concrete, or 98% of the total quantity, being in place. The concreting plant has been dismantled. The backfilling is about half completed. Beach avenue wall is 45% complete, 1500 cubic yards of concrete being in place. First street wall is 38% complete, 670 cubic yards being in place. Construction of the several small retaining walls along the Mad River levees has been started.

Price Brothers are driving a steel piling barrier to stream bed grade across the mouth of Wolf Creek.

J. C. McCann has started the earthwork construction on Mad River, excavating from the north bank above Keowee street. Four houses on Ohio street are being removed in connection with that work.

To date 56,800 cubic yards of sand and gravel have been issued from the gravel plant.

Previous to December 1, 853,100 cubic yards of channel excavation (Item 9) had been removed and 147,800 cubic yards of levee embankment placed. The total yardage handled in accomplishing that work amounted to 1,869,400 cubic yards. These figures do not include 105,000 cubic yards of excess excavation for the launching basin and scowling canals.

C. A. Bock, Division Engineer.

December 17, 1920.

HAMILTON

The total amount of channel excavation (Item 9) to December 1st, was 827,700 cubic yards. The electric dragline, D-16-18, is working between the railroad and the Columbia bridge, finishing up the west bank.

At the Black street bridge all of pier 5 and the footing of pier 6 have been completed. The dragline has driven the piling for the falsework on span No. 6 and part of span No. 5.

Price Brothers have driven a trestle for the support of the Belt Line Railroad at the west end of the bridge and the track is now being moved to this temporary location. As soon as this track is moved the dragline will start excavating for the west abutment.

Price Brothers have started to drive piling for the revetment on the west side of the river south of the Main street bridge.

The driving of steel sheet piling and the excavation are being continued on the Black-Clawson wall.

C. H. Eiffert, Division Engineer.

December 22, 1920.

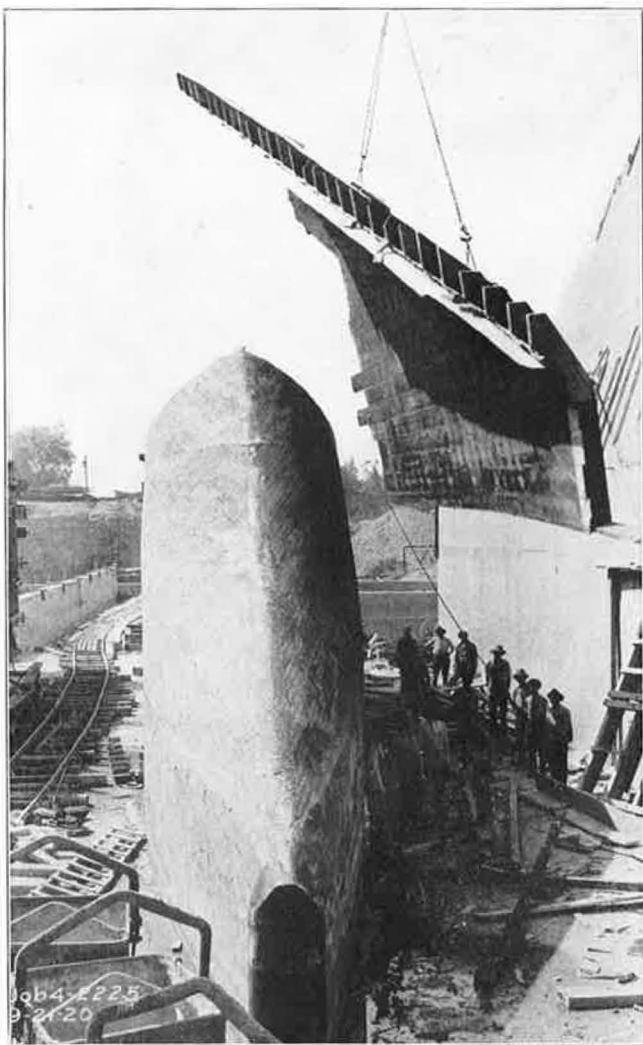


FIG. 253—LIFTING FORM FROM UPSTREAM NOSE OF AN OUTLET PIER. SEPT. 21, 1920.

This is the near pier of Fig. 251. The nose is made of the shape seen as a protection against drift ice, and other floating debris. The form in the air is one-half of that seen in Fig. 251. The $1\frac{1}{4}$ cubic yard buckets used to carry the concrete appear in the lower left corner. They are carried on small platform cars running on the track at the left, and lifted by the derrick. The piers are 11 feet wide and about 100 feet in extreme length, the four conduit openings formed by the piers and side walls being 15 feet wide and 40 feet long, with a total height of 19 feet 2 inches.

UPPER RIVER WORK

Troy—The dragline, under the direction of Donald Jeffrey, completed its river excavation between the Market street and B. & O. bridges on December 10th and moved back to the B. & O. embankment, in order to place about 1,000 cubic yards of earth to form a siding for the new city electric light plant. Since then it has crossed over North Market street and is at present excavating in the river channel on the upper side of the Market street bridge. The excavation under the Market street bridge will be completed, and the dragline will then start excavating the narrow channel and building the levee on the right side of the river, between the Market and Adams street bridges.

The C. & C. Haulage Company has continued to haul gravel from the river channel below Market street into the spoil banks on either side of North Market street. The high water of Thanksgiving week caused a delay of one week, and only one of their two shovels has been working since then.

The Finke Engineering Company has been idle since our last report, due to the flooding of their borrow pit and the weather conditions making the hauling so heavy. They are starting operations again at this time.

Piqua—During the last month, the electrical department has placed a transformer station near the place where the dragline is to be unloaded, and the derrick has been assembled on the ground in readiness to be raised into position.

Tippecanoe City—The District electrical department has started to place a pole line along the location of the proposed levee, which parallels the M. & E. Canal for some distance. The power will be obtained from the Dayton Power and Light Co. and the construction line will connect with their line near the D. & T. power plant at the southeast end of town.

A. F. Griffin, Assistant Engineer.

December 20, 1920.

LOWER RIVER WORK

Miamisburg—During the past month Cole Brothers have constructed 1,000 lineal feet of the east levee, bringing it to a point just back of the Miamisburg paper mill. Here it will be necessary to construct concrete conduits and flood gates to take care of the tail race of the mill. In order to reduce the yardage of concrete and facilitate construction a new permanent channel more nearly at right angles to the levee line was excavated with the dragline, and a temporary channel was also dug. The water is now flowing through the temporary channel, thus leaving the permanent channel free from running water during construction of the concrete work. A storage pile of material has been left with which to fill the gap across the two channels. The dragline has crossed the old tail race and is again building levee.

Franklin—Jeffrey, Boorhem & Co. have completed the levee on the west side and are shipping out their equipment.

The Cincinnati Northern Railway has commenced the work of raising their bridge and track, as required by the District, in order to give the necessary cross-sectional area in the river channel.

Middletown—Price Brothers have completed the revetment construction and commenced work on the Hydraulic street crest wall. About 100 lineal feet of wall has been constructed, leaving 1,275 lineal feet to be built.

F. G. Blackwell, Assistant Engineer.

December 22, 1920.

RAILWAY RELOCATION

Big Four & Erie—There is very little to add to the report of December. M. K. Frank has dismantled the old Erie track from Dayton to the Mud Run bridge just east of Osborn. This work is 75% completed.

Baltimore & Ohio—Mr. J. C. McCann has completed the contract for the work at the Narrows. This finishes the relocation of this railroad.

Ohio Electric Railway—The date for beginning operation of the Ohio Electric from Huffman to Fairfield has been tentatively set for January 10, 1921. The railway company are now bonding the rails.

Albert Larsen, Division Engineer.

December 30, 1920.

RIVER AND WEATHER CONDITIONS

The rainfall in the Miami Valley during the month of November varied from 3.42 inches at Germantown to 4.45 inches at Taylorsville. The most of the precipitation occurred in two storms; the first on the 16th and 17th, in which the precipitation was in the form of snow, and the second, on the 21st and 22nd. The rainfall during the latter, together with the melted snow from the former, resulted in small rises of from 5 to 10 feet in the streams throughout the valley.

At the Dayton Weather Bureau office the total precipitation was 3.46 inches, or 0.57 inches greater than normal; the mean temperature was 41.4 degrees, or 0.9 degrees less than normal; there were 6 clear days, 7 partly cloudy days, 17 cloudy days, and 14 days on which the precipitation amounted to 0.01 of an inch or more; the average wind velocity was 10.1 miles per hour, the prevailing direction being from the southwest; and the maximum velocity for five minutes was 28 miles per hour from the northwest, on the 2nd.

Ivan E. Houk, District Forecaster.

December 30, 1920.

The Common Sense of Concrete Mixing

The Proper Relation Between Theory and Practice in Proportioning Concrete, as Exhibited on the Taylorsville Outlet.

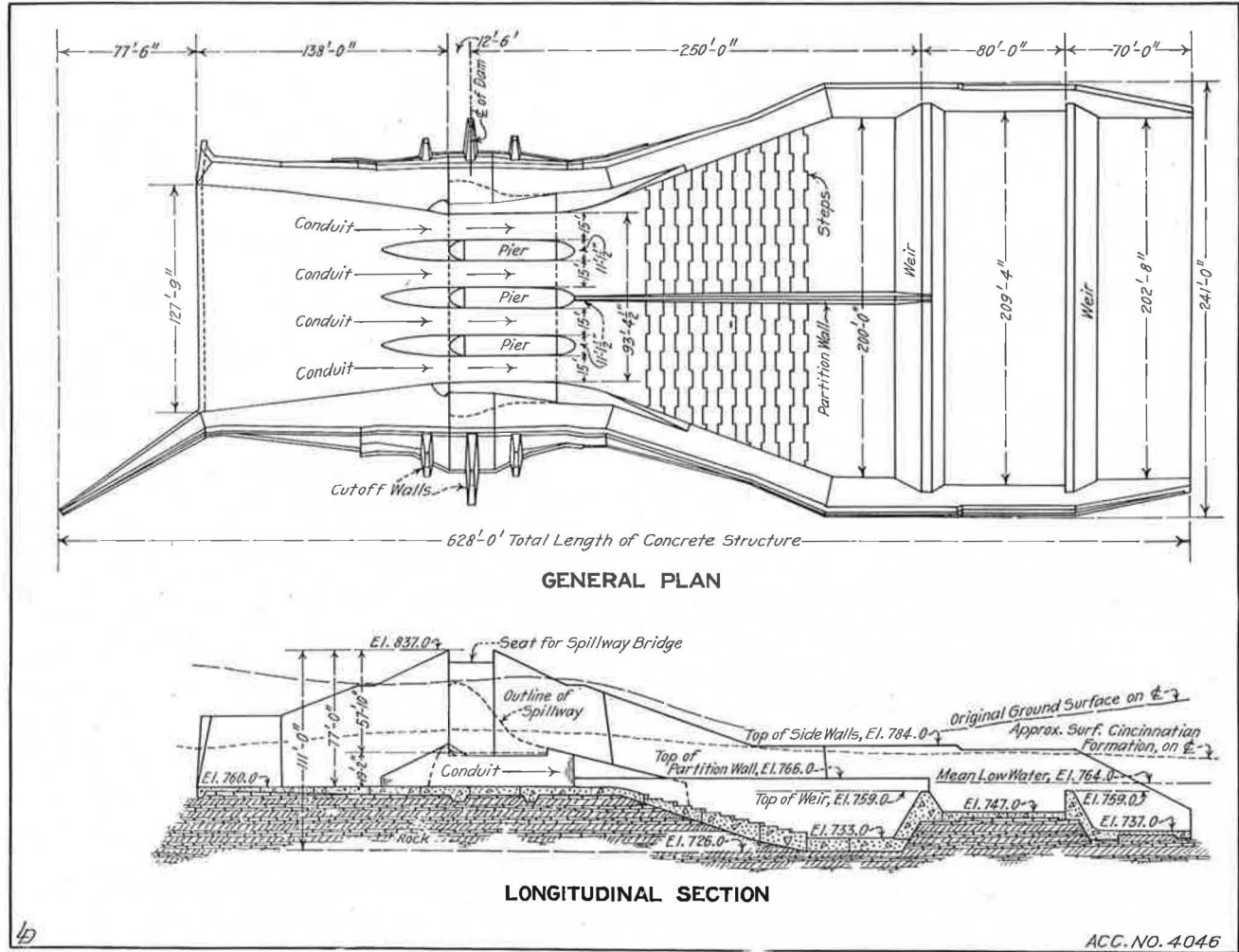
Much has been said and written about theoretical mixes of sand and gravel for concrete, so proportioned that the voids in the coarser sizes are just filled by the next size smaller, and the voids in these by the next; and so on down to the cement itself, which is then supposed to fill the final voids and lock the whole mix into one solid mass. But the conditions at Taylorsville are a capital illustration of the frequent collision between the demands of actual work and the teachings of these fine spun theories. It comes down to a question of dollars and cents. In actual work one must take beds of gravel as they occur conveniently to the work, with such rejection of undesirable sizes as screening costs permit, the expense of inhaul usually more than off-setting any gain in cement obtained by going to a distance. At Taylorsville the grading of the sand and gravel in the beds (in the valley bottom next the dam,) was very irregular. A screening plant separating the sizes, to be subsequently recombined, (see Bulletin for April, 1919,) could not entirely cure this diffi-

culty, on account of the preponderance of finer gravel. All washed material below $\frac{1}{4}$ inch went into the sand bin. The gravel was screened into two sizes—fine, running from $\frac{1}{4}$ inch to $1\frac{1}{2}$ inch, and coarse, running from $1\frac{1}{2}$ inch to 3 inch, (with a little "oversize" rock thrown in as it came in the pit). The rule was to combine these two grades in the mixing "50-50," because experiments showed this gave least voids in the mix and hence, theoretically, solidest concrete... But in practice, most of the time the finer gravel exceeded the coarser in the ratio of 18 to 15, or even 17 to 13, and as the throwing away of the excess finer size, after washing and screening it, would be a foolish waste without corresponding gain in strength of concrete, the variation was permitted and the entire gravel material used up. (With exceptions noted later.) The strength of the mix was assured by breaking concrete cylinders, made from the actual materials put in the work, in a testing machine, leaving always the standard margin for safety.

Much more flagrantly theory was disregarded in the proportioning of the sand to the gravel, in order to secure economy in working the concrete in the forms. Fresh "pudding" concrete, dumped from the bucket in masses equal to a wagon load, has to be tramped and shoveled laboriously into place in the forms by men in heavy hip rubber boots, wading often a foot deep in the thick material. The mixture consists of a mortar of sand, cement and water, to which enough gravel has been added to make a thick pudding. In the tramping and shoveling the mortar acts as "grease" to the gravel, greatly facilitating the getting of the dumped mass to all sides and corners of the form. The mortar acting as binder to the gravel, the strength of the resulting concrete depends on the strength of the mortar, and gravel may theoretically be added as long as there is mortar enough to fill the voids, without loss of strength. Practically, long before this point of saturation, as it may be called, had been reached, the mixture became so stiff for lack of sufficient mortar to "grease" it, that the tramping and shoveling,

laborious at best, became so much so as inordinately to increase the cost. Hence the practical rule,—secure a mortar of sufficient strength, and then add as much gravel to it as it will bear and still work smoothly in the forms; and the tests at Taylorsville (described in the Bulletin for March, 1920), were simply to determine what proportions of the sand and gravel, with the peculiarities of grading in size of these materials in the Taylorsville pits, would have to be measured into the concrete mixer in order to secure a mix which when it arrived at the forms would fulfill this practical test.

But this practical rule came into sharp conflict with theoretical concreting mixing. The "50-50" combination of fine and coarse gravel (16 cubic feet of each to the batch of concrete,) was found experimentally to contain 34.8 per cent of voids, and to shrink in the process of mixing to a volume of 25.8 cubic feet. Its voids then were 9 cubic feet. Theoretically, this would mean that 9 cubic feet of sand must be added to fill these voids, with sufficient cement to fill the sand voids, and enough water to



ACC. NO. 4046

FIG. 254—PLAN AND LONGITUDINAL SECTION OF TAYLORSVILLE OUTLET WORKS.

The dimensions are given and need not be repeated. Note the dotted outline of the spillway structure, comprising about 10,000 cubic yards of concrete, which is yet to be built, (after the earth embankment is completed,) as a cross dam between the walls, whose crest is the spillway floor, and beneath which are the conduit openings. The flow of the river will be toward the right. Note how the cross section of the four conduits, (15' by 19' 2" each, totaling 60' by 19' 2"), broadens and deepens down the notched stairway into the basins below, the hydraulic jump pool, (just above the left hand weir,) being 200 feet wide and 33 feet deep below the top of the central partition wall, (the latter being seen in Fig. 258 with its top just above the water level.) It is this broadening and deepening, which, together with the weir, produces the hydraulic jump that absorbs the destructive energy of the issuing water.

The gravel was dug by a Class 14 Bucyrus drag-line in the gravel pits at the right and transported on the construction tracks shown, by means of 12-yard Western air dump cars drawn by 40-ton American locomotives, to the gravel washing plant on the east bank of the river. Here the material was washed and screened into sand and fine and coarse gravel, which were then recombined and mixed with cement into concrete under the same roof, the cement house being immediately adjacent, and the latter material being wheeled in barrows. From the 1-yard Smith concrete mixer the material was dumped into 1¼-yard bottom dump buckets and transported to the

(Continued below.)

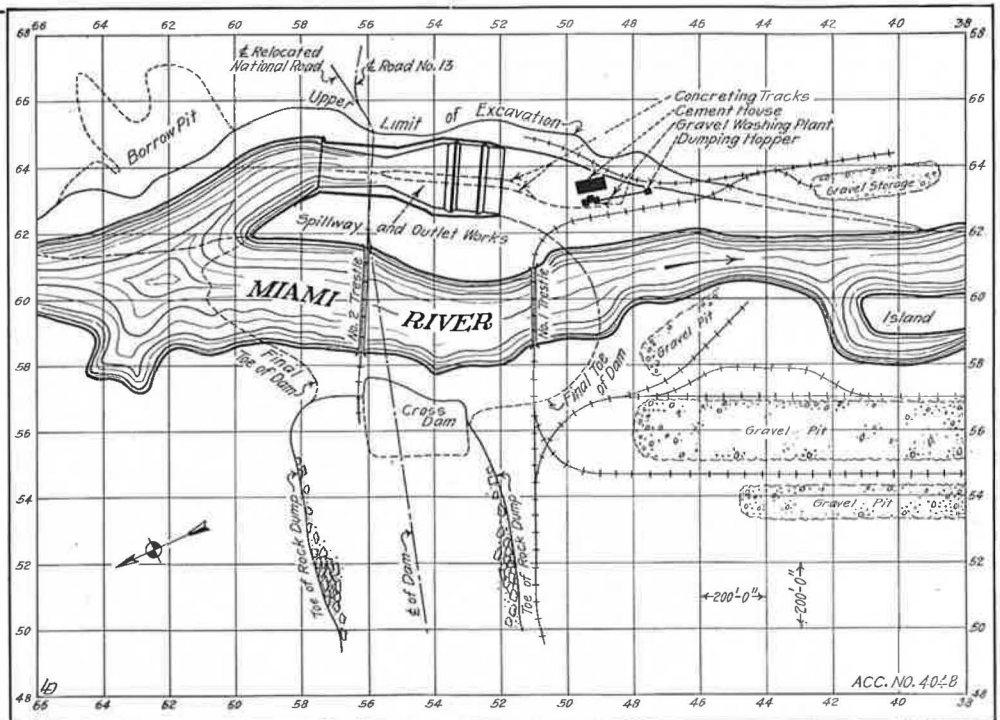


FIG. 255—PLAN OF TAYLORSVILLE CONCRETING LAYOUT.

forms on small platform cars, drawn by three-foot gage Fate gasoline locomotives. The buckets were lifted and dumped by two stiff-leg electric derricks with 105-foot steel booms, (later 90-foot) two being necessary on account of the great width of the work, (241 feet maximum.)

make a proper mortar. Practically, however, 9 cubic feet of sand gave a concrete which was so difficult to tramp and shovel into place in the forms that using this proportion was out of the question. The proportion of sand had to be run up to 13 cubic feet—an increase of more than 50 per cent over the theoretical quantity—to secure a smoothly working, economical concrete, (the strength again being always and regularly checked by breaking tests of the actual material used).

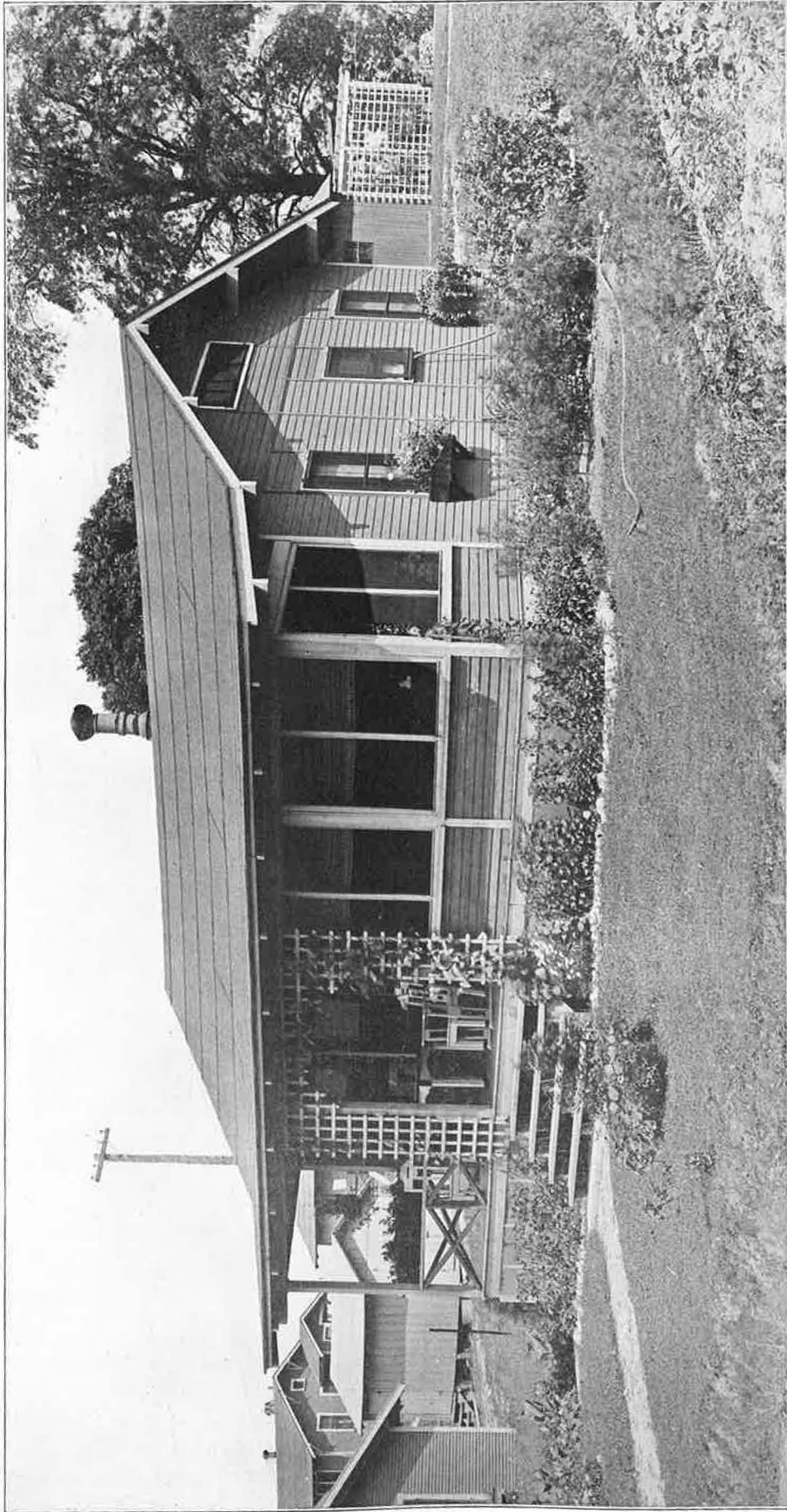
Practically, any excess of gravel in the concrete was easily avoided. The appearance and behavior of the "mix" as it poured from the mixer into the buckets in which it was carried to the forms indicated the trouble at once to the man in charge of the mixer. In the forms, the material "would pile up like a heap of rocks," and the labor of shoveling it would become so great that the men could be "depended on to kick quick and loud" whenever signs of excess gravel appeared. Addition of water in such a case—a frequent expedient with the uninitiated—is worse than useless. It simply thins the mortar, making it less adherent to the gravel, and hence more readily separated, so that the "heap of rocks" piles up more stubbornly than before.

But the troubles were not all a matter of measure and proportion. In the Taylorsville gravel pits there were pockets of "buckshot sand"—coarse angular material with large excess of the ⅛ to ¼-inch sizes. Thirteen cubic feet of this—the regular charge—would make a batch work as hard in the forms as if it contained excess of gravel. The regular 4-bag charge of cement—with the water the true "grease" of the mix—while sufficient with the aid of finer sands to fill the voids between coarser grains, was totally insufficient in the buckshot sand where these finer grains were lacking. Thus the mortar,

instead of becoming a true slime and "grease" for the gravel to slide in, would become a mass of small angular pebbles painted with a thin coat of cement, with several gallons of cement grout at the bottom of the bucket. The resulting concrete, arrived in the forms, was as sure to produce the "quick and loud kick" from the men as in the case already mentioned. Addition of water, here as before would have aggravated the trouble instead of curing it.

Methods of getting rid of the excess of the buckshot sand and "pea gravel" were given in the Bulletin for March, 1920, (these materials being so persistent in the pit at times as to require the excavator to dig in a new location). In the end the holes in the sand screen were enlarged over a strip 15 inches wide at the lower end, permitting the obnoxious materials to drop through into a waste chute discharging into the river.

The work being most of it massive, with little steel reinforcement, the mix was in general, approximately, 1:3:6. (1 of cement: 3 of sand: 6 of gravel.) It being convenient to measure the cement in the full bags as shipped, the measures to secure the proportions named were 4 bags of cement, (one cubic foot to the bag,) to 13 cubic feet of sand, to 25.8 cubic feet of mixed gravel, the latter figure being the result of mixing 16 cubic feet each of the fine and the coarse grades, as given by preliminary tests. But practically, as stated, the 16:16 mix was varied to suit the run of gravel in the pits. A 1:3:6 mix would seem to require 12 cubic yards of sand instead of 13, but as repeated tests, made regularly as the work proceeded, showed that 10 to 25 per cent of the "sand" which came through the sand screen exceeded ¼ inch in size and could be considered really as fine gravel, the extra cubic foot was added to secure a true sand ratio.



A Number Two Conservancy Cottage

The above is a picture of the residence of O. K. Guthrie at the Taylorsville Dam. It is of the exact plan and size of the No. 2 cottage listed for sale at the bottom of the opposite page. This style is put together in sections to facilitate taking apart and removing.

AUCTION SALE

At Germantown Dam, 2½ Miles Northwest of Germantown Village
Wednesday, January 26, at 1:30 P. M.



This shows what a beautiful home can be made of one of these bungalows. It is the residence of Chief Steward McCarthy at Taylorsville Dam, and is of the exact size and plan of the No. 4 cottage to be sold at Germantown.

BUNGALOWS—COTTAGES—HOUSES

These dwellings are most of them of the bungalow type, and have been used as homes by the Conservancy employees during construction of the Germantown Dam.

They are attractive modern houses, equipped with up-to-date toilets, shower baths, electric wiring, and plumbing for hot and cold water.

They are bargains for anyone desiring—

A Cozy Bungalow Home
A No. 1 Garage

A Summer Cottage
A Farm Tenant House

They are well built and can be moved at a very nominal cost. Some are built on the sectional plan, so as to be readily taken apart for removal.

These Houses will Positively be Sold to the Highest Bidder

If the Weather Is Bad the Sale Will be Held in the Steam-Heated Camp Mess Hall

TERMS OF SALE

20 per cent in cash at time of sale. 40 per cent at end of three months. 40 per cent at end of six months. 5 per cent discount for full payment in cash. The 40 per cent payments must be secured by notes without interest and with approved security. Reasonable time for removal of houses.

Following is List of the Houses for Sale

No. 1—3-room frame cottage, 24 ft. x 24 ft; shower bath, toilet, 2 closets, built in cupboards and sink, pantry, porches, front and rear.

No. 2—4-room frame cottage, 24 ft. x 26 ft., shower bath, toilet, 2 closets, pantry, porches front and rear, sleeping porch, built-in cupboards and sink.

No. 3—4-room cottage, 18 ft. x 26 ft. (2 rooms first floor, 2 rooms second), 2 porches front and rear, shower bath, toilet, storage room, pantry, built-in cupboard and sink, closets.

No. 4—5-room frame cottage, 32 ft. x 24 ft, colonial stoop, porch in rear, shower bath, toilet, 3 closets, built-in cupboards and sink, pantry.

No. 5—5-room frame cottage, 34 ft. x 26 ft., colonial stoop, porch in rear, shower bath, toilet, pantry, built-in cupboards and sink, closets.

No. 6—2-room frame cottage, 18 ft. x 18 ft., shower bath, toilet, porch, 2 rooms (18 ft. x 10 ft. and 8 ft. x 13 ft.), one large enough to convert into two rooms.

No. 7—Cottage type boarding house, large dormitory with toilet and bath separated from living rooms and bath room of the family. Sectionally built and could be converted into 2, 3 or 4-car garage. Also ideal for summer cottage.

No. 8—Cottage used for First Aid Hospital, 30 ft. 6 in. x 18 ft., 4 rooms, including kitchen, shower bath, 2 sinks, toilet, front porch.

These houses may be inspected at any time by seeing A. L. Pauls, Division Engineer Germantown Dam. Call the Miami Conservancy District, Telephone Main 2903, Dayton, Ohio.

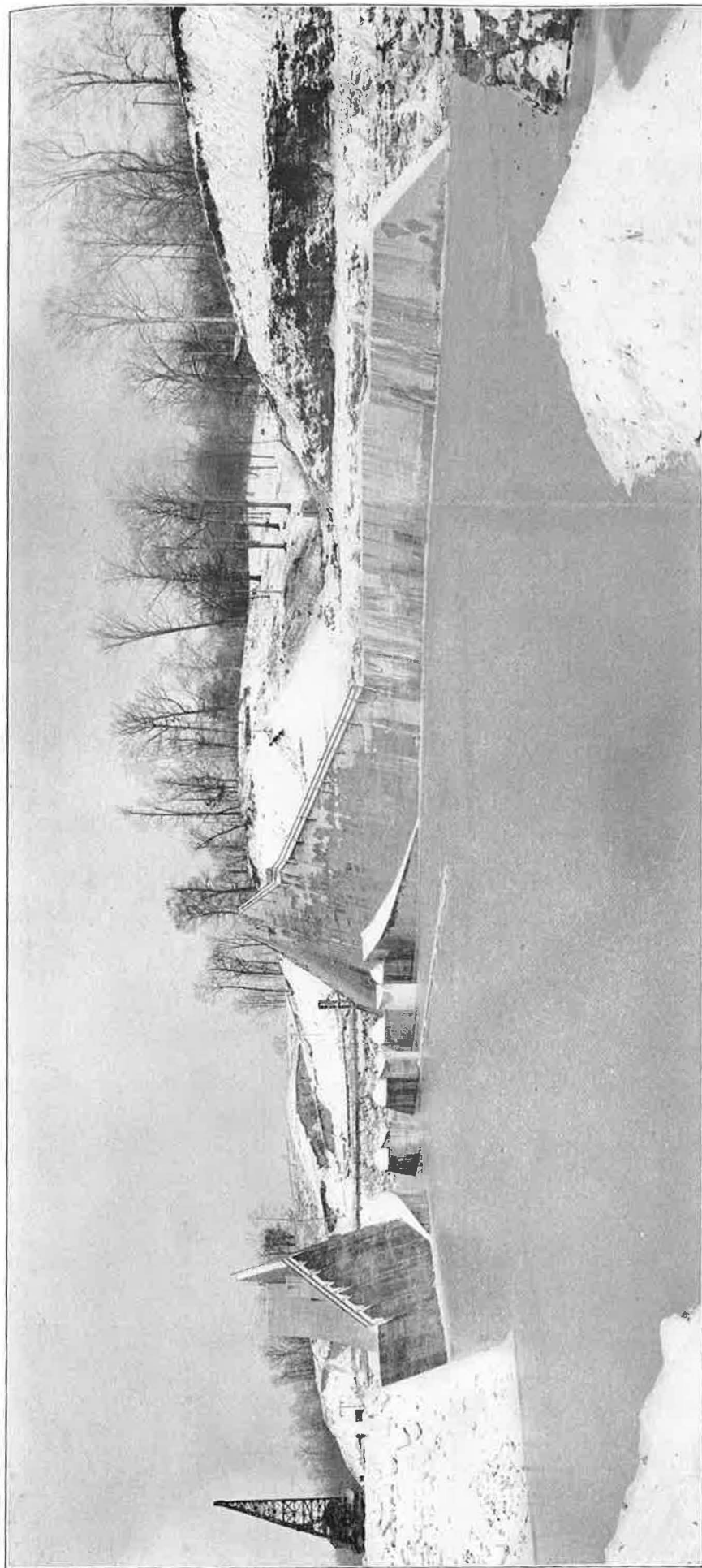


FIG. 258—DOWNSTREAM END OF TAYLORSVILLE OUTLET WORKS, DEC. 28, 1920

The picture is shown to give a better idea of the magnitude of the pool into which the water of the river, passing through the four conduits after the dam is completed, will issue. (The men at the left near the machine give a good scale for comparison). This pool appears in the foreground, the river having been admitted to the outlet, although it cannot make its way down the valley through the new channel, because the downstream end of the latter is not yet excavated. The snow covered earth in the immediate foreground is at the beginning of this excavation, which is now in progress. The four conduit openings are seen between the walls, each 15 feet wide, and when completed to be 19 feet, 2 inches high, their arch tops to be formed by the cross dam and spillway structure described under Fig. 254. Issuing from the conduits, (93 feet in combined width, including the intervening piers), the water will flow on into the wide, deep pool in the foreground. This pool is 200 feet wide, and 33 feet in maximum depth below the top of the center wall (which may be seen, looking like a floating plank projecting from the center pier, its snow-covered top just above the ice). A cross wall, or "wier," 26 feet high, its top 7 feet below the ice surface, crosses the pool from side wall to side wall just at the end of the center wall; and a second wall

crosses about 80 feet below (nearer in the view). Thus what seems one large pool is really two, the "hydraulic jump pool" between the conduits and the first cross wall, and the "stilling pool" between the first and second cross walls.

The discharge of a spillway level flood, through the Taylorsville outlets, if one should ever occur, which is unlikely, will be an imposing spectacle, 53,600 cubic feet of water, equal to 1,675 tons, or about the mass of a twenty-five car freight train, rushing through the conduits every second, at a speed of 33 miles per hour and dashing itself into a "standing wave" of lathering foam, twenty feet or more in height, in the massive concrete basin forming the hydraulic jump pool.

From this pool it flows on over the first wall into the stilling pool, where the water quiets itself and flows on over the second wall with its destructive speed reduced to a harmless six or seven feet per second. The problem of curbing this destructive energy, was one of the most important the Conservancy engineers had to face. Its solution in the above shown outlet works has been already tried (in the Conservancy outlets at Germantown and Lockington) during the April flood of last year and was found to operate satisfactorily in accordance with the design.

THE MIAMI CONSERVANCY BULLETIN

FEBRUARY, 1921



FIG. 259—EXCAVATION FOR PIERS 5 AND 6, BLACK STREET BRIDGE, NOV. 19, 1920.



FIG. 260—BLACK STREET BRIDGE CONSTRUCTION, FROM WEST BANK DOWNSTREAM. JAN. 27, 1921.

Piers 6, 5, 4, 3, and 2 are seen in the order named, from left to right. Compare Fig. 259, taken at an earlier date, where the piling and part of the forms for pier 5 are seen in the excavation, with a pool of water in the foreground occupying the site of pier 6. Compare also Fig. 269, which shows the same view as is here seen, taken from the west tower of the cableway on the same date. The east tower of the cableway is here seen at the right in the background. The piles driven between the piers are to support the falsework for the bridge arches, which will be built during the coming season. Both abutments and 5 piers have been now nearly completed, leaving pier 1, (beyond the farthest seen) still to be built.

Compare Figure 260, showing the machine on the same day and in the same situation. The caterpillar dragline excavator has completed its work of excavation at the west end of the bridge and is crossing the river on its way back to the east bank, building as it goes an embankment to travel on, by picking up the gravel behind and placing it in front. The carriage of the cableway which handles the concrete for the piers, is seen above the dragline boom, with a suspended concrete bucket. The machine at the left is a centrifugal pump awaiting removal.

(Continued below)

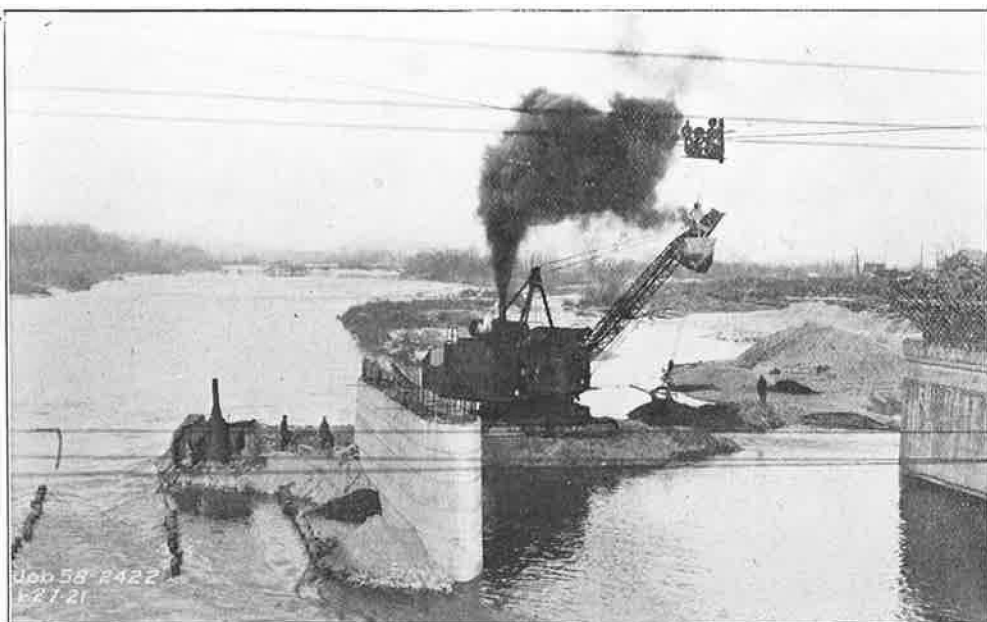


FIG. 261—DRAGLINE EXCAVATOR "TREKKING" BACK TO WORK ON PIER 1, BLACK ST. BRIDGE. JANUARY 27, 1921.

The piles next it have been driven to support the falsework for building the bridge arches, this work being planned for the coming season.

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THE MIAMI CONSERVANCY BULLETIN

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DAYTON, OHIO

Volume 3

February 1921

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

G. L. TEMPLE, Assistant Engineer, EDITOR.

Resignation of R. M. Riegel

The Bulletin records with much regret the resignation of Mr. Ross M. Riegel, the chief designing engineer of the District, who goes to accept a position on the engineering staff of the West Penn Railways Co. at Pittsburgh. Mr. Riegel came to the work of the District in August, 1915, and has been on the engineering staff ever since, except for a time in 1918-19, when he was with the Emergency Fleet Corporation, Housing Division, on war work. His experience includes also work on Mississippi River improvement, with the New York Board of Water Supply and with the Pennsylvania Water Supply Commission. He won the Fuertes gold medal in 1918, awarded by Cornell University, for original research on the hydraulic jump. He was appointed designing engineer of the District in 1919, following the resignation of Mr. W. M. Smith, to take charge of design on the Illinois Canal Link. His colleagues all wish him the largest measure of success.

Partial Failure of the Third Street Bridge, Dayton

On January 20, at about half past five p. m., there was a partial failure of the second pier from the south end of Third Street bridge across the Miami in Dayton, the north part of the pier cracking away from the rest and sinking about a foot, thus permitting the adjacent portions of the arches to collapse and fall into the river.

Traffic was of course at once stopped until an examination of the bridge could be made as to the cause of the accident, and proper steps taken to provide a remedy. On consultation between the city

and Conservancy authorities, it was decided to call in Mr. John L. Harrington, of the firm of Harrington, Howard and Ash, bridge engineers, of Kansas City, Mo., to take charge of an independent investigation. This examination has been made, and Mr. Harrington is now engaged in preparing his report, with recommendations as to the restoration of the bridge, and as to what precautions should be taken, if any, as regards the other bridge structures. A sketch showing the part of the bridge which failed, and also some other bridge structures in the Conservancy District, including Black Street bridge in Hamilton, now building by the Conservancy forces, will be found on page 100. The importance of properly designed piers is obvious from the sketch.

Conservancy Technical Reports

In connection with the publication of Part VII of the Conservancy Technical Reports, noted last month, it is thought desirable to print in this issue a full list of these reports, with prices, etc., for the information of the public. The prices are all net, post-paid; the reports all in paper covers, 6" x 9".

Part I—The Miami Valley and the 1913 Flood.

By Arthur E. Morgan, Chief Engineer.

Price, 50 cents.

Part II—History of the Miami Flood Control Project. By C. A. Bock, Division Engineer.

Price, 50 cents.

Part III—Hydraulic Jump and Backwater Curves.

By Sherman M. Woodward, R. M. Riegel and J. C. Beebe.

Price, 50 cents.

(Continued on Page 111)

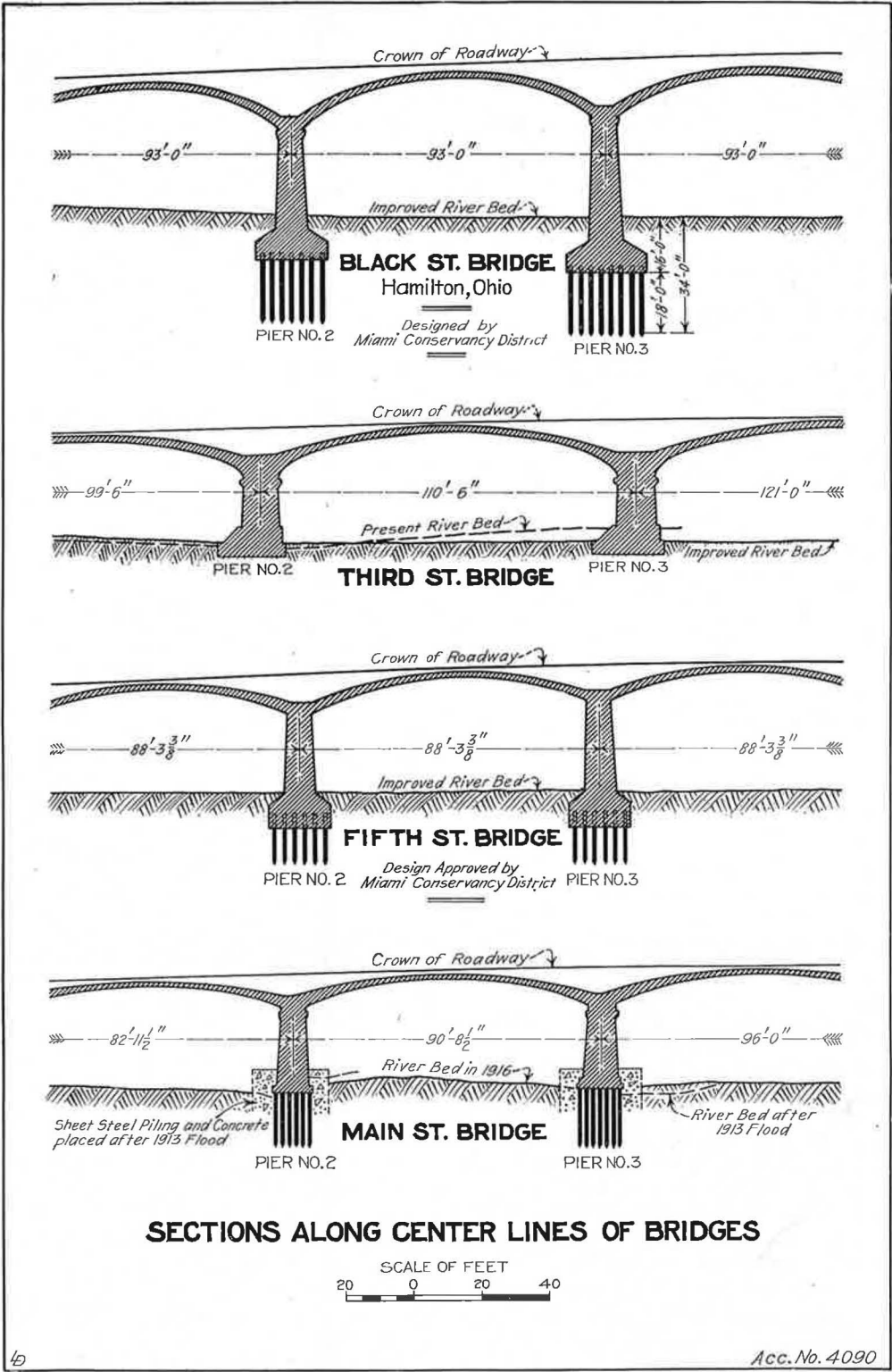


FIG. 262—SHOWING FOUNDATION CONDITION OF FOUR MIAMI VALLEY BRIDGES

Piers 2 and 3 of each bridge are exhibited, pier 2 of Third Street bridge, Dayton, being the one whose recent partial failure makes the above sketch a timely one for comparison. Black Street bridge at Hamilton, now under construction by the forces of the Conservancy District, is shown at the top, with the Third Street structure immediately below. The fundamental fault with the design of the Third Street bridge piers, according to Mr. John H. Harrington, the bridge engineer, called in to make an independent investigation of the defective structure, was that the piers were not carried to a sufficient depth and that no piles were driven under them. The ample provision at the Black Street bridge, designed and now building by the District forces, is evident as to both these particulars. (See also page 101.)

The Design of Conservancy Bridge Foundations

Piers Carried Down 12 to 16 Feet Into Gravel Material, With Piling Beneath Driven 18 Feet Deeper.

The partial failure of the second pier of the Third Street bridge in Dayton naturally directs public attention to the bridges which are on the building program under the direction of the Conservancy District; and especially to the bridge now under construction at Black Street, Hamilton, since it is a structure of the same type, and of about the same size, as the Dayton bridge which proved defective. The nature of the foundation materials and the character of the river, are also practically the same in the two cases.

It should be understood at the outset that bridge foundations in the Miami Valley cannot usually be carried down to rock. The valley was scoured out by glaciers and the valley floor is underlaid hundreds of feet deep with gravels, sands and clays deposited at the time of the great ice sheet. To go down to rock through these deposits is out of the question. Gravel mixed with sand, when excavated to a sufficient depth so that the concrete of the pier footing, when built upon it, will not be undermined by the river during flood, makes a solid and sufficient foundation. To make the assurance as to undermining more sure, however, round timber "piles," like telegraph poles, should be driven into the gravel beneath the pier footing. And there should be enough of these piles so that, even if all the gravel immediately underlying the pier should be washed away, the pier would still stand firm, supported by the piles alone. Such timber piles, it needs to be said, when below ground water level, (as in a river bed) will last indefinitely without decay.

As to both these criticisms, the facts are well brought out in Fig. 262, which shows piers 2 and 3 in each of four Miami River bridges, all drawn to the same scale, the new Black Street bridge at Hamilton being at the top; and the Third Street, Fifth Street and Main Street bridges in Dayton following in order down the page. Main Street bridge was built in 1902, Third Street in 1903, Fifth Street in 1916, while the Black Street bridge is now under construction. Inspection will show that the Third Street design, which failed, is the shallowest of the four, and also the only one which has no piles under its foundations.

The effect of the 1913 flood on Miami River bridge design is naturally very noticeable. The figure shows this, as does the record of all the Dayton bridges. Only one bridge in Dayton built before the flood has piling under its piers, and that is Main Street bridge, shown in Fig. 262. All the bridges built subsequent to the flood—Keowee Street, Webster Street, Fifth Street and the Dayton Union railway bridge—have piling beneath the piers, except the last, and in this case the concrete is itself carried to so great a depth—(26 feet below the river bed)—that piling would be superfluous.

The clearest example of the value of piling beneath bridge piers was given at the Main Street structure in Dayton during the 1913 flood. These piers, built in 1902, were not carried a sufficient distance below the stream bed, so that the flood undermined them to depths varying from 5 to 7 feet beneath considerable portions of the foundation footings, leaving

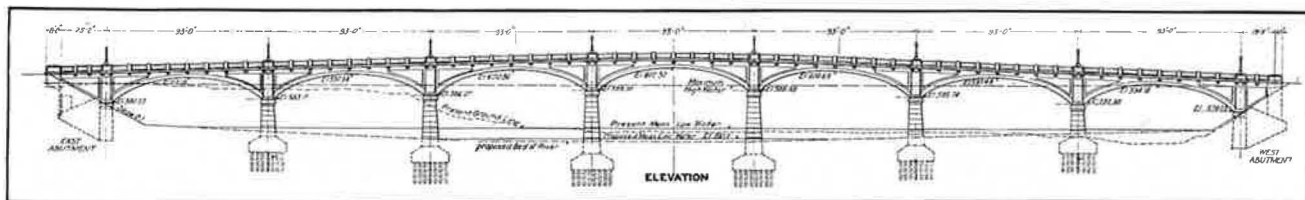


FIG. 263—ELEVATION OF BLACK STREET BRIDGE SHOWING FOUNDATIONS.

Foundations built of gravel, carried to a sufficient depth, and supported below in addition upon piles driven into the river bed in the manner described are very satisfactory. Such foundations have been provided for the Black Street bridge in Hamilton, now under construction; such also will be designed for the new Adams Street bridge in Troy, the work on both of these bridges being in charge of the Conservancy forces. Similar foundations are exemplified by the piers built for the Fifth Street, Webster Street, and Keowee Street bridges in Dayton, all of which were approved in plan by the Conservancy engineers before the structures were built.

Mr. Harrington, the consulting engineer who was called in by the city authorities of Dayton to examine and report on the cause of the trouble at Third Street, declared the fundamental cause to be faulty design in failing to carry the piers to a sufficient depth, and in failing also to provide piling beneath the concrete foundation "footings."

these portions supported by the piling alone. Undoubtedly the piling saved the structure, which in fact stood quite undamaged. The piers, under recommendation of the Conservancy authorities, were reinforced by driving a 10-foot fence of steel sheet piling around each pier, and filling the space between the piling and the pier with mass concrete. This provides a strong defensive armor against such an accident as overtook the Third Street bridge, in addition to the piling beneath the piers.

Examination of the Black Street piers in Fig. 262, will show that the concrete "footing" extends from 12 to 16 feet below the bottom of the new bed of the river as established by the flood prevention plans; and that beneath each pier the timber piles extend 18 feet below the pier bottom. The tops of the piles are imbedded two feet in the concrete of the pier. An idea of how thickly these piles are driven is given in Fig. 265, which shows the piles in the process of being driven by a steam pile driver. (The pile

driver is carried in the vertical "leads," (guides) suspended from the end of the slanting boom of the dragline excavator, the latter machine having been adapted to this use by removal of its bucket and a few other minor changes). Fig. 266 shows a test made on one of these piles after it was driven, in order to see what weight it would support. Thirty tons of pig iron were piled on a timber platform braced on top of the pile. The top of this platform during 3 days settled $\frac{3}{4}$ inch in reaching a full bearing below, after which there was no further measurable settlement during the week which the test continued. There are from 130 to 150 of these piles under each pier, the number depending on the size

of the "footing," the piles being three feet apart each way. The test then corresponded to a load of $3\frac{1}{2}$ tons per square foot of pier bottom, supported by the piles alone, supposing the gravel immediately beneath the pier top entirely washed away. This is more than would be brought by a string of loaded street cars extending end to end entirely across the bridge. Foundations under the larger buildings of Dayton, on gravel material, with timber piling, are calculated to carry from five to six tons per square foot, with an ample factor of safety. The adequacy of the Black Street pier foundations, considering these figures, will be seen to be well assured.

Earth Cofferdams for Hamilton Bridge Piers

Piers Built in Open Excavations Enclosed by Levees, Without Sheet Piling.
Dragline Substituted for Clamshell.

Excavation in the open for pier foundations, as at Hamilton, by means of a dragline excavator, appears to be an unusual procedure. (See Bulletin for August, 1920). For this reason, and because in practice it has proved so advantageous in a number of respects, a more extended notice of it is thought to be worth while.

It is imperative that bridge foundations be carried down till perfectly stable and solid material is reached, sufficient, with the aid of piles where necessary, to provide a safe support for the bridge structure, and to eliminate danger of scour. This often means excavation to considerable depths. The most obvious difficulty in making the excavation is that the foundation site is under water. This diffi-

culty is overcome by enclosing the site with a sufficiently tight wall of some material, and pumping the water out.

This wall may be either a "caisson," or a "cofferdam." A caisson is simply a box with an open top and bottom, which is towed into position over the pier site, loaded with weights (rock or pig iron), and sunk to the river bottom, with its top projecting above the surface. The box is then pumped out, and the river bottom within it excavated, the box sinking little by little as the material is dug from under its sides. Water leaking into the excavation under the box edges and through the earth of the bottom (always more or less porous), is led to a "sump" or hollow in the bottom, and pumped out.

The pump is direct connected to an electric motor in the little house. The suction pipe is seen sloping down into the water of the excavation. A pulley hung from the timber tripod seen at the pool, enables the lower end of the suction to be lifted clear of the water to clean it in case of clogging. The horizontal pipe (the discharge), was laid of course in the open, being covered later by the dragline in building the earth levee of the cofferdam. The dragline machine (see Fig. 261), dug the hole, and piled the excavated earth around the edge, forming thus an earth "cofferdam," just as a child might dig a hole at the edge of a park pond, with a toy shovel, and pile the sand around the hole he had dug. The two processes are in ef-

(Continued below)



FIG. 264—PUMP "UNWATERING" ABUTMENT EXCAVATION, BLACK STREET BRIDGE, JUNE 10, 1920

fect precisely the same. The pump was then set up and the excavation "unwatered." The nature of the river gravel of all the pier excavations was much like that here seen.

The pile driver can be seen hung between the "leads" (vertical timber guides), the latter being suspended from the end of the slanting boom of the dragline excavator by a wire cable lashing. The hoist cable of the dragline can be seen between the two timbers of the leads, and passing to the top of the pile driver cylinder. The pile driver frame and hammer are attached to the cylinder, the entire mechanism can thus be raised and lowered in the leads by the hoist engine of the dragline. Steam is supplied to the pile driver cylinder by the rubber hose seen passing in a

(Continued below)

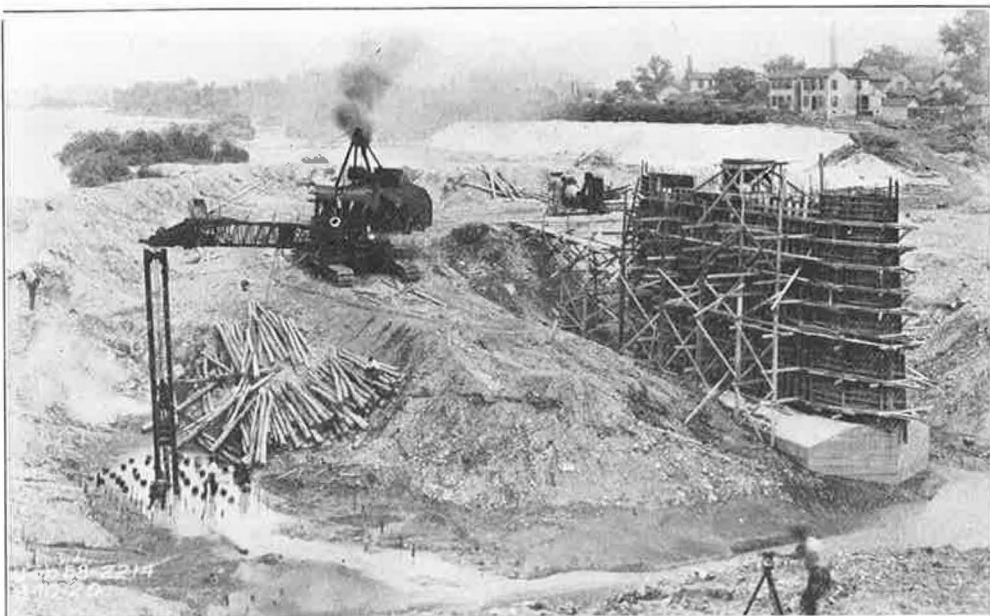


FIG. 265—DRIVING PILES FOR BLACK ST. BRIDGE PIERS SEPT. 10, 1920

loop from the pile driver to about the center of the dragline boom, whence it passes to the dragline boiler. The heads of several driven piles can be seen projecting from the pool of water at the foot of the leads, and beyond these appears a heap of piles ready to be driven. To drive a fresh pile, the leads are raised bodily, carrying the piledriver with them, this being done by pulling on the "boom fall," (the wire cable seen running back from the boom end to the top of the frame above the dragline, whence it passes down to a hoist engine). The suspended leads are then swung to the proper position for the pile to be driven, by swinging the dragline boom, the "spotting" being assisted by running the whole machine backwards or forwards on its caterpillar traction, (the latter operating like the tanks in the late war). The leads are then lowered by slacking on the boomfall, bringing the weight of the boom to bear and forcing the foot of the leads about two feet into the gravel. The leads are thus firmly held at the top and bottom and need no guy wires. The load cable of the dragline, (which for this work is passed through a pulley lashed to the boom end) is then attached to a loose pile by means of a hook, and the pile hoisted into place between the leads. The pile driver is then lowered upon the top of the pile, steam admitted to the cylinder, and the driving begins, the pile driver resting on the pile top during this process (as a wood pecker hammers a telegraph pole while standing on top of it, except that the woodpecker is cutting instead of driving). A finished pier "footing" can be seen at the right, surmounted by the form for the pier shaft. A similar footing will rest on the top of the piles which are being driven.

The caisson may be replaced by a "cofferdam." This may be a tight fence of wooden planks ("sheet piling,") driven side by side, edge to edge, into the river bottom, enclosing the pier site. Flat steel bars of "interlocking steel sheet piling" are often substituted, especially for greater depths, the edges of the bars so shaped that the adjacent piles interlock, making a fence much tighter and stronger.

When the water level within such a cofferdam has been lowered considerably by the pumps, the water without it exerts a heavy pressure tending to crush in the sides. This must be resisted, usually by placing horizontal struts of steel or timber across the enclosure, bearing against the sides, to act as braces. A network of such timbers, running lengthwise and crosswise, thus obstructs the enclosure.

The excavating is usually done by a "clamshell" bucket, raised and lowered into and out of the excavation by a steam derrick. The two halves of the bucket open on hinges (hence the name "clamshell"), and drop wide open into the material at the bottom, then close while the bucket is lifted; something as one would scoop up a double handful of mud.

The clamshell is somewhat slow and laborious in operation when working in a cofferdam like that described. It has a pernicious trick when loading, especially in gravelly material, of biting the bucket teeth every now and then on a large cobblestone, so that the jaws cannot close. Thus when the bucket

is lifted—mouth down as it must be with a clamshell—the finer material all runs out and the machine must go back and load up again. In cemented material there is also often failure to load, due to the teeth sliding over the material instead of biting in. In a sheet piling cofferdam, on account of the obstructing criss-cross of braces, the bucket must first be lifted entirely clear of the piling; then swung aside to be dumped; then swung back again; then lowered for the next load. In the open the swinging and lifting, or swinging and lowering, can be done simultaneously. Care must be exercised also in "spotting" the bucket for the raising and lowering, to avoid knocking the braces down. These various difficulties consume time; and time is money.

All the troubles enumerated were avoided at Hamilton by substituting for the sheet piling cofferdam an open cofferdam of earth, which needs no obstructing cross braces, and by substituting a dragline bucket for the clamshell. The material from the excavation was taken out by the dragline bucket, and built into a rectangular levee enclosing the pier site. This excavation could be done under water, whereas a sheet piling cofferdam must be kept dry during the excavation by pumping, to permit the placing of the braces. The cost of the braces was also saved, together with the time and labor lost in placing them. The substituted process, theoretically, is as simple as when a child digs a water hole at the edge of a park pond with a toy shovel, and piles

the sand he has dug in a circle around the hole. When with his cupped hands he tosses the water out of the hole he has made, his little feat of hydraulic engineering is completed—he has “excavated” and “unwatered” an “earth cofferdam.”

The big hole seen in the foreground in Fig. 259, showing the work for two of the Black Street bridge piers, is nothing but the child's toy performance, magnified. The operations by which it was built are in essence precisely the same. The dragline excavator at the left, riding on its caterpillar traction (like the tanks in the war), with its seventy-foot boom slanting in front, carrying a steel bucket which lifts a load of three or four tons of earth, represents the toy shovel. The centrifugal pumps, seen in the shadow of the shelter at the right far corner of the excavation, answer to the boy's cupped hands. They draw the water through the two “suction pipes” seen slanting down into the “sump” or hollow at the bottom of the slope, to which the water runs from the pond in the foreground, and indeed from every part of the enclosure, since the levee walls, being of gravelly material, “leak like a sieve” in the more porous places, with the entire river outside to draw on as a reservoir of supply. The maximum water pumped under these conditions, to keep the cofferdam dry, was probably not more than 1,500,000 gallons per day—which would be “some job” for the little boy with his cupped hands.

Such an amount, however, with so large a cofferdam, is all in the day's work. That is what the pumps are for. The pumpage was in fact surprisingly small, the thick gravel wall of the cofferdam quickly silting up with suspended clay from the muddy river water, caulking the leaks to a gratifying degree. A sheet piling cofferdam would also have leaked; and on account of the lack of room, the placing of the pumps within such a cofferdam is always troublesome and often expensive. Sheet piling cofferdams have been used in the Miami for building bridge piers, both at Hamilton and Dayton, and have at times given more trouble due to water than has been experienced in any case on the Black Street work.

The open excavation has a further advantage in permitting a much easier placing of the foundation piles for the pier, after the excavation is completed. With a sheet piling cofferdam, these piles (at Hamilton 20 feet in length), would have had to be swung, “spotted,” lowered and driven through the criss-cross of brace timbers within the enclosure. With the earth cofferdam these operations were all done in the open without this interference. Thus at Hamilton as many as 52 piles were swung, “spotted,” and driven home, with an average penetration into the gravel of 18 feet, in one ten-hour shift; which is “going some,” as any construction worker who is “onto his job” will understand.

Here again the remarkable adaptability of the dragline excavator as a construction tool was demonstrated. It was converted into what was virtually a locomotive crane travelling on caterpillar traction, for handling the pile driver. The bucket was removed. The “leads” of the pile driver—(the vertical timber guides in which, seated on top of the pile, it follows the latter down)—were hung from the end of the dragline boom by a wire cable lashing. (See Fig. 265). By swinging the boom, and

by running the machine backward or forward on its caterpillars, these “leads” were “spotted” over the place where the pile was to be driven. The “boom fall”—(the cable running back overhead from the boom end, then down to a hoist engine drum in the house)—was then slacked away, bringing the heavy weight of the boom to bear on the top of the lead frame, pushing it about two feet into the gravel. Firmly supported thus by the boom above and the gravel below, the usual guy ropes employed to steady the leads (and requiring readjustment for each pile driven), were made unnecessary. With 130 to 150 piles to drive for each pier, the saving in this one little item of guy rope adjustment was appreciable. The load cable of the dragline (unhooked from the bucket and passed over a pulley lashed to the boom end), then picked the pile up from the heap, and swung it into place between the leads. The pile driver (hung in the leads by the hoist cable of the dragline), was then lowered onto the top of the pile, and the driving began. Steam for the pile driver was supplied from the dragline boiler through a flexible hose carried up the boom.

Of the objections which may be raised to the method of open excavation used at Hamilton, the most obvious is the much greater quantity of material to be excavated, due to the flat slopes of the enclosing levee wall; but this is largely offset by the much less cost per yard of such work done in the open by the dragline bucket. Probably also, in cases, the material of the river bottom might be unsuitable. High water again, if it comes while the work is on, is likely, especially with silty material, to wash away part of the levee, or perhaps all of it, and deposit it in the bottom of the excavation. At Hamilton the river rose only once so as to flood the cofferdam, carrying away one corner and a side. Fortunately, very little of the material was deposited in the excavation, so that the damage was readily repaired and the cofferdam again pumped out. The upper ten feet of the Hamilton river bed was porous gravel, with a more or less clay-cemented deposit below, the entire excavation averaging about 20 feet below the normal stream bed.

The advantages of the method, as set forth above, may be summarized as follows:

The quicker handling of the bucket due to lack of interference from a network of braces.

The superiority of the dragline over the clamshell bucket as an excavating implement.

The superior efficiency of the caterpillar dragline in handling the pile driver.

The cutting out of pump cost during excavation.

The cutting out of the costs due to sheet piling and bracing.

Considering the simplicity and directness of the method, and in the light of the experience at Hamilton, it would seem to be of a considerably wider application than it has had. Its neglect is perhaps due to the apparent lack of general information among engineers and contractors regarding the merits of the dragline excavator as an allround construction tool. The gospel of the dragline needs to be more widely spread.

An objection to the dragline excavator is its cost. A machine of the size and type used at Hamilton can be bought in fair second-hand condition for from \$20,000 to \$25,000; or new for about \$38,000,

of which in the latter case about \$12,000 can be charged to the caterpillar traction. The expense and time required to erect the dragline machine is also somewhat more than in case of the clamshell. The Conservancy forces were fortunate in having the Hamilton machine as a regular item of construction equipment, which only needed to be turned to the new use. The 70-foot boom and 1½-yard bucket of this machine are considered by Mr. Eiffert, the division engineer at Hamilton, to have proved best adapted to the Black Street job. It should be said, however, that a smaller machine, costing two-

thirds to three-fourths as much, could probably have done the work at a saving as compared with the usual equipment, though not as cheaply as it was actually done.

It might be also—(although the caterpillar has undoubted advantages)—that a stiffleg derrick on the ordinary skids and rollers and equipped with a dragline bucket—(such a machine as did the embankment building on the Ohio Electric line, described in the Bulletin for December, 1920)—would be worth the consideration of a contractor who lacked a dragline and had a job of pier building in hand.

December Progress on the Work

GERMANTOWN

Outside of placing the slope revetment just below the outlet works, which was finished during the month, the entire work of the month has been dismantling.

The large dragline is entirely dismantled and moved off the job, as is also the steel guy derrick. The dragline is shipped to Piqua; the derrick will go to Franklin. The entire blacksmith shop has been also dismantled and billed to Franklin.

The last meal was served in the mess hall Saturday, January 29.

All buildings that were for sale in camp have been sold at present writing and the several buyers have started to wreck their buildings. The first sale of buildings was held Wednesday, January 26, when ten buildings were sold at public auction. By Saturday, January 29, the entire camp was disposed of.

A. L. Pauls, Division Engineer.

January 31, 1921.

ENGLEWOOD

The only item of actual construction work in progress during the past month was the excavation of the permanent spillway. At this place one large electric dragline has continued digging, passing the excavated material into a levee paralleling the spillway outlet.

Numerous items of plant have been overhauled, including locomotives, pumps, draglines, etc. The large steam dragline has been partially dismantled and the floor girders, which were not sufficiently strong to stand up under the strain of heavy digging, have been reinforced. Car bodies have been repaired, and locomotive wheels turned down to true shape. Advantage was taken of the favorable market to lay in a supply of lumber for spillway forms and general stock. Coal has been coming in as purchases could be made to advantage.

New tracks for handling material in the borrow pit have been laid, as has a return track down the side of the dam from sump No. 4, which will be constructed in the spring.

H. S. R. McCurdy, Division Engineer.

January 15, 1921.

LOCKINGTON

During the past month only a small amount of work has been done, as the job was practically closed down for the winter on December 23. The work has been confined to odds and ends that could be worked upon to good advantage and that should be out of the way by the time work is resumed in the spring.

Repairs were made to various pumps and pipe lines, sections in the dredge pipe lines were sorted according to their future usefulness and relaid where they would give the longest service. Stone that had been taken from the pit and stored in piles about the dam, has been gathered and laid on the slopes of the dam and outlet channel. Some clearing was done below the highway bridge over the outlet channel, thus removing an obstruction to the heavy current along the west bank of Loramic Creek.

Duncan is making good progress on drilling for blasting the hard clay banks of the borrow pit.

Barton M. Jones, Division Engineer.

January 29, 1921.

TAYLORSVILLE

The Lidgerwood dragline was in place and started excavation on the outlet channel on January 10. It has made good progress since. The excavated rock is being taken from the dragline in 12-yard dump cars and dumped on each side of the river in the flat downstream toe of the dam.

The dredge pump shells are being patched and new liners and runners put in. The four 6-inch high pressure pumps are being moved from the west bank of the river to the east bank alongside of the other water pumps and just above the dredge pump.

The warehouse and shop has been moved about 400 feet south from the original location so as to clear the outlet excavation.

Very little has been done on Road 12 this month on account of the frozen condition of the ground.

O. N. Floyd, Division Engineer.

January 27, 1921.

HUFFMAN

The work during the past month has been concentrated on the placing of hydraulic fill in the dam. This work has been carried on without any marked hindrances on account of winter weather.

62,600 cubic yards of material were pumped into the dam during the month of December.

The steam dragline has completed the downstream slope up to elevation 810 (about 25 feet above the valley floor), and is now shaping up the miscellaneous embankment along the outlet works below the dam.

The ditcher is building the upstream slope up to elevation 815. This will be completed the full length of the dam about February 1. This height is sufficient to prevent the embankment from being overtopped by spring floods.

The oversize rock rejected by the revolving screen at the pumping plant is being placed for paving on the upstream slope of the dam as fast as it accumulates.

C. C. Chambers, Division Engineer.

January 22, 1921.

DAYTON

River channel excavation below Stewart Street was started by dragline D-16-15 on January 20, 1921. Hauling material on scows was discontinued January 17, when the last scow load was taken from the channel above Fifth Street bridge. Wrecking of the large spud scow was completed January 20.

D-16-16 is preparing to lower the 24-inch water main above Fifth Street bridge to a position below the finished channel grade. D-16-8 is grading the spoil bank upstream from Wolf Creek. D-16-19 is cleaning up a small quantity of channel excavation on the left bank above Dayton View bridge, placing the material in an adjacent spoil bank.

The Ohio Street retaining wall has been completed and the wall along the Delco-Light property between Keowee Street and the C. H. & D. R. R. tracks is being constructed. No other concrete work is under way.

J. C. McCann is making good progress with the earth work on Mad River.

Price Bros. Company is removing the old stone wall above Keowee Street. Part of the stone is being used as rip rap below the apron of Island Park dam, that work being done under contract with the City of Dayton.

The Finke Engineering Co. has been awarded a contract for constructing the Apple Street sewer culvert.

To date 58,260 cubic yards of sand and gravel have been issued from the gravel plant. The plant is working intermittently because of unfavorable weather.

Previous to January 1, 884,000 cubic yards of channel excavation (Item 9) had been removed and 170,000 cubic yards of levee embankment placed. The total yardage handled in accomplishing that work amounted to 1,924,000 cubic yards. These figures do not include 105,000 cubic yards of excess excavation for scowing canals.

C. A. Bock, Division Engineer.

January 26, 1921.

HAMILTON

The electric dragline D-16-18 has completed the work between the Main Street bridge and the Columbia bridge, with the exception of trimming up a part of the west bank. The tracks and trestle have been removed. The total channel excavation, Item 9, to January 21, 1921, was 842,000 cubic yards.

Piling for false-work have been driven in spans 5, 6 and 7, Black Street bridge. The excavation for the west abutment has been completed and two-thirds of the concrete has been poured.

Price Brothers are continuing their work of driving wood piling for the toe wall of the slope revetment.

Excavation is being continued at the Black-Clawson wall, the driving of sheet piling having been completed.

C. H. Eiffert, Division Engineer.

January 22, 1921.

UPPER RIVER WORK

Troy—The total amount of channel excavation (Item 9) handled under the Jeffrey contract, to date, is 25,000 cubic yards. The dragline D-16-21 has nearly finished the excavation under both spans of the Market Street bridge since the last report, and has also undergone repairs to the propelling machinery during the last two weeks. At present it is starting on its river crossing just above the Market Street bridge.

The C. & C. Hauling Co. is still excavating in the river channel between Market Street and the B. & O. R. R. with both shovels. The gravel part of the excavation is being placed in the Adams Street-Market Street levee and the earth used for top soil on the Market Street spoil banks. Their yardage to date amounts to 70,000 cubic yards (Item 9).

The Finke Engineering Co. has hauled about 2,500 cubic yards of material into the south levee and south approach of Harrison Street during the last month, making their total yardage 27,000 cubic yards.

Piqua—Four cars, carrying parts of the electric dragline for the work at Piqua, have arrived. They are being unloaded at the Western Ohio freight station by the derrick.

C. F. Griffin, Assistant Engineer.

January 25, 1921.

LOWER RIVER WORK

Miamisburg—During the past month Cole Bros. have placed 11,600 cubic yards of material in the east levee and excavated a temporary channel for the tail race of the Ohio Paper Co. A portion of the levee between the Miamisburg Paper Co. and Sycamore Creek has been left temporarily incomplete, owing to lack of material in the adjacent borrow pit. The dragline has just completed the embankment on the south side of Sycamore Creek between Main and Fourth Streets. The next work to be done will be the construction of the levee on the north and south sides of Sycamore Creek between Fourth Street and the Big Four R. R.

The elevation of the C. & D. Traction line over the levee at the north edge of town has just been completed. The maximum raise was six feet at the center line of levee; total length of track raised 800 feet. The material was hauled by the Traction Company from their borrow pit at Carrmonte in 12-yard dump cars, furnished by the District; the cars were loaded by Thos. E. Daniel & Son, a "whirly" shovel being used; the track raising was done by the Traction Company's forces. The work required 13 days to complete.

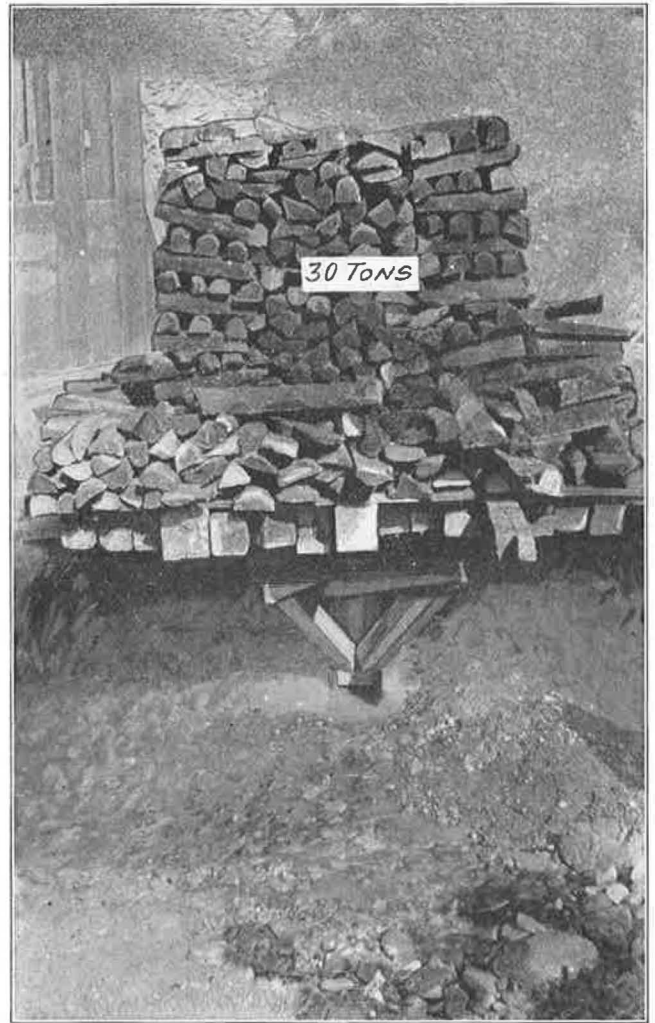


FIG. 266—FOUNDATION PILE SUPPORTING THIRTY TONS OF PIG IRON

The pile was 8 inches in diameter and 19 feet long, driven 16 feet into the gravel below the bridge pier. This was a small pile, most of those driven being 9 to 14 inches in diameter and averaging 20 feet long, driven 17 to 18 feet into the gravel. 130 to 150 of these piles were used under each pier, driven 3 feet apart each way, the total number depending on the pier width and this on the particular location. To make the test, a 12 by 12-inch timber about 7 feet long was braced on top of the pile, a steel plate being interposed to prevent mashing of the timber. Cross timbers about 6 by 8 inches by about 7 feet long, were then laid across the main timber, and braced to the pile below. The pig iron was placed on the 7 by 7-foot platform thus formed, as shown in the picture. It was hauled by wagon, after being weighed on the Niles Tool Works scales, the loading taking about two days, and the timber platform being supported by jack screws at each corner during this process. The jack screws were then removed, permitting the full weight of the 30 tons to come upon the pile. There was a slight settlement for about three days, amounting in all to $\frac{3}{4}$ inch, most of this coming early in the test. No further settlement could be observed after the third day, although the total time of the test was continued for a week. Much of the settlement probably occurred in the timber platform, the observations being taken on the top of this, due to difficulty in taking levels on the pile itself underneath the center of so large a platform. This pile, in driving, yielded about $\frac{1}{2}$ inch under the last blow of the pile driver hammer, which was more than the average with the piles under the piers as driven. The usual last yielding was an inch to the last 30 to 40 blows. The driving in some cases was carried "to refusal," i. e., till there was no farther measurable yielding. The safety of a street bridge pier, supported on 130 to 150 such piles, in addition to the direct support of the intervening gravel, will be evident.

Franklin—The District's forces, under direction of Mr. Armstrong (formerly construction superintendent at Germantown Dam) are erecting a Bucyrus Class 14 dragline with 60-foot boom on the east bank of the tail race of the American Writing Paper Co. The first work to be done with this machine will be the excavation for the conduits and flood gate structure for this tail race. Work on trestle construction for the east levee will soon be started.

Middletown—Work on the Hydraulic Street wall has been delayed by cold weather. Five hundred twenty-five linear feet of wall was poured this month.

F. G. Blackwell, Assistant Engineer.

January 29, 1921.

Big Four and Erie—There is very little to report for the month's progress on these two railroads. Mr. M. K. Frank has removed the rail and bridges off of the Old Erie line with the exception of about 1 mile of track. The Big Four track will be taken up later by the Big Four Railroad.

The District forces have dismantled the signal plants and are removing all salvageable material.

Ohio Electric Railway—The Railway Company have not completed the bonding of the rails and operation of the

line from Huffman will be delayed until this work is completed.

Baltimore & Ohio Railroad—Work completed.

Albert Larsen, Division Engineer.

January 20, 1921.

RIVER AND WEATHER CONDITIONS

River stages were comparatively low throughout December. Although small rises of a foot or two occurred at times, no freshet of appreciable size resulted.

The total rainfall for the month varied from 1.54 inches at Dayton, 1.08 less than normal, to 2.51 inches at Pleasant Hill. The accumulated deficiency at Dayton since January 1 amounted to 3.98 inches.

The local Weather Bureau records show that the mean temperature for the month was 34.0 degrees, or 1.1 degrees greater than normal; that there were 3 clear days, 9 partly cloudy days, 10 cloudy days, and 10 days on which the precipitation amounted to 0.01 of an inch; that the average wind velocity was 14.0 miles per hour, the prevailing direction being from the west; and that the maximum wind velocity for five minutes was 52 miles per hour from the west on the 15th.

Ivan E. Houk, District Forecaster.

January 31, 1921.

Construction Details of Black Street Bridge Piers

The general design of the piers is indicated in the first article in this issue, showing the large margin of safety provided as compared with the Third Street bridge, Dayton, where the partial failure of one pier makes the matter of peculiar present interest. Plan of the construction layout is given in Fig. 267 and of the piers in Fig. 268.

The foundations are on sand and gravel, more or less cemented with clay. Where in one or two cases clay strata were encountered, this material was removed and the foundations carried deeper. The maximum pressure below any pier occurs at one edge of the footing when one adjacent arch is loaded with the maximum live load. At Black Street this pressure is a $3\frac{1}{2}$ tons per square foot. With the entire bridge loaded this reduces to $2\frac{1}{2}$ tons. To provide ample resistance to these pressures 130 to 150 piles are driven under each pier footing, spaced 3 feet each way, the number depending on the width of footing and this in turn on the conditions at the particular pier. The piles are of 20-foot length, driven 18 feet into the sand and gravel and imbedded at the top 2 feet in the concrete of the pier footing. The piers are carried down 12 to 16 feet below the improved channel grade, so that the danger of scour reaching the pier bottom is remote. However, if it occurs, the penetration and spacing of the piles is such that the entire material immediately underlying a pier might be washed away, and the pier would still stand, supported by the piling. This supporting power was determined by actual test, as well as by observations on the piles under the last blows of the pile driver. The test pile, under its load of 30 tons of pig iron, is shown in Fig. 266. The tests and observations together give proof by demonstration that the maximum loads indicated above can be carried by the piles alone without failure. The initiated will understand the ample margin of safety provided.

The pile driver was a No. 3 Vulcan, with 1,800 pound tup, cylinder 8 inches by 30 inches and total weight of 3,800 pounds. Including the leads the total weight was $2\frac{1}{2}$ to 3 tons.

The pier footings vary from 21 feet by 62 feet to 24 feet by 62 feet, according to the conditions encountered. They are reinforced transversely to distribute the heavy loads on the pier shafts evenly over the material below the footings. Bending effects in the shaft (due to unequal loading of the arches on each side), are resisted by light reinforcement near the shaft surfaces, this reinforcement also acting to prevent surface cracks. Horizontal grooves or "rustications" are carried around the surfaces of the shafts at regular intervals, to break up the monotony of appearance, acting in this respect like the courses in stone masonry.

The method of open excavation for the piers has been used throughout, having been found so efficient on pier 3, the first pier excavated, that its use was immediately extended to pier 4, then to pier 2, then to piers 5 and 6. Pier 1 remains to be done. To save moving the pump outfit, the excavation for pier 3 was extended to include pier 4, and later pier 2, all in one large cofferdam. Seepage did not increase with these extensions, due to the silting up of the gravel of the cofferdam by river mud brought down in suspension during a rise in the river. The seepage with all three piers included was indeed scarcely greater than with pier 3 alone. The maximum was about 4,000,000 gallons per day, kept up for about a week, a quantity about equal to $\frac{2}{3}$ the daily consumption of the city of Hamilton. The excavation for piers 5 and 6 was also thrown into one (shown in the foreground in Figs. 259 and 265). In to this double excavation the seepage was not measured, but was probably not more than 1,500,000 gallons per day.

After the concreting had been completed for piers 3 and 4 to above water level, a cross dam was thrown between piers 2 and 3. The levees of the cofferdam between piers 3 and 4 were then cut and the river turned through. The dragline, which did this work, was so maneuvered that while finishing it the machine stood on the west levee of the cofferdam and was thus able to proceed at once with the excavation for the next piers, 5 and 6, concrete work on

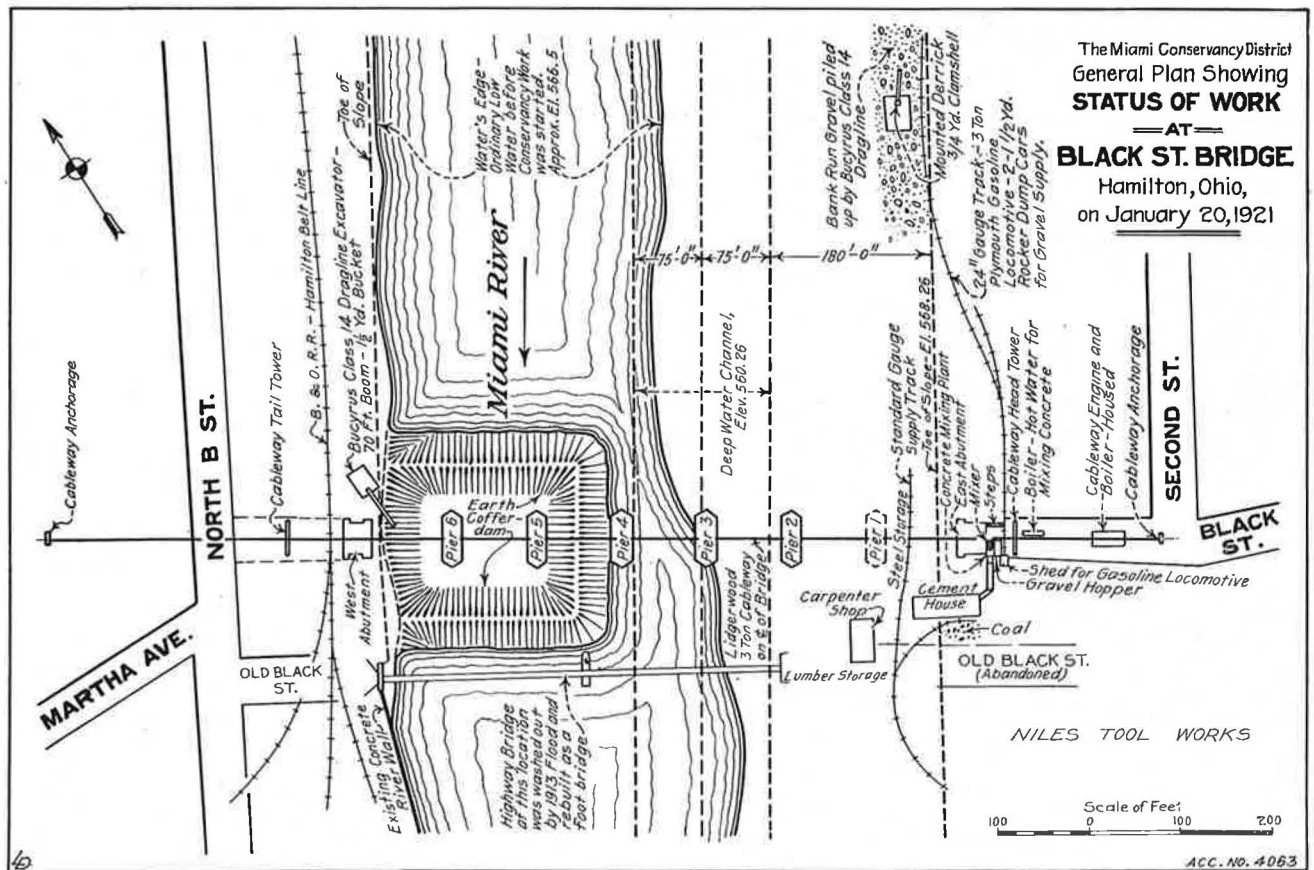


FIG. 267—PLAN SHOWING STATUS OF WORK AT BLACK STREET BRIDGE, HAMILTON, JAN. 20, 1921.

pier 2 proceeding simultaneously. The seepage into the excavation at pier 2, after this had been isolated by the cross dam, was so slight that it was easily handled by a 6-inch pump working part time.

The pumps in the triple excavation for piers 2, 3 and 4 were an 8-inch running constantly, and an 8-inch and a 6-inch running part time. They handled the 4,000,000 gallon maximum without difficulty. The 6-inch pump had an 8-inch suction, one 8-inch had a 10-inch suction, the other a 12-inch. All were electrically driven, with 30, 40 and 50 horse power motors respectively. For piers 5 and 6 two of the above pumps were first used, superseded later by one 12-inch pump with 15-inch suction, driven by a 75 horse power motor. All the pumps were of the centrifugal type. Fig. 264 shows a pump setting, and also the appearance of the cofferdam. The horizontal discharge pipe was, of course, laid in the open and later covered by the dragline in building the cofferdam. The river is to the right outside the picture.

The pumps were set with a normal lift of 20 feet, increased at times to 22 or 23 feet. This, of course, was in the face of "conventional good form," which is to reduce the lift by setting the pumps as low as possible in the excavation, in order to avoid air leaks and loss of time in priming. The reason for the high setting was to avoid flooding the electric motors by the water rising in the excavation when the electric power shut down, a contingency occurring quite frequently. To meet this condition the pumps were set as high as possible and still lift the water. They worked well at the lift mentioned.

The dragline excavator used was a Class 14 Bucyrus, with 70-foot boom and 1 1/2 yard bucket. It weighed 85 tons with the caterpillars, the latter with its drive mechanism weighing about 29 tons. The weight gave no trouble on the levees, the latter standing up perfectly under the load. The caterpillars were a distinct aid in maneuvering the machine around the cofferdams, and also have an advantage in enabling a quick "getaway" in case of high water. The machine was bought at second hand for \$18,000.

The chief risk in using the method of open excavation (see article on page 104), is, of course, that high water may wash away the earth of the cofferdam levees. At Hamilton, on November 22 and 23, this happened. The river rose 9 feet, and flowing mostly in a rather narrow channel between piers 3 and 4, acquired a high velocity. As a result first one corner and then all of the east side of the cofferdam enclosing piers 5 and 6, (the farther side as seen in Fig. 259, which was taken only a day or two before the rise), was washed away, including also about half of the north and south sides. Only the upper ten feet of the levees was affected, the material below remaining in place. Fortunately, the eroded material was not deposited within the cofferdam, so that after the levees had been rebuilt by the dragline and the water pumped out, it required only about two hours' hand work to clean up the excavation. The pump motors and loose material and equipment had been removed by the cableway before the break occurred. The delay due to the accident was just two weeks.

The concreting layout is shown in Fig. 267, and the mixing plant in Fig. 270. Gravel for the concrete was dug from the river bed by the dragline, and piled in a stock pile on the east bank a little north of the bridge site. An electrically operated stiffleg derrick, running on a 28-foot gage railway, and equipped with a 34-foot boom and a $\frac{3}{4}$ cubic yard Owens clamshell bucket, loads this material into 1½-yard Western rocker dump cars. These are transported to a storage hopper at the mixing plant by a 3-ton Plymouth gasoline locomotive on a 2-foot gage track. The storage hopper, of 34 cubic yards capacity, feeds the material in turn through chutes into the batch hopper of the mixer on the charging floor. The mixing plant is on the east bridge abutment. The oversize rock, (above 6 inch), is screened out by a gridiron steel screen over the mouth of the storage hopper. The cement is wheeled from the cement house to the charging hopper by hand trucks. The mixer is a one-yard Smith. It discharges directly into the bottom dump bucket, which stands in a pit directly below the cableway. The latter transports the bucket from the mixer to the work, where the concrete discharges into a hopper, whence a chute takes it to the forms.

Tests made on the bank run gravel which is used show that the ratio of sand to gravel is about 1 to 2 at all times. For the mass concrete of the piers and abutments, therefore, no screening is necessary except to reject the oversize mentioned. The gravel is so clean that it requires no washing. For the bridge arches, floors, etc., the gravel will be screened and proportioned as required.

The mix employed in the piers varies with the location. In the footings an approximate 1:3:6 ratio is used, 4 bags of cement being charged into a batch of concrete. The measuring is virtually done in the concrete bucket which transports the material to the forms, enough of the bank run gravel being run

into the charging hopper, with the 4 bags of cement, to just fill the bucket after being mixed and discharged. For the stems of the piers 5 bags of cement are employed per bucket; and for the pier tops and for the last 8 or 10 feet of the upstream pier nose, 6 bags are used.

The cableway is a Lidgerwood of 5 tons capacity. The towers are 80 feet high and 800 feet apart, the hoist engines being housed on the east bank, with the 60 H. P. boiler which feeds them. The cables comprise the main suspension cable, the fall line, the button line, and the endless cable which pulls the carriage. No trip line is used, the bucket being dumped by hand. A fuller description of this cableway will be given in a future issue.

Five of the six piers, the east abutment, and about half the west abutment, are completed. Pier one still remains to be built.

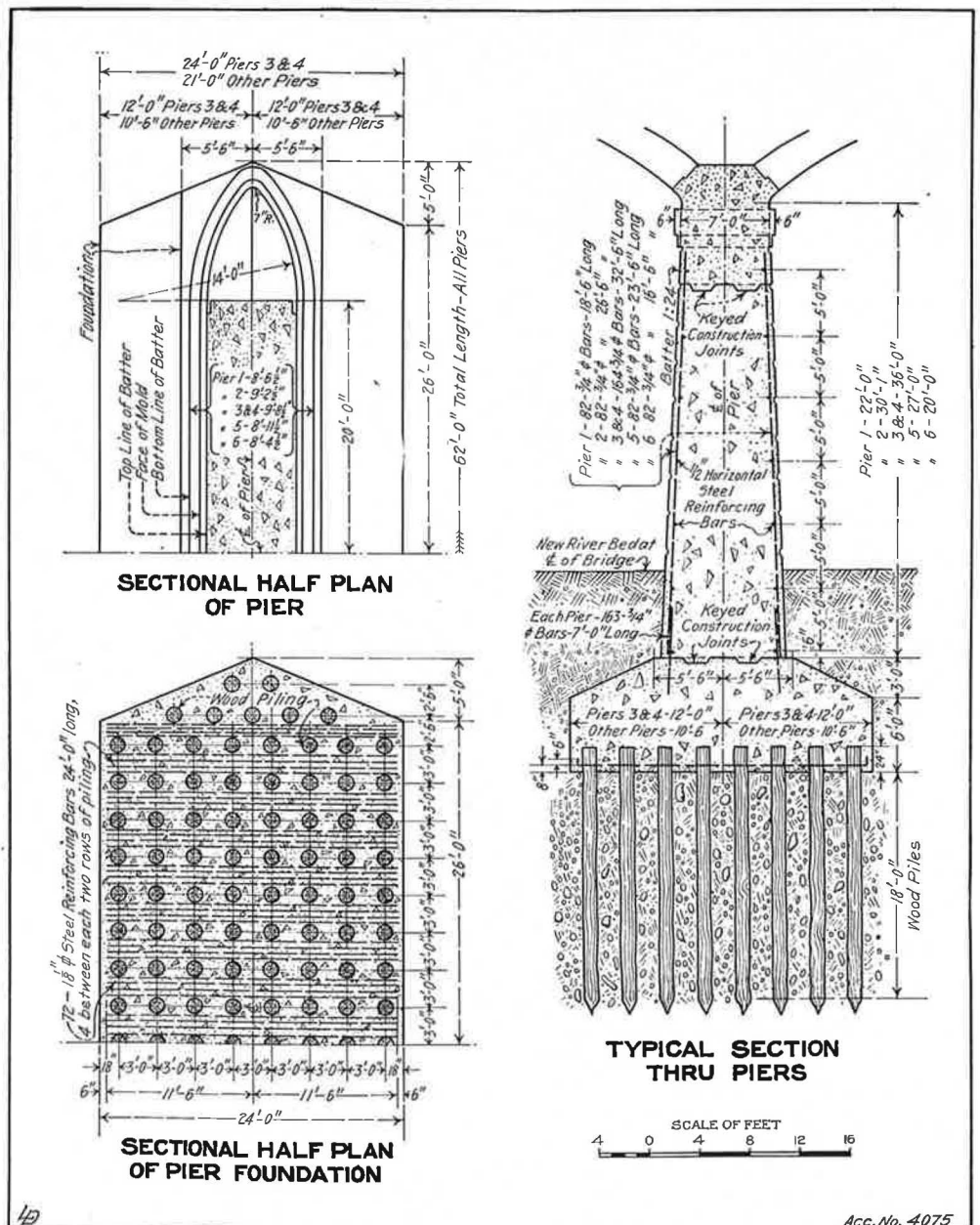


FIG. 268—DETAILS OF BLACK STREET PIERS.

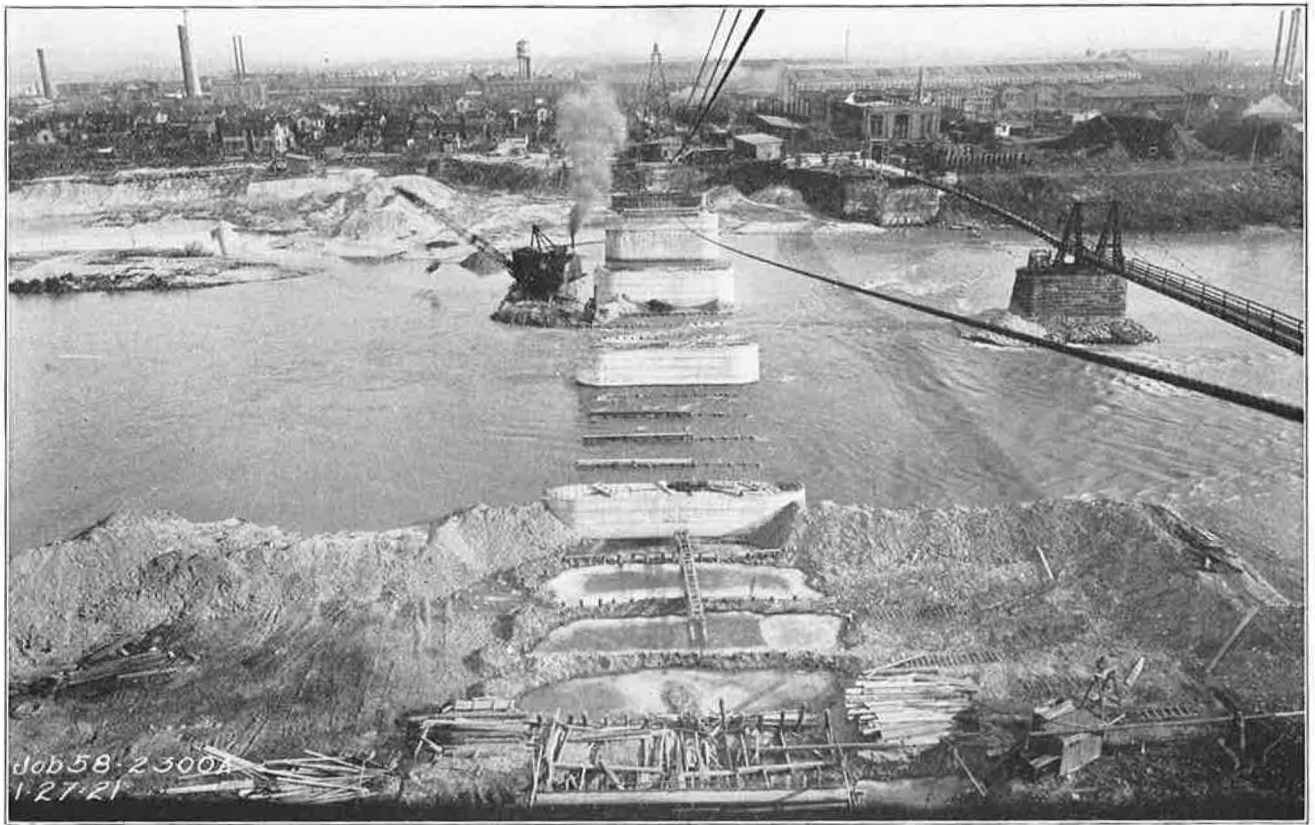


FIG. 269—BLACK STREET BRIDGE UNDER CONSTRUCTION, JANUARY 27, 1921, SEEN FROM THE WEST CABLEWAY TOWER.

This should be compared with Fig. 259, taken from the same tower on November 19, 1920. The excavation seen in that figure, with its enclosing earth cofferdam, has here disappeared, the two nearest piers in this picture occupying the place of the piles and forms (for pier 5), in the foreground of Fig. 259, and of the nearest pool in that figure, (which occupies the site of pier 6). The river here is seen flowing in a wide channel, occupying most of the space, between piers 2 and 6. In Fig. 259 it is almost all flowing between piers 3 and 4. The east cableway tower is seen in the distance on the pier center line. The four cables in the foreground are the steel cables of the cable way, stretched between the east tower and the one from which the picture was taken. The foot bridge at the right was built to replace the old Black Street bridge, the latter being swept away in the 1913 flood.

Germantown Camp Houses Sold

Practically the Entire Camp, Including 22 Houses, 11 Bunkhouses, and 31 Other Buildings, Sold Within Three Days.

The recent completion of the Germantown dam brought the officers of the District, for the first time, "up against" the problem, how to dispose of the houses and other equipment constituting a Conservancy construction camp. These camps were planned to meet not only the unusual conditions incident to the nature and size of the flood prevention project, but the abnormal difficulty of obtaining and keeping an efficient and desirable class of workers under the stress of war. They were made into attractive villages, whose location in every instance but one is in the vicinity of electric and steam lines, and at such near distances from the cities of the valley as to render it possible to make them permanent homes for workers or those in search of a summer home.

The Germantown camp was the one location referred to, not in the immediate vicinity of traction or other rail service. Also, this camp was the first which it was necessary to put on the market, and selling values, for this reason, as well as on account of the unusual industrial circumstances, were pretty

much an unknown quantity. What were the houses worth, and how could that worth be got?—were questions no one was quite prepared to answer.

In these circumstances it was decided to put up a limited number of houses—eight was the final number adopted, of various types and sizes—on sale at public auction. If a reasonable number of people could be got together—real candidates for ownership—supply and demand would meet, and the question of worth be settled.

The first job was to get a crowd, and to this end a thorough-going campaign of publicity was undertaken. It was put under the direction of Mr. Hosea Moyer, the District's labor agent and an old advertising man. The work included a newspaper program covering all publications within 25 miles of the Germantown camp; also a poster campaign over the same territory; and space in the Conservancy Bulletin. This advertising "drive" took a week. It was well worked out, and it paid.

The day of the sale, January 26, was cloudy and cold, but the weather cleared at noon, so that a

crowd of 400 to 500 people gathered by the time the auctioneering began. This was a new role for Mr. Moyer, but was excellently carried out, the bidding being brisk till ten houses and six sheds had been disposed of, the sale being so successful that it was continued after the original eight buildings advertised had been disposed of.

Prices having thus been set, negotiations were continued during the same afternoon by private sale, till by nightfall the sum realized in this way approached the total by the auction. The private sale continued during the remainder of the week, (the auction being on Wednesday) the demand being maintained until by Saturday noon practically the entire camp had been sold. The last buildings disposed of were sold to Mr. Howard Stine of West Carrollton, fourteen in a job lot. There still remain six buildings which are necessary for workers engaged in a few last bits of cleaning up on the dam, including buildings of the farm on which the camp stands, these buildings, used temporarily as camp houses, thus reverting to their original use. The buildings sold were 22 houses and cottages, 11 bunkhouses, a shop, a clubhouse, a first aid hospital, 2 warehouses, a school house, a garage, a boiler house, and 23 sheds. The plumbing and electric fixtures in the houses, (except the hot water tanks) were included with the buildings.

The unsold houses will be disposed of later in the present season, probably at private sale, after the work above referred to has been completed.

(Continued from Page 99)

PART IV—CALCULATION OF FLOW IN OPEN CHANNELS.

By Ivan E. Houk,

Hydrographer of The Miami Conservancy District.
283 pages, 6" x 9", 79 illustrations, 48 tables, paper covers; price 75 cents net, postpaid.

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By Sherman M. Woodward,

Consulting Engineer of the District.

343 pages, 6" x 9", 126 illustrations, paper covers; price \$1.00 net, postpaid.

The order of presentation is arranged to show: (1) the general nature of the Miami Valley flood control problem; (2) a general comparison of the various plans considered and the reasons for the adopted plan; (3) a more detailed description of the adopted plan; (4) a detailed technical discussion of the principles, theories and methods of the hydraulic calculations required.

The sand and gravel were dug from the river bed by the dragline excavator, and piled in a stock pile next the east bank a little north of the bridge site. They were transported to the mixing plant in 1½-yard Western rocker dump cars on a 2-foot gage track, drawn by a 3-ton Plymouth gasoline locomotive, (seen, with two cars in the dumped position, at the top of the picture). The cars dump the material into a 34 cubic yard storage hopper, (seen just below the cars) whence it is again drawn into a batch hopper, (seen just to the right of the mixer) as it is wanted. The cement to mix with it is stored in the house, one end of which is seen at the right, and wheeled to the batch hopper in hand

(Continued below)

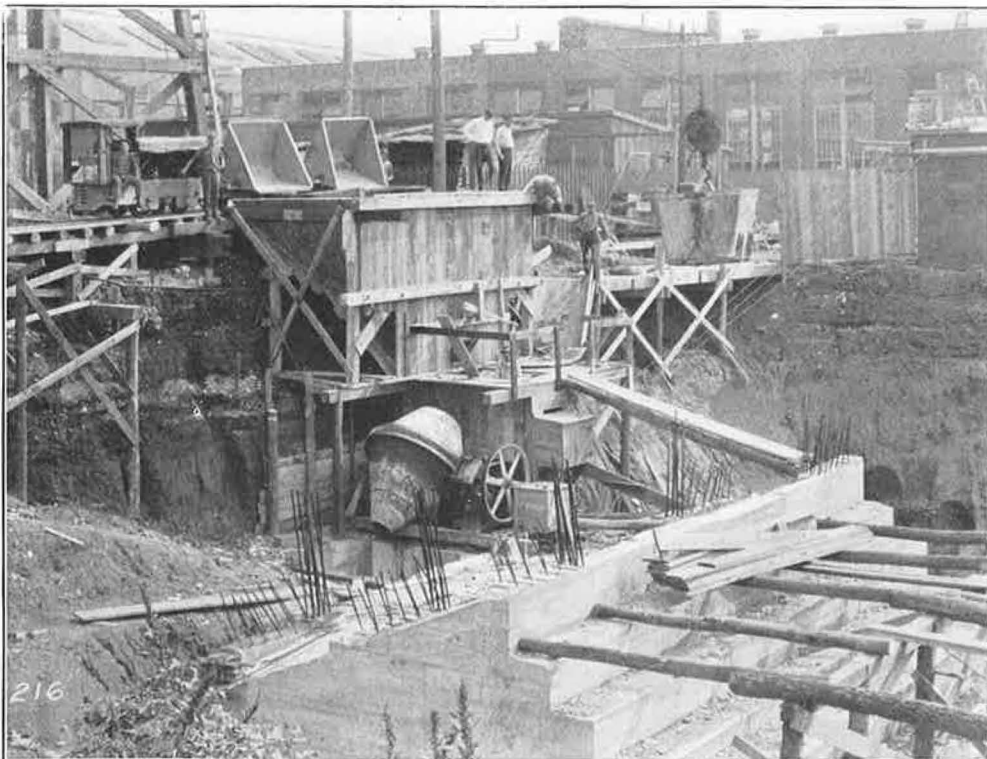


FIG. 270—CONCRETE MIXING PLANT, BLACK STREET BRIDGE. SEPTEMBER 10, 1920.

trucks which dump it down the chute seen just below the man. The mixer, (shown in the dumping position) is a "one-yard Smith." It unloads into a bucket standing in a pit which is seen below the mixer mouth. This pit is directly below the Lidgerwood cableway, (not seen in the picture) on which is a travelling carriage which picks up the bucket (seen hanging to the right of the man) and carries it to a hopper built over the pier which is being "poured." From the hopper, gravity chutes take the concrete to the forms below. The cableway is stretched along the bridge center line between two timber towers erected on shore at either end, and thus serves any part of the bridge construction, handling not only concrete, but forms, steel, pumps, etc.



FIG. 271—GERMANTOWN CAMP ON DAY OF AUCTION SALE OF HOUSES, JAN. 26, 1921

The work on the Germantown dam being completed, the camp houses were no longer needed. To determine a proper selling price 8 houses were put up at auction on January 26. Following a week's advertising campaign ten houses were disposed of at this auction, following which the remainder of the camp was disposed of at private sale in the three following days.



FIG. 272—BLACK STREET BRIDGE PIERS, SEEN FROM FOOTBRIDGE. JANUARY 8, 1921.

This shows piers 2, 3, 4, 5, and 6, in the order named, right to left. It should be compared with Fig. 260. The second pier in the picture (pier 3) has been carried to a little later stage than any of the others, the pier shaft being complete, and the "skewback" surfaces ready to receive the springing of the arches. The bars of reinforcing steel may be seen "sprouting" from these skewback surfaces, ready to be wired inside the arch forms to be built the coming season, to become imbedded later in the concrete of the bridge arches, which they will thus tie with the steel to the concrete of the pier top.

THE MIAMI CONSERVANCY BULLETIN

MARCH, 1921



FIG. 273—DRAGLINE EXCAVATOR DIGGING MATERIAL IN ENGLEWOOD BORROW PIT,
OCT. 28, 1920

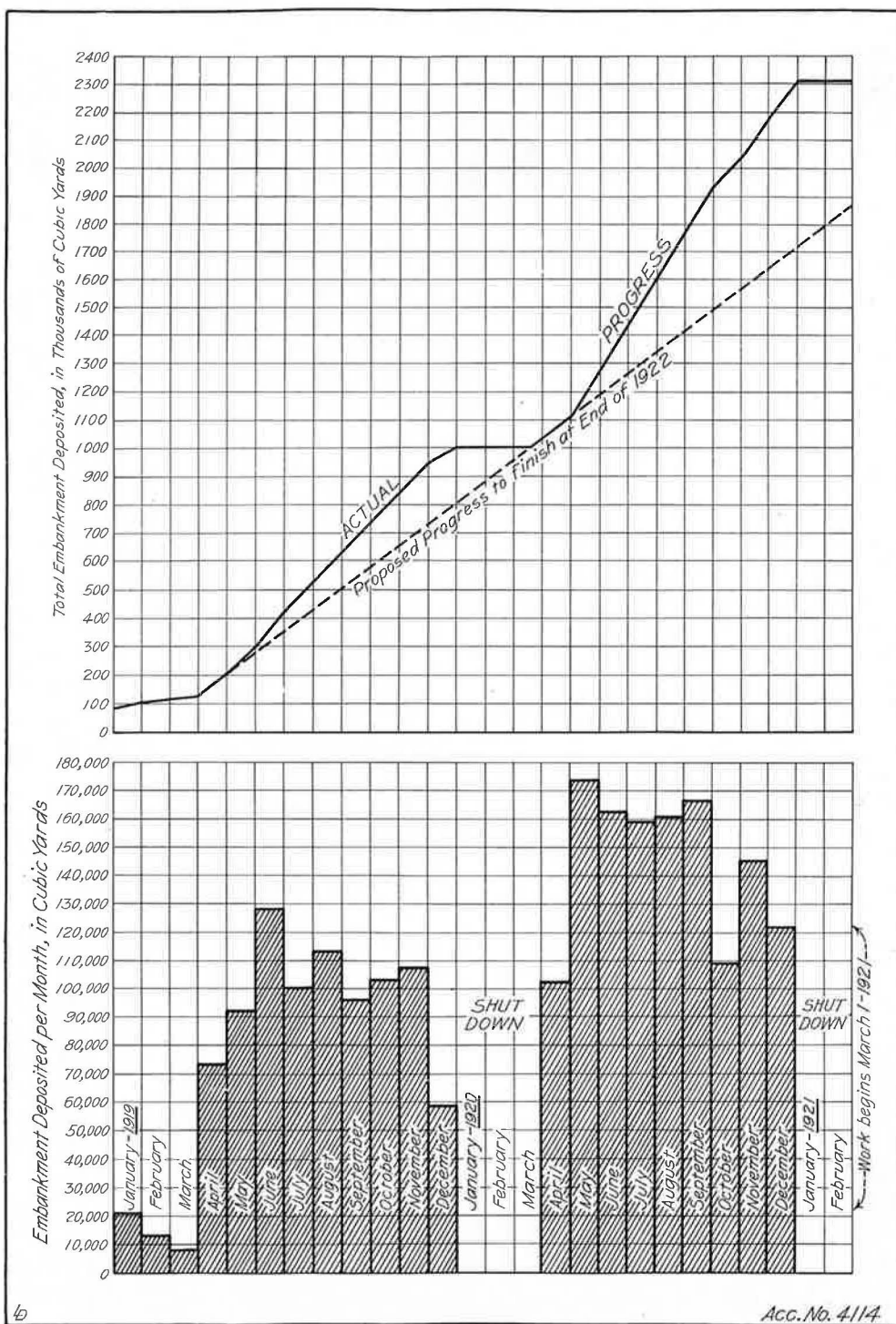


FIG. 274—DIAGRAMS OF PROGRESS, ENGLEWOOD DAM EMBANKMENT

The lower diagram shows the amount of earth deposited in the embankment each month during 1919 and 1920, each vertical shaded rectangle representing one month's work. The height of the rectangle is proportional to the quantity of earth deposited. A scale for approximate measurement is shown at the left, each horizontal space running across the diagram representing 10,000 cubic yards of earth. (A cubic yard being just about an old-fashioned dump-board wagon load). The more rapid progress during 1920 as compared with 1919, is evident.

The upper diagram shows the total earth deposited in the dam at any date, during 1919 and 1920, this being given by the upper line, marked "actual progress." The time scale corresponds to that in the diagram below. The scale at the left gives a measure of the earth deposited, each horizontal space running across the diagram representing 100,000 cubic yards in this case (instead of 10,000 as below). Thus at the end of December, 1919, the curve of actual progress had just reached a million cubic yards. The dotted straight line represents the line of proposed progress as given by the schedule laid down originally, to complete the dam at the end of 1922. Note that during 1919, including the three months' shutdown made necessary by the cold weather of the winter of 1920, the actual progress was just up to this proposed schedule. During 1920, however, the curve of actual progress rises much more sharply, and ends, even including the winter shutdown (two months long this time), far above the line of proposed progress. Work began in 1921 on March 1.

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

G. L. TERPFE, Assistant Engineer, EDITOR.

Building of Dam Embankments Resumed After Winter Shutdown

The pumping of earth materials into the various dam embankments was stopped, except at Huffman, at the end of 1920, to permit an overhauling of the machinery and equipment for the active work of the coming season, and also because during the cold weather of the winter months this work cannot usually be carried on at highest efficiency. At Huffman the work was continued owing to the desirability of pushing the embankment above the danger of overtopping by spring floods. At the other dams the embankments were at a height sufficient to render them already safe in this regard.

The winter has been so mild and open that the cold weather shutdown has been much shorter than it was a year ago, pumping being resumed at Taylorsville on February 25, and at Englewood and Lockington on March 1. At Taylorsville the materials are being pumped into the section west of the river, the same as last year. The river section will be begun later in the season, after the river has been turned into the new channel through the new outlet works, the downstream portion of this new channel being now in process of excavation. At Englewood the materials are being pumped into the river section. The west section (west of the temporary spillway), will be started a little later in the season, and pushed at the same time as the other two. At Huffman work has proceeded during the favorable weather of the winter almost as fast as during the regular season. During the coming season materials at Huffman will be pumped from both

the hillside and valley bottom borrow pit, the upper levels of the former having now been exhausted so that gravity flow alone will no longer carry the materials into the dam embankment. At Lockington the pumping begins with the dam embankment only 20 feet from the summit, so that the topping out of the dam will be finished early in the present season. At Germantown the stripping of the camp and the dismantling of the machinery and equipment, following the completion of the dam, have been brought practically to an end.

Interesting New Work Up and Down the River

Several interesting pieces of work in the smaller cities along the river are on the program for the coming season. One is the building of the flood gates for the hydraulic canal and for the tailrace of the American Writing Paper Company at Franklin. Excavation for the tailrace conduits has already begun, this work being done by the dragline excavator which dug the gravel material for the Taylorsville conduits (a Class 14 Bucyrus steam machine). The work at Franklin will be the subject of an early illustrated article in the Bulletin.

At Troy the chief interest is perhaps in the new bridge work. This includes a new steel span for the Market Street bridge, and work on the new concrete bridge at Adams Street. The excavation for the north abutment of the new steel span is under way and the steel has been ordered. Gravel and lumber for the abutment is on hand. The Adams Street bridge, which will cost approximately \$350,000, and which will be of the same general type

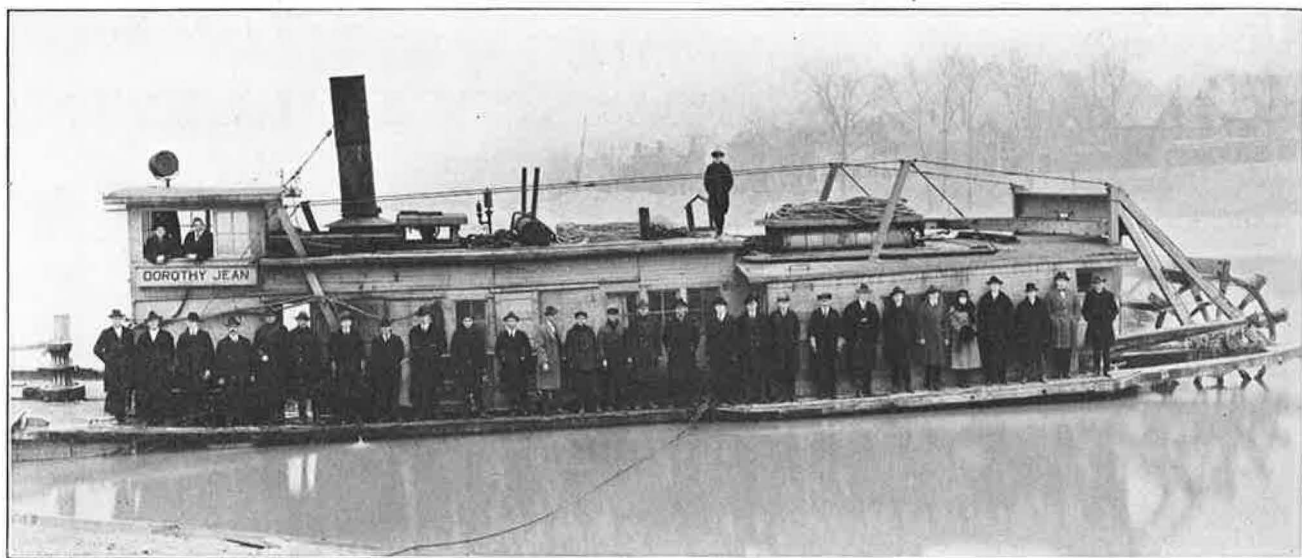


FIG. 275—THE PASSING OF THE DOROTHY JEAN. DEC. 10, 1920.

as the Black Street bridge in Hamilton, described in our last issue, will be begun later in the season. An article on this bridge is in preparation and will be presented in a later number.

The Passing of the Dorothy Jean

An unusual local interest attaches to the picture on this page, Fig. 275, because it marks the passing of the first, and last, steamboat which has ever run on the waters of the Miami River. She was built to transport materials excavated to make the improved river channel through Dayton, the material being loaded upon scows instead of dump car trains as at Hamilton, river conditions making the use of trains along the banks in Dayton uneconomical. She was built in the period between October, 1918, and February, 1919, in the Conservancy "shipyard" near Herman Avenue bridge, and took her maiden voyage February 27. She was of the usual stern-wheel Ohio River model, 70 feet in length by 20 feet beam, and drew about 2 feet of water. She was equipped with a pair of Barnes engines, 8 inch by 42 inch, developing 125 horse power. Her original boiler was of the locomotive type, built for 150 pounds pressure, but this proved insufficient, and was replaced by a Scotch marine type boiler, 66 inch by 117 inch, built for 175 pounds pressure. The scows she pushed were 40 feet by 120 feet by about 6 feet deep, taking a load of about 250 cubic yards, and drawing, thus loaded, about 5 feet of water. The usual summer flow of the Miami did not provide this depth, so that a low timber dam was built across the river just above Third Street, which raised the level there about 4 feet. The surplus material between Fifth and Washington Streets will be more easily transported by dump car train than by scow. Hence the work of the Dorothy Jean was discontinued with the end of 1920. She transported a total of half a million cubic yards of material.

The Character of the Engineer

The following, quoted from the ancient Roman engineer and architect, Vitruvius, shows that the ultimate foundation of an engineering work in the

character of him who builds it, was a truth as well understood then as now.

"Moral philosophy will teach the engineer to be above meanness in his dealings and to avoid arrogance. It will make him just, compliant, and faithful to his employer, and what is of the highest importance, it will prevent avarice gaining an ascendancy over him, for he should not be occupied with the thought of filling his coffers nor a desire of grasping everything in the shape of gain, but by gravity of his manners and a good character should be careful to preserve his dignity."

Review of Conservancy Technical Reports, Part VII

By Ivan E. Houk

Hydraulics of the Miami Flood Control Project—By Sherman M. Woodward, M. Am. Soc. C. E., M. Am. Soc. M. E., Consulting Engineer of the District, Professor of Mechanics and Hydraulics, State University of Iowa. Technical Report, Part VII, The Miami Conservancy District, Dayton, Ohio. Paper; 6x9 inches, 344 pages, 126 illustrations, index. \$1.00.

This volume is the seventh of the Technical Reports issued in connection with the planning and execution of the notable system of flood protection works now being built in the Miami Valley. These works, which will cost approximately \$35,000,000 and which are rapidly approaching completion, consist of five large earth dams, forming retarding basins, and numerous channel improvements in the larger cities and villages. The present volume discusses in a comprehensive manner, first, the considerations which led to the adoption of the retarding basin plan; and second, the numerous hydraulic problems entering into the design of the works. No matters referring solely to structural design are included.

The material has been arranged in a clear, logical manner, without reference to the actual chronological order of development. A considerable part of the hydraulic matter, so far as is known, has never been worked out or published before. Other portions have been presented previously, in more or less similar form, in scattered and fugitive publica-

(Continued on Page 128)

Englewood Dam Embankment Pushed Rapidly in 1920

Earth Totalling 1,300,000 Cubic Yards Placed During the Season. Only 1,200,000 Cubic Yards Now Remain To Be Done.

Pictures in the Bulletin for November, 1920, showed something of the rapidity with which the Englewood dam embankment was carried up during the season of 1920. The diagrams in the present issue tell the story of embankment building in greater detail, and over a period carried back to the beginning of the work in the summer of 1918.

To understand the progress made at Englewood, a brief outline of the construction program is necessary, especially that relating to what is known as "stream control; that is, the provision made for the safe passage of the river around and under the dam during construction. This is of prime importance during flood seasons, when the river rising might overtop the unfinished dam embankment, which, being of earth, might thus be swept away or seriously injured. The worst floods coming in winter and early spring, the general endeavor is to push the work of embankment building as rapidly as possible during the season following the spring flood, so that the crest of the dam may by winter be carried above flood level. At Englewood, however, the great width of the Stillwater valley makes the dam so long (4,660 feet), that its entire length cannot be carried up to a safe elevation in a single season. As a result, the dam has to be built in sections, one af-

ter the other, each being carried up so rapidly, during a single summer season, that by winter the working section may be above the danger point.

At Englewood these sections are three in number. The first extends from the east river bank eastward. The second occupies the old river bed. The third extends from the west river bank westward. These sections are being built in the order named; the first in 1919; the second in 1920, and the third in 1921. The ordinary river flow during all three seasons is being carried by the dam conduits, these having been built before the work of embankment building seriously began, and being the same which will carry the river under the dam after its completion. In case of flood during construction, however, the division of the dam into sections permits the river to pass not only through the conduits, but through much ampler channels in addition—through the old river bed during 1919, and through a "temporary spillway" (dug on the valley floor just west of the old river bed), during the seasons of 1920 and 1921. The carrying up of all three sections of the dam to final elevation, after pushing them up consecutively to safety in the manner described, will be done simultaneously, during the latter part of 1921 and the season of 1922.

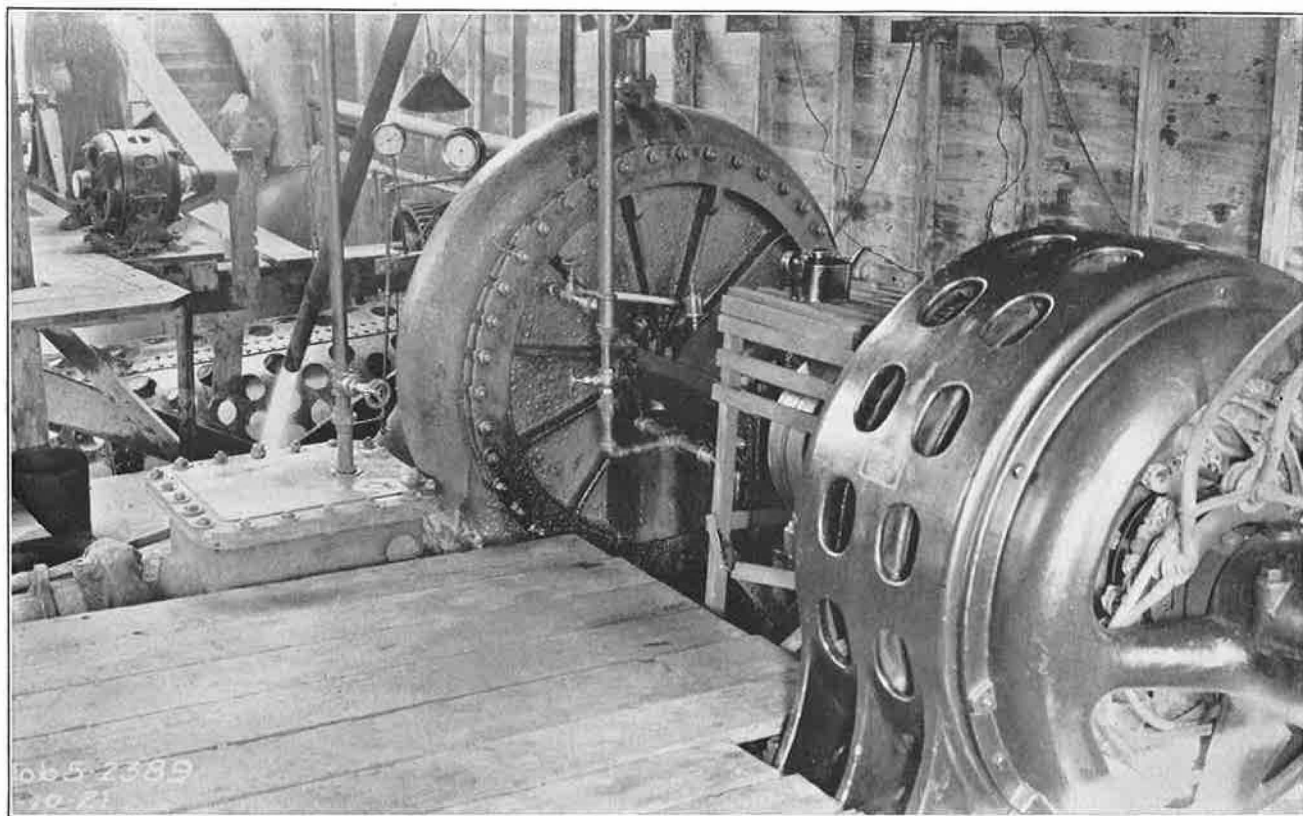


FIG. 276—DREDGE PUMP WORKING AT HUFFMAN DAM, JAN. 10, 1921

This is an "Amsco" centrifugal pump, of 7,000 gallons per minute nominal capacity, and working up to 150 feet head. It is driven by the 350 horse Allis Chalmers electric motor seen at the right, both being mounted on the same shaft. The pumps and motors at Englewood are similar machines to these, except that the motors are of 500 horse power in order to pump to the greater height of the Englewood dam. The electric lamp shade hanging just beyond will give a rough scale of size. See page 118.

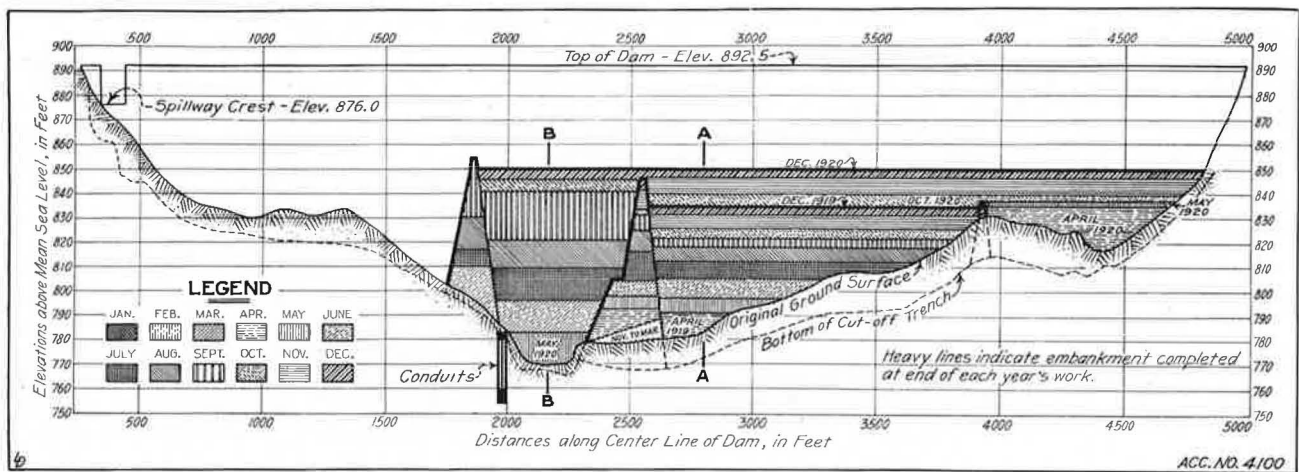


FIG. 277—LONGITUDINAL SECTION, ENGLEWOOD DAM, SHOWING PROGRESS

These facts are brought out in Fig. 277, which is a section of the Stillwater valley taken on the dam center line (the vertical distances being much exaggerated to bring out the desired features more plainly). The hatched line below is the original ground surface; the upper heavy line is the top of the dam when completed (in 1922). BB is the river section, the old river bed being the sag in the ground line just above the lower B. The sharp spurs rising on each side of the river bed represent very high levees built on the two river banks and crossing the damsite. They are known as cross dams or cross levees, and separate the dam into the three sections above referred to—the east section to the right of the right levee; the west section to the left of the left levee; with the river section between.

The shaded portions of the figure represent the parts of the dam already built, each season's work (that of 1919 and 1920), being bounded above and to the left by very heavy lines. The various cross hatchings are to indicate the work done in successive months, the key to this scheme being shown in the lower left corner. The portion of the diagram left blank between the heavy line marking the top of the completed dam, and the ground line and shaded portions below, represents the part of the dam embankment still to be done, comprising roughly 1,200,000 cubic yards of earth.

In carrying out the program just outlined, the work of the season of 1918 was preparatory. It included work on the concrete conduits; the stripping of the top soil from the dam site, to be used later as a top covering for the completed dam; the digging of a deep "cut-off trench" along the dam centerline, to be later filled with impervious clay material; and the laying of a 3-foot thick impervious "blanket" of clay extending from the cut-off trench to the upstream "toe" or limit of the dam. The object of both the last operations was to prevent seepage of backwater underneath the dam in times of flood. The east section of the dam being first on the program, the operations of cut-off trenching and laying of the impervious blanket during 1918 were confined to this section. At this time also the east cross levee was begun.

The building of the cross levee was necessary on account of the method of dam construction used—the method of "hydraulic fill," described in the Bul-

letin for February, 1920. This method involves the carrying of a pool of water along the centerline of the dam summit, mud deposited on the bottom of this pool forming the central core of clay material which makes the structure impervious. The cross levee, built along the east river bank crossing the dam site, was to enclose the west end of this pool, enabling it to be carried high above the river bed.

These preliminary operations being completed, the real work of embankment building began on April 1, 1919. The general method is to dig the material from the valley bottom above the dam by means of big steel buckets of "dragline excavator" machines, the buckets dumping into cars which transport the material to the north slope of the dam. Here it is dumped into a "hogbox," from which it is washed by water jets into a concrete "sump" or cistern, whence in turn it is pumped, mixed with much water, by powerful "dredge pumps" through pipes to the top of the dam, where it is deposited on the beaches and bottom of the pool. The water runs back to the "sump" by an overflow pipe running down from the pool surface.

One of the dragline excavators is shown in Fig. 273, with its boom projecting over the train of dump cars being loaded, its bucket hanging from the boom end after dumping its load. The machine runs on rollers, on which it "crawfishes" backwards very slowly up the valley, parallel to the track on which the train stands and to the bank of the pool of water seen at the left, and digging as it goes the bank behind it (the bank between the machine and the observer). The entire upper part of the machine, carrying the boom and bucket, swings on its center, to permit the loaded bucket to be dumped into the cars on the track.

One of the large "dredge pumps" for pumping the mixed earth and water to the top of the dam is shown in Fig. 276, coupled to the electric motor which drives it. This particular machine is at the Huffman dam, but is a duplicate of the pumps in use at Englewood. (The motor in the picture, however, is of 350 horse power as against the 500 horse power motors used at Englewood, the difference being due to the higher head pumped against at Englewood). Such a pump is very simple in its elements;—nothing more than a set of three curved paddles revolving swiftly within an iron shell, sucking very

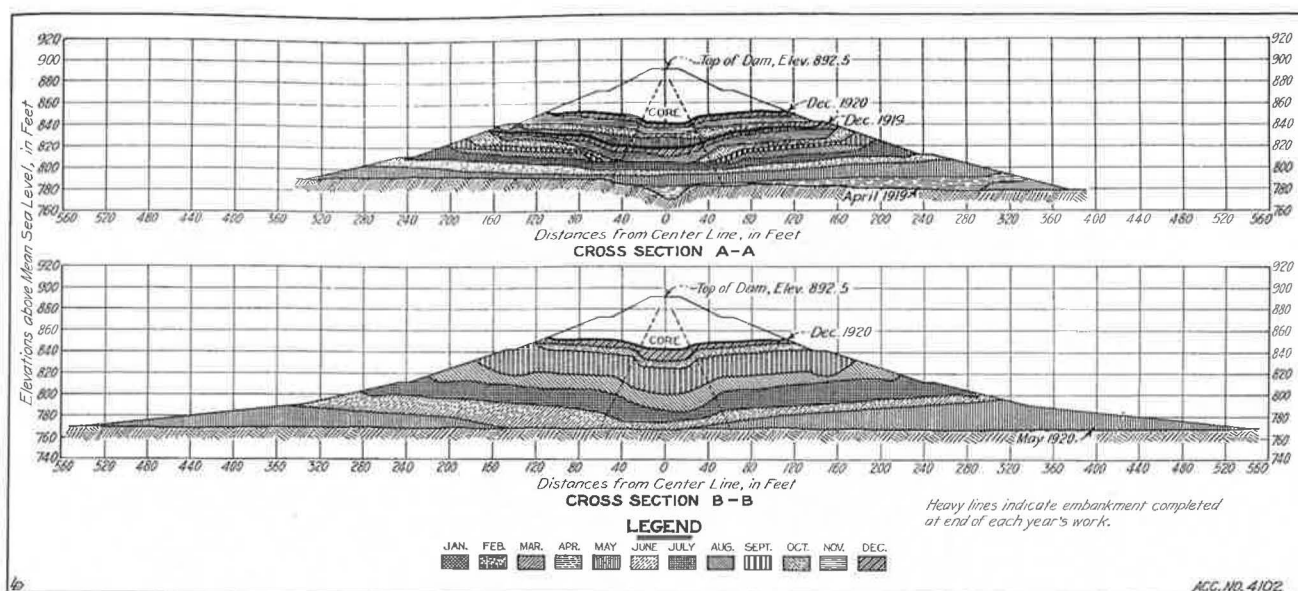


FIG. 278—CROSS SECTIONS, ENGLEWOOD DAM, SHOWING PROGRESS

muddy water in through a pipe at the center of the shell and hurling it out again with great force into another pipe at the shell's periphery. The electric lamp shade hanging beside the pump in the picture will furnish a rough scale of size. The pumps have a nominal capacity of 7,000 gallons per minute, and work up to 150 feet head.

The valley floor to be excavated to furnish materials for the embankment (the excavation and the area to be excavated both being known technically as a "borrow pit"), is shown in its relation to the dam in Fig. 281, reproduced from the Bulletin for November, 1920. The scale of the operations is

shown by the small squares, each of which is 500 feet on a side. The extreme limit of the excavation in the borrow pit is thus seen to be more than four-fifths of a mile up the valley from the dam center line. (The boundary of the excavated area being indicated by hatching). A strip next the east bank of the river has been left so as not to interfere with the river's flow. Next east will be seen a long excavated area; then a long narrow unexcavated island and peninsula; then another long excavated area; then a wide unexcavated area running to the east boundary of the map. The first excavated area, nearest the river, was taken out in 1919, together with a

TABLE I.
Earth Placed in Englewood Dam Embankment in Cubic Yards

1919 Month	Hydraulic	Semi-Hyd.	Rolled	Tot. for Mo.	Tot. to Date	Per Cent.
Previous	9,880	49,090	26,100		85,070	2.5
January	2,185	19,100		21,285	106,355	3.0
February		13,480		13,480	119,835	3.3
March	2,445	6,330		8,775	128,610	3.6
April	69,900	3,840		73,740	202,350	5.6
May	87,700	4,550		92,250	294,600	8.2
June	113,180	14,980		128,160	422,760	11.8
July	92,870		7,540	100,410	523,170	14.6
August	101,900	1,560	9,780	113,240	636,410	17.7
September	93,900		2,390	96,290	732,700	20.4
October	98,490		4,460	102,950	835,650	23.3
November	103,160		4,120	107,280	942,930	26.3
December	58,420		810	59,230	1,002,160	27.9
For Year	824,150	63,840	29,100	917,090		
1920						
April	102,750			102,750	1,104,910	30.3
May	173,760			173,760	1,278,670	34.6
June	144,550		17,700	162,250	1,440,920	40.2
July	153,380		5,450	158,830	1,599,750	44.6
August	153,900		6,970	160,870	1,764,950*	49.2
September	161,800		4,700	166,500	1,931,450	53.8
October	108,270		1,240	109,510	2,040,960	56.9
November	143,030		2,440	145,470	2,186,430	60.9
December	122,250			122,250	2,308,680	64.3
For Year	1,263,690		38,500	1,302,190		

* Includes 4,330 cubic yards backfilling.

short strip of the second, furnishing in all something less than 900,000 cubic yards of earth materials for the dam embankment. The remainder of the second excavated area (all but the short strip just mentioned), was taken out in 1920, amounting to a little more than 1,300,000 cubic yards delivered into the dam. The dotted lines running down the excavated areas are the abandoned railway tracks used by the dump car trains during the work. The cross hatched lines in the eastern part of the borrow pit are the tracks still in use at the time the map was made (October, 1920.)

The results at the dam are shown in Figs. 277 and 278, the first giving a longitudinal section and the second two cross sections, the lower one taken through the river section of the dam at BB, the upper one at AA (in Fig. 277), a little east of the river section. In both figures, the cross hatchings indicate progress in successive months, and each year's work is topped by a heavy line of separation. The "legend" in each case gives the key to the months. The cross sections (Fig. 278), show clearly the sag in the center occupied by the core pool, and also the slope of the beaches on each side of the pool, running up to the levees at the tops of the outer slopes. These general lines are followed by each month's deposit of fresh material as shown on the chart. The longitudinal section shows how the cross levees were carried steadily up in advance of the pools that they enclosed, the right levee for the river section of the dam, in 1919, the left levee for the river section in 1920.

Fig. 274 shows the embankment progress in two other ways. The lower part shows the relative quantities deposited in the dam month by month, each vertical rectangle corresponding to one month, and the heights of the rectangles being in proportion to the quantities deposited. A scale to read approximate quantities is given at the left, each horizontal space carried across the diagram corresponding to 10,000 cubic yards of deposited material. The best month is seen to be May, 1920, when 173,760 cubic yards were built into the river section of the dam. The advance in the performance in 1920 as a whole, as compared with 1919, also shows plainly.

The upper part of Fig. 274 shows in its irregular line, marked "actual progress," the total amount of material built into the dam up to any date. The scale at the left is here ten times as great as in the part below, each horizontal space representing 100,000 cubic yards of material deposited in the dam. The time scale is the same as in the lower part of the figure, each vertical space representing one month's time. Thus at the end of 1919, and during the early part of 1920, the line of actual progress becomes horizontal, indicating a stoppage of operations (due to the cold weather), with a total of a million cubic yards of material built into the dam. In the latter part of March, 1920, the line starts up again, with the opening of the new season's work, and in May begins rising rapidly, corresponding to the heavy record noted in the paragraph above. The straight line sloping up to the right, just below the curve of actual progress, is a line of proposed progress, on the supposition that the dam would be completed at the end of 1922 (this being the actual schedule laid out in the headquarters office). It will be noted that the progress for 1919, including the

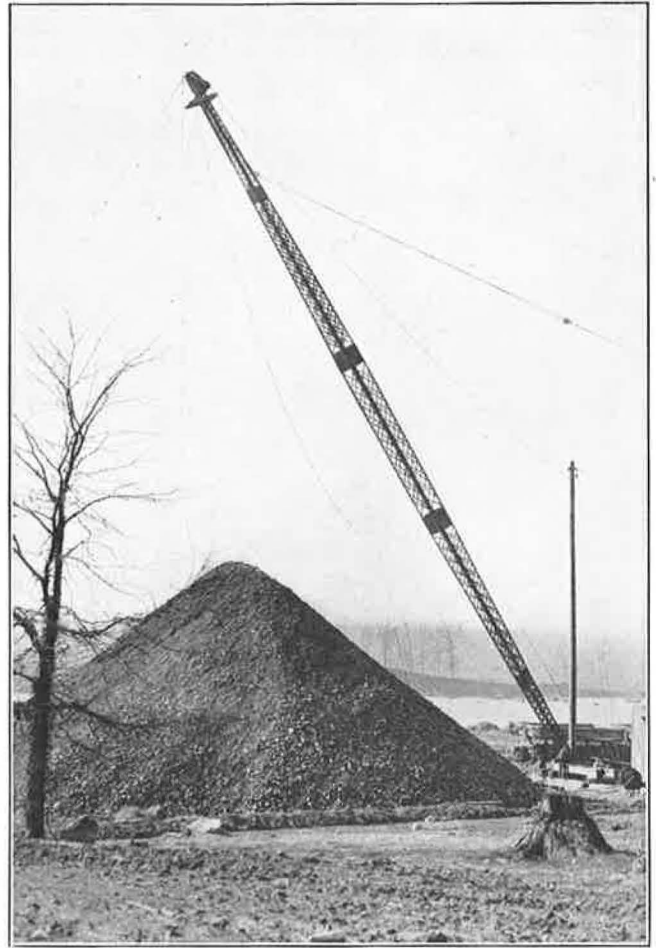


FIG. 279—LOWERING DERRICK MAST, ENGLEWOOD DAM

Taken Feb. 15, 1921. This is a 120 foot steel guy-derrick mast, which has been in use to unload coal for the locomotives transporting materials from the Englewood borrow pit to the dam. It is being taken down to be set up again at the west end of the dam, where it will be used to swing the concrete buckets, etc., in the construction of the new spillway. The foot of the mast is being held firm by a steel cable controlled by the man standing near it, while the top of the mast is being very slowly lowered by means of the compound pulley blocks seen attached near its top.

necessary winter shut-down at the end of that year, ends exactly on this line of proposed progress. The record for 1920, however, including the shut-down of the present winter (ending March 1 this year), ends far above the proposed progress line. In fact, if the coming season could show as rapid work as last season did, the Englewood dam embankment would be completed by the end of December, 1921. This will be plain also by comparing the figures in the table on page 119. They show that the total embankment built last season amounted to 1,300,000 cubic yards; and that the total remaining to be done is 1,200,000 yards. It is not to be expected, however, that the present season will equal the last. The low levels, of the dam embankment, the easier parts to pump, are completed; and the higher the dam is pushed, the harder it becomes to push with the old speed, because the material must be pumped against continually higher and higher pressures. The topping out process also, described in the De-

cember, 1920, Bulletin, takes its additional quota of time which must be reckoned.

The situation of the Englewood dam embankment at a glance is best shown in Fig. 280, where the shaded portions again represent the portions completed month by month, according to the same scheme of cross hatching already noted. The entire "clock-face" shaded would represent the dam entirely finished. The work began in 1918 at "12 o'clock," and the shaded portions grew as indicated, the figures on the clock face margin giving the percentage of the dam completed. December 31, 1919, saw the embankment 27.9 per cent complete. December 31, 1920, saw it 64.3 per cent complete—nearly two-thirds done.

The very creditable speeding up of the 1920 embankment construction is well brought out by a comparison of its high records with those of 1919. In 1919 the high record for a single 10-hour shift was 3,830 cubic yards pumped into the dam, and 7380 cubic yards in 20 hours (two full shifts). This was on September 6 with two pumps in service. In 1920, on April 27, one pump placed 2,808 cubic yards in the dam in 9 hours, 19 minutes. On May 14, one pump placed 4,000 cubic yards in 8 hours, 48 minutes, or 455 cubic yards per hour. On May 28, one pump placed 4,600 cubic yards in 8 hours, 48 minutes, or at the rate of 522 cubic yards per hour. On July 15, 611 dump car loads, equal to 5,500 cubic yards in place in the dam, was pumped into the embankment in a single shift. The best monthly record for the pumps was in May, 1920, the quantity being 173,760 cubic yards.

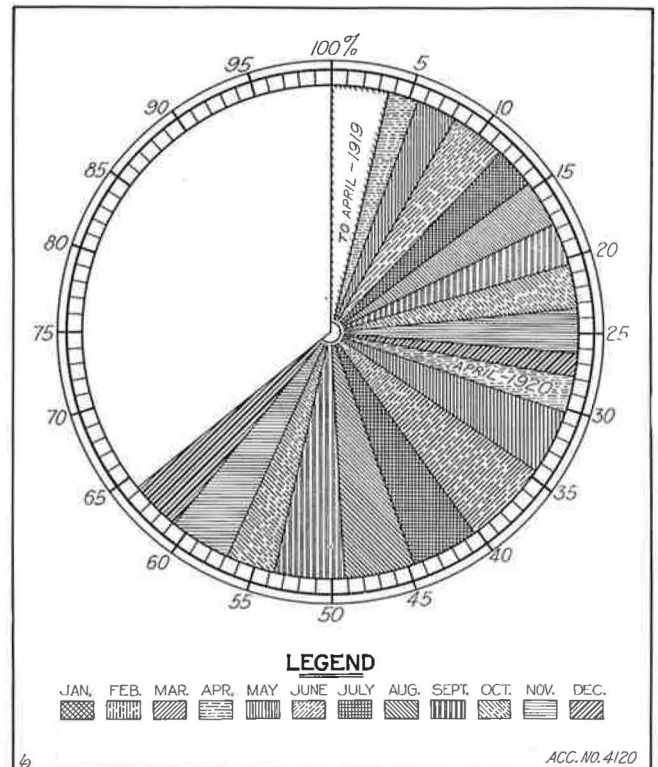


FIG. 280—PROGRESS DIAGRAM, ENGLEWOOD

Showing progress on dam embankment. The shaded parts indicate percentages done during successive months, the various hatchings being given under the "Legend." See page 121.

Shows where the earth was obtained to build the 2,300,000 cubic yards of dam embankment already in place at Englewood. Note the size of the operations, each small square in the plan being 500 feet on a side. Thus the extreme excavation was taken out more than four-fifths of a mile up the valley from the dam center line. (The edges of the excavated areas, which are so marked, are hatched). The left-hand excavated area was taken out in 1919, together with a short strip of the right hand one. Most of the right hand excavated area was taken out in 1920, in amount about 1,300,000 cubic yards. The quantity in 1919 was a little short of 900,000 cubic yards. The dotted lines in the excavated areas are the abandoned railway tracks used in transporting the materials from the borrow pit to the dam. On the un-excavated area at the right these tracks are still in use.

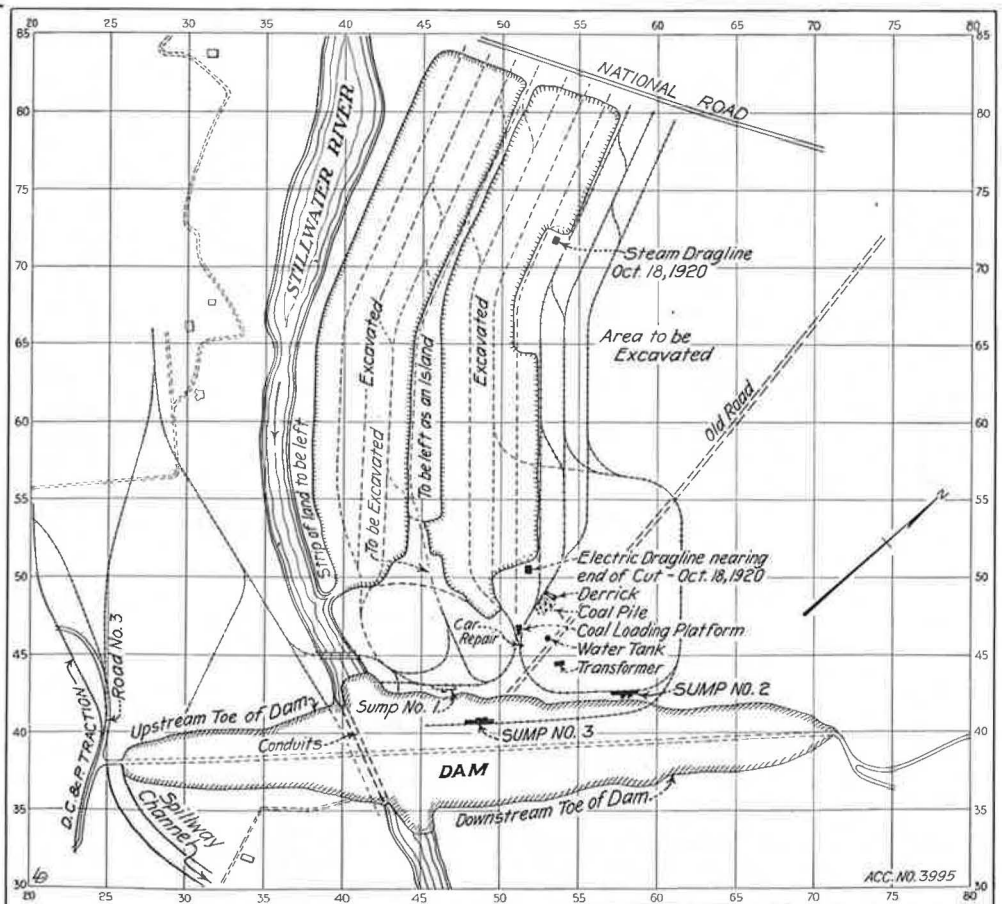


FIG. 281—MAP OF ENGLEWOOD BORROW PIT, OCTOBER, 1920

Such rapid progress as has been evident at the Englewood dam during the season of 1920 comes, of course, only as consequence of continuous, careful and efficient supervision, and the harmonious co-operation of the working staff. The following notes by Mr. H. S. R. McCurdy, the Division Engineer in charge at Englewood, indicate some of the means employed to secure the results noted.

"At all times the plant and equipment are under constant inspection and every effort is made to keep them in a high rate of efficiency. Dragline crews are expected to spend such time each Sunday as is necessary to keep their machines in proper order. (Each machine being in service 20 hours per day through the six-day working week, leaves Sunday the only available time for such adjustment and tuning up). The dump cars are detached from the trains and sent to the yard as they show signs of needing repair. Locomotives are kept in use only while in a condition to render maximum service. As soon as a dredge pump or any part of it shows signs of letting down, replacement is immediately made. A force of expert mechanics and repair men are available at all times for service of this nature; for, with a payroll such as is cared at this dam anything but maximum output is expensive, and a weak piece in the construction equipment can easily throw the working program out of gear, thereby reducing

production and correspondingly increasing unit costs."

"Every effort is made to instill into the men a wholesome pride in their achievement, and to create a friendly rivalry between the day and night shifts. Each morning the number of cars of material placed in the dam by the preceding day and night shifts is plotted upon a diagram kept in a conspicuous place. On this diagram is also shown the accumulated total of cars for each shift during the month, as well as the daily averages to date. The highest record for a single shift, for a single pump, for two pumps, for a week, for a month, etc., are conspicuously posted. Also the name of the dragline runner holding the best excavating record is included, together with his best output. These bulletins are matters of lively interest, and are constantly consulted by the workmen vitally concerned, as well as by interested visitors. The average American workman is a good sport; he loves a contest; and whenever he sees a chance to pit his wits and brawn against an antagonist he will put forth his very best efforts to win."

The work at Englewood is under the direction of H. S. R. McCurdy, Division Engineer; H. W. Horne, Assistant Division Engineer; Richard Byers, Superintendent of Construction; Kirby Jones, Assistant Engineer and Inspector; Wm. Pennington, Night Superintendent; and Peter Haskell, Master Mechanic.

January Progress on the Work

GERMANTOWN

Grading the roadway on the top of the dam has been started this last month. The gravel slopes between the top of the dam and the 810 berm have been trimmed to an even grade. The 810 berm, both upstream and downstream, has been graded so that the run-off collected on this berm will drain to the gutters at the center and either end of the dam.

Dismantling has continued throughout the month and at the present writing is practically complete.

The cleaning up of the reservoir above the dam is now in progress. This work consists of felling old trees that are liable to be washed away during high waters and cutting them up in lengths so that they may easily pass through the conduits without danger of clogging them. Also the cleaning up of any rubbish, etc., that obstructs the creek bed.

The wrecking of the camp is continuing at a rate indicating removal at an early date.

A. L. Pauls, Division Engineer.

February 22, 1921.

ENGLEWOOD

The large electric dragline engaged in excavating for the permanent spillway, has temporarily discontinued this work and moved down to the temporary spillway, where it is used for filling with gravel the crib work protecting the downstream spur levee. This work will be completed by February 19 and the dragline will then resume the permanent spillway operations.

Plant repairs and overhauling have proceeded to the point where it is definitely expected to resume pumping operations the latter part of this month. The open winter has greatly favored an early start and it is figured that work this year will be in progress three weeks earlier than was the case last year.

H. S. R. McCurdy, Division Engineer.

February 15, 1921.

LOCKINGTON

A small amount of work has been continued on the stone surfaces of the dam, stone being hauled to such places as will be difficult of access after the dredge pipes have been laid in position for use. Some stone has been laid on the west slope of the outlet channel.

All the dredge pipes have been repaired. Patches and lugs have been welded to the pipe and some split seams re-welded.

The drilling and blasting of the clay portions of the borrow pit have been continued.

The electrical equipment is being put into shape and the line from Piqua changed back to 33,000 volts for resuming the pumping operations on the first of March.

Barton M. Jones, Division Engineer.

February 23, 1921.

TAYLORSVILLE

The progress on the excavation from the outlet channel has been very satisfactory. It now appears that the temporary channel that is being excavated along the east half of the outlet channel will be finished by April 15, which is well up to schedule. This will permit the old river channel to be closed as soon as the danger from spring floods is past, following which pumping of the river section of the dam will begin.

The dredge pumps have been repaired and pipe lines repaired and relaid where necessary and we expect to start pumping February 24. Pumping will be continued into that portion of the dam west of the cross dike until such time as the old river channel is closed.

The weather has not permitted any further work on Road 12.

O. N. Floyd, Division Engineer.

February 23, 1921.

HUFFMAN

The pumping of material into the embankment of the dam has been in progress until February 10th. On that date the work was closed down in order to do some necessary repair work on the electric dragline and to move the booster pump up the slope of the dam to elevation 815, which is sixteen feet above the first set up. This work has been completed, and pumping was continued on February 21st.

All the available material in the upper part of the borrow pit on the hillside at the north end of the dam has been taken out. The remaining part of the material to be obtained from this pit is at too low an elevation to be washed directly into the dam by gravity alone, as has been done to

date. A standard 15" dredge pump is being installed in the sluice line to act as a booster to assist in lifting this material into place on the dam. This unit will be in operation again the first of March.

The steam dragline is taking out the remainder of the earth coffer dam across the outlet channel below the concrete outlet works, and giving this channel its final shaping up.

C. C. Chambers, Division Engineer.

February 22, 1921.

DAYTON

Progress has been slow during the past month owing to several rises in the river stage.

Dragline D16-15 has continued river excavation below Stewart Street. D16-16 has done the necessary trench work for lowering the easterly half of the 24" water main above Fifth Street bridge, and has cleaned up part of the debris left by the bridge building contractors in 1916. D16-8 has completed its work at the mouth of Wolf Creek and is being dismantled. It will be erected again below the Big Four railroad bridge near Miller's Ford. D16-19 is undergoing repairs. The steamboat machinery has been dismantled.

Ohio Street and Grant Street walls have been completed. The land along the Delco-Light Company property on the south bank of Mad River and the southwesterly wing wall for Keowee Street bridge are under construction. Work is being resumed on the river walls at Beach Avenue and First Street and excavation is under way for the river wall west of Main street bridge.

The gravel plant is again operating. The total quantity of sand and gravel issued to date is 59,100 cubic yards. A steel stiff-leg derrick has been installed for use in feeding the stock gravel to the plant.

Construction work is being installed for the work to be done along Wolf Creek.

The Finke Engineering Co. is placing concrete in the Apple Street culvert. Price Brothers Co. is continuing the removal of the old stone wall at Keowee Street on the north bank of Mad River. J. C. McCann completed about 6000 cubic yards of excavation from Mad River channel previous to February 1.

The total quantity of channel excavation (Item 9) up to February 1 was 903,500 cubic yards, and 173,000 cubic yards of levee embankment has been placed. The total yardage handled was 1,980,000 cubic yards. None of the figures include 105,000 cubic yards of excess excavation for scowling canals.

C. A. Bock, Division Engineer.

February 23, 1921.

HAMILTON

The west bank above the Columbia bridge is being finished by the electric dragline D-16-18. The total of Item 9, channel excavation, to February 1 was 861,700 cubic yards.

At the Black Street bridge the mass concrete in the west abutment has been completed, and the spandrel walls and counterforts are being poured. The Bucyrus Class 14 dragline has moved across the river and completed the excavation for Pier No. 1. It is now ready to drive the piling.

Excavation has been continued at the Black-Clawson wall and piling are being driven in the portion excavated to grade.

Top soil has been placed on the completed banks between Main Street and the Columbia bridge.

Several sewer outlets on the west bank are being extended to the line of the concrete slope revetment.

C. H. Eiffert, Division Engineer.

February 22, 1921.

UPPER RIVER WORK

During the last month, the dragline (D-16-21), at work on the Donald Jeffrey Contract, brought its total river excavation to 27,000 cubic yards. This work was completed the first part of the month, and since then the dragline has moved into position, about 800 feet above Adams Street, to place the embankment for the levee extending from Adams Street to a point opposite the entrance to Riverside Cemetery. To date about 7,000 cubic yards of material has been placed in this levee.

The C. & C. Haulage Co. has continued its work between Market Street and the B. & O. Railroad. A third Osgood

shovel has been added to their equipment. Their total excavation amounts to 75,000 cubic yards.

On February 22nd the C. & C. Haulage Co. started the excavation for the north abutment of the new span of the Market Street Bridge. The gravel and lumber for the abutment is at hand and the forms will be started as soon as the excavation is complete.

Weather conditions have continued troublesome to the progress of the work near Morgan Ditch. The total levee embankment for the Finke Engineering Co. amounts to 27,800 cubic yards and the street fills contain 2,800 cubic yards. The Harrison Street approach to Morgan Ditch has been completed except for the gravel roadway, and also the Atlantic Street approaches to Harrison Street.

The house belonging to the District, and known as the "Briggs House," has been moved from its former location at the north end of Market Street Bridge, to its new location on one of the lots made by the spoil bank on the west side of Market Street. This work was done by Chas. E. Foreman of Dayton.

The storm sewers entering the river at the street ends between Market and Adams Streets are being extended down the slope and out towards the new toe of slope of the levee that will be constructed on the right bank of the river. The C. & C. Haulage Co. has already started this embankment at the north end of Short Street.

A. F. Griffin, Assistant Engineer.

February 24, 1921.

LOWER RIVER WORK

Miamisburg—Since our last report, Cole Bros. have constructed the levee along the north side of Sycamore Creek between Fourth Street and the Big Four R. R., and along the south side from the alley east of Fourth Street to the railroad. Wet weather caused three days' delay and moving and repairs to the machine occupied five days. The dragline will now be moved to the extreme southern end of the work and levee construction will proceed northward. Cole Bros. are making this move in order to keep the machine working on comparatively high ground, which prevails below Linden Avenue, during the next two months, as more or less high water may reasonably be expected at this time. The work above Linden Avenue, which requires putting the machine down into the river bed, will thus be left for the dryer summer months.

Franklin—The dragline, D-16-10, has been limbered up and after undergoing a few repairs has commenced excavating for the conduits for the tail race of the American Writing Paper Co. When this is done the machine will cross the tail race and excavate a temporary channel to handle the water during construction of the conduits. The present channel will simply be widened and a cofferdam constructed around the excavation for the concrete work. A good start has been made on trestle construction for levee embankment and the narrow gage locomotives are being fitted up and made ready for use. Guard rail construction on the west side has been completed with the exception of painting. The engineers' office has been moved from the downtown location to the temporary building erected at the intersection of Bridge Street and Van Horne Avenue, which is one square west of the Dixie Highway and just north of the "Harding" mill.

Middletown—Since our last report, Price Bros. have poured 464 lineal feet of the Hydraulic Street wall. Top soil is being hauled on to the levee between Milburn Avenue and the canal bridge at the west end of Tytus Avenue.

F. G. Blackwell, Assistant Engineer.

February 23, 1921.

RAILWAY RELOCATION

Big Four and Erie—Mr. M. K. Frank has removed all of the rail and bridges from the Erie Line, which work was completed the first week in February. The Big Four started removing the rail off the old Big Four line Tuesday, February 15. The District forces are removing the salvageable material that remains. The old ties are being shipped to other features of the District.

Ohio Electric Railway—The bonding is not completed and diversion of traffic will be deferred until this work is completed, which will be about March 1st. Mr. Joseph Connelly was awarded the contract for the grading of about 4000 cubic yards of earth at Mud Run bridge, just east of Osborne. This work was left uncompleted at the time the regular grading for the Ohio Electric was done,

because of interference with the old Big Four and Erie railroads. As these roads are now out of service the work of filling in the gap was started on February 14th.

Baltimore & Ohio Railway—Work completed.

Albert Larsen, Division Engineer.

February 23, 1921.

RIVER AND WEATHER CONDITIONS

No floods of any importance occurred during the month of January, although small rises of from two to five feet occurred on the ninth and again on the thirty-first. At the District's stations the total rainfall for the month varied from 2.19 inches at Fort Loramie to 2.91 at the German-

town Dam. At Dayton the total amounted to 2.59 inches, or 0.42 inches less than normal.

The local Weather Bureau records show that the mean temperature for the month was 35 degrees, or 5 degrees greater than normal; that there were 11 clear days, 6 partly cloudy days, 14 cloudy days, and 9 days on which the precipitation amounted to 0.01 of an inch; that the average wind velocity was 11.9 miles per hour, the prevailing direction being from the southwest; and that the maximum wind velocity for five minutes was 37 miles per hour from the northwest on the 16th.

Ivan E. Houk, District Forecaster.

February 25, 1921.

Old Hollow Headed Rail Found on Harshman Siding

Interesting Pear-Shaped Sections Rolled Before Steel Came Into Use.

An interesting circumstance in connection with the wrecking of the old Big Four R. R. line, following the relocation, was the discovery of two pieces of "prehistoric" rail in use in the Harshman Siding, three miles northeast of Dayton. This siding served an old mill, still standing, dating back into the fifties of the last century. Near the end of the siding a few short lengths of light rail were found with a pear-shaped head instead of the T head now in use. Inspection showed that in addition to its peculiar shape, one of these old rails had a hollow head, as shown in Fig. 282. This picture is taken from a "sulphur print," kindly furnished by the Hunt Inspection Bureau of Chicago, who were good enough to make an examination and analysis of a section of the old rail sent them. The end of the rail was polished. A piece of photographic paper was then dipped in a dilute solution of sulphuric acid and laid on the polished face of the rail for a short time (the period being usually about one minute). The parts of the steel higher in sulphur left a darker impression on the photographic paper than those parts lower in sulphur. Thus the "sulphur print" shows in a rough way the distribution of sulphur in the specimen, this element being one of the most deleterious impurities. This action shows plainly in Fig. 282, the base and web of the rail appearing much darker than the head, indicating that the latter, which in service took the wear, was of much purer matter. Besides furnishing the sulphur print, the rail was analyzed chemically.

The etching and analysis both show that the pear-headed rail is of iron and dates back to the old days before steel had taken the place of the earlier used material. The transition began about 1865 and was due to the better wearing qualities of steel under the increasing severity of the hammering and mashing action of car wheels on the rail head; this being due in turn to the steadily increasing weight of locomotives and cars.

Thus the chemical analysis carries the date of the rail back to 1865 or earlier. The shape carries it still further back, to 1859 or 1860. This is shown by records of the Cambria Iron Company, at Johnstown, Pa., given in the upper part of Fig. 283. This series shows the shapes of the successive grooves of the rolls through which the redhot iron "bloom" or billet was passed in the mill to bring it to the final rail shape. These successive grooves are numbered "1, 2, 3, 4, 5," the last showing the identical pear-shaped hollow head found in the Harshman Siding. The date of the record is 1859.

This information was furnished by Mr. G. B. Waterhouse, Metallurgical and Inspecting Engineer for the Lackawanna Steel Company of Buffalo, N. Y., to whom also sections both of the solid and hollow-headed rail were sent.

The lower set of shapes in Fig. 283, also kindly furnished by Mr. Waterhouse, show the successive rail shapes used on American railways, from the beginning (on horse-drawn tram lines) in 1808, up to the present time. Development in size is shown as well as in shape, the rail at the right (1910 model) being 6½ inches high. The hollow pear head appears in this series, dated 1860.

It is interesting to note in this development that by 1831 the T-headed, broad-based rail, in practi-

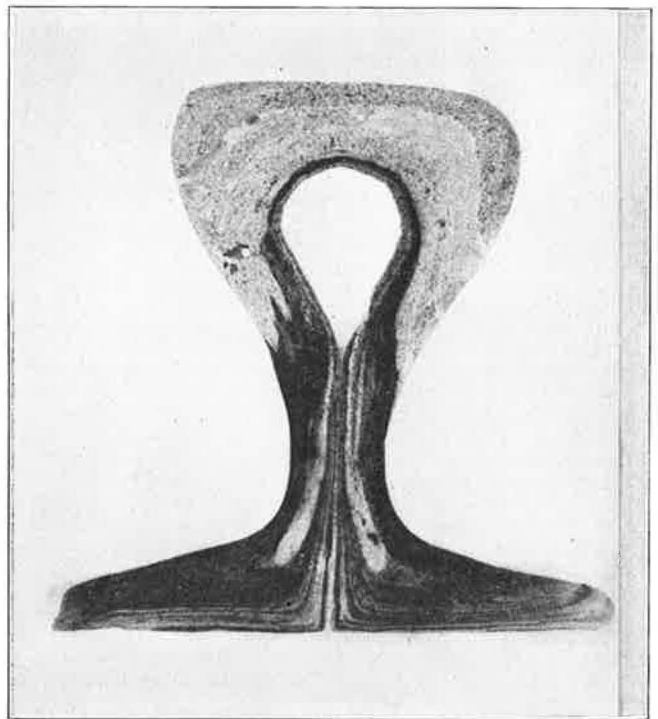


FIG. 282—SULPHUR PRINT OF OLD RAIL, DEC. 1920

This curious hollow-headed old rail was taken from the Harshman Siding of the Big Four R. R. near Dayton, where it was probably originally laid about 1860. It was rolled by the Cambria Iron Works of Pennsylvania, as roll records in their mill show, the metal being iron instead of steel, the latter metal not coming into use till 1865. The head was rolled hollow to save about 10 per cent in metal. The pear-shaped head is to reinforce the web of the rail against its tendency to bend, and thus permit one side of the head to lop down. See page 124.

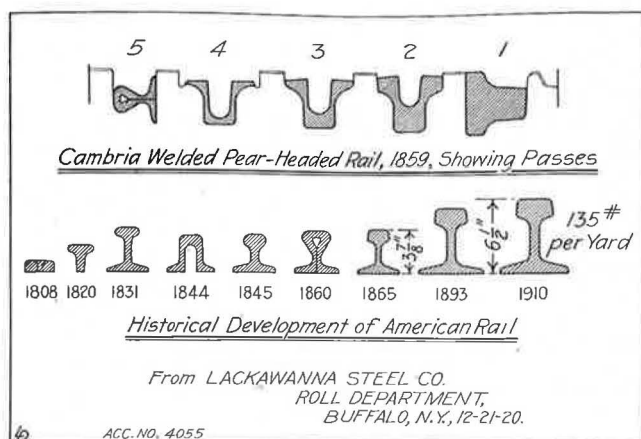


FIG. 283—PASSES USED IN ROLLING OLD RAIL

cally its present shape, had been already reached. The U-shaped and pear shaped sections, competing "Darwinian variations" which sprang up later, went to the wall in the struggle for existence where only the fittest survive. The reason for both the U-shape and the pear shape was evidently to support the edges of the rail head against the tendency to buckle or mash down under pressure of the car wheel tread. With iron, which is much softer than steel, this support was necessary, as all the sections in Fig. 283 between 1831 and 1865 show. In all these we see the broad supporting base and the somewhat narrower head, connected by a shape built stiffer than the present narrow vertical web. With the coming in of steel, a more rigid material, in 1865, these stiffer shapes were no longer necessary and to save metal were discarded.

It is interesting to note that the use of the hollow head, as in the Harshman rail, was also to save metal, the amount saved being about 10 per cent. The metal was saved at some excess labor cost for rolling the rail head hollow, indicating a relatively low labor cost at this period of manufacture.

It will be understood that the historical development shown in Fig. 283, gives dates of introduction of the several shapes. In actual use, of course, the older forms survived many years (as in the Harshman siding), gradually disappearing, and finally becoming extinct.

The Bulletin wishes to acknowledge, in addition to those mentioned, the kindness of Mr. E. T. Howson, Western Editor of The Railway Age, of Mr. C. W. Sennet, Jr., of the C. W. Hunt Co., of Mr. A. J. Sebastian of the Cincinnati Iron & Steel Co., and of Messrs. Albert Larsen, Division Engineer, and Fowler S. Smith, Purchasing Agent, of The Miami Conservancy District, in securing the information here presented.

We append Mr. Waterhouse's letter as giving some additional interesting technical matter.

The two specimens of old rails taken from a switch leading from the Mad River (Miami Conservancy District, Dayton, Ohio,) have been carefully examined.

One is a solid pear-shaped rail, and in its present condition weighs 57.6 lbs. per yard, the other is a hollow pear-shaped section and weighs 54.6 lbs. per yard.

Both rails proved to be made of wrought iron, and so are of the class of material in general use be-

fore Bessemer steel rails were made. The results of analysis were:

	Carbon	Manga- nese	Phos- phorus	Sulphur	Silicon
Solid Rail	0.04%	0.025%	0.552%	0.067%	0.212%
Hollow Rail	0.03	0.013	0.254	0.209	0.184
Hollow Rail*	0.005	0.085	0.49		

In order to show the difference between this and present day material, below are given typical analyses of Bessemer and Open Hearth steel, such as would be used in a 60-lb. rail.

	Carbon	Manga- nese	Phos- phorus	Sulphur	Silicon
Open Hearth	0.57%	0.75%	0.035%	0.055%	0.12%
Bessemer	0.42	0.95	0.10	0.070	0.12

Our Roll Shop Department has investigated the rolling of these two sections. The hollow pear-shaped rail was undoubtedly rolled by the Cambria Iron Company at Johnstown, Pa., about 1860. A sketch of the roll grooves for this section, as found among the old records at Cambria, is given on the accompanying blue print. There is a tradition that this hollow-headed rail was rolled at a time when the size of rail, and not the weight, was specified. The hollow place reduced the amount of metal by about 10 per cent.

The solid rail is a good example of the pear-shaped iron rails rolled at a number of places in this country from 1845 to about 1860. The so-called strap rails were discontinued about 1844. The first T-rails were designed by Robert L. Stevens, Chief Engineer, Camden and Amboy Railroad. They were 36 and 40 lbs. per yard, and rails of this kind were apparently first rolled in 1845 at the Montour Rolling Mill, Danville, Pa. The pear shape was used because it provided metal to support the sides of the head, and prevent them breaking down. The use of steel in place of iron for rails commenced about 1865, and the new design of rails from which our present sections were developed was worked out by Mr. Ashbel in 1866.

Steel became necessary because the iron rails gave very poor service as traffic and the weight of rolling stock increased. Because of lack of homogeneous material and uniformity the iron rails scaled, splintered, laminated or else disintegrated and mashed down in spots before they wore out. A brief historical development of rails in this country is shown on the same blue print as the roll passes for the old hollow rail.

Electrical vs. Steam Dragline Excavator

The dragline excavator shown operating in the Englewood borrow pit in the picture on our front outside cover, is an electrical machine. The machine seen in the distance in the same picture is a machine identical in size and equipment except that its motive power is steam instead of electricity. These machines have worked at Englewood under similar conditions, digging similar materials, for the past two seasons. A comparison of the machines, as to efficiency, etc., under these circumstances, will be published in an early Bulletin.

* This third line shows the analysis of the hollow headed rail by C. W. Hunt & Co., the metal in this case being taken from the head of the rail, the upper analyses being of metal taken over the entire rail section. The difference corroborates the testimony of the sulphur print in indicating that the head of the rail is of purer metal.

The Cableway Used at Black Street Bridge

Three-Ton Cableway Stretched Between 80-Foot Towers 800 Feet Apart Handles All Construction Material.

Space in last month's Bulletin did not permit a sufficient account of the cableway used at Black Street bridge; hence the present article.

The general view of the cableway is shown in Fig. 285. A heavy suspension or trolley cable of steel wire is stretched between the timber towers, one on either shore of the river. On this cable a carriage runs, shown near the right-hand tower in Fig. 285, and in larger detail in Fig. 284. (The two views being taken from opposite sides of the cableway). This carriage is drawn back and forth by means of another (the conveying) cable. (The lower one in Fig. 284, the heavy cable being the suspension or trolley cable). The carriage carries a bucket hanging by a third cable (the hoist cable), by which the bucket is raised and lowered. The conveying cable and the hoist cable are both actuated by means of a hoist engine in a little house behind the "head tower" (the left (east) tower in Fig. 285, the right tower being the "tail tower.")

The conveyor cable is virtually an endless cable with the carriage lashed to it at one point. It passes from the carriage to a sheave on the "tail tower;" thence to a sheave on the "head tower;" thence to and around the engine drum (the conveyor drum); thence back over a sheave on the head tower to the carriage. Thus, rotating the conveyor drum pulls the carriage along the suspension cable. Reversing the rotation reverses the direction of the carriage's motion.

The hoist cable passes from the bucket up over sheaves on the carriage directly to a sheave on the head tower and thence down and around a second drum (the hoist drum), of the same size as the conveyor drum and mounted beside the latter on the same shaft. When pulling the carriage along the suspension cable the two drums are locked together and act as one. The conveyor and hoist cables also act as one (since the two drums are of the same diameter); and the bucket therefore hangs at a constant distance below the carriage during the latter's travel. When the carriage stops over the concrete hopper at the work, the hoist drum is unlocked from the conveyor drum, and rotates independently, unwinding the hoist cable and thus lowering the bucket. Reverse rotation raises the bucket.

Details are shown in Fig. 284, except that the upper portion of the endless cable—the cable which pulls the carriage to and fro—does not appear in it, as will be clear on comparing the carriage in Fig. 285. The lower part of the endless cable is the lower wire of Fig. 284; the heavy wire is the suspension cable, on which the carriage runs by means of the three middle wheels. The two lower wheels are sheaves carrying the hoist cable; the latter being "becketed" to the bucket sheave; thence passing up over the left lower carriage wheel, thence down around the bucket sheave; thence up over the right lower carriage wheel to the head tower and down to the engine drum, (it being the cable between the heavy cable and the lower cable at the right in Fig. 284.)

The upper cable in Fig. 284 is the "button line," the vital part of a necessary mechanism for sup-

porting the hoist cable and the lower loop of the conveyor cable as the carriage runs out toward the tail tower. The two towers at Hamilton are 800 feet apart. With the carriage in the position shown in Fig. 285 (the tail tower being at the right), there would be nearly 800 feet of unsupported hoist cable, and the same length of conveyor cable, between the carriage and the head tower at the left. Without support, these cables would sag so low in the center that they would interfere with the work below. A cable (the "button line") is therefore stretched

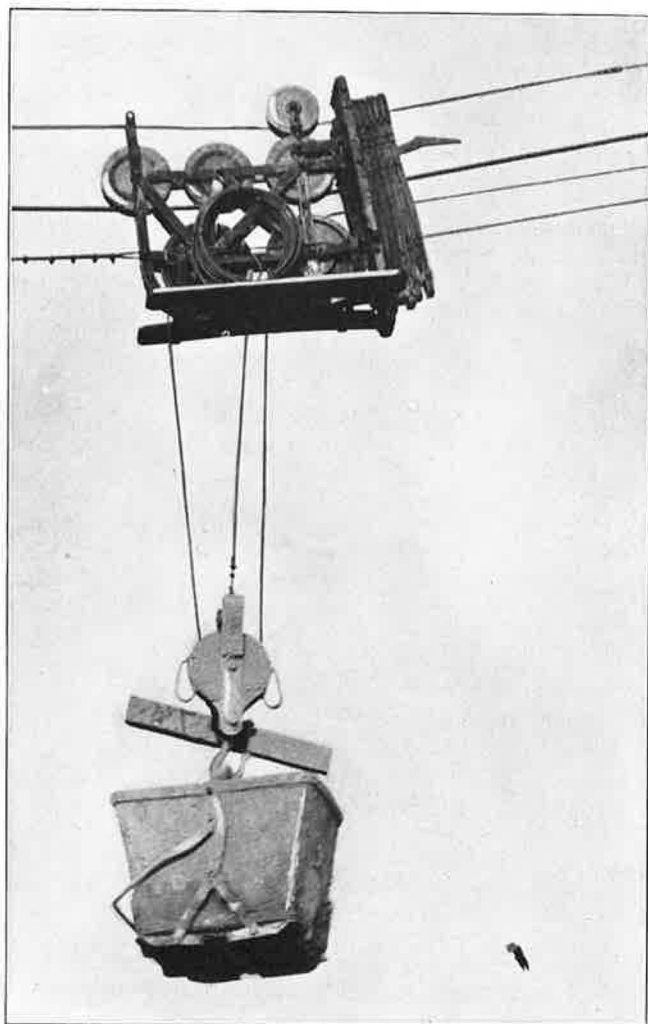


FIG. 284—CABLEWAY CARRIAGE AND BUCKET

The carriage rides on the heavy cable (the suspension cable; see also Fig. 284), on the middle row of three wheels carrying with it the hook and concrete bucket below. It is pulled back and forth by the lower cable (the conveyor cable). The bucket is raised and lowered by means of the hoist cable (next the bottom cable at the right, and passing also round the bucket pulley below). The upper line is the "button line," used to support the hoist and conveyor cables by means of slotted steel bars. (Four of these may be seen supporting these cables in Fig. 284). The suspension cable and button line are both anchored at each end to timber towers ("head tower," "tail tower,") on either shore. The hoist and conveyor cables are actuated by a hoist engine near the head tower. See page 126. Taken January 27, 1921.

between the two towers, just above the main suspension cable. (It is the upper line in Fig. 284). "Fall rope carriers"—slotted steel bars—are hung on this "button line," and the two sagging cables passed through their slots. Four of these "rope carriers" may be seen in Fig. 285, hanging from the button line at equidistant points along its length, and supporting the conveyor and hoist cables below. As the carriage runs back toward the head tower it picks these carriers up, "spearing" them with the horn or spear point seen projecting at the right of the carriage in Fig. 284. This figure in fact shows the four carriers "speared," and hanging from the button line, just behind the horn. (There are in fact five carriers, the fifth being supernumerary, for use with longer spans than the 800 ft. at Black Street). The carriers are picked off the carriage as it runs out (running toward the left in Fig. 284), by means of metal "buttons fastened to the button line at proper intervals (one is shown at the extreme right in Fig. 284). These buttons are of progressively larger and larger diameter toward the tail tower, and thus pick off the carriers, one after the other, by means of eyes at the upper end of the carriers, these eyes being also of progressively larger and larger diameter and each threaded by the smaller buttons till its proper button arrives.

For work like bridge construction, where the lay out is long and narrow, the advantage of such a cableway as that described is obvious. It can distribute materials at or close to any part of the work, including not only concrete, but steel reinforcement, motors, pumps, timbers, form lumber, forms, or any other necessity. By stiffening the tower structures, and mounting them on wheels running on parallel railways at right angles to the cables, the entire mechanism can be moved along so that materials can be delivered over a wide area, after the manner of a travelling crane. At Hamilton this more expensive extension was not necessary.

The cableway at Hamilton was built by the Lidgerwood Company and is of 3 tons capacity. The main cable is $1\frac{1}{2}$ " diameter, the conveyor line $\frac{3}{4}$ ", the button line $\frac{3}{4}$ ", and the hoist line $\frac{1}{2}$ " diameter. All the cables are of steel wire. The hoist engines are actuated by steam, fed by a 60 horsepower boiler. The two timber towers are simple "A-frames," 80 ft. high and 800 apart. The working of the cableway on the Black Street work has been very satisfactory.

The work at Hamilton, including the Black Street bridge, is under the direction of C. H. Eiffert, Division Engineer, R. B. McWhorter, Assistant Division Engineer; W. T. Rains, Supt. of Excavation; W. A. Roush, Supt. of Concrete Work; G. W. Schrader, Inspector. The bridge was designed by R. M. Riegel, Designing Engineer for the District.

FIG. 285—LIDGERWOOD CABLEWAY DISTRIBUTING CONSTRUCTION MATERIALS, BLACK STREET BRIDGE, HAMILTON, JAN. 27, 1921

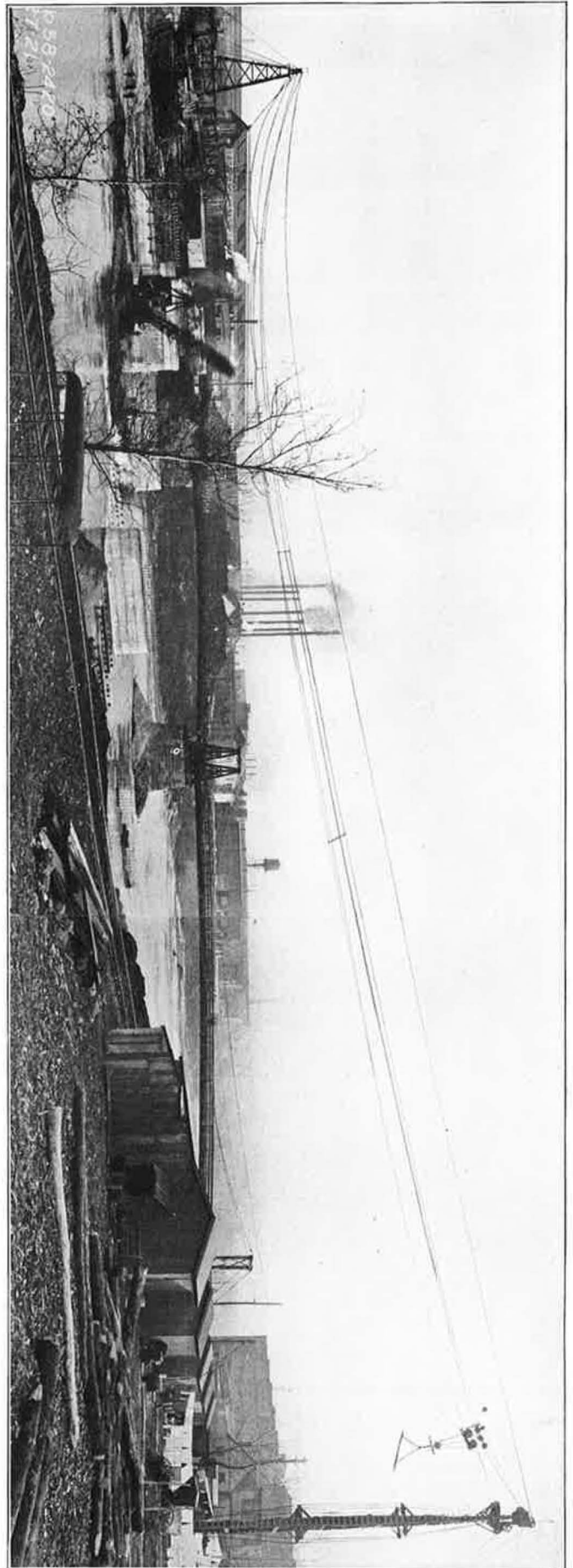




FIG. 286—ROBERT BOULEVARD WALL, DAYTON, JANUARY 12, 1921

A View of Robert Boulevard Wall

We present on this page (Fig. 286), a view of Robert Boulevard wall in Dayton, in its finished condition. This is of interest as being typical of the concrete walls built in several places to take the place of the usual levees, when the latter would have encroached too much on valuable river bank property, owing to the space taken by their wide slopes. A description of the construction of the wall here shown was given in the Bulletin for March, 1920. Its total length is 1036.4 feet, extending from Third to Fifth Streets on the left bank of the river. Its total height, including the base, is 25 feet, of which 20 feet, 8½ inches is wall proper, the remainder being below ground. The base is 12 feet, 4½ inches thick; the wall proper 5 feet, 4 inches thick at the bottom and 12 inches at the top. It contains 4,500 cubic yards of concrete. It was begun in October, 1919, and finished in August, 1920. To build it five dwelling houses had to be wrecked. The picture was taken from Fifth Street bridge, and shows Third Street bridge in the distance, with one of the large dragline excavators engaged in loading a scow with some of the last of the material to be excavated above Fifth Street.

Review of Conservancy Technical Report, Part VII (Continued from Page 116)

tions. In order to make the book more complete some matter more or less generally known has been included.

Chapter II, which follows the introductory chapter, contains valuable data relating to storm rainfall and flood runoff. The great flood of March, 1913, the earlier floods in the Miami Valley, a few long records of floods in European rivers, and the great storms which have occurred in the eastern half of the United States in the last half century, are all discussed with reference to the Miami problem.

Chapter III is principally descriptive. It will be interesting to engineers who wish to obtain a bird's-eye view of the Miami Valley and the works being constructed therein. The description is supplemented by a lengthy table of existing flood control reservoirs, of which 45 are in Europe, 1 in India and 10 in the United States.

With the exceptions of Chapters X and XIII, which deal with the action of the reservoirs during localized cloudbursts and the alternative flood protection plans, respectively, the remaining chapters contain the information most valuable to hydraulic engineers. These take up the methods used in solving the numerous hydraulic problems connected with the work, and also the general hydraulic principles followed in the channel improvement designs. The greater part of this material can be readily followed by most engineers, but in one or two cases, such as the treatment of spillway operation, the mathematics is of such a nature as to appeal only to mathematicians. Probably the parts dealing with the flow through the outlet conduits and the design of river channels will be referred to most.

It is believed that the book as a whole will prove unusually valuable to engineers engaged on flood protection work. Had such a volume been available when the Miami Conservancy work was started much time and money would have been saved.

THE MIAMI CONSERVANCY BULLETIN

APRIL, 1921



FIG. 287—GERMANTOWN DAM, COMPLETED, AT WORK CHECKING FLOOD, MARCH 28, 1921



FIG. 288—"THE EYE OF THE STORM," GERMANTOWN DAM, MARCH 28, 1921

Compare Fig. 303, where the same vortex is shown just beyond the two men at the right. It was $32\frac{1}{2}$ feet above the entrance to the dam conduits, and is formed by the motion of the water in the same way that the vortex is formed in a lavatory basin when the outlet plug is drawn. Boards, branches and other floating debris were sucked down this vortex into the conduits and thrown out at the exit on the other side of the dam. (See Fig. 292). As the water in the lake behind the dam grows deeper with higher floods, this vortex will be drowned out.



FIG. 289—HIGHWAY CROSSING TWIN CREEK VALLEY ON CREST OF GERMANTOWN DAM, MARCH 4, 1921.

This highway connects the Twin Creek valley roads on the north and south sides of the creek. It is 109 feet above the old creek bed. The slope at the right is the upstream dam slope. The conduits carrying the water seen in Fig. 287 pass under the dam a little beyond the automobile and 107 feet below it (measured to the conduit floor). The dam crest is 1,210 feet long. The road width is 30 feet.

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G. L. TERPFE, Assistant Engineer, EDITOR.

The Successful Test of the Germantown Dam

The leading interest in the present Bulletin is in the account of the successful test of the Germantown dam in the storm of March 28. This being the first trial of a Conservancy dam in an entirely finished condition, the result is of unusual importance. The storm was a small one, the maximum rainfall on the Twin Creek watershed, which the Germantown dam stand guard against, being 2.22 inches; but as pointed out in the leading article, small storms furnish a test of the working of the dam and retarding basin system out of all proportion to their size. The quantity of water trapped behind the Germantown dam by the storm of March 28 was only one-twelfth of what would be trapped by such a storm as that of 1913; yet the depth of water behind the dam on March 28 was nearly one-half, and the amount of water discharged into the valley below was more than one-half of the corresponding quantities with a 1913 storm. This is due to the increased flatness of the upper slopes of the valley which forms the basin into which the water backs up behind the dam; the effect being a rapid rise of flood water in the basin with small rainfalls, in which the water only reaches the lower valley slopes, and a slower and slower rise with greater floods, as the water in the basin spreads out over the flatter and flatter upper slopes.

As to the effect of the dam on the flood level of March 28, measurements showed that it lowered the flood crest just below by $3\frac{1}{4}$ feet. They showed also that a storm as great as that of 1913 will not give a flood crest in the valley just below quite as

high as the little storm of March 28 would have given had no dam been built.

The working of the concrete outlet basin, specially designed and built to receive and quench the destructive energy of the flood water as it is discharged from the dam conduits into the valley below, was another feature of the test which gave great satisfaction to the Conservancy engineers. The velocity in the conduits on March 28 was 29 feet per second—more than half that which would be given by a 1913 flood, and the basin handled it with ease. The velocity was reduced to $5\frac{1}{2}$ feet in the valley below, and the destructive energy was reduced to less than $\frac{1}{27}$ of its intensity in the conduits. The stability in position of the "hydraulic jump" under widely varying speeds of conduit flow, and the remarkable evenness of the flow through the jump under high speeds of discharge mentioned, with the complete quenching of undesirable back eddies, were very notable. Much attention was given to the design of the outlets in order to secure these desirable features, the problem presented by the high velocities of discharge of flood waters being regarded as one of the most formidable which the Conservancy engineers had to meet. The performance at Germantown on March 28, corroborating so fully as it did the expectations and calculations of the designers of the outlet, was especially gratifying.

Such a performance it was a pleasure to watch, and it is a pleasure to record. It furnishes another link in the strong chain of reassurance which the Conservancy work is forging, whereby the minds of the people of the Miami valley may be at peace in the

face of any flood which may befall. To the workers it furnishes additional stimulus to push forward the remaining links in the project until the full work is completed.

The Work of the Present Season May Bring the Miami Valley Practically Full Flood Protection

It needs to be emphasized, in connection with the successful test of the completed structure at the Germantown dam, that the Conservancy work of the present season will probably bring to the Miami Valley full flood protection. The work is so far ahead of schedule that its practical completion during the present season is not at all unlikely. The Germantown dam is done. Lockington dam will be finished during the summer; the dams at Huffman and Taylorsville, barring unforeseen mishaps, by the end of next winter. The dam at Englewood, the largest of all and therefore the latest to be done, will not be entirely completed, but the work is being pushed so rapidly and is so far ahead of schedule that by winter the embankment will be above the level which can be reached even by a 1913 flood. The conduits at Englewood are now in their temporary form, to act more efficiently as safety-valves for flood water behind the dam during construction, but it is not unlikely that one of these may be brought to final form before another spring. Even as they are, with the embankment above 1913 flood level, and the other dams all finished, the water released into the valleys below will not be sufficient to work any material damage. With the present flood season practically at its close, the people of the Miami valley can look forward with high confidence to complete protection from flood.

New Application of the Acetylene Torch to Restoring Outworn Machine Parts

An original and ingenious application of the acetylene torch to the converting of an outworn steel shaft into one which is even better than new, has been lately perfected by Mr. Wm. McIntosh, Master Mechanic of the Conservancy shop. It produces what is in effect a new bronze bushing welded to the shaft and replacing the outworn surface. The old shaft is first turned in the lathe over the worn portion to a smaller diameter, "necking" it down thus about one-eighth inch. Bronze is then fused to the surface of the neck by the acetylene torch until the diameter is a little greater than it was originally. The fused new bronze surface of what was the neck is now, of course, rough. This surface is now turned down to its original diameter, making what is in effect a new shaft, but with a bronze bearing surface at the journal instead of a steel one.

This method has been successfully applied to heavy shafts like the 6-inch swing shafts of the large dragline excavators on the Conservancy work; also to dredge pump shafts, which in some designs are peculiarly liable to quick wear on account of the sifting of fine sand into the bearings from the material going through the pump. The same method has been successfully applied also to refacing the nut which takes the end thrust of the drum shaft on a dragline shaft, when the friction clutch is thrown in. Many other applications will suggest themselves to those interested. The method gives

a very inexpensive replacement of a worn part, which in many cases—as in the swing shaft above noted—may have cost a good deal of money and would otherwise have to be thrown away.

Little Delay to Work by Flood of March 28

The effect of the storm of March 28 at Germantown is treated elsewhere in this issue. On the remainder of the work the storm did little damage and led to only insignificant delay. The rainfall varied over the valley from 0.94 at Greenville to 2.28 at Germantown dam. It produced a rise in the Miami at Main Street bridge, Dayton, to a maximum stage of 11.9. The maximum in April of last year was 16.2. At Lockington Loramie Creek rose 5 to 6 feet back of the dam, the water getting into the warehouse, but not to a depth sufficient to do any damage. There was no stoppage of work. At Taylorsville also there was no damage and no stoppage of the work. At Englewood the condition in the valley above the dam is shown in the picture on the back outside cover page. It created "some lake," but the damage was trifling. There was two days' delay to the work, the borrow pit being under the water in the picture referred to. The trestle across the Stillwater above the dam, which is on a 3 per cent grade, was just covered from end to end, but entirely undamaged, possibly in part because the main current was switched temporarily through the west borrow pit. The water rose 3 to 4 feet above the top of the entrance arch, to elevation 791, and 21 feet short of the "safety valve" formed by the temporary spillway. A modified "hydraulic jump" was formed at the outlet which was much like that at Germantown a year ago, the dam conduits at Englewood being still of double depth. There was a slight wash at one point in the borrow pit tracks. At Huffman the water rose a foot higher than in April of last year, but the flow was considerable slower, on account of the shift in the Mad River flow from the old diversion channel through the concrete outlet works. There was a drop of 3 feet in the water level through the outlet, with strong current, but no damage. The work was stopped for three shifts, due to the necessity of lifting the pump's motors above flood level. Through the cities there was a some delay to the channel improvement work, but no material damage.

Ohio Electric New Line Opens from Huffman to Fairfield

The relocated line of the Ohio Electric Railway between Huffman and Fairfield was put in operation on April 9. This is the portion of the new line running through the big rock cut at the south end of the Huffman dam, and thence northeastward along the border of the Huffman retarding basin on top of the inner levee. This levee is 35 feet above Mad River valley bottom, and together with the big cut (120 feet in height) makes this road a real "scenic line." The northern section of the Ohio Electric relocation, from Fairfield to Medway, is not yet built, the southern portion being the more important to get into operation to clear the way for the Huffman dam construction. Work on the uncompleted section will be begun at once, and is scheduled to be ready for operation about August 1.

Successful Test of the Completed Outlet Works at Germantown Dam

Solution of the Important Problem of Quenching the Destructive Energy of the Issuing Flood Water

The storms of March 9 and March 28 gave the first opportunity of seeing the "hydraulic jump" at a Conservancy dam outlet in full operation. In April of last year the jump was seen at two of the dams—Germantown and Lockington—but in both cases the conduits were in their temporary form, much enlarged in order to act as safety valves for flood water back of the dams during construction. The completion of the conduits in their final form at Germantown during the winter gave a chance this spring for a decisive test, the more so that the storm water of March 28 was sufficient—backing up behind the dam to a depth of 37 feet, and issuing at the outlet with a velocity of 29 feet per second—to furnish an excellent line on the operation of the jump under high floods.

The object of the peculiar design is to kill the destructive speed and energy of the flood waters as they issue into the valley below the dam. The problem is a very real one. At Germantown on March 28 a mass of water came plunging from the outlets every minute, equivalent to 195 freight cars of 100,000 pounds each, going nearly 20 miles an hour. With a storm like that of 1913, the mass issuing per minute would be equivalent to more than

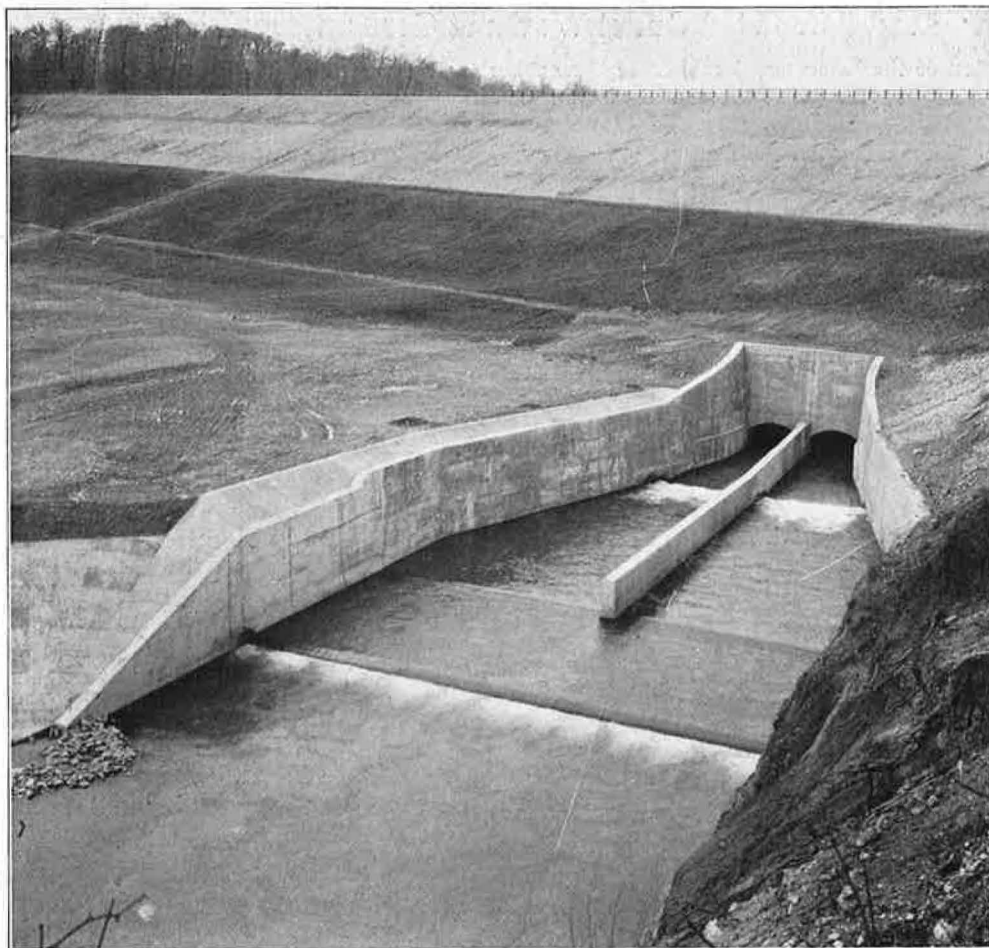
six 50-car freight trains, going at 37.5 miles an hour. The destructive effects of letting loose such powerful masses to plow up the creek bottom below, with possible undermining of the dam itself, can be readily imagined. The problem of the Conservancy engineers was to kill this destructive force. They did it by perfecting and adapting the "hydraulic jump." It was one of the most important problems connected with the project, and took a year of investigation, experimentation, repeated design, and repeated trial of the design by a working model, before the problem was fully solved.

The result at the Germantown dam, operating at an ordinary stage of water, is shown in Fig. 291. The conduits are seen to be twin tunnels of concrete, carrying Twin Creek beneath the dam (the downstream slope of the embankment being seen rising behind the outlet mouths). The water, issuing from the conduits, is seen to break a little below into a narrow sheet of foam, indicating the position of the "hydraulic jump." (A second sheet of foam in the foreground, indicating another hydraulic jump, is merely incidental). The scene is quite peaceful and harmless, the water purling gently through the jump, like a kitten at play.



FIG. 290—GERMANTOWN CONDUIT OUTLET BASIN, FLOOD OF MARCH 9, 1921

Looking downstream from top of headwall over conduit mouth. The smooth dark water in the foreground is the rushing flow from the conduits as shown in Fig. 294. See also Figs. 287 and 292. The end of this smooth water is the beginning of the "hydraulic jump." The saw-toothed climbing of the water through the jump is shown clearly along the wall at the left as far as the angle in it. (Compare the wall top, which is level). The rise in water level was about $5\frac{1}{2}$ feet. The surface water flowed back down the incline toward the observer.



Compare with the picture on the opposite page which shows the same outlets under flood discharge. See also pages 133 and 134. The conduits are here seen to be twin tunnels of concrete, carrying Twin Creek under the dam, the downstream slope of the dam embankment rising behind the conduit mouths. The water issuing from the conduits is seen to break a little below them into a narrow sheet of foam, indicating the position of the "hydraulic jump." (The nearer sheet of foam is incidental). The scene here is very peaceful and serene, the water purling gently through the "jump" like a kitten at play. Fig. 292 is a corresponding view during high water, with a flood flow through the conduits more than half that which would be produced by a storm like that of 1913. The kitten—here seen to have been a cub—is as it were half grown, "making consid-

(Continued below)

FIG. 291—CONDUIT OUTLETS, GERMANTOWN DAM, AT ORDINARY STAGE, MARCH 4, 1921

erable splash," but powerless for harm, a young lion, but with its teeth drawn. A 1913 storm will bring the beast to full growth, but the same mechanism which pulled the young lion's teeth will pull the grown one's. The mechanism has proved itself amply adequate to its full task.

Fig. 292 is a corresponding view during the high water. Fig. 290 is a close-up looking downstream from the top of the wall over the outlets. Fig. 287 is similar to Fig. 292, but from a greater distance. All show very well the conditions with a flood flow through the conduits more than half that which would be produced by a storm like that of 1913. The kitten—now seen to have been a cub—is here as it were half grown, making "considerable splash," but powerless for harm—a young lion, but with its teeth drawn. A 1913 storm will bring the beast to full growth, but the same mechanism which pulled the young lion's teeth will pull the grown one's. The mechanism has been tried, and given ample evidence of its adequacy to the full task.

The mechanism is a simple one—an adaptation of a device often seen in Nature doing a similar work. It has no moving parts to get out of order. It is built of concrete and bedded in the solid rock, as it needs must be to withstand the shock of the impact of such powerful masses of water as have been indicated. It consists in a widening and deepening of the conduits below their outlet, into a double concrete basin which opens downstream into the creek channel below the dam. Inspection of Fig. 291 will make this quite clear. Each conduit is 13 feet wide; the width of the double basin is 85 feet. The basin

floor slopes down to a depth 16 feet below that of the conduits. There is thus formed in the basin a wide, deep pool of water, like the pool often seen at the foot of rapids in a brook.

The action in the pool in both cases is the same—to provide a water cushion which receives the sharp impact of the descending stream, and checks its velocity. And just as the stones in the brook act to aid the water cushion in slowing down the flow, by roughening the bottom and offering obstructions; so the concrete basin has its bottom purposely roughened, and artificial obstructions provided, to produce similar effects. The roughening is produced by building irregular steps in the descending floor, as it leads down from the conduits to the bottom of the "pool chamber." The artificial obstructions are in the shape of two submerged walls which are carried across the entire width of the outlet basin at its downstream end. The tops of both of these walls can be seen through the water in Fig. 291, the nearest foam sheet being formed by the water pouring over the crest of the lower one.

Both in the brook rapids and the conduit outlets, where the swift current strikes the slower water of the pool below, there is formed what is known as a "hydraulic jump." In the case of the brook the jump is apt to be rather imperfect. A more perfect

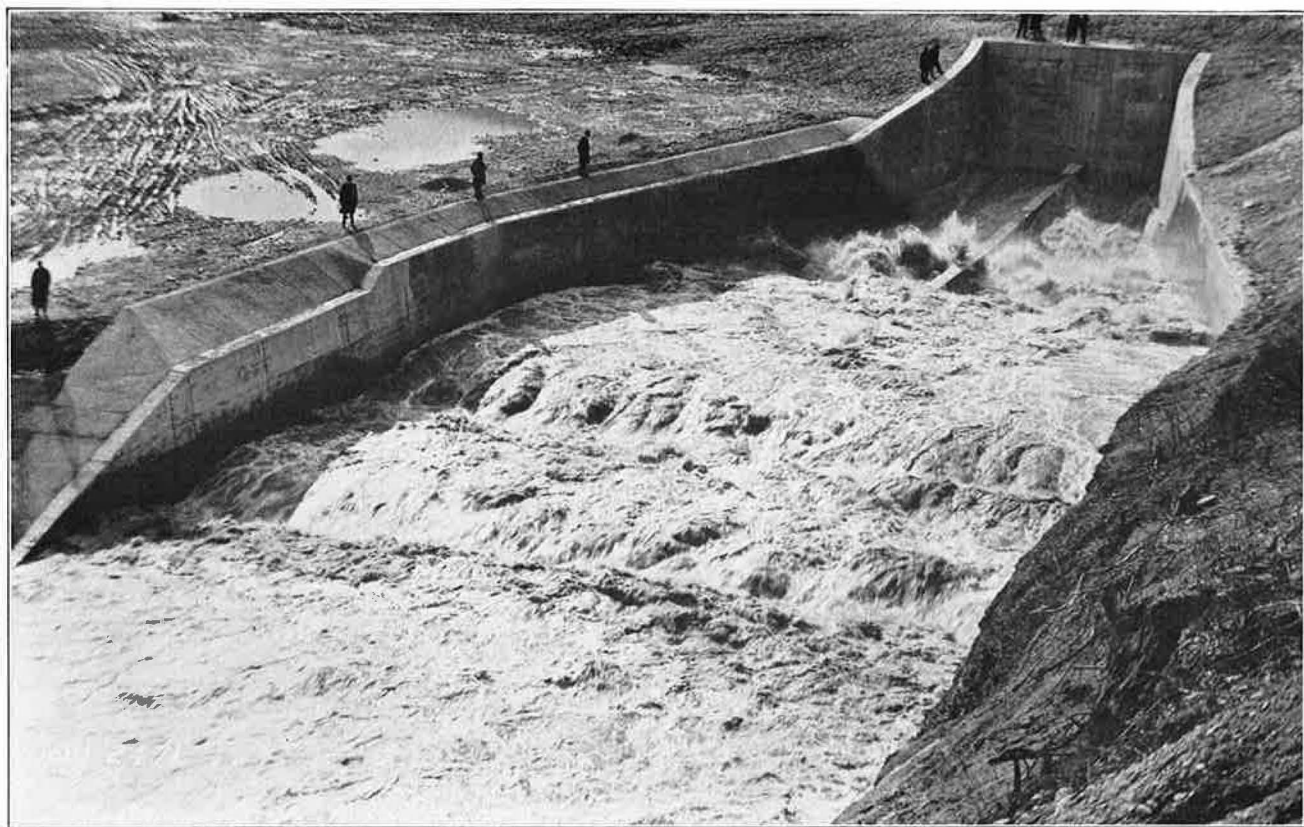


FIG. 292—OUTLET CONDUITS, GERMANTOWN DAM, FLOOD OF MARCH 9, 1921. (SEE FIG. 291.)

form may be seen where the sheet of water which slips over the level crest of a dam (as at the Steele dam in Dayton), slides on down the sloping "apron" and strikes the water of the stream below. Where it strikes, a stationary wave is formed, the sheet of water shooting into the base of this wave, and by its momentum forcing the water below to a higher level, whence it flows away downstream. Down the sloping wave front, from this higher level, the water is perpetually tumbling over backward toward the dam, breaking into foam as it tumbles, precisely in the manner of a breaking wave on a sloping sand beach. In fact, it very much resembles such a wave, except that instead of rolling onward it stands still. It is in this standing wave that the "hydraulic jump" occurs.

The name, "hydraulic jump," is an apt one as describing the appearance presented. The water does seem to jump suddenly up; but the jump is only in seeming. Actually the higher level is the effect of the plunge of the descending sheet into the base of the wave, lifting the water below as it were on its shoulders.

It is this work of lifting the water which robs the descending stream of momentum and slows it down. There is, however, a further effect, due to what may be called the boiling away of an additional fraction of the momentum into foam. The water in the jump is churned into a white lather of tiny eddying bubbles. The eddying water particles rub against each other, and against the air of the breaking bubbles, with resultant friction. And this friction acts as truly in checking the momentum of the moving water as the friction of the brake shoes on the car

wheels checks the momentum of a moving railway train. The tiny brakeshoes of air and water are very small, but there are millions of them, and the sum total of their effect is as unquestionable as the sum total of the sand grains that build a sea beach.

There are thus two ways in which the hydraulic jump operates to destroy the velocity and kill the destructive energy of the water as it issues from a Conservancy dam outlet—by compelling it to lift a mass of water below, and by means of friction.

Besides these must be reckoned the effect of what may be called diluting the speed of flow, by spreading it over a deeper and wider channel than it had in the conduits. The combined effect was to reduce the velocity from 29 feet per second in the conduits to 5.5 feet in the creek below.

This result seems very good; but the actual effect in killing the destructive energy of the flood water was far greater than the figures make it appear. A railway train "side swiping" another at a crossing at a speed of 50 miles an hour, has far more than 5 times the destructive effect which it would have at a speed of 10 miles an hour. Power for destruction varies as "the square of the speed." The two speeds are as 5 to 1. The two powers for destruction are as 25 to 1. The 50-mile-an-hour train would smash things up with a power 25 times as great as the 10-mile train would have.

Applying this law (which is as solidly established by physical science as the law of gravitation) to the case of the Germantown flood of March 28, it will be seen that more than 26/27 of the destructive power possessed by the issuing water from the conduits was "killed." Less than 1/27 of it remained.

It need hardly be said that this result, which was quite in accordance with the expectations of the engineers who perfected the design of the outlet works, was highly satisfactory. Not only the engineers

who designed and built them, but primarily the people of the Miami valley, for whose safety they were built, are to be congratulated on the proved efficiency of these very important features of the work.

Efficient Work of Germantown Dam in Checking Flood

Storm of March 28 Furnishes Satisfactory Demonstration of the Ability of the Dam to Hold Back Great Floods.

The storms of March 9 and March 28 were of unusual interest in showing the beneficial effect in actual operation of the flood protection works at the Germantown dam, in reducing the high water stages in Twin Creek and in the Miami River through Middletown and Hamilton, these being the two cities which this dam was especially built to serve.

The storm of March 28, the greater of the two, which backed up the water behind the dam to a height of 37 feet above the conduit floor (39 feet above the old creek), especially illustrates this. The appearance of Twin Creek valley above the dam, with the water a little below its maximum, is shown in Fig. 303. The lake formed extended about four miles up the valley, and contained 267,000,000 cubic feet of water, or 6130 "acre feet" (equivalent to 613 acres flooded ten feet deep). The appearance of the water emerging from the conduits is shown in Figs. 287 and 292. These latter pictures were taken on March 9, the date of the earlier storm, but the appearance on March 28 was very similar.

The water at maximum flood (5 p. m., March 28), standing 37 feet above the conduit floor, had a velocity through the dam conduits of 28.8 feet per second (20 miles per hour), and discharged at the outlet 5,250 cubic feet of water per second (equivalent to a mass 7 feet square and 107 feet long.)

These figures should be compared with those of a flood at Germantown equal to that of 1913, supposing one to occur. The velocity then would be 55 feet per second, a little less than twice that of March 28 of this year. The corresponding discharge from the dam conduits would be 9,300 cubic feet per second. The lake behind the dam would stand at a level about 45 feet higher than on March 28. The water storage in it would be 73,000 acre feet, 12 times that of March 28.

The figures bring out sharply the crucial fact regarding the system of flood protection adopted on the Miami valley project. The water stored behind the dam with a 1913 storm rainfall would be 12 times that stored on March 28 of this year, while the water permitted to pass into the valley below would be less than twice that of March 28. With the 1913 storm, the water level just below the dam would rise only three feet higher than it actually rose on March 28 last.

The effect of the dam on the flood stage just below the outlet on March 28, was to lower it 3.2 feet below where it would have been without the dam. With another 1913 storm the dam would lower the flood water level just below the outlet by 14 feet, as compared with the actual level of the 1913 flood. Here again the rapidly increased efficiency of the dam as a flood damper, with the heavier storm rainfalls, shows clearly.

The facts just given as regards the effect of the Germantown dam on the stage of water just above

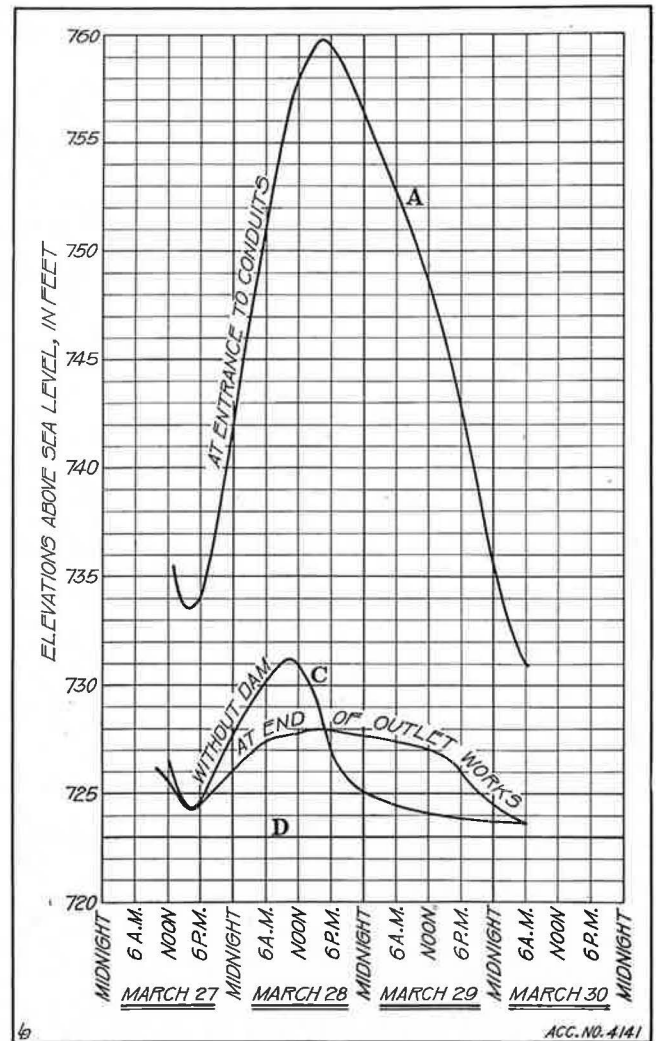


FIG. 293—DIAGRAM SHOWING FLOOD CONTROL

Platted from measures at Germantown Dam, storm of March 28, 1921. The water elevations above and below the dam are shown as they varied during four days, as indicated below the curves. Curve "A" shows the rise and fall of the water above the dam; the curve marked "At end of outlet" shows the rise and fall in the creek just below the dam; and curve "C" shows what the rise and fall would have been if no dam had been built. The horizontal lines mark elevations a foot apart, the sea level elevations being given at the left. The heavy horizontal line "D" marks the elevation of the conduit floors at the outlet. The curves show that the maximum elevations were reached at 5 p. m., March 28, the difference in stage above and below the dam being then 31 feet. Without a dam the maximum stage would have occurred at about 10 a. m. the same day, as shown by the curve "C." The crest of this curve shows that the effect of the dam was to lower the peak of the flood 3.2 feet.

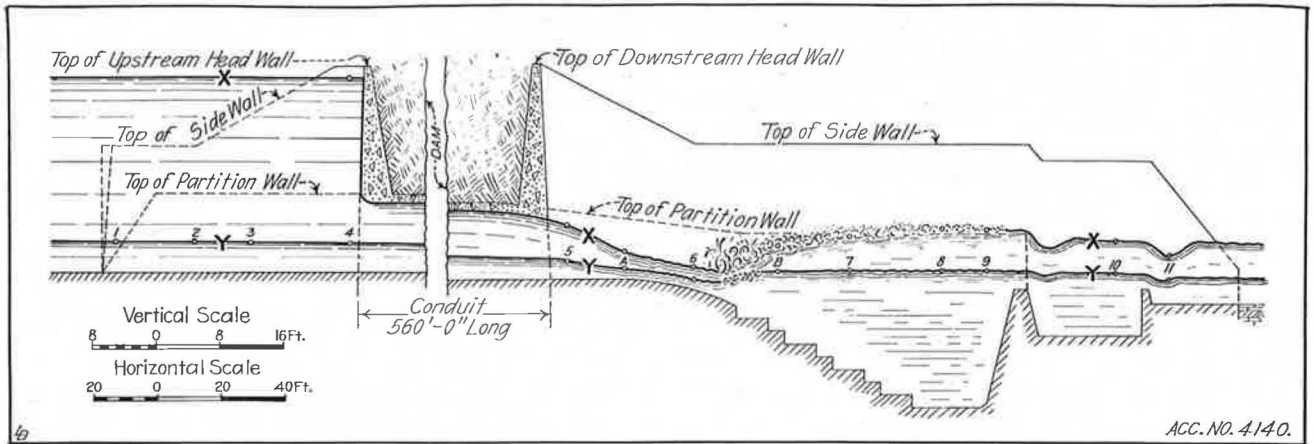


FIG. 294—DIAGRAMMATIC LONGITUDINAL SECTION, GERMANTOWN DAM CONDUITS, SHOWING HYDRAULIC JUMP

The vertical scale is here magnified $2\frac{1}{2}$ times, as compared with the horizontal, to show more clearly the action of the "jump." Compare with figure below, which shows a regular section, with both scales alike. The heavy line "Y Y Y" shows the water surface at an ordinary stage, corresponding to Fig. 291. The line above it, "X X X," shows the water surface at flood stage, corresponding to Fig. 292. Water levels were read at the points marked by the small circles, 1, 2, 3, 4, 5, A, 6, etc. (The locations of these points is shown also in Fig. 295.) Both lines show that the water, (flowing toward the right) emerges from the conduit mouth (under the downstream head wall), and flows down the slope until it strikes the mass of water in the pool. Here it breaks into foam, rises in level and flows on over the two walls, (shown one on each side of the right-hand "Y"). The rise in level, accompanied as it always is by the breaking into foam, constitutes the "hydraulic jump." (See pages 133-135). It is remarkable how little change in the point of beginning of the jump occurred with the great increase in head. This stabilization, and the elimination of undesirable eddies, were very satisfactory. The velocity of the water was reduced from 29 feet per second in the conduits to 5.5 feet in the creek channel below.

and just below it, are exhibited directly to the eye in the diagram, Fig. 293. Three curves are there shown, exhibiting the rise and fall of the water at the dam from March 27 to March 30. Curve "A" shows the rise and fall just above the conduit entrance. Curve "B" shows the rise and fall just below the outlet works. Curve "C" shows the rise and fall at the same point as Curve "B," supposing the same storm rainfall, but without the dam. The figures at the left are elevations above sea level, giving a means of measuring the differences in level. The actual difference, above

* Through inadvertence, the "B" meant to mark this curve has been omitted. The curve is marked "At End of Outlet Works."

and below the dam, was 31.3 feet. The reduction in the flood crest by the dam, as shown by the difference between the highest points of curves "B" and "C," is 3.2 feet. The line "D" is added to show the level of the conduit floor at the conduit outlet. At the conduit inlet the floor level is one foot higher.

The rainfall which caused the high water of March 28 occurred most of it during the preceding night (March 27-8), but there had been intermittent rainfall for a number of days preceding. The quantity varied from 1.51 at Ingomar to 2.28 at Germantown dam. The total rainfall on Twin Creek watershed during the storm of March, 1913, to compare with these figures and the flood data given above, was from 9 to 11 inches.

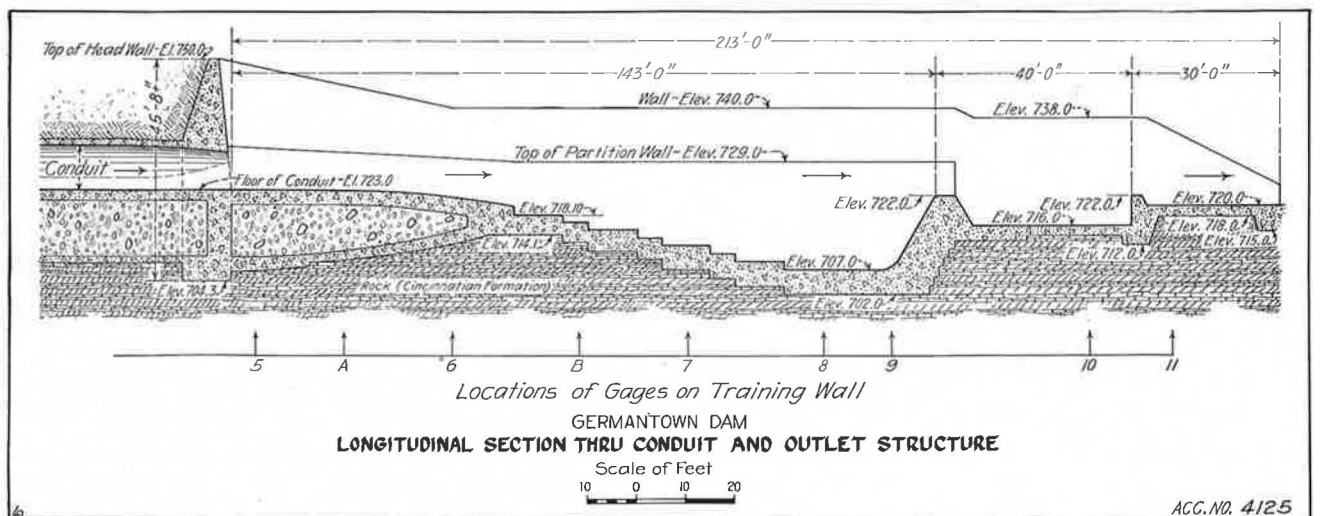


FIG. 295—LONGITUDINAL SECTION THROUGH GERMANTOWN DAM CONDUIT AND OUTLET

February Progress on the Work

GERMANTOWN

Dismantling having been completed, the work of the past month has consisted principally of cleaning up.

Some work has been done on the grading of the roadway on top of the dam, and Road No. 1, between the dam and the State Road is being re-graveled wherever repair is needed.

The clearing of old trees, brush and rubbish from the reservoir above the dam is nearly completed.

The guard rail for the roadway along the top of the dam has been straightened and a gang of men are painting it.

Planting of trees in the creek basin above the dam and of shrubs on the slopes of the dam has been started.

A. L. Pauls, Division Engineer.

March 19, 1921.

ENGLEWOOD

Embankment construction was resumed, after the winter's layoff, on March 1, using the day shift only. On March 7 the night shift was put on. From the start the output has averaged 400 cars or better per shift, with a few exceptions. This compares favorably with the best progress of last season. The date of beginning work this year is three weeks ahead of any previous season.

The large electric dragline has completed the filling of the crib at the outlet of the temporary spillway and has also completed the excavation for the permanent spillway. This machine is now engaged in leveling off the excavated material, forming with it a levee between the spillway channel and the dam.

At the permanent spillway plant has been erected for concreting. A trestle for dumping concrete aggregates has been constructed and a cement house built. The large steel derrick, which has been unloading coal at the coal pile, has been taken down and set up at the permanent spillway. The gravel screening plant has been overhauled and put in running condition preparatory to furnishing concrete aggregates.

H. S. R. McCurdy, Division Engineer.

March 15, 1921.

LOCKINGTON

Hydraulic fill operations were resumed on March 1 and good progress is being made. A 12-in. centrifugal pump has been installed to handle the circulating sluice water. This relieves, for use as a booster, the dredge pump which was used temporarily for the purpose.

Stone surfacing on the dam is nearing completion and a footing was laid during the low water of the winter for rip rapping on the west side of the outlet channel.

Work on Road 11 in the basin, about six miles above the dam, is nearing completion and the last fill on Road 9 will probably be finished during the coming month.

Preparations are being made for placing the remaining concrete of the outlet structure, and the concrete bridge over the spillway. This work will commence as soon as river conditions will warrant, which will be during the latter part of April.

Barton M. Jones, Division Engineer.

March 22, 1921.

TAYLORSVILLE

The river has been partly turned through the new outlet channel, and in about two weeks the lower end of this channel will be sufficiently widened to carry the entire flow. The old channel can then be closed as soon as the danger from spring floods is passed. All rock excavation has been finished. The estimated total rock excavation was 219,000 cubic yards, and the actual 230,600 cubic yards.

The sluicing is now running two 10-hour shifts, and is making good progress. That part of the dam from the cross dike west is now within 10 feet of the spillway elevation, or 29 feet from the top.

A contract has been let to Robert Brothers, of Chicago, to dress up the rock dumps on each toe of the dam, west of the river, to a uniform slope and berm width and use the surplus to continue these slopes and berms across the river; also to make the long Class "F" blankets in the old river channel.

Roberts Brothers started work on this contract on March 17.

O. N. Floyd, Division Engineer.

March 22, 1921.

HUFFMAN

The major operation during the past month has been the pumping of material into the embankment of the dam. The greater part of this is being excavated from the main borrow pit in the valley above the dam, and the remainder from a pit on the hillside at the north end. Work in the latter was continued on March 1, when a new pit was opened up just east of the one used during the past season. To date the quantity and quality of material found in this pit checks very closely with previous estimates. It has a high percentage of the finer elements, which added to the earth from the main borrow pit, containing an excess of gravel, makes the proper balance in the dam between fine material for core and coarser material for slopes. It is also expected that the material from this pit will boost the progress sufficiently to insure the completion of the embankment this season, as there is some question whether the one dragline in the main pit could excavate the required material alone.

On March 1 a total of 654,000 cubic yards had been placed in the dam. This is just 50 per cent of the total material required for the embankment.

The steam dragline has practically completed the excavation work in the outlet channel below the concrete works. Rock paving is being placed on the slopes of this channel where necessary.

C. C. Chambers, Division Engineer.

March 22, 1921.

DAYTON

Dragline D-16-15 has continued river excavation below Stewart Street. The 24-in. water main above Fifth Street bridge has been lowered to a new level, below channel grade, and dragline D-16-15, which performed the excavation for that work, is about to pass under the bridge. D-16-8 is beginning levee construction on the right bank of the river below the Big Four railroad bridge near Miller's Ford. D-16-19 has completed the channel excavation above Dayton View Bridge and is now cleaning up the surplus excavation from the Sunset Avenue retaining wall at Third Street bridge.

Retaining walls are under construction at Beach Avenue, First Street, First Baptist Church, Negley Place at Ferguson Avenue, Taylor Street and at the southeast wing wall of Keowee Street bridge.

The Finke Engineering Company is continuing work on the Apple Street culvert. Price Brothers Company has constructed the head wall and discharge channel for the Herman Avenue storm sewer. J. C. McCann has moved his steam shovel to Findlay Street and started levee construction on the south bank of Mad River.

To date 63,950 cubic yards of sand and gravel have been issued from the Sunrise Avenue gravel plant.

The total quantity of channel excavation (Item 9) completed up to March 1, was 918,500 cubic yards. Levee embankment amounted to 176,250. Total yardage handled was 1,995,000 cubic yards. None of the figures include 105,000 cubic yards of excess excavation for scowing canals.

C. A. Bock, Division Engineer.

March 23, 1921.

HAMILTON

Work on the west bank above the Columbia bridge has been completed and the electric dragline has crossed to the east side, where it will pass under the bridge and then proceed south to about Station 93, near Hanover Street. There it will again cross the river and begin work on a cut of 360,000 cubic yards. The material from this cut, with the exception of 90,000 cubic yards, will be hauled over the trestle at Station 110 into the spoil bank in Peck's Addition. The 90,000 cubic yards mentioned will be wasted along the west side of the cut.

Concreting of the west abutment of the Black Street bridge has been completed to a point about three feet below the sidewalk level. The abutment is being backfilled with cinders from the Champion Coated Paper Company. Concreting of pier No. 1 has been completed. The Bucyrus Class 14 dragline is at present piling up gravel for further use on the bridge and the Black-Clawson wall, after which it will drive the piling for the false work for spans 1, 2, 3 and 4.

The work of concreting has been resumed on the footing of the Black-Clawson wall.

The small Marion dragline is grading for temporary tracks on the west side of the river below Station 95.

C. H. Eiffert, Division Engineer.

March 21, 1921.

UPPER RIVER WORK

Troy—The high water during the first of the month did not affect the work of Donald Jeffrey to any great extent. The dragline (D-16-21) has continued to place the embankment for the East Levee, and to date about 20,000 cubic yards of material has been placed. The levee is nearly complete for a length of 1600 feet. After this work is finished the dragline will cross the river above the old dam and start work on the levee extending along the M. & E. Canal. This levee joins the levee, known as the South Levee, being made by the Finke Engineering Company at Morgan Ditch, and extends southeasterly to the Adams Street bridge.

The Finke Engineering Company has suspended operations until they have better weather conditions.

The contract of the C. & C. Haulage Company has been turned over to T. Daniels & Son of Dayton. Their equipment will consist of an Osgood steam shovel and teams. Only one shovel and five trucks remain of the C. & C. Haulage Company's equipment. They have about 1500 cubic yards of material to place in the levee on the right side of the river and expect to leave as soon as this work is complete. Their total excavation will amount to 80,000 cubic yards.

The high water caused considerable delay in excavating for the north abutment of Market Street bridge. It is expected to be completed in the next day or two. A formation of very fine sand or silt above the gravel is causing considerable difficulty in the work of keeping the water down and in the excavating.

The contract for building the aforesaid abutment has been let to Price Brothers Company. Three of their men have already arrived and have been helping with the pumping outfit.

Tippecanoe City—The work of erecting a pole line at Tippecanoe City has progressed favorably, and is practically completed at this time.

A. F. Griffin, Assistant Engineer.

March 20, 1921.

LOWER RIVER WORK

Miamisburg—On the fourth of March Cole Brothers commenced construction of levee on the Balon property at the southern extremity of the protected area, after a two-mile move. Since that date they have completed 1,200 linear feet of levee, containing 14,000 cubic yards of material. They have also torn up the brick pavement for the Fourth Street elevation, laid 145 feet of 24-inch sewer pipe to carry the water off this street and made most of the gravel fill.

Franklin—The dragline has made the excavation for the conduits for the tail race of the American Writing Paper Company, raised the 95 foot mast of the derrick to be used in the construction of the conduits and crossed to the north side of the tail race, where excavation for the temporary

channel has been commenced. This work has been delayed considerably by high water.

Trestle construction north of the head race of the American Writing Paper Company is about 75 per cent complete. A trestle has also been built across the hydraulic canal. All the material which goes into the levee north of the paper mill will be hauled across this bridge.

Clearing of timber along the west bank of the hydraulic is progressing. About 45,000 cubic yards of material from the channel excavation will be wasted along this bank.

—**Middletown**—Price Brothers have completed the Hydraulic Street wall and are now making repairs to a portion of the wall which was injured by freezing temperature.

F. G. Blackwell, Assistant Engineer.

March 22, 1921.

RAILWAY RELOCATION

Big Four and Erie. The Big Four maintenance forces are removing the rail from the old Big Four line. They have approximately 60% of it taken up.

The District forces have completed constructing cattle pens for the Big Four at New Osborn. They have also been salvaging material from the old lines, the ties being shipped to other features of the District.

Ohio Electric Railway. The rail bonding has been completed and the railway company are now cross bonding, which will be completed within a short time.

The contractor, Joseph Connelly, completed grading the gap at Mud Run bridge, just east of Osborn, with the exception of a small portion that still remains where the Big Four tracks cross the Ohio Electric. This will be completed as soon as the Big Four tracks are torn up, which will be about the last of April.

Mr. Joseph Connelly was also awarded the contract for grading the gap at Mad River bridge which was washed out by the spring flood of 1920. This work, about 3,000 cubic yards, will be completed about April 1st.

The Brookville Bridge Company have completed the fabrication of the steel for the bridge over Mad River. This is ready for shipment to the site of the work just as soon as the track is laid to the bridge from Fairfield.

Baltimore & Ohio. Work completed.

Albert Larsen, Division Engineer.

March 25, 1921.

RIVER AND WEATHER CONDITIONS

No freshets of importance occurred in any of the streams of the Miami Valley during the month of February.

The rainfall at the District's stations varied from 1.20 inches at Pleasant Hill to 2.57 inches at the Germantown Dam. At Dayton the total amounted to 2.25 inches, or about .83 inches less than normal.

The local Weather Bureau records show that the mean temperature for the month was 35.8 degrees, or 5.2 degrees greater than normal; that there were 4 clear days, 5 partly cloudy days, 19 cloudy days, and 9 days on which the rainfall amounted to 0.01 of an inch or more; that the average wind velocity was 11.4 miles per hour, the prevailing direction being from the southwest; and that the maximum wind velocity was 39 miles per hour from the west on the 16th.

Ivan E. Houk, District Forecaster.

March 25, 1921.

Screen for Boiler Feed Water Sediment

In the early days of the "Dorothy Jean," the Conservancy river tug pictured in our last issue, the purchasing division of the District was rather amused and puzzled by receiving a requisition for marsh hay and turkish toweling, to be used in connection with the boat's steam boiler. They are old hands at their job, but marsh hay and turkish toweling for a steam boiler, were new kinds of "fodder," requiring explanation.

The two materials were in fact for use in the construction of a hay filter for the removal of sediment from the boiler feed water. The origin of the device is not known. It is not new, but does not seem to have been described, and is believed to be worth

presenting. It was introduced on the Miami River job by Messrs. H. A. Hanson, Superintendent, and V. H. Tucker, "Fleet Captain" of the scow and tugboat service, who had used it successfully on the Barge Canal in New York (at Rome) on the work of Charles H. Locher there.

The mechanical construction is shown clearly in the illustration, and needs little explanation. It shows a long rectangular wooden tank, divided into compartments by cross partitions, through which the feed water is made to circulate, entering at one end and leaving at the other, passing through repeated filters of the hay and turkish toweling in the course of its journey. It enters perhaps yellow or

brown with unsettled river mud. It leaves (ready to enter the boiler), "clean enough to drink."

Five filters are shown, but the number is not arbitrary. In some cases probably fewer would be sufficient. In each the direction of flow is upward—an important consideration. The five compartments are separated by double baffle boards, the two boards in each case two or three inches apart, sufficient to leave space for the water between them, the water passing in all cases over the top of the board nearest the inlet, and under the bottom of the other, thus delivering the water always at the bottom of the next compartment. Each compartment is simply packed full of the hay, up to the level of cross cleats near the top, these cleats providing support for a finer screen made of the turkish toweling. This is made by tacking the toweling to a rectangular frame after the manner of mosquito netting.

The water in its passage—always upward, through the filter compartments—leaves sediment in the meshes of the hay and upon the under side of the toweling rather than upon the upper side. This may seem a small matter, but it means a difference between cleaning the filter twice a week, and cleaning it several times oftener; in other words, it stops the deposition and packing of a thick layer of silt on the top of the left-hand towel screen, with consequent rapid clogging of the flow.

On the Dayton job the use of this device has meant the elimination of a shutdown during the week to clean sediment from the Dorothy Jean's boiler; one boiler cleaning, during the regular week-end shutdown, being sufficient for this period.

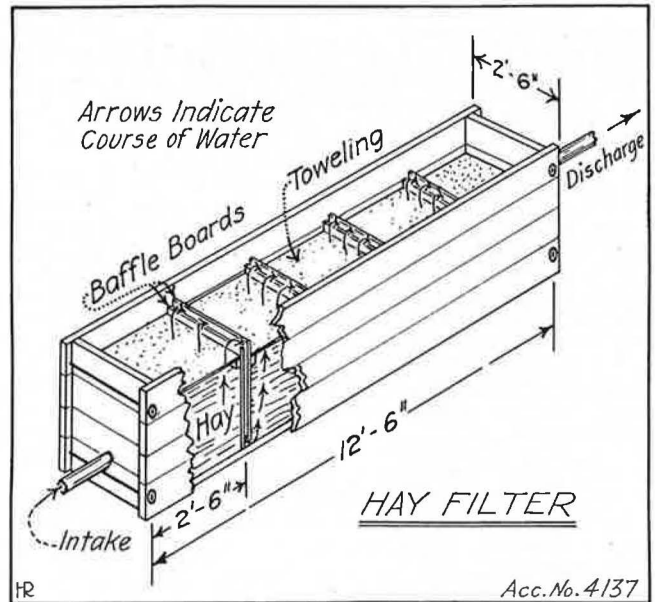


FIG. 296—HAY FILTER FOR FEED WATER

The filter was cleaned twice a week, very simply, by removing the towel screens and washing them off with a small hose, the hay not being removed, or indeed treated in any way except to remove and replace it at long intervals with clean material.

The simplicity and efficiency of the device, which can be easily built by any carpenter, makes it worth trial. It should be understood that it is for sediment only; lime or other deleterious chemical ingredients being of course untouched.

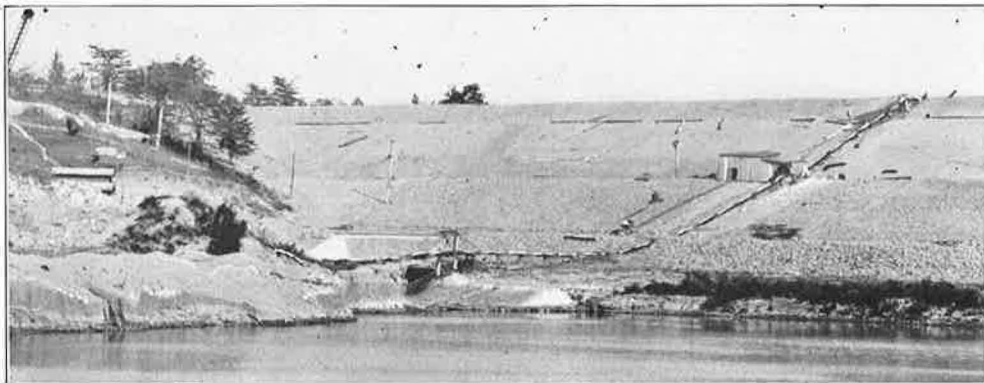
White Iron Dredge Pump Shells Again

Remarkable Performance of 15-Inch Pump at Germantown, Which Was About One-third Worn Out After Pumping 380,000 Cubic Yards of Sandy Material.

In the Bulletin for June, 1920, an account was given of the building at the Conservancy shop of a new centrifugal dredge pump shell of white cast iron, and of unusual thickness, to give greater wear and thus save in cost of pumping equipment. The wear is due to the attrition of the particles of sharp sand and gravel thrown from the rapidly revolving pump runner, cutting away the metal of the interior surface of the pump shell. In the pumps first operated at the Conservancy dams (in pumping the

mixed earth and water to the summit of the dam to be placed in the embankment), the shell would be worn out after handling 160,000 to 180,000 cubic yards of the earth material. It was hoped by use of the thick white iron shell to increase this duty by a large percentage.

The pump was a "15-inch pump," absorbing at maximum load 500 horse power, and capable of pumping 7,000 gallons of water per minute against 150 feet maximum head. It was set up at the Ger-



The white iron "booster" pump is at the house half way up the slope; the "primary pump" in the house at the extreme left. The pipe line carries the earth (mixed with water) up the slope to build the dam at the summit. The "primary pump" drives the material as far as the "booster;" the latter "boosts" it on to the top.

FIG. 297—PIPE LINE CLIMBING UPSTREAM SLOPE, GERMANTOWN DAM, JUNE 6, 1920.



This is the pump half way up the slope in Fig. 297. It is driven by a 350 horse power electric motor in the house. The mixed earth and water coming up the pipe at the slope are sucked in at the center of the pump shell and driven out again up the pipe at the right to the dam top. Revolving paddles within the shell do the work, whirling the material from the pump shell into the pipe at the bottom like a stone from a sling. This pump drove 380,000 wagon loads of earth to the top of the dam.

FIG. 298—WHITE IRON BOOSTER PUMP, GERMANTOWN DAM, JUNE 1, 1920

mantown dam, on March 20, 1920, on the lower berm, about fifty feet above the valley floor, to act as "booster" to the "primary pump," of similar capacity, which was in the main pump house, on the lower valley slope, 40 feet below the booster. The dam summit was 47 feet above the booster, and the "sump" or cistern which fed the primary pump suction was 7 feet below the primary pump. This layout is shown in Figs. 297 and 298, the booster being in the lower right-hand corner of Fig. 298, and the primary being in the pump house in the upper left. In Fig. 297 the booster is at the upper pump house (at the right), and the primary pump house is at the left; this figure showing plainly also the pipe line connecting the two and proceeding on to the dam summit.

The material pumped was derived from the valley bottom and the valley slope, the latter being drawn on to remedy a deficiency in clay materials which developed in the borrow pit on the valley floor. The mixed material may be roughly graded as 20 per cent clay and 80 per cent sand and gravel, the latter being deposited in the dam slopes and the former in the center core, as described in earlier numbers of the Bulletin.

The matter of the nature of the material is important. The most common application of the dredge pump is to the excavation of the soft silts deposited in harbors and similar situations where the lack of the sharper sand and gravel enables ordinary cast iron to give excellent service in resisting wear. Some of the earlier pumps installed on the Conservancy work were of this type, the necessity of rushing the work, and the exigencies of securing equipment during the press of war time, not permitting the application of rigid selection and choice. In the materials available in the Miami Valley for the Conservancy dams, however, such pumps quickly showed their inability to stand up under the hard service required. The No. 1 pump at German-town cracked along the midline of the outer rim of the shell after pumping only 85,000 cubic yards of

the valley bottom material. It was then patched with a liner inside, which carried the yardage delivered to 166,450, when the pump had to be abandoned on account of air leakage breaking down delivery of material to the suction end. The No. 2 pump cracked in a similar way after pumping 95,650 cubic yards, and was similarly treated, but in an improved manner, so that after pumping 150,800 yards it had still a good deal of available wear remaining, but was replaced for other reasons.

These facts are stated in order that the performance of the white iron pump may be the better appreciated. This pump, "No. 5," operating from March 20 to November 6, when the embankment was completed, delivered 380,000 cubic yards of materials into the dam, of which about 80 per cent, as stated, was sand and gravel. At the end of this task, the greatest wear to the pump shell was $1\frac{3}{4}$ inches. This occurred next the bottom, at the outside rim, where the original thickness was $5\frac{1}{4}$ inches, leaving thus $3\frac{1}{2}$ inches of shell thickness available. That is, the shell, roughly speaking, was about one-third worn out; or, since the skin of a casting is somewhat harder than the remainder, a little more than one-third worn out.

A little more detail on this point may be interesting. Considering the face of the pump in Fig. 298 under the analogy of a clockface, at "six o'clock" the original thickness was $5\frac{1}{4}$ inches, the final $3\frac{1}{2}$ inches; at eight o'clock, the original thickness was 5 inches, the final thickness 4 inches; while at 10 o'clock and 12 o'clock, where the original thickness was $4\frac{1}{2}$ and $4\frac{1}{4}$ inches respectively, the wear was so little as to make its measurement uncertain, considering the irregularities of the metal surface. The concentration of the wear at the bottom and lower left quadrant is notable, and if shown by later tests to be normal, may well be taken account of in the design.

This No. 5 pump is to be set up later at the Taylorsville dam, where its subsequent performance will be watched with interest. The Conservancy

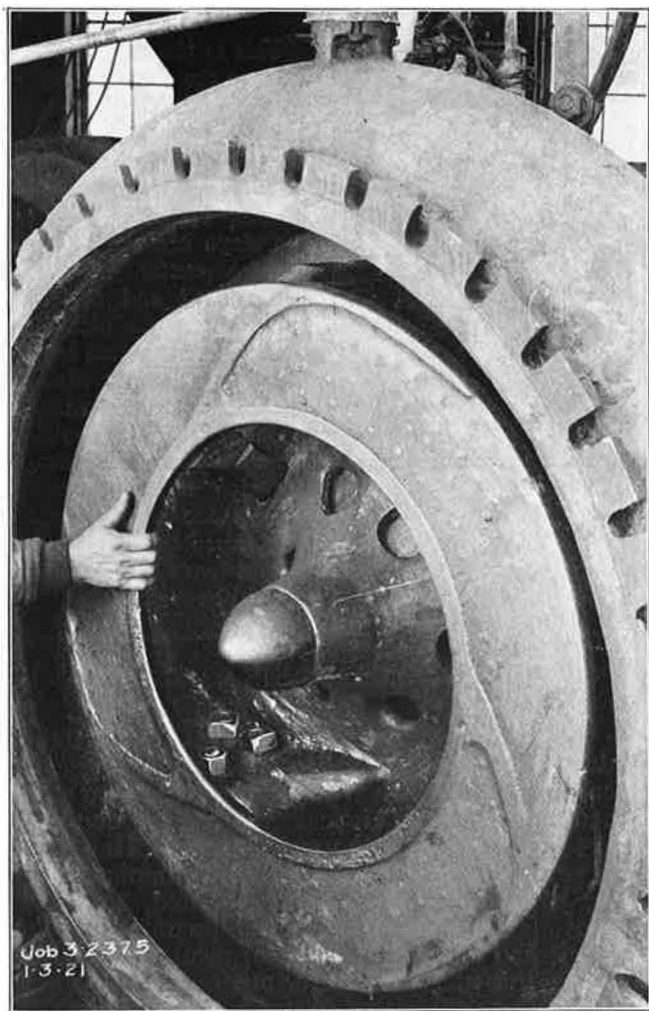


FIG. 299—PUMP RUNNER, LOCKINGTON DAM

Taken Jan. 3, 1921. The mechanism differs in detail only from the Germantown pump. The drum on which the hand is laid, with most of what can be seen within it, is the "impeller" or "runner." A flat circular plate fits close against both the runner and the outer shell, but does not cover the large central opening, through which the mixed earth and water enters the hollow interior of the runner. Three curved revolving blades throw it out again, through openings in the outer face of the runner (the latter being drum-shaped), into the hollow interior of the outer ring or "pump shell." At the same time the material receives a swift circular motion which throws it into the pipe shown at the pump bottom in Fig. 298. The curve of the three runner blades is shown on the flat face of the runner drum, and one face of one blade can be seen within the drum's interior. (The three nuts fasten a removable shoe to the blade to take the wear). The curved blade is seen to be solid at its edges with the flat face of the drum, blades and drum being cast in one piece. The projecting central boss is to direct the entering material into the hollow of the drum interior. The cobblestones in the materials (all sizes up to 6 inch diameter passing through the pump) made this an undesirable feature at the Conservancy dams, and it was removed in later designs..

engineers look for 500,000 to 600,000 cubic yards additional delivery from it, bringing the total to 900,000 or a million; perhaps more.

This pump was of very hard white iron, so hard as to make the machining of it in the lathe rather difficult. On this account, the No. 6 pump, set at work at Germantown on May 15, as a primary pump, was made of a grayer grade, and was there-

fore softer. This pump up to November 6 pumped 270,000 cubic yards of material, and was judged by the division engineer, Mr. Pauls, to be then about half worn out. It also will be set up later at Taylorsville, where its record will be available for further study.

In connection with what has been said, Figs. 299 and 300 will be of interest, as giving a vivid idea of the sharp-cutting, emery-like action of the Miami Valley material on pump metal. Fig. 299 shows the interior of a 12-inch dredge pump at the Lockington dam, of slightly different pattern from the white iron pumps. The conspicuous feature here is the impeller, its blades or paddles, outlined on the face of the runner, and most of one blade visible through the opening. To take the wear, removable shoes are bolted to each blade, the nuts of some of these bolts appearing on the blade seen. Fig. 300 shows what happens to the bolt heads under the sharp impact of the sand and gravel particles. The near face of the worn bolt head is ground to a knife edge over part of its length, the original thickness of the head, shown at the right, being one inch. The curious erosion of the bolt shank next the head, due to fine sand particles burrowing their way beneath, is also notable. The bolt head shown was worn to the condition presented in about one month of service, the material pumped during that time, in this particular case, being about 30,000 cubic yards. An inch scale is placed in the figure to give approximate sizes. The central projecting boss in Fig. 299 proved a bad feature when large stones (up to 6" at Lockington) must pass the pump.

The ribs cast on the new pumps, which appear prominently in Fig. 298 are an important feature. The pump shells wear thin and fail eventually, cracking along the midline at the outside rim. The ribs prevent this cracking, and will enable the shells to wear till actual holes appear at the rim. Even then,

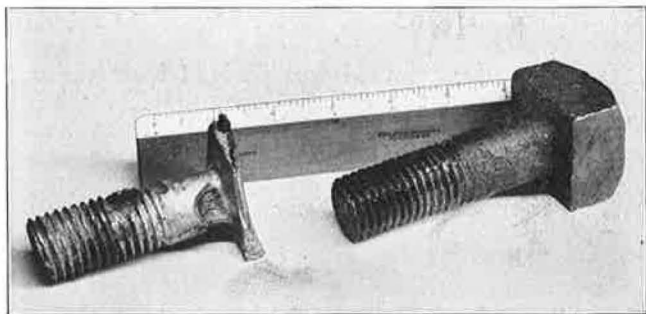


FIG. 300—PUMP RUNNER SHOE BOLTS

Taken January, 1921. There is plenty of sand and gravel in the earth material which mixed with water passes through the dredge pumps at the dams, and they are driven through at high speeds, including stones and pebbles up to six inches in diameter. These materials keep up a combination of sand blast action and rattling machine gun fire on the pump interior when the pump is in action, which makes a massive design necessary to withstand. The wear is also very severe. Holes were sand-blasted through the heavy pump shell, when made of ordinary "gray" cast iron, in a few months' time. The left hand bolt in the picture shows what one month's wear at Lockington did. The bolt head on one face is worn to a knife edge. The original thickness of this bolt head (shown at the right) was one inch. A six-inch scale is set up behind the bolts to show sizes. Note the curious wear on the bolt shank, where the sand sifted in under the bolt head.

a metal lining can be added, as was done to the first pumps quoted above, and a considerable additional yardage obtained.

Manganese steel pump shells in use at some of the dams of the District, it should be added, have also shown a high duty. Details of their performance will be presented at a later date.

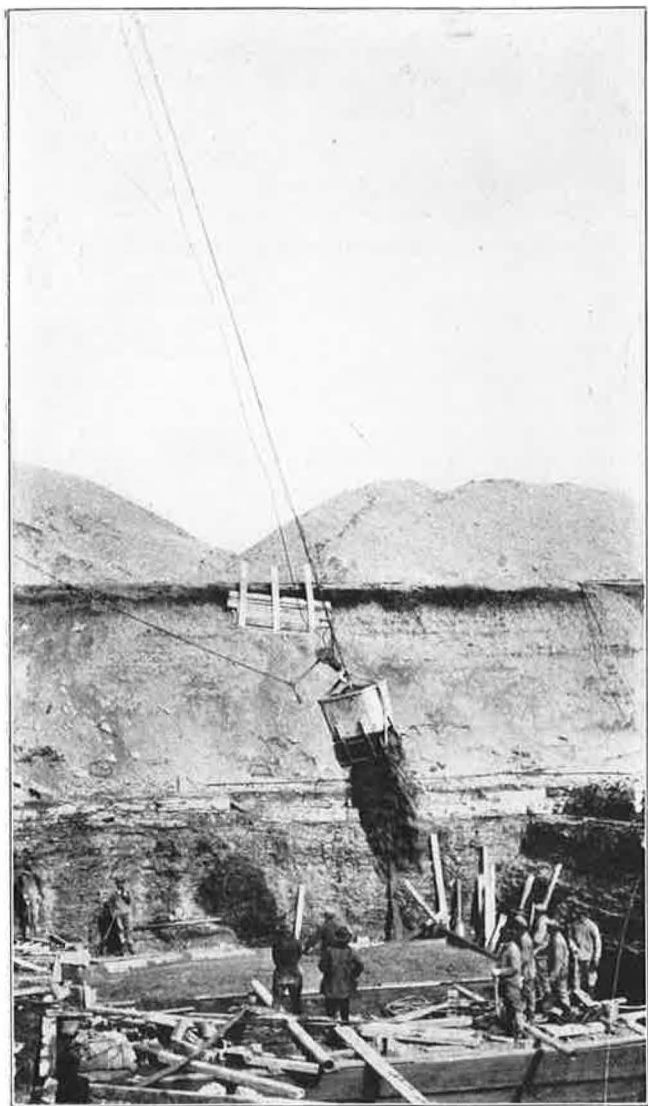


FIG. 300—"THROWING THE BUCKET" AT LOCKINGTON DAM

The picture shows what a skilful derrick artist can do in an emergency. A concrete bucket is shown in midair (the derrick boom which supports it being out of sight above), in the act of dumping its load of nearly 3 tons of mass concrete for the outlet conduit walls at the Lockington dam. The form below, into which the concrete is seen falling, was in this case too far away from the derrick to be reached by the regular procedure, and with only a comparatively few remaining yards of concrete to deposit, it did not pay to move the derrick to a new position. Hence the novel procedure shown. By hauling and slacking alternately on the boom line, keeping time to the natural pendulum motion of the bucket suspended from the boom end, the bucket was set swinging to and from the derrick foot. The load was dumped just as it reached its extreme outward swing, as shown in the picture. It was a $1\frac{1}{2}$ cubic yard bucket—36 cubic feet, which at 150 pounds to the cubic foot, gives 5,400 pounds, or $2\frac{3}{4}$ tons, to the load of concrete. It was a "guy derrick," with 120 foot mast and 105 foot boom. The derrick artist was Mr. Ed. Hines. The work was done in the spring of 1919.

As to Finishing the Englewood Dam During the Present Season

The work at the Englewood dam, as originally planned, was to be completed at the end of the season of 1922, but the rapid progress of last year has put the schedule far ahead. The east section and the river section are now within about 42 feet of the dam summit. Pumping of earth materials into the remaining section (west of the river) began last week. By May another "sump," or pumping station, will be in operation—sump No. 4. This will be operating alone until July, bringing the west section of the dam up to the level of the other two. It is hoped to celebrate this event on the fourth of July, as it will bring the entire dam up to safety level with a 1913 flood, with the dam conduits as they now are (at double flow). Sumps 2 and 3 will then be started, with the three sumps running in rotation, each building one section of the dam, until the embankment is completed. It is hoped to bring the entire embankment to elevation 862—1913 flood level with both conduits in fully finished condition—by October, or in any case by the beginning of winter; and then during the winter to finish the conduits. This, if it can be carried out, will give complete protection from a 1913 flood by next spring. Work on the permanent spillway is already begun.

The Flood of March 28 at the Englewood Dam

Figure 302, on the outside of the back cover, shows the lake of water behind the Englewood dam during the storm of March 28, 1921. The upstream slope of the dam is in the foreground, with the entrance to the dam conduits at the left, the conduit head wall projecting a little above the slope. The Stillwater River is at the left of the flooded area, with its east bank, marked by the "marooned" row of trees, covered by the water. What looks like a pier projecting into the river from its west bank, is the construction railway trestle, with most of its length submerged. At full flood, a few hours after this picture was taken, the entire bridge was just submerged; but the water was still several feet below the conduit headwall. The maximum stage was at elevation 791, and was still 21 feet below the level of the temporary "spillway" channel. This channel is provided as a safety valve in case of a flood rising high enough to threaten the work already done at the dam, but with the flood season so nearly at an end, the likelihood of its being brought into use is very remote. The lake in the picture, it is interesting to note, shows only a little larger than it will look in its normal condition after the dam is completed, as a feature of the Englewood "Conservancy Park," referred to in an earlier issue of the Bulletin.

Only immaterial injury was done to the work at Englewood by the high water. The submerged trestle was entirely undamaged, this being perhaps in part due to the fact that the main current of the flood was "short-circuited" through the west borrow pit, thus slowing down the current in the regular river channel. The picture shows this. Electric pump motors, peculiarly liable to flood damage, were removed from the flooded area. The principal damage was to the construction tracks a little east of the submerged trestle, where the main current of the flood swept across them, but this was slight and readily repaired.

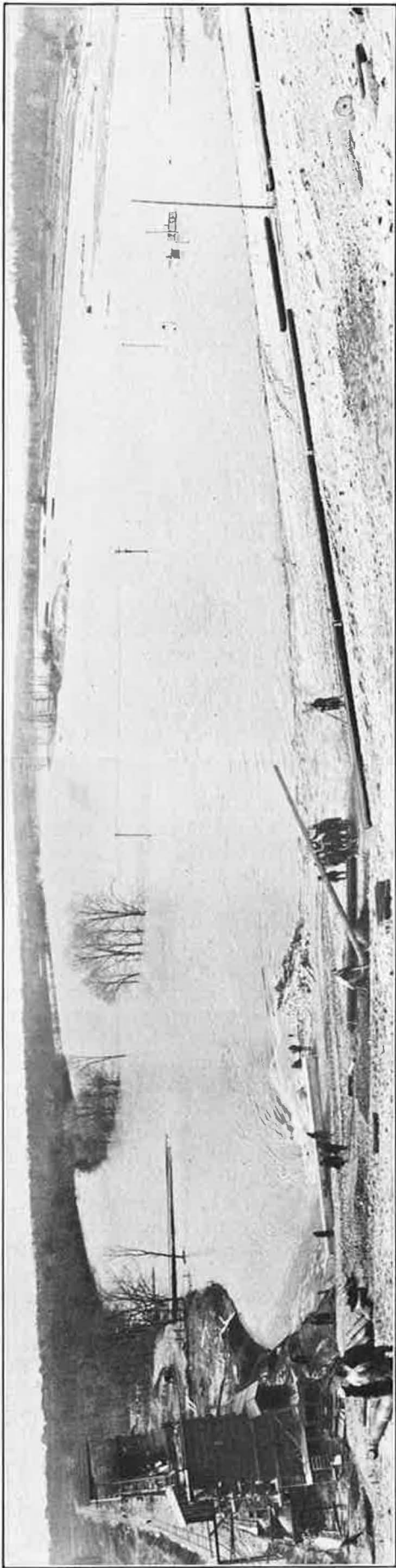


FIG. 302—FLOOD WATER ABOVE ENGLEWOOD DAM, MARCH 28, 1921.
For description see page 143

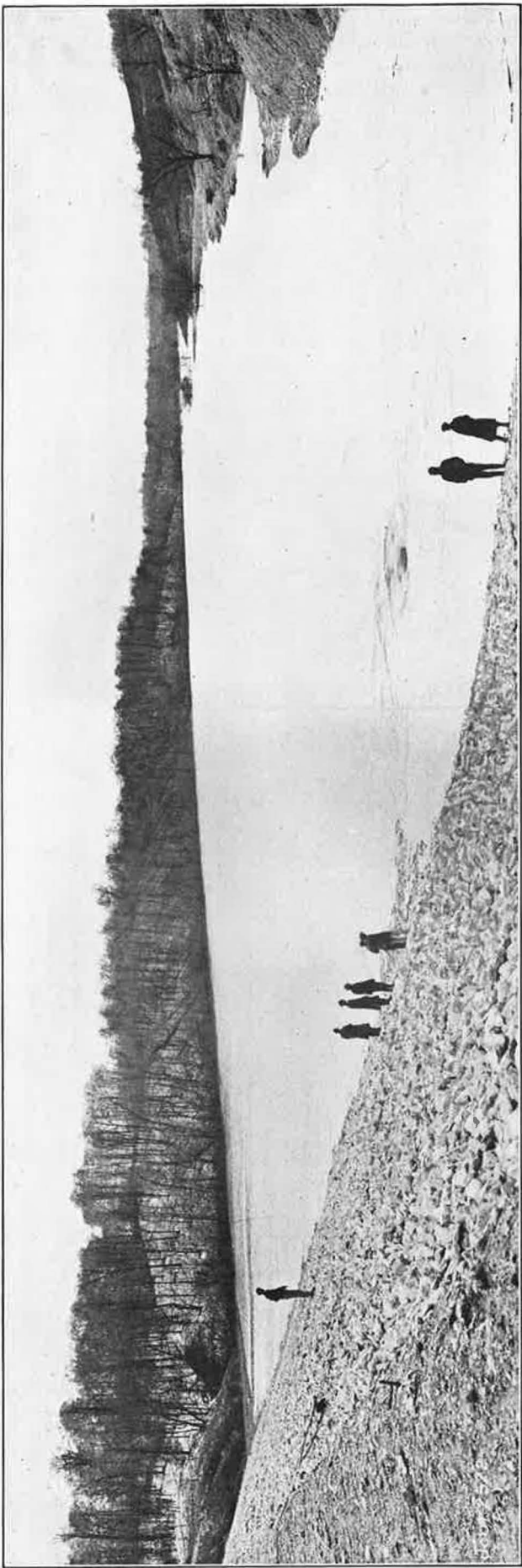


FIG. 303—FLOOD WATER ABOVE GERMANTOWN DAM, MARCH 28, 1921.
See caption of Fig. 288

THE MIAMI CONSERVANCY BULLETIN

MAY, 1921



FIG. 304—ROCK EXCAVATION BELOW OUTLET WORKS, TAYLORSVILLE DAM,
MARCH 10, 1921



FIG. 305—CHANGES AND EXTENSION OF MARKET STREET BRIDGE AT TROY, APRIL 20, 1921

The present bridge is shown at the right. It is in two parts. The highway section is the higher of the two, on the down stream or far side. The darker colored, narrow section on the upstream side is the traction bridge. The highway bridge is to be swung around to better conform to the alignment of the street, and is to be raised four feet to afford a larger waterway under the bridge.

The river channel through Troy is being greatly widened. The excavation in the foreground is for this extension. The bank on the left is the toe of the new levee. A new span is being added to the Market Street bridge to conform to the widened channel. The photograph shows the progress of the work to date. The foundation for the abutment is being put in where the men are standing on the left in the picture. The steam shovel is removing the old roadway on the downstream side of the street. The steel work for the new bridge span is now being fabricated and will be erected on the ground.

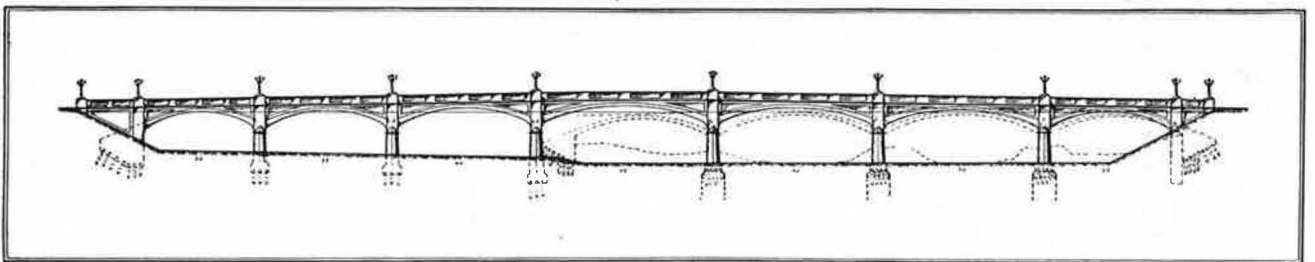


FIG. 306—THE ADAMS STREET BRIDGE AT TROY, DEC. 13, 1915

The upper picture shows the present bridge. The lower one shows the present bridge in dotted outline under the right-hand portion of the proposed new structure, which is shown in full lines. Notice how much higher the new bridge will be than the old one. This is necessary since with maximum flood and the improved river channel the water will rise above the old arches. Three spans will also be added to the old bridge, to increase the width of the river bed. The piers of the old bridge will be carried up and used for the new structure; also the old north abutment will be carried up and made into a pier. The present arches will be used as a support for the new ones during construction in place of erecting the usual "falsework." In all these ways expense will be saved. The present piers have piles driven under them. For additional security they will also be underpinned and protected by a fence of sheet piling driven into the river bed around them. The new piers will be sunk to safe depths in the river gravel, and for additional security piles will be driven beneath them, the design being similar to that shown for Black Street, Hamilton, in the February Bulletin. This work will begin in a few weeks.

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THE MIAMI CONSERVANCY BULLETIN

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G. L. TEEPLE, Assistant Engineer, EDITOR.

Visit of Mr. Arthur P. Davis

Mr. Arthur P. Davis, Director of The United States Reclamation Service and Past President of the American Society of Civil Engineers, visited the work of the Conservancy on April 22. Mr. Davis is an engineer of international reputation. Along with Professor Mead and Major Seibert, he was called to China to study and report on the flood conditions in the Yangste Valley. He was also called by the Turkish Government to investigate and report on irrigation projects in Turkestan. Under his direction a very large number of dams were built in connection with the Reclamation Service, including the three highest dams in the world. This wide experience gives his favorable judgment of the Conservancy work especial weight. He was much impressed with the progress which has been made on the project in the face of so many difficulties, and especially with the unusual team work exhibited by the Conservancy organization.

Conservancy Supplies and Equipment for Sale

With the finishing of the Germantown dam, a large quantity of the supplies, material and equipment formerly in use there has been disposed of or removed to other features of the Conservancy work. Nevertheless, there still remain a considerable number of items to be disposed of, to which are being constantly added items from the other points in the District, as the work gradually approaches its end.

In view of these facts, the District will begin at once to sell such articles as are not needed longer on the work. Arrangements have been made to issue a semi-monthly list of the various items of ma-

chinery, supplies and materials for sale, which will be posted on the various bulletin boards of the District, and published in the Conservancy Bulletin, giving the description, location and price of each item.

Persons desiring to purchase any article on these lists should get in touch with Mr. Hosea Moyer, Sales Agent for the District, at the headquarters office in Dayton, or with the District's local office at the locality where the item is stored, as given on the list.

The prices given are for cash sale in all cases. For larger articles, approved security, with cash partial payment down, will be accepted by special arrangement.

Enlargement of the Bridges at Troy

By an arrangement made by the Miami County Commissioners the enlargement of the Adams and Market Street bridges in Troy and the raising of the Main Street bridge at Piqua, which were to be made by the County, are being done by the District. To arrange for the expense of this work the estimated cost is added to the Miami County Assessment. In this way it is made easier for the County to finance the work than could otherwise be done.

The largest piece of work in the three bridge modifications is the reconstruction of the Adams Street bridge. Fig. 306 shows a view of the bridge as it stands today. The structure was designed previous to the flood and was under construction when the flood came. It has been recognized ever since that time that the bridge opening was entirely inadequate. In addition the foundations are insuffi-

cient, the restricted opening causing such a scour during the flood that a hole was washed in the river bed immediately below the bridge to a depth 12 feet below the concrete foundation. The computations made in the design of the Troy local improvement show that the water surface at extreme flood would be above the top of the existing arches. It was evident, therefore, that the bridge is too short, the top is too low, the foundation is too high and it is inadequate in water way, all these features combining to make it unsafe in times of big floods.

The proposed enlargement is shown in Fig. 306. From this it will be seen that the bridge is to be enlarged from a 4-span to a 7-span bridge. It is the purpose, in order to make the expense of construction as low as possible, to incorporate the present piers into the new structure. Also, the old arches will be used as a support for the new spans just above them, during the work of construction, in place of erecting the usual "falsework." It is expected that in these ways the cost of reconstruction will be greatly decreased.

A levee on the north side of the river above Adams Street is now being constructed and when completed will confine all the river flow to the bridge opening. In order to make the present piers

secure they will be underpinned with concrete and protected by sheet piling. The pile foundation which was built under the present piers simplifies the work involved in this underpinning. After the completion of the bridge it is proposed to excavate the river bed so that the present arches may be dropped and buried in it below the grade of the improved channel. The new piers and abutments will be carried to a safe depth and supported on pile foundations. The structure will have "cantilever" sidewalks on each side. The sidewalks and carriage way will have the same width as at present.

The Adams Street and Market Street bridges carry considerable traffic from the city of Troy to the villages and the county north of the river. It is not possible to close both bridges at once, and as work is now under way in the construction of the additional span for the Market Street bridge, the work upon the Adams Street bridge will not be commenced for several weeks.

The District is also engaged upon the enlargement of the waterway under the Market Street bridge at Troy. The two existing trusses are to be raised about 4 feet and an additional span of about 100 feet in length is to be built on the north side of the pres-

(Continued on page 155)

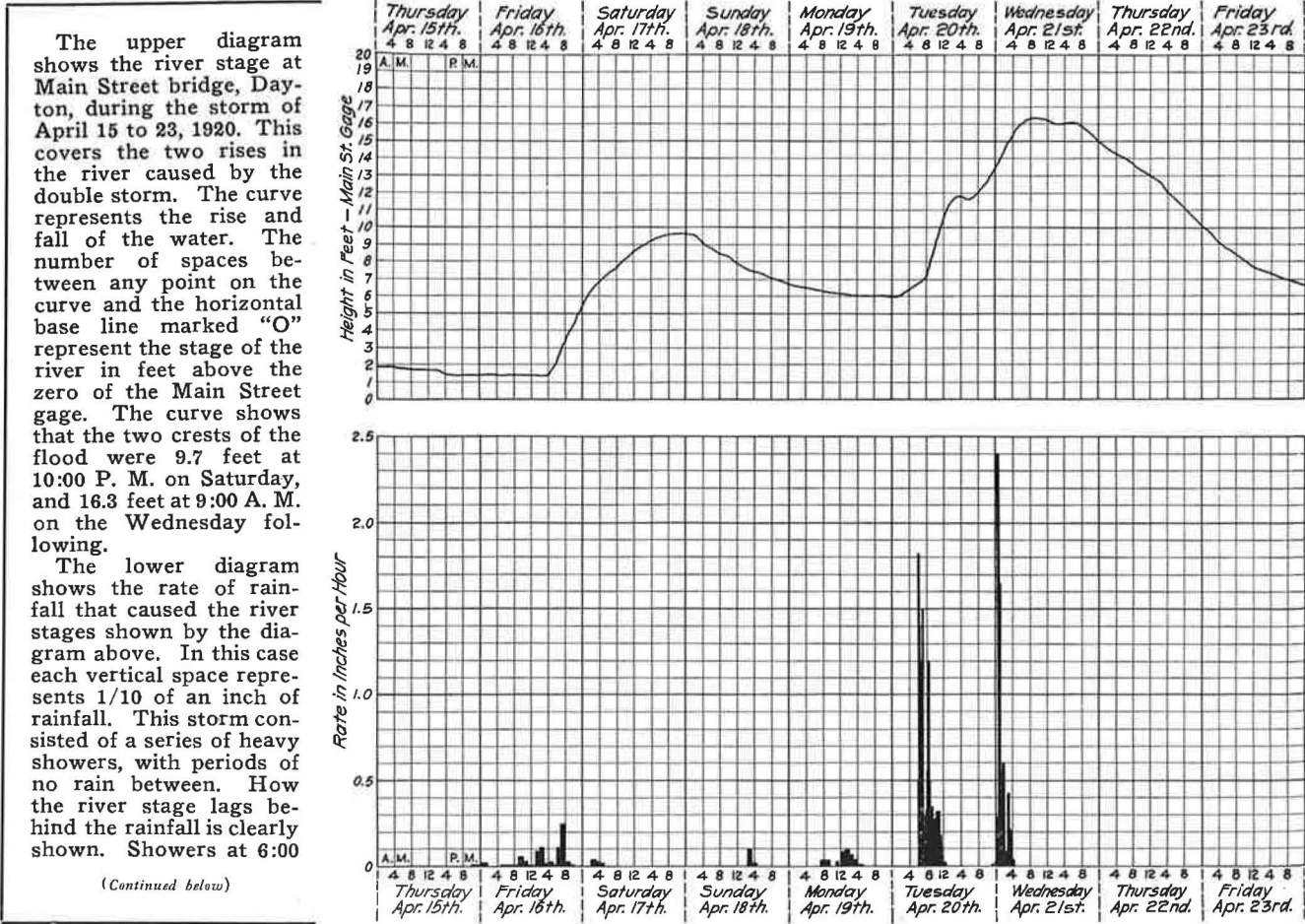


FIG. 307—DIAGRAMS SHOWING COMPARISON BETWEEN RAINFALL AND RIVER STAGE.

A. M. and 8:00 A. M. in and around Dayton caused humps in the curve about 3:00 P. M. in the afternoon. After the hump caused by the rain at Dayton subsided somewhat, the river began to rise again when the water from farther up the valley reached Dayton. A similar effect may be seen from the shower occurring shortly after midnight Tuesday. Except for the slight dropping of the hump caused by the local shower, the river stage did not begin to fall until 6:30 P. M. Wednesday, despite the fact that Wednesday was bright and clear. The sharp showers indicated by the tall black strips were showers in Dayton. Similar showers took place up and down the valley at different times.

The Forecasting of Miami Valley Floods

Telephone Reports from Field Observers, Applied to Charts, Permits Forecasts of River Stages 10 to 20 Hours Ahead, Within One Foot

To the average citizen of the Miami Valley, the river stages mean little save when, after a heavy rain, the river rises in an ominous manner. Then the probable stage that will be reached immediately becomes of the liveliest interest to him, and together with a thousand or more of his friends and neighbors, he calls up the Conservancy to find out what the river height will be. The forecasts issued by the District have generally been within a foot of the real stage, and many times but an inch or two has separated the actual and the estimated river height. Generally the predictions are more accurate for Dayton and the cities below than for the upper points, such as West Milton, Piqua and Springfield. The service is accepted much as a matter of course, and what is back of the simple figures given with such a degree of precision is a mystery to most people, including many engineers. The prediction is not a guess, as many suppose, but is a definite calculation based on measurements and past experience.

The study of rainfall, runoff, and flood history of the Miami Valley and the consideration of the laws governing such phenomena were first undertaken by the engineering staff of the Flood Prevention Committee in 1913. The volume of water that might be expected during floods in the Miami Valley was, of course, the determining factor in all the plans for the flood prevention work.

In 1916 a flood forecasting system was established, both to give warning to the Valley in time of danger

and also to have such a service well established and in good running order by the time the construction period opened. The District in carrying out its widely diversified construction program is vitally interested in the daily stage of the river, and the stages resulting from moderate rain falls, as well as the larger floods that approach the danger line. Originally a "side line" in connection with the major studies of rainfall and runoff as a basis for the

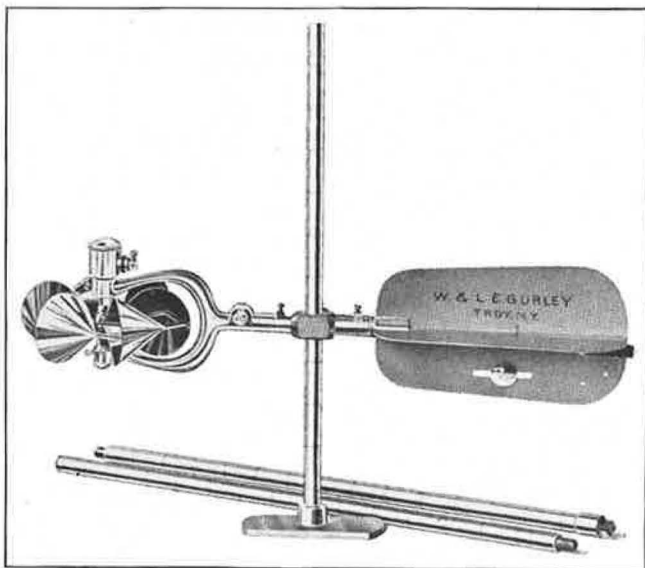


FIG. 308—PRICE CURRENT METER

This instrument measures the velocity of a river current by registering the rapidity of revolution of the little wheel at the left. The wheel rotates on a vertical axis, and carries 6 cone-shaped paddles at its rim. These catch the current and cause the wheel to revolve. The wheel is carried by a forked rod armed at its rear end with a rudder which keeps the rod pointed upstream, the rod being carried on another rod which is pushed down into the water from above and held firmly against the bottom. The vertical rod is jointed to permit use at various depths, the forked rod being slipped up and down on it according to the depth at which the river current is to be measured.

design of the flood prevention work, the flood warning service is now used principally in connection with the work of construction.

The flood forecaster has a mania for information. The principal part of his work consists in carefully collecting accurate data on the weather, soil conditions, and the history of past floods. He has certain tools with which he works.

His most important tool is his staff of observers. The map, Fig. 309, shows where these are located. Some of them are U. S. Weather Bureau employees who also make special reports to the Conservancy District through co-operative arrangements with the Weather Bureau. They are evenly distributed over the whole area of the valley. The individuals comprising the staff of observers are selected with great care for their reliability and intelligence. They are people who have other occupations, and give but a small fraction of their time to the flood warning work. From them come daily observations on weather, soil, and river conditions.

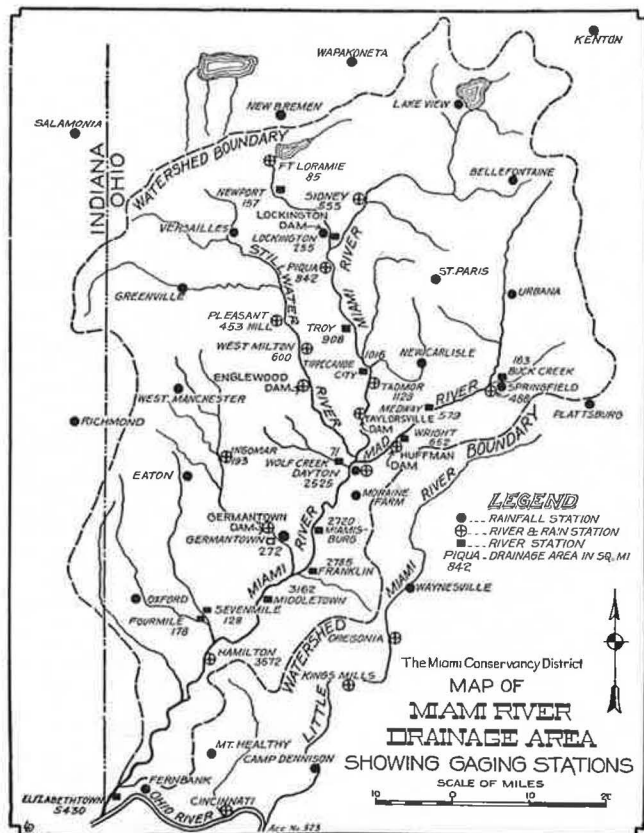


FIG. 309—DISTRICT GAGING STATIONS

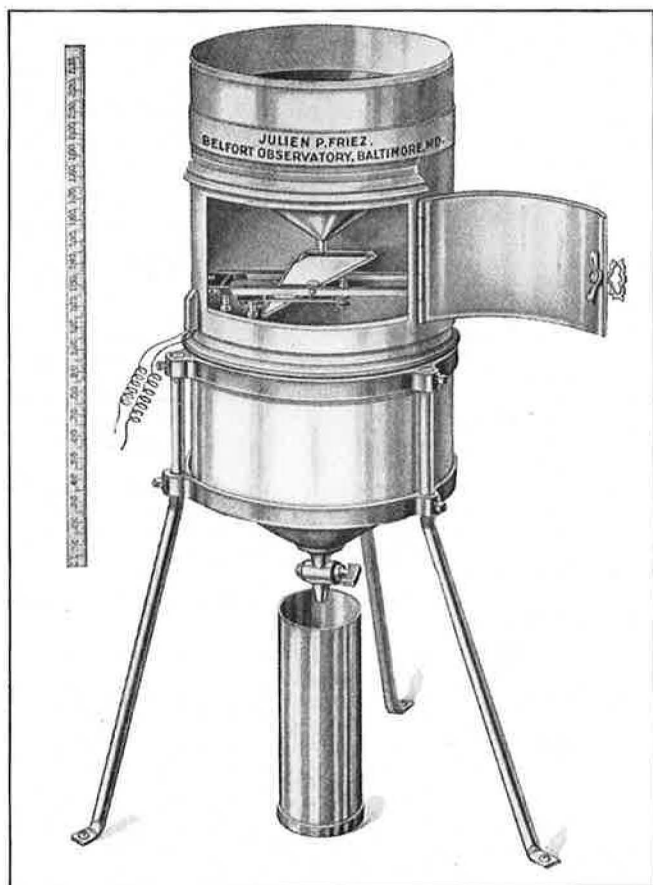


FIG. 310—RAIN GAGE

This is a "tipping" gage, such as is in use at the U. S. Weather Bureau Station in Dayton. Rain falls into the circular pan or vessel at the top and runs down a central tube into the tall narrow vessel at the bottom, in which it is measured by the measuring stick at the left. The sizes of the upper and lower vessels are so adjusted that one inch of rain will give ten inches in the lower vessel. On the way down the rain fills the upper bucket of the tipping mechanism, which, when full, overbalances, tilts and empties, bringing the second bucket up, which then fills and the process is repeated. Each tilt is electrically registered and means 1/100 inch of rain. The rapidity of the oscillation measures thus the intensity of the rainfall.

The information on the rainfall comes from readings taken on rain gages. A rain gage is a wide metal pan of known area, that is placed in a level position open side up. The falling rain intercepted by the pan is drained into a narrow tube. As the cross section of the tube is only one-tenth that of the pan, an inch of rain will show in the tube as 10 inches of water. By so magnifying the rainfall, accurate measurements are more easily obtained. The tube is read by a scale that gives inches of rain directly, and reads to one-hundredth of an inch. The gage is so carefully made that the displacement of the measuring stick is taken into account. (Fig. 310.)

The observers also read the river gages daily. The gages, except two electrically operated, are all staff gages, like the one shown in Fig. 312. By using a "rating curve," Fig. 311, the amount of water flowing past the station, at the different gage heights is determined. The rating curve is made by plotting the results obtained by actually measuring the amount of water at as many different river heights as possible. It is revised as conditions change.

The river stations where the gages are located are selected because of the uniform cross section and grade of the river channel at that point and are usually at some bridge, in order to simplify the physical work of measuring. The water in the streams does not flow in a uniform manner, even in the selected channels, but is faster in the middle of the stream, slower near the bank, faster at the top, slower at the bottom. Therefore, readings are taken at points at a uniform distance apart, across the width of the river. Two readings, one at 2/10 and the other at 8/10 of the depth, are taken at each point. This is termed the "two point method." The readings are taken with a Price current meter (see Fig. 308). The rate at which the wheel of the meter spins, gives, with the aid of a table, the velocity of the water. The average velocity in feet per second for each division of the section is the average of the readings, at 2/10 and 8/10 of the depth. The discharge for each division is its average velocity multiplied by the square feet in the area of the division. The total discharge of water in cubic feet per second is the sum of the discharges of all of the divisions of the section.

The discharge must be determined by actual measurement for different stages of the river, as the discharge does not vary directly as the stage. Twenty to thirty separate determinations of the discharge are necessary for stages from low water to large floods. As high stages are comparatively infrequent, a year or more of intermittent work is necessary before a good rating curve can be prepared. In general, the longer the river station is maintained, and the larger the number of gagings taken, the more dependable will be the results.

Every water shed has its peculiarities, and the idiosyncracies of the Miami are especially pronounced. Data on the performance of other water sheds under various conditions are only of general application to the Miami. Therefore, the action of the various portions of the valley under different conditions of rain intensity, ground saturation, etc., had to be determined by observation of actual occurrences, and the results tabulated and studied. Under the same conditions, the storm of today will produce much the same results as the storm of yesterday, on the same water-shed. The preparation and use of these experience tables are an essential part of flood forecasting.

The U. S. Weather Service reports are received daily, and oftener in time of storm. The District has received close co-operation and great assistance from the Bureau at all times, and does not attempt to duplicate their service.

The tools the forecaster works with take years to build and develop and patient endeavor to keep in repair, as they must always be ready to meet the ever present storm menace.

The forecaster studies the U. S. Weather Charts every day. He notes a marked "low" to the west of us, moving eastward, or other conditions that generally speaking mean a heavy storm over the Miami Valley. The forecaster calls up the construction jobs and warns them of what is probably coming.

When the storm breaks, the organization in the field knows just what to do. Each observer watches

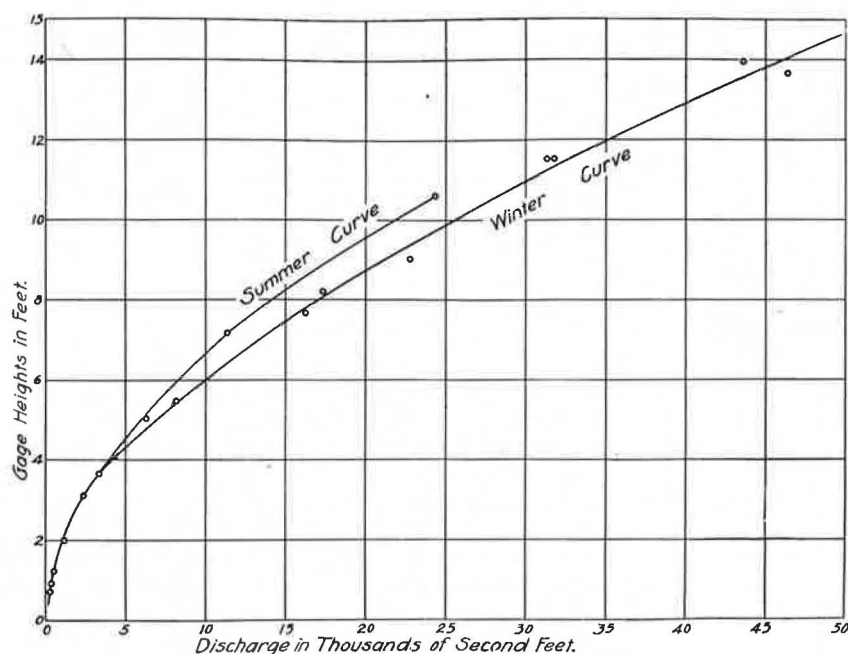


FIG. 311—MIAMI RIVER RATING CURVES

These rating curves are for the Miami River at the Main Street Bridge station at Dayton. In this case two curves have been developed, as winter conditions cause the channel action to be quite different from its behavior in summer. The vertical scale gives the height of the river on the gage. The horizontal scale gives the discharge in thousands of second feet. For instance, during a winter month when the river reaches a height of ten feet on the gage on the Main Street bridge, 25,600 cubic feet of water are passing through the bridge openings every second. The small round circles represent the actual measurements that have been made by the hydrographers during periods of different river stages. As wide a variation in the stages as is possible to secure is used. The river improvement in Dayton is rapidly changing conditions at this station.

his rain gage, and when $\frac{3}{4}$ of an inch of rain falls he telephones to the forecaster at his desk in the Dayton office and telephones again, each time an additional one-half inch of rain falls. The river gage readers phone when the first four-foot rise comes in the stream, and then when each 2 feet additional rise comes. The telephone is used, because telegrams are often delayed and because the phone conversation enables the forecaster to ask questions as to general conditions.

The forecaster has a map of the valley before him. As the information comes in it is posted on this

map on the spot where the readings are taken. As the storm progresses, and the calls keep coming in, and the information is plotted, the forecaster really has a picture before him that shows where the center of the storm is located, how fast the rain is falling, and how fast the streams are rising. He knows, from his daily reports, the conditions of the ground. He has his experience tables at hand. He is ready, by utilizing all his tools, to work up his prediction.

The various parts of the Miami Valley act in different ways during a storm. So the valley is divided into sections. A river station is on the lower

The picture shows the staff gage on the middle pier of the bridge over the outlet channel just below the Lockington Dam. The stream section at this point is very uniform, making the discharge measurements especially dependable. The measurements of the hydrographers are taken from the bridge except at times of extreme low water, when it is possible to wade across the stream. The divisions into which the section is divided are permanently marked on the bridge, so that the measurements are always taken at the same place, even if several months elapse between the readings. The staff gage itself is of carefully selected cypress. Cypress is used because it does not warp, and is easily worked. Special care is used in the selection of paint.



FIG. 312—STAFF GAGE ON LORAMIE CREEK, FEB. 2, 1921

end of each section. For example, the Stillwater basin above West Milton, containing 600 square miles, is a typical section having particular effect on Dayton and towns below. Other sections are the Miami above Piqua, the Mad above Springfield, the Miami from Piqua to Tadmor, the area above Dayton, Twin Creek, Four Mile Creek and Seven Mile Creek.

Knowing the ground conditions, noting the location of the center of the storm, and obtaining the intensity of the rainfall from the map before him, the forecaster predicts, using his experience tables, how much of the rain will reach the streams, how fast it will come, and when the crest will be reached at the river station on the section. This prediction is for the individual section only. It is repeated for each section of the valley. Now, experience has shown how long it will take for water passing a gaging station to reach the towns below. For instance, it takes twelve hours for water to come from West Milton to Dayton under flood conditions such as prevailed in the spring of 1921. This time varies with the extent of the flood and with the location of the section. Combining this information for all the divisions, the river stage as far in advance as twelve to twenty hours for Dayton, and longer for cities below Dayton, can be predicted with surprising accuracy.

As the storm progresses, the forecaster keeps eight to twelve hours ahead with his predictions. The center of the storm generally passes the Miami Valley from twenty to thirty-six hours before the crest is reached in the river at Dayton and below. After the rain ceases to fall, better forecasts can be made, and generally speaking, the predictions of the time and the height of the crest stage are then the most accurate. During the high waters of March, 1921, the final crest forecast for Dayton was given twenty-four hours in advance.

The construction forces of the District have much equipment in reach of even moderate river stages. The construction forces receiving advance notice of the amount of water that may be expected, remove out of harm's way the equipment that the water might injure. They do not move anything that is

at a higher elevation than the one set by the forecaster. This alone has saved to the District many times the cost of the service.

The Miami through Hamilton receives the flow from three streams—Four Mile Creek, Seven Mile Creek and Twin Creek—that have steep slopes, quick run-off and good sized drainage areas. A relatively high stage at Hamilton is reached in a few hours, then the river falls somewhat, to be followed by another rise caused by water from farther up the valley. Little forecasting can be done for this first rise, as the water gets to Hamilton almost as quickly as the readings from the observers reach Dayton. Ordinarily the first rise does not reach dangerous heights, and accurate predictions can be made of the second rise. In the same way, Wolt Creek often causes a sudden small rise at Dayton, but this gets out of the way before the main rise comes.

As high stages of the river are comparatively infrequent, the hydrographers, who are the men who measure the actual flow of water in the streams, hasten out in times of flood to secure readings on the streams. During especially interesting floods, engineers are drawn from other parts of the work to assist in doing this.

The flood forecasting is not costly, and has been invaluable to the District. It exists not only for the benefit of the construction work, but also for the good of the public. An operator is on duty day and night at the Conservancy Building at Dayton, and gives information on river stages to everyone who asks. During high water many persons avail themselves of this service.

Part VIII of the Technical Reports, which will be ready for distribution May 1, contains a chapter on flood forecasting, and also much of the data on which the forecasts are based.

When the Conservancy Dams are finished, new conditions will be introduced that will modify the present methods. The principal thing to determine then will be how deep the water in the basins will be. Only a limited amount can pass the dams, and the volume will depend on the depth reached by the water in the basins.

The water has been drained out of the canal, and some of the trees cut, preparatory to filling the canal with earth. This view is looking towards the Main Street bridge from a point near the start of the levee. The constricted space is clearly shown. First comes River Street, then the Western Ohio tracks, then the canal, then the narrow bank, and then the Miami River, very close to the canal.



FIG. 313—THE BED OF THE MIAMI & ERIE CANAL AT PIQUA

The Work at Piqua

The big Lidgerwood dragline that was formerly at Germantown has been moved to Piqua, erected and is now busy moving dirt on the first section of the work there.

The first section consists of levee work above Main Street. The nature of the ground makes construction difficult at this point. River Street runs north from Main Street along the Miami and Erie Canal. The space between the property line and the canal is so narrow that the street, which also contains the tracks of the Western Ohio Railroad, is very narrow. A thin bank separates the Miami and Erie Canal and the Miami River. These conditions are shown by Figure 313. There is no room

Due to the constricted space, no material is close at hand to use in filling the canal and building the levee, except in the river bed itself. The best way to reach this material is with a dragline with a long boom. The machine selected is fitted with a hind itself. This is shown by Fig. 314.

Work was started at the upper end of the levee, where it joins high ground. The machine is building its own roadway by roughly filling up the canal ahead of itself, and is finishing the filling of the canal, and building the levee on top of the fill, behind itself. This is shown by Fig. 314.

There was an extensive growth of trees on the canal bank next to the river. Much thought was

This picture is looking in the opposite direction from Fig. 313 and was taken from the same point. The dragline is reaching over into the river for a bucketful of earth. The water in the river is hidden by the narrow bank of the canal at the right of the picture. The two men in front of the machine are standing on the track the dragline is building in front of itself by filling up the canal bed. The small group of people in the background are standing on the new levee the machine is building behind itself as it advances down the old canal bed, this levee occupying the space formerly occupied by this bed. The levee will be eight foot wide on top, with side slopes of two feet horizontal to one vertical, and will not occupy the entire bed of the old channel. Enough space will remain so that River Street can be materially widened.



FIG. 314—THE START OF THE LEVEE AT PIQUA

for a levee high enough to protect the town, in any place except in the canal or in River Street.

Many devices were considered that would overcome these difficulties, but no satisfactory way was found until the state gave permission to fill in the bed of the Miami and Erie Canal, and build the levee on top of the fill. Not only does this give room for an adequate levee, but will provide space for widening River Street if the city wishes to do so. The canal has long been an eye-sore to the citizens of this part of town, and its removal will greatly improve the property in the vicinity. Upon the completion of the levee great possibilities will exist for the beautifying of the river bank.

given to the problem of preserving these. The people of Piqua were much interested, and after conferences with them and further study, it was found possible to preserve many of them, although some had to be cut to permit the use of the dragline machine. Any other method of filling would have necessitated the transportation of the material by wagon or train, with a very large increase in the cost, as 60,000 cubic yards of dirt are to be placed on this portion of the work.

The city of Piqua will have an opportunity of securing a greatly improved street when the filling work is done. The District, however, will not go farther than the filling of the canal.

March Progress on the Work

GERMANTOWN

Guard rail fence on top of the dam has been painted. Additional guard rail fence on Road No. 1 on the stretch between the north end of dam and the spillway is now under construction.

The road embankment at the Boomershine bridge, which was partially washed out during the last flood, has been repaired and is again open to traffic.

The planting of trees in the river basin and the seeding of the dam slopes has been completed.

Some work has been done on riprapping of the outlet channel below the concrete revetment. This work will be finished in a day or two.

A. L. Pauls, Division Engineer.

April 15, 1921.

ENGLEWOOD

Hydraulic fill operations were continued in the section of the dam east of Cross Dam No. 2 until March 31, when the filling of the gap left for the temporary spillway was begun. To March 22, which is the date upon which progress is measured for the estimate, 115,000 cubic yards were pumped during the month. The total fill on that date aggregated 2,420,000 cubic yards, or 68 per cent of the entire dam. Two new pumping records were established during the past month. The record for a week's run was advanced to 5,090 cars and for a two-shift run (day and night) to 990 cars. At this writing, April 15, the fill in the temporary spillway gap has been carried up 30 feet. Work on Sump No. 4, to be used in pumping materials into the dam, has proceeded to the point where its early use may be predicted.

The large electric dragline working on spillway excavation has finished and been shipped to Tippecanoe City for use on the local protection at that place.

The concreting plant at the permanent spillway has been given a preliminary try-out and is ready for service. The gravel screening plant is again in operation and is delivering concrete aggregates to the bins at the spillway. Excavation at the spillway has progressed to the point where concreting will begin in a few days. A small steam dragline has been moved into the borrow pit and is excavating gravel for screening into concrete aggregates.

Additional tree planting, as a part of the scheme for reforesting the reservoir basin, is in progress.

H. S. R. McCurdy, Division Engineer.

April 15, 1921.

LOCKINGTON

Work on the dam the first six weeks of this season consisted principally of hydraulic fill and the stone surfacing. About 60,000 cubic yards of the fill and about 2,500 cubic yards of stone work, including drain gutters on the dam, were placed.

The drilling for blasting the blue clay banks in the borrow pit is practically completed.

The wet weather this spring has greatly delayed progress on Roads 9 and 11, but both will be completed within a few days.

Preparations for building the concrete weir, which blocks the space between the walls of the outlet works, and for constructing the bridge above it, are nearing completion. The derrick, which will be set in an elevated position between the walls, is ready for erection.

On the night of April 16 the dredge pump house caught fire during the electrical storm. The cause of the fire is not definitely known, but it appears that it was either from the effects of lightning or from rain water reaching the 2300-volt wiring. Good work on the part of the operating crew prevented a total loss of the buildings and equipment. Fire was kept out of the motors and away from three barrels of oil, one barrel of grease, and a can of gasoline. The principal damage was confined to the operating room. The switchboards, resistance grids and wiring were entirely destroyed. It is expected that replacements and repairs will be completed and the pumping resumed in about eight days.

Barton M. Jones, Division Engineer.

April 18, 1921.

TAYLORSVILLE

The Lidgerwood dragline has finished the temporary outlet for the new channel and has moved to the extreme lower end of the permanent outlet channel, where it is finishing this channel as it backs up. About 200 feet of this channel has been completed and the excavated material has been cast up on to the high ground to the east, whence a little later it will be sluiced to the south dredge pump.

The installation of the south sluicing outfit has been finished and it was started today on the closure of the old river channel.

The north sluicing outfit has been running two 10-hour shifts per day all this month, pumping into the west section of the dam.

Roberts Brothers are making good progress with the rock on the north toe of the dam. The rock fill has been crowded about one-third of the way across the old river channel, and they are now arranging to support their tail track for the empty cars on a cableway, so that the fill can be carried across the river without so much shifting of track.

It is expected that in this way they can close off the old channel on the upper toe by the time the lower toe closure is sluiced in and pumps set for cleaning out that part of the old channel between the two toes.

Mr. Crampton has started finishing the grade on Road 12, and will start the placing of gravel in a short time.

O. N. Floyd, Division Engineer.

April 21, 1921.

HUFFMAN

Placing of material in the main embankment of the dam has continued to be the major operation during the past month.

Material totaling 81,000 cubic yards was put in during the month of March. 62,000 cubic yards of this amount being excavated by the electric dragline in the main borrow pit in the river valley. The remaining 19,000 cubic yards were sluiced from the pit at the north end of the dam.

Rock paving on the upstream slope of the dam is being continued. The south half of the dam had been covered up to the first berm. These rocks are the oversize rejected by the revolving screen at the main pump house.

C. C. Chambers, Division Engineer.

April 19, 1921.

DAYTON

Excavation below Stewart Street is being continued by dragline D16-15. This machine is now grading the spoil bank on the right and is excavating along the left bank of the river, throwing the material over toward the other bank preparatory to hauling it out on cars. D16-8 is making good progress with levee construction on the right bank of the river downstream from the Big Four railroad bridge. D16-19 is cleaning up the track fill left by D16-16 upstream from Fifth Street bridge. This machine has also placed a part of the backfill for the First Street wall.

Excellent progress is being made on the big river walls at Beach Avenue, First Street and the First Baptist Church. Work has been started preliminary to excavating for the Platt Iron Works wall. Walls have been completed, since the last report, at the southeast wing wall of Keowee Street bridge and on the north bank of Wolf Creek, one at Ferguson Avenue and another west of Williams Street. A wall is also under construction along the Delco-Light property east of Taylor Street. The wasteway culvert on the south bank of Mad River, just east of the old Miami and Erie aqueduct, is nearing completion. Since March 31, about 1,000 cubic yards of concrete have been placed in the walls, making that work 76 per cent completed.

The Finke Engineering Company will soon finish the Apple Street culvert. Price Brothers Company has started revetment work on the east bank of the river near Herman Avenue. J. C. McCann is making good progress on the Mad River south levee west of Findlay Street.

To date, 65,950 cubic yards of sand and gravel have been issued from the Sunrise Avenue gravel plant.

The total quantity of channel excavation (Item 9) completed up to April 1 was 947,500 cubic yards. Levee em-

bankment amounted to 187,600 cubic yards. The total yardage handled was 2,040,000. These figures do not include 105,000 cubic yards of excess excavation for scowing canals.

C. A. Bock, Division Engineer.

April 21, 1921.

HAMILTON

The work on Item 9, channel excavation, by the electric dragline, has been delayed somewhat by high water. The track has been laid across the trestle and along the first cut on the west side. The dragline is now crossing the river at station 92.

All the footings and piers of the Black Street bridge have been completed. The copings and tops of piers, to the skewbacks of the arches, have been poured on all piers except No. 5. The erection of the false work is in progress on spans 1, 2 and 3, and the piling for the false work has been driven for all the spans. The backfilling of the west abutment has been completed and the Hamilton Belt Railway track moved back to its original location.

The Bucyrus Class 14 dragline has completed its work at the bridge and is finishing the excavation on the north side of the old river channel.

The work of building forms and concreting is being continued on the Black-Clawson wall.

C. H. Eiffert, Division Engineer.

April 22, 1921.

PIQUA

Work here began on March 21, at the point on River Street where the Miami and Erie Canal leaves it. The old canal here is being filled up, the earth being taken from the river bed. The new levee will be built on top of the filled-up canal bed. The work is being done by the Lidgerwood machine formerly at the Germantown dam, this machine having been thoroughly overhauled and in part rebuilt for the new work. It is equipped with a 100-foot boom and a 4½-yard bucket. The quantity of earth to be moved between the point of beginning and the Main Street bridge is about 60,000 cubic yards.

Albert Schroeder, Assistant Engineer.

April 15, 1921.

UPPER RIVER WORK

Troy. The Dragline D-16-21, at work on the Donald Jeffrey contract, completed that section of the east levee being made from side borrow, and moved across the river during the first part of April. Fortunately, the river crossing was made at the lowest stage of the river that has occurred this spring... The total embankment made in the east levee to date amounts to 23,500 cubic yards, and since crossing the river the dragline has placed about 5,000 cubic yards of material in the levee along the M. & E. Canal.

From the 22nd of March to April 5th, Daniels' outfit was at work for the District, excavating for the north abutment of the Market Street bridge. The high water of March 28th caused considerable delay. Since then Daniels has excavated 2,500 cubic yards from the old approach to Market Street bridge and the river channel below.

Price Bros. completed the pouring of concrete for the footing of the north abutment of Market Street bridge on April 13th and the forms are now ready for the next eight feet in height. The contract for remodeling the old north abutment into a pier has also been let to Price Bros. and this work will start immediately.

Tippecanoe City. The electrical department has practically completed setting up the steel tower for the transformers and the lightning arrestors at the junction with

the Dayton Power and Light Co. power line at the south end of town. This equipment came from the Germantown dam.

The dragline D-16-4, a Class 24 Bucyrus electric, with a 135-foot boom, has arrived in town and is being set up near the north end of the proposed levee. This machine came from Englewood, and is to build the levee skirting the town on the east side and following the present location of the M. & E. Canal.

A. F. Griffin, Assistant Engineer.

April 19, 1921.

LOWER RIVER WORK

Miamisburg. Since our last report Cole Bros. have completed 1,000 lineal feet of levee containing 15,000 cubic yards of material, along the east bank of the river at the south end of town.

Franklin. During the past month the dragline has finished the temporary channel for the tail race of the American Writing Paper Company; moved northward and cut a temporary channel for the headrace; made the excavation for the floodgate structure in the headrace; thrown a dam across the west side of this excavation and moved across to the west bank of the hydraulic canal. The next work it will start will be the widening of the river channel.

Middletown. Except for the completion of repairs to the Hydraulic Street wall there has been no work done in Middletown this month.

F. G. Blackwell, Assistant Engineer.

April 18, 1921.

RAILWAY RELOCATION

Big Four and Erie. This Big Four old rail is now removed except 4 miles to be used for an industry at Enon. The Erie sidetracks at Osborn are finished. Salvaging of old line material continues.

Ohio Electric. The new line, Fairfield to Huffman, is operating. Most of the Wilbur Wright Field war track material will go into the new line east of Fairfield, work on which is begun. Grading at Mad River bridge is completed. Filling of Mud Run gap, at crossing of new steam and electric lines, remains to be completed.

Baltimore & Ohio R. R. Work completed.

Albert Larsen, Division Engineer.

April 20, 1921.

RIVER AND WEATHER CONDITIONS

The rainfall during March was considerably greater than normal. At the Dayton Weather Bureau station the total for the month amounted to 7.41 inches or about 3.96 inches more than normal. At the District's stations the amounts varied from 6.17 inches at Pleasant Hill to 8.39 inches at the Taylorsville Dam.

Two small floods occurred; one slightly smaller than the average yearly flood, and the other slightly larger. The first crested at Dayton on March 9, at a stage of 9.7 feet; the other on March 28, at a stage of 11.9.

At the Dayton Weather Bureau Station the mean temperature for the month was 50.4 degrees, or 10.1 degrees greater than normal; there were 4 clear days, 17 partly cloudy days, 10 cloudy days, and 16 days on which the precipitation amounted to 0.01 of an inch or more; the average wind velocity was 12.6 miles per hour, the prevailing direction being from the southwest; and the maximum wind velocity for five minutes was 42 miles per hour from the southwest, on the 8th.

IVAN E. HOUK, District Forecaster.

April 21, 1921.

The New Bridges at Troy

(Continued from page 148)

ent structure. In order to meet the location of Market Street at its intersection with the new north bank of the river the bridge is to be rotated slightly about the south end, the north end of the present north span being moved about 7 feet down stream.

The concrete for the north abutment is now being placed. Excavation is also being made at the north end of the present bridge to permit the change necessary upon the old abutment at that point. This abutment is to be converted into a pier and to make

it secure it will be increased in thickness, underpinned as far as practicable and protected by a steel sheet piling and concrete apron. The photograph, Fig. 305, shows a portion of the new north river bank and indicates roughly the extent to which the bridge is to be lengthened. A portion of the forms for the new north abutment may be seen at the left of the picture. The approach to the bridge from the city side will be made by constructing a center carriage way conforming to the width at the bridge and retaining such of the carriage way at the sides as will be necessary for the local street traffic.

A contract for the new steel truss for the bridge has been made with the Central States Bridge Company of Indianapolis and the preparation of the steel work is under way at the company's shops so that the truss will be ready for erection as soon as the foundations are completed.

At the present time it is uncertain as to the future of the Traction Line bridge which now extends on the west side of the highway bridge. The Traction Company has not operated its line for some time and it appears to be doubtful when the operation will be resumed, if at all.

Moving Earth by Motor Truck

Sterling 7-Ton Trucks Move 82,000 Cubic Yards at Troy

An interesting application of the motor truck to the work of moving earth from the excavation to levee or spoil bank was seen on the work of the Miami Conservancy District at Troy, Ohio, during the winter of 1920-21. The excavation was for the improved channel of the Miami River through the city. Part of this was done "in the wet" by dragline excavator, and part "in the dry" along the bank by steam shovel. A part of the wet excavation was overcast into a spoilbank along shore, from which it was again handled by steam shovel. Materials from both wet and dry excavation were transported to their final location in a spoil bank along Market Street by 7-ton Sterling trucks, the average haul being about 500 feet. All of the work was between the railway and the Adams Street bridge in the city, the total quantity being 140,000 cubic yards.

The work was let by contract by the Miami Conservancy District to the C. and C. Haulage Company of Columbus, Ohio. Under the conditions and especially with the length of haul, it was not, of

course, considered that such a contract, so handled, would prove especially profitable, but with the usual winter season giving a chance for "hard bottom" for the trucks on frozen ground, and as furnishing employment for equipment through the slack season of the year, it was thought by the C. and C. Haulage people to be a "bet" worth taking, and work was begun in July, 1920.

The two figures show the equipment at work. The excavation was done by two Osgood No. 18 steam shovels, with buckets of $7/8$ cubic yard capacity. The trucks hauled, as an average over the entire work they did, $2\frac{1}{2}$ cubic yards per load, measured in the finished work. The material was deposited on low ground on each side of Market Street, the plan being to bring this low ground to an elevation sufficient for building lots. Part of the excavated material was used also to build a 115-foot levee between Market and Adams Streets. The total quantity hauled was 82,000 cubic yards, or about 60 per cent of the total, after which the trucks were



These were seven-ton Sterling trucks, used at Troy in transporting earth from the point of excavation on the bank of the Miami, to be used in building an adjacent levee, or in raising the level of low land on each side of Market Street so that it would be suitable for building lots. During good weather the trucks worked well in this service. Rain, however, would put them out of business, due to the difficulty of climbing the steep grade (8 per cent) of the "ramp" or incline leading from the river bottom to the top of the embankment to be built. A fifteen minute shower would not infrequently "grease" the ramp sufficient to make the wheels slip. Of course, wet weather interferes seriously with earth moving by wagon also, but not so seriously as it did with the trucks. The average haul was about 500 feet. The average load was $2\frac{1}{2}$ cubic yards. About 82,000 cubic yards were moved by the trucks.

FIG. 315—TRANSPORTING EARTH IN SEVEN-TON TRUCKS, SEPT. 7, 1920

withdrawn for other work. About 25,000 cubic yards of the 82,000 was used to fill the building lots, the remainder going into the levee. The average haul, as stated, was about 500 feet. The maximum grade on the "ramp" leading to the top of the embankment where the material was dumped was 8 per cent.

The performance of the trucks during fair weather was good. They took the incline with little difficulty, going either head-on, or backing up, just as it came convenient, the backing being similar to the backing up an incline to dump gravel into the hopper of a concreting layout, and therefore a familiar operation to the drivers. Dumping of the materials was assisted by building a false bottom into the truck bodies, with its forward end raised about 8 inches above the regular bottom, thus steepening the slope of the truck body when in the dumping position, sufficient so that the material would not stick. This was necessary, since although the trucks were built to dump gravel, and would do this without the gravel sticking, most of the material in the Troy excavation was top soil, more tenacious than gravel, and requiring a steeper slope to slide the material out clean.

The chief difficulty was due to wet weather. A smart 15-minute shower might "queer the whole works," the rain "greasing" the incline of the ramp to a point where the truck wheels would spin helplessly without getting action. Such a shower not infrequently would stop the work for a half day. A

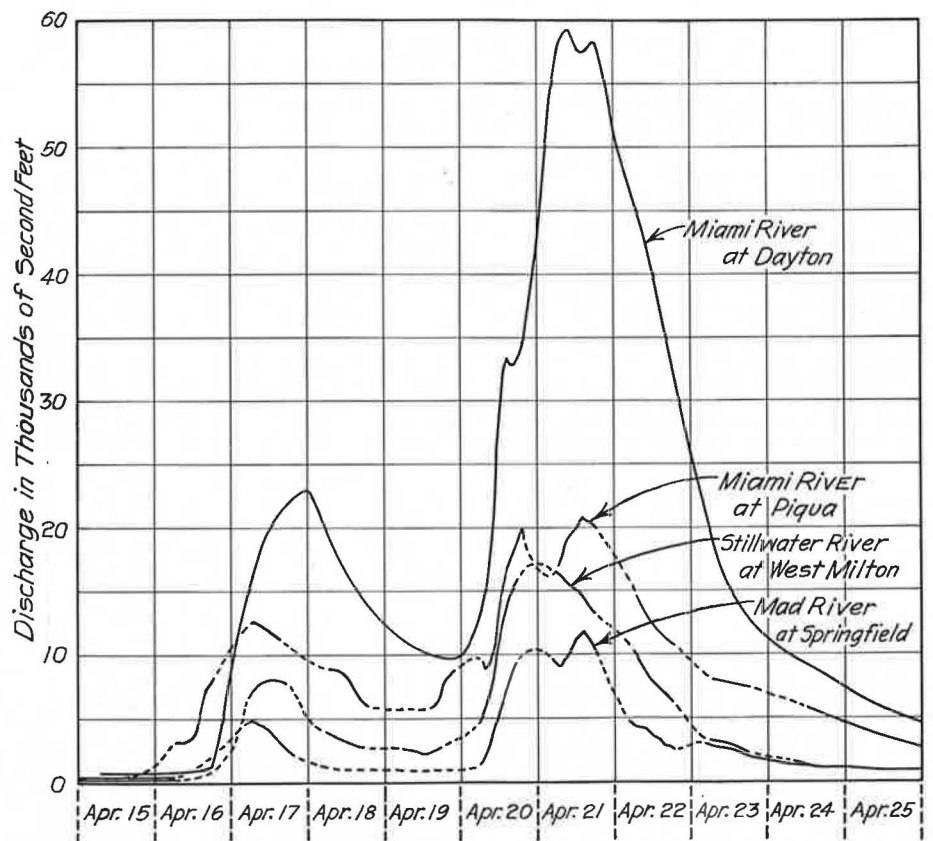
longer storm did not increase this difficulty, but simply extended the trouble over a longer period. It was simply a question of how long it would take the ground surface to absorb the "grease," after the rain was over. Horse-drawn dump wagons used on another part of the work experienced similar difficulty, due in that case, of course, rather to "gumming up the works" than to wheel slippage. Naturally, the trucks suffered somewhat more than the dump wagons during such stormy seasons. Probably, with the quantity of material to be moved, 4-yard narrow gage dump cars on tracks would be most economical for a contractor in such a case.

Conditions as they developed during the work were not so favorable as had been expected. The weather was so mild during most of the winter that there was little frozen ground to work on, and this made the hauling materially heavier. There was also a thicker upper layer of the stickier top soil than was expected, with a correspondingly less depth of gravel, and this also made a decided difference in the time lost in keeping the truck bottoms clean so as to permit quick, free dumping.

The C. and C. Haulage Company has recently arranged with T. Daniel and Son, of Dayton, to take over this work, in order that they might themselves devote their entire equipment to road work, contracts for which had been made the preceding autumn. They had completed, up to the time of removal of their equipment, about 82,000 cubic yards—or approximately about 60 percent of the total.

The vertical scale gives the amount of water flowing in the rivers in thousands of cubic feet of water per second of time. The storm that caused this period of high water consisted of a series of heavy showers. These showers are illustrated in Fig. 307. The intermittent rainfall introduced some variations in the curves, as compared with curves made from a storm with steady rainfall. The abrupt jumps in the curves all come from heavy local showers. Separate curves are shown for the Miami at Piqua, the Mad at Springfield and the Stillwater at West Milton, points where the conditions have the most effect on the river stage at Dayton. The time it takes for the crest stage at these stations to reach Dayton can be observed by noting how the crest of river stage at Dayton lags behind the crest of the stations to the north. In general, high stages

(Continued below)



Acc. No. 4151

FIG. 316—DIAGRAM SHOWING COMPARISON OF RIVER STAGES, FLOOD OF APRIL, 1920

from several upper stations must arrive at Dayton simultaneously to produce a high stage there.

FOR SALE

COMMISSARY SUPPLIES

CAFETERIA EQUIPMENT

BAKESHOP OUTFIT

The finishing of the Germantown dam, and the drawing toward an end of the entire flood prevention project, enables the Conservancy District to place on sale the following items, some new, some used, and all in good condition.

Terms Cash F. O. B. Point of Storage.

List No. 1.

Articles For Sale by the Miami Conservancy District

Dayton, Ohio, April 16, 1921.

All Articles Sold in Standard Packages Only as for Wholesale Shipment.

COMMISSARY SUPPLIES, UTENSILS AND FOODS

Article	Quantity	Prices	Location	Condition
Allspice—Durkee ($\frac{3}{4}$ oz.)	6 doz.	\$.35 doz.	Dayton Warehouse	New
Asparagus—No. 1	79 $\frac{1}{2}$ "	1.75 "	" "	"
Chimneys—No. 1 Lamp	9	1.15 "	" "	"
Clams—Savoy No. 2	27 $\frac{3}{4}$ doz.	2.50 "	" "	"
Cloves—Ground (1 oz.)	40 "	.45 "	" "	"
" " (2 oz.)	18 "	.75 "	" "	"
" " (5 lb. c.)	15 lbs.	.30 lb.	" "	"
" Whole (5 lb. c.)	20 "	.35 "	" "	"
Corn—Pop	58 "	.15 "	" "	"
Cullenders—Retinned Hotel	11	1.50 each	" "	"
Dishes—Small Nickeled Soap	24	.10 "	" "	"
Dishes—Butter	1680	.06 "	" "	"
Forks—18" Daisy Meat	1 $\frac{1}{2}$ doz.	2.00 doz.	" "	"
Gelatine—Plymouth, 2 oz.	2 "	1.50 "	" "	"
Ginger—Ground (1 oz.)	35 "	.40 "	" "	"
" " (5 lb. c.)	120 lbs.	.20 lb.	" "	"
Jugs—3 gal.	4	.60 each	" "	"
Leaves—Bay, 1 lb. pkgs.	10 lbs.	.15 lb.	" "	"
Mace—1 oz. cans	52 doz.	.70 doz.	" "	"
" Ground—10 lb. pails	20 lbs.	.40 lb.	" "	"
Meat—Imperial Club Potted, $\frac{1}{2}$ tins	6 doz.	.90 doz.	" "	"
Nails—Cobbler's Shoe, size 4-0	4 boxes	.60 box	" "	"
Netting—Mosquito (24 yds. to bolt)	1 bolt	1.00 bolt	" "	"
Olives—Heinz Calif., Ripe-Med. Empress	6 doz.	2.25 doz.	" "	"
Olives—Heinz Calif., ripe, small tins	4 "	1.00 "	" "	"
Pans—Frying, 9"	21	.25 each	" "	"
Pans—Frying, 12"	4	.26 "	" "	"
Paper—Wheat Straw Cigarette	1900 books	4.60 C. B.	" "	"
Paprika—1 oz. cans	38 doz.	.45 doz.	" "	"
Pepper—Red, 1 $\frac{1}{2}$ oz. cans, shaker tops	9 "	.40 "	" "	"
Pepper—Red, bulk	4 lbs.	.20 lb.	" "	"
Pepper—White, 1 oz. cans	30 doz.	.40 doz.	" "	"
Peppermint—Essence of (1 oz.)	4 "	1.25 "	" "	"
Pins—Rolling	10	.25 each	" "	"
Polish—White Shinola Shoe	9 doz.	.85 doz.	" "	"
Polish—Barkeeper's Friend—Brass	18 "	10.00 gross	" "	"
Powder—Savoy Curry, 1 lb. tins	5 $\frac{1}{2}$ "	5.15 doz.	" "	"
Sage—Ground, 2 oz. tins	52 "	.40 "	" "	"
" " 1 lb. tins	5 lbs.	.40 lb.	" "	"
Sago—Bulk	110 "	.06 "	" "	"
Savory—1 oz. cans	52 doz.	.50 doz.	" "	"

COMMISSARY SUPPLIES, UTENSILS AND FOODS—(Continued)

Article	Quantity	Price	Location	Condition
Scoops—Tin, 2 lb., 3 lb., 4 lb.	42	.25 each	Dayton Warehouse	New
Screws—Cork	2 doz.	.50 doz.	" "	"
Sets—Shinola Shoe Polishing	5 "	2.00 "	" "	"
Shoes—Style 2	21 prs.	2.00 pair	" "	"
" —Style 19	4 "	2.75 "	" "	"
Soap—Goblin (50 to c)	8 cs.	1.50 case	" "	"
" —Vulcan (100 to c)	6 cs.	4.50 "	" "	"
Spoons—Mustard	30 doz.	.25 doz.	" "	"
Strainers—No. 080 Hotel Chinese	11	1.70 each	" "	"
Straws—For Soft Drinks	5 M.	.40 M.	" "	"
Tartar—Cream of (1½ oz. cans)	6 doz.	.30 doz.	" "	"
" " (1 oz. cans)	2 "	.50 "	" "	"
" " (2 oz. cans)	20 "	1.00 "	" "	"
Thread—Giant White Carpet	12 "	.59 "	" "	"
Thyme—1 oz. cans	52 "	.20 "	" "	"
" —4 oz. tins	4 "	.75 "	" "	"
Turners—Cake, Plain	32	.15 each	" "	"
Mapleine—Crescent, 1 qt.	12 qts.	30.96 doz.	" "	"

CAFETERIA OUTFIT

Hughes Electric Frying Griddle—18"x54"	1	\$100.00	Dayton Warehouse	Used
Urns—10 gal. coffee urn, 20 gal. hot water	1 set	70.00	Englewood	"
Urns—10 gal. coffee urn, 20 gal. hot water	1 "	100.00	Dayton Warehouse	New
Steam Table and Service Counters—18 ft. x 24 in.— Built in sections, 9 ft.	3 "	100.00 sec.	Englewood and Dayton Warehouse	Used
Dish and Glass Washers and Dish Tables—Washer Model "AA" Crescent Electric Dish and Glass Washer—Motor 220 v — Tables square, 39' 6" around, 30" wide	2 "	225.00 each	Dayton Warehouse	Used
Enterprise Vegetable Slicer	3	9.00	" "	New
Meat Block—3"x40"x17"—Sectional Maple	1	15.00	" "	Used
Dish Wagon with 2 trays	4	35.00 each	" "	New
Vegetable Steamer—2 bu. capacity	1	25.00	" "	Used
Aluminum Trays—14"x18"—T. A. C. U. Wearever	476	1.75 each	" "	New
Model C Tyson Brine Ice Cream Freezer	1	225.00	Taylorville	Used
Creasey Ice Breaker—52 Y	1	40.00	"	"
Sterling Meat Slicer—Hand or Power	1	70.00	"	"
Refrigerator—Schmidt Kitchen—12'x3'x3'	1	200.00	Germantown	"
Buffalo Meat Chopper—18"x20" Bowl—2 H. P., 3 Ph., 60 Cycle, 440 v, motor	1	175.00	Taylorville	"
*Butter Dishes—Individual	1680	.06 each	Dayton Warehouse	New
Vegetable Side Dishes	1256	1.20 doz.	" "	"
Dinner Plates—9"	40 doz.	.15 each	" "	"
Bull Dog Mop Buckets—Wood	12	3.50 "	" "	"
*Colander—Retinned Hotel	11	1.50 "	" "	"
*Forks—Daisy Meat, 18"	1½ doz.	2.00 doz.	" "	"
*Pans—Frying, 9"	21	.25 each	" "	"
*Pans—Frying, 12"	4	.26 "	" "	"
*Pins—Rolling	10	.25 "	" "	"
*Scoops—Tin, 2 lb., 3 lb., 4 lb.	42	.25 "	" "	"
*Mustard Spoons	30 doz.	.25 doz.	" "	"
*Strainers—No. 080 Hotel Chinese	11	1.70 each	" "	"
Turners—Cake, Plain	32	.15 "	" "	"

*Also listed under Commissary Supplies, Utensils and Foods.

MISCELLANEOUS ITEMS

Blankets—Wool	280	\$ 4.00 each	Dayton Warehouse	New
Blankets—Wool	201	2.50 "	" "	Used
Sink Lavatory	5	5.00 "	" "	"
Toilets	5	5.00 "	" "	"
Drinking Fountains	2	2.00 "	" "	"
Wood Frame Cots	17	1.00 "	" "	"
Steel Bunks—Single	7	3.00 "	" "	"
Steel Bunks—Double	39	4.50 "	" "	"
Hospital Outfit	1	25.00 "	" "	New
Oak Office Desks and Tables		10.00 up	" "	Used
New Crocker Type Office or Waiting Room Chairs	94	3.60 each	" "	New & Used
We also have for sale various sizes of the following:				
Electric Motors—alternating current—5 to 50 H. P.		As Agreed	" "	Used
York Refrigeration and Ice Making Machine		" "	Germantown	"
Studebaker Roadster	1	" "	Dayton Warehouse	"
Steam Radiators of various sizes		" "	" "	"
Window Sashes		" "	Dayton Warehouse	New & Used
Door and Window Frames		" "	" "	New & Used
Doors		" "	" "	New & Used
Office Printing Press, Type and Type Cabinet		" "	" "	"

ONE COMPLETE BAKE SHOP EQUIPMENT

Article	Quantity	Price	Location	Condition
Dough Mixing Machine, 2 bbl. capacity, with 440 v., 60 cycle, 3 phase motor A. C. connected.....	1		Taylorsville	Used
Buckeye Bread Racks—9 shelves 5½"x2", height 5' 8".....	2		"	"
Steel Dough Troughs—6 ft. long—3/16 boiler plate—flange top.....	2		"	"
Galvanized Iron Proofing Ovens—250 2-lb. loaves capacity. Made in 6 ft. lengths—6 shelves to each.....	3		"	"
Pastry Stove—Made of wrought steel.....	1		"	"
No. 2 Bread Pans—5 strapped together—17"x4½"—16½"x3½"—B. 3¼" deep.....	220		"	"
Sink—42"x24"—16" deep.....	1		"	"
Baker's Bowls—25 qt.—tinned steel.....	2		"	"
Hotel Egg Beating Bowls—17 qt.....	2		"	"
Bowl Truck and Casters.....	1		"	"
Oven Peels with Handles.....	2		"	"
Peel Blade.....	1		"	"
Biscuit or Cake Sheets—18"x25"—Welded corners, made of No. 12B Iron.....	39		"	"
Bread Pans—Heavy tinned—8½"x4½" top—7⅝"x3⅝" bottom—2¾" deep.....	446		"	"
Baker's Coal Truck—18"x20"x24".....	1		"	"
Chantillon Dough Scale.....	1		"	"
Bonanza Apple Peeler and Corer.....	1		"	"
Muffin Pans.....	12		"	"
Cake Rack—with adjustable arms.....	1		"	"
Oven Table.....	1		"	"
Baker's Work Table—12'x4'x35".....	1		"	"
Total.....		\$900.00	"	"

Terms Cash F. O. B. Point of Storage.

Call or Address

Hosea F. Moyer, Sales Agent,

Miami Conservancy District,

Dayton, Ohio.

Telephone Main 2903.



FIG. 317—MESSHALL DINING ROOM, TAYLORSVILLE DAM, MAY 14, 1920

THE MIAMI CONSERVANCY BULLETIN

JUNE and JULY, 1921



FIG. 318.—HYDRAULIC GIANTS EXCAVATING MATERIAL IN THE BORROW PIT
AT TAYLORSVILLE, APRIL 18, 1921



FIG. 319.—CLOSING THE OLD RIVER CHANNEL AT TAYLORSVILLE DAM, MAY 5, 1921.

This view was taken from the east side of the outlet structure and looking west along the north face of the dam. The steam shovel in the background is loading rock into four-yard cars. The rock is being used to push the rock blanket at the toe of the dam, across the old river channel. A train is shown on the swinging trestle.



FIG. 320.—SLUICING MATERIAL INTO OLD RIVER CHANNEL AT TAYLORSVILLE DAM, JUNE 1, 1921

This view was taken from the west bank of the old river looking towards the outlet structure. An early stage of the hydraulic fill across the old river bed is shown. The trestle in the background has now been torn down. The fill in the background, on which the men are working, is the rock blanket on the upstream toe of the dam, placed by train from the swinging bridge shown in Fig. 319. The machine in the foreground is an Austin back filler, with caterpillar traction, and driven by gasoline. It is used to build up the toes of the dam.

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THE MIAMI CONSERVANCY BULLETIN

PUBLISHED BY THE MIAMI CONSERVANCY DISTRICT
DAYTON, OHIO

Volume 3

June and July, 1921

Numbers 11 and 12

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

Death of Judge Cosgrave

Judge Otway Cosgrave, formerly of the Common Pleas Court of Hamilton County, Ohio, died on Monday, July 25, 1921, after an illness extending over several weeks. Until his retirement a few months ago, Judge Cosgrave was a member of the Conservancy Court, representing Hamilton County, one of the nine counties comprising the Miami Conservancy District. He participated in all the hearings from the inception, including those incident to the organization of the District, the adoption of the Official Plan, and the confirmation of the appraisal roll. His sympathetic and intelligent grasp of the many intricate problems growing out of this enterprise, also his quick perception and understanding of the plight of an unprotected valley won the warm regard and gratitude of all. Judge Cosgrave interested himself in the progress of construction from the very first and always keenly enjoyed the annual trips of inspection. Although no longer on the bench, yet he was expected to accompany the Court on this year's inspection which had been postponed until September on account of the intense heat. It is much to be regretted that Judge Cosgrave did not survive to see the completion of the great project to which he had devoted so much thought and attention, both as a citizen and as a member of the Court.

Visiting the Conservancy Work

Visitors from all over the world come to the Miami Valley to look over the construction work. The organization, the methods of doing work, and the very size of the job, are unique, and will not be equalled in this country again for a long time.

While outsiders go to a good deal of trouble and

expense to see the work, many citizens of the valley have never seen any of it. Many of them are planning to take an inspection trip over the work, but put it off from time to time. In a short while it will be too late. Englewood, Taylorsville, and Huffman dams are all very interesting right now. The Conservancy men welcome visitors on the work, and hope that more of the people of the valley will take occasion to inspect the work for which they are paying.

Future Issues of the Bulletin

This issue of the Bulletin has been edited by one of the members of the Engineering staff. Mr. G. L. Teeple, editor of the Bulletin since the start of its publication in 1918, has left the District for other fields of endeavor.

Under his guidance the Bulletin has been a true chronicle of the construction work, and has done much to foster the Conservancy spirit. The employees of the District wish him well in his new work.

A new editor will not be selected. The work of the District is rapidly drawing to a close, and there is no longer the need of a monthly Bulletin. This issue is a combination of the June and July numbers. In the future, Bulletins will be issued at irregular intervals, and each issue will mark the completion of some important feature of the work. The publication will be composed of articles and pictures similar to those that have made up the past numbers.

Persons who have subscribed in advance can leave their subscriptions stand. In the event that a balance is left to the credit of the subscriber when the Bulletin finally suspends publication, a refund will be made of the unused amount. Future numbers will be sold at the same rates as now prevail.

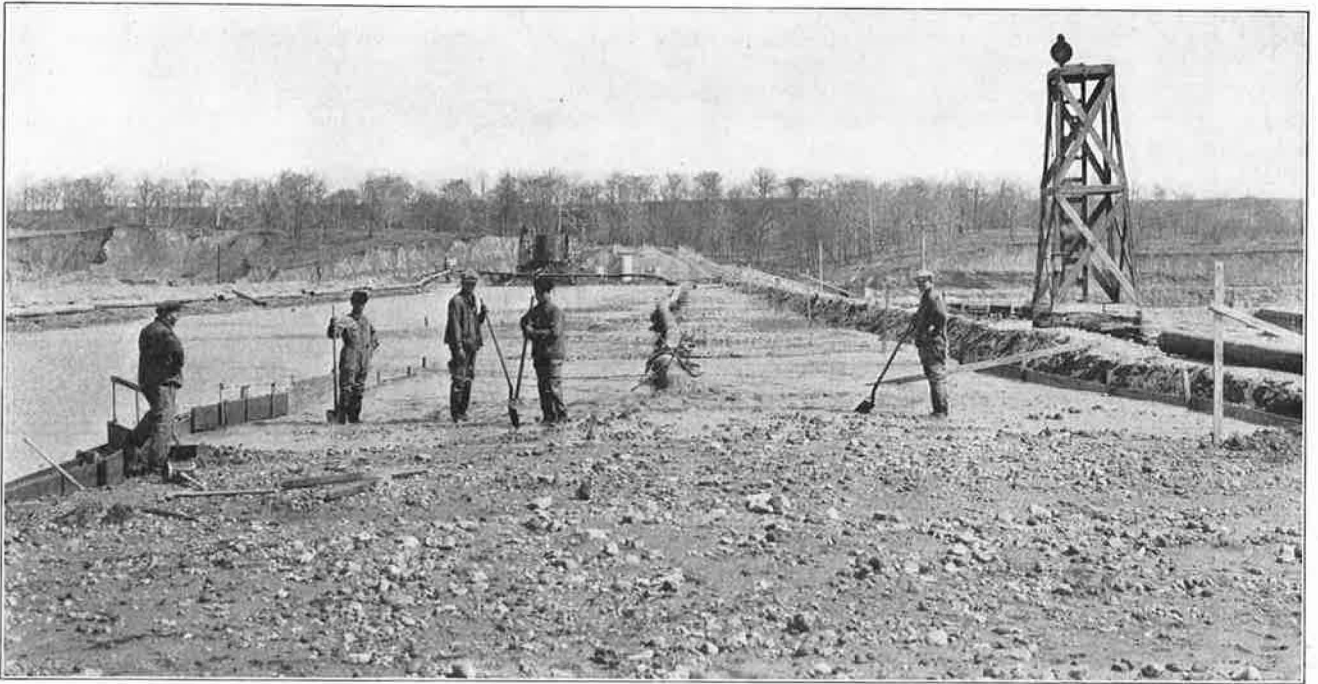


FIG. 320.—DEPOSITING MATERIAL ON THE DOWNSTREAM SIDE OF TAYLORSVILLE DAM, APR. 1, 1921

The pipe line is being "backed up." A layer has been placed on the dam, starting at the east end near the water tank in the background and coming westward, by adding pipe as the area in front of the discharge is filled in by material. Then the water in the pool has been raised, and another layer is being deposited by allowing the material to pile up in front of the discharge until the required depth is reached, and then pulling off a length of pipe and repeating the operation. The boards at the left are called "shear boards," are movable, and are used to deflect the current of water flowing towards the pool, so that sand will not be crowded out into the section reserved for impervious core material.

As regards the placing of the concrete in the channel structures, the solution was also to place the entire concreting equipment above even extreme flood level, and lower the material into place in concrete buckets swung into position for dumping by derricks on the higher level. Only a few small pieces of equipment, like pumps, rock drills, etc., were permitted below water level, pieces of a size which enabled them to be lifted readily to safety by the derricks in case of emergency.

The river, during all this work, would be carried in its regular channel, with a wide shelf left on the valley bottom on its west bank, between that and the valley section of the dam, for flood expansion. This would mean, of course, that the building of the river section of the dam embankment must be postponed until the new concrete channels were ready to take the river flow; otherwise an expensive third chan-

nel—a "diversion channel"—would have to be dug to carry the river during the concreting.

One other important feature remains to be noted—the removal of the Baltimore and Ohio Railroad out of the way of the dam building. A channel for this "river of traffic" had to kept open at all times. The tracks ran along the lower portion of the west valley slope, while the Miami runs along the foot of the east slope, with the "valley section" of the dam between the two. The new tracks, pushed up the west slope to a higher safe level, must be built before the old tracks were abandoned. At the same time, the valley section of the dam could be built up to the level of the old tracks. Then, as soon as traffic took to the new tracks, the old ones must be removed and the valley section of the dam pushed on up.

"Orders for work" or the important features of the program would then stand as follows:

This chart supplements Fig. 319. It represents a profile taken along the center line of the dam, and shows the elevations reached by the fill during certain periods. The different elevations do not give a true picture of the quantities placed, but Fig. 319 does show the true relationship of volume and time.

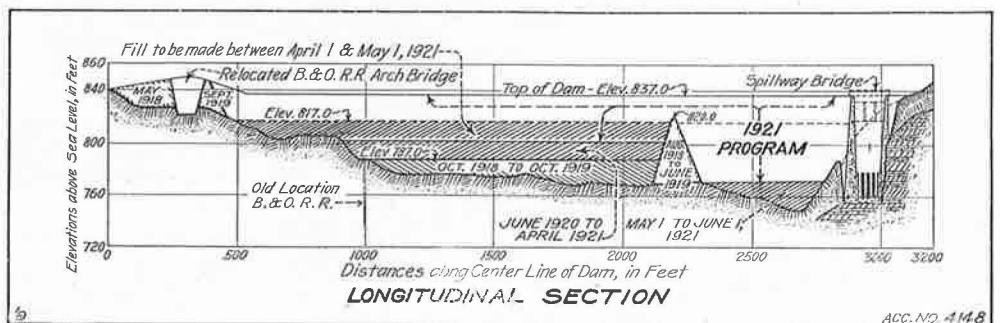


FIG. 321.—PROGRESS DIAGRAM.

During 1918 and 1919; clear the ground, get the equipment together, build the new B. & O. line and carry the valley section of the dam embankment up to the level of the old B. & O. tracks. If possible, also transfer traffic to the new tracks, remove the old ones, and carry the valley section on up as high as the season would permit. At the earliest possible date start excavation for the new concrete river channels, which would furnish the materials for the valley section. Start the concrete work as soon as the excavation permitted.

During 1920; finish excavation for the concrete and rush the concrete placing to completion during the warmer season. At the same time carry the valley section of the dam embankment up to within 20 feet of the proposed summit, which would be well above any possible flood. The river, during all three years, would be left in its regular channel.

In 1921; rush the river section of the dam embankment as fast as possible, beginning as soon as the Spring flood season should be past, to a point above flood damage; then carry the entire embankment up to completion. As soon as the river section should be well up, start on the concrete "spillway weir," and the bridge spanning it, and bring the entire work to completion as rapidly as possible. It was expected that some of this work would carry on into the season of 1922, but in any case the dam would be in safe condition against floods by the end of 1921. Also, it would be furnishing practically its full flood protection to the valley below at the same time.

It is a pleasure to be able to record that this program, although somewhat delayed in places—principally in connection with the shifting of the Baltimore and Ohio traffic to the new line—has on the whole been carried out in accordance with the plans and is now somewhat ahead of schedule. The vital parts of the work promise to be entirely finished by the end of the present season, unless something unexpected occurs.

The Work at Taylorsville Dam for 1921

As indicated in the preceding article, the job for 1921 includes two main parts—the finishing of the dam embankment and the topping out of the new concrete river channel with its "spillway weir" and bridge.

Of the embankment, the total quantity remaining to be done at the beginning of the year was about 850,000 cubic yards, (wagon loads). Of this amount, (except a very small quota of 10,000 cubic yards east of the river channel walls—about 457,000 cubic yards was to go into the yet untouched river section of the embankment, and the remainder into the valley section. The latter had already received about 400,000 cubic yards of material, which had carried it within about 35 feet of the proposed dam summit.

Since the river section, on account of its peculiar exposure to flood damage in its earlier stages, could not be started until the danger of Spring floods should be past, the early period of the 1921 work was devoted to carrying up the valley section still higher, reaching by the end of May a level of only

This drawing shows the dam as it existed on June 1, 1921, and as it will look when completed. The railroad is shown in its new location at the west end of the dam. A concrete bridge has already been built connecting the small piece of dam west of the tracks to the main fill. This bridge will carry the National Road, which will cross the valley on the top of the dam, over the railroad track, thus eliminating a dangerous grade crossing. The west section of the dam extends from the overhead bridge just mentioned to the west bank of the river. By June 1st, it had been built across the old location of the B. & O. and had been raised to spillway elevation. Before June 1st the river had been turned through the outlet structure and by that date the rock blanket on the upstream toe had been pushed across the old river channel. On the upstream face of the rock blanket left in place on the west section of the dam, a machine is shown cutting the bank outside of the berm to a four-to-one slope.

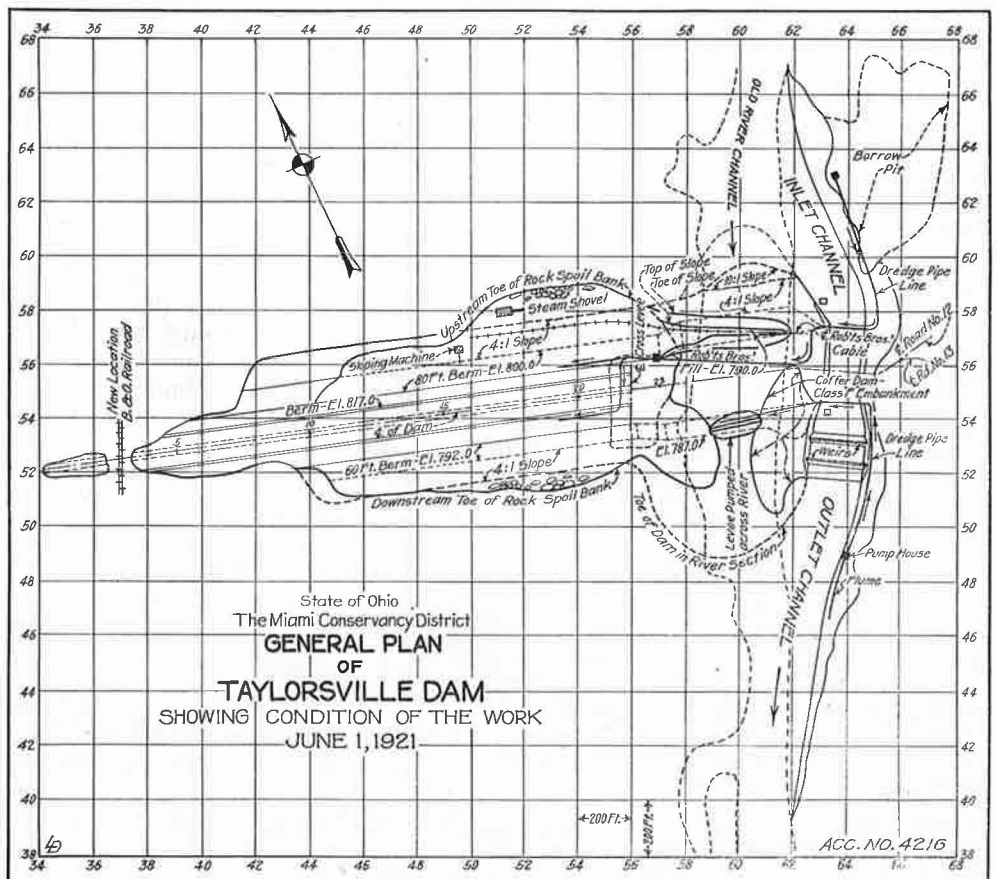


FIG. 322.—GENERAL PLAN OF TAYLORSVILLE DAM.

These two sections show how the rock blanket will be located along the upstream and downstream toes of the dam proper. The so-called blankets are really massive buttresses reinforcing the base of the dam. The material in the "blankets" came from the excavation for the outlet structure and had to be disposed of in some manner, so it was put where it would add to the strength of the dam. The material is not suitable for use in the dam proper.

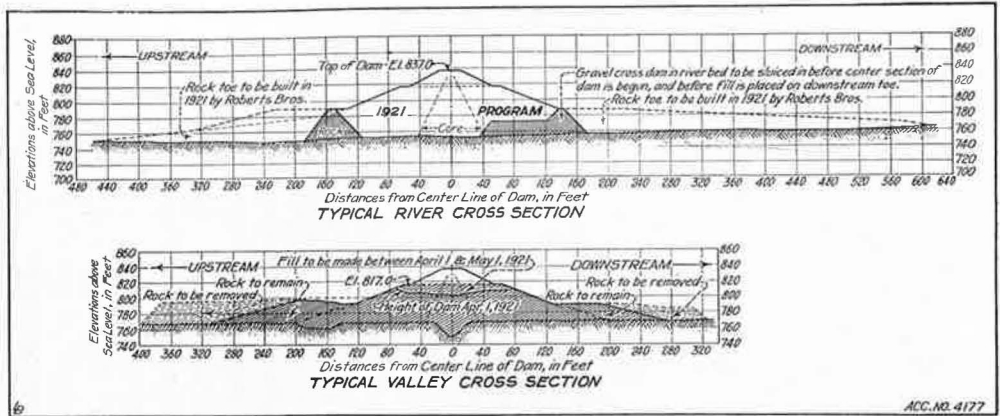


FIG. 323.—CROSS SECTIONS OF THE TAYLORSVILLE DAM.

20 feet from the summit. Work on this section was then stopped, to permit a concentration of the entire embankment building equipment on the river section, to rush it to a safe level before it could be overtaken by high water. To expedite this, a new "borrow pit" was opened on the east hillside, thus providing a second source of earth material, with a complete outfit of equipment to carry it to the dam. By these means it is expected that the river section, already well under way, will be up to the same level as the valley section—and far above flood danger—by September 1. The two sections will then be thrown into one and carried up to completion together.

The danger of overflow of the river section was greatest naturally in its earliest stages, when the embankment was still at very low elevation. To diminish this danger a narrow dike was thrown rapidly across the river just at the upstream toe of the embankment, high enough to be above any probable rise of the water. This dike, which will become a part of the upstream toe of the finished embankment, was rapidly built by dumping rock from trains running on an overhead bridge as described later.

This preliminary operation was practically free from flood danger, and was done first as a protection for the next and really vulnerable stage—that of cleaning out the old river bed, and depositing the

lowest layers of the dam core. To clean the river bed, a second dike was thrown across it by "pumping gravel" as in the regular operation of hydraulic fill, the location this time being just at the downstream toe of the dam. There was thus formed between the two dikes an enclosed rectangular basin occupying the damsite and filled with river water. This was pumped out, leaving the stream bed exposed, with its snags, muck and other material which would be undesirable to include in the embankment. These were then removed, the muck and similar earth material being washed down by a powerful water jet to a central depression or "sump," and pumped out as a thin mud. This operation has been completed, and the upstream crossdike carried to such a height that further interference by floods is practically eliminated.

The Borrow Pits Which Furnish Earth for the Dam

The earth for the entire dam embankment comes from "borrow pits" in the hillside just east of the river, where a blanket of clay and "glacial till" from 10 to 60 feet thick overlays the bed rock. It was this same material, overlying the rock excavated in digging for the foundations of the new concrete river channel, which was used in the earliest work in building the valley section of the embankment. The present borrow pits are simply extensions of this original excavation.

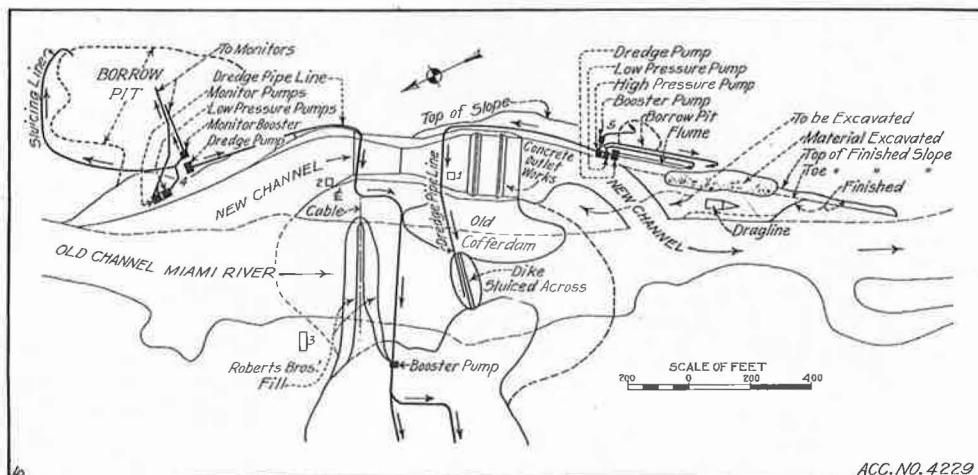


FIG. 324.—LAYOUT OF PUMPING PLANT AT TAYLORSVILLE DAM.

This sketch shows the layout of the plant and borrow pits, at the start of the work on the river section of the dam. The borrow pit south of the outlet structures is the new one opened up especially to supply enough extra material to push the river section along at maximum speed. Both the pipe lines are carried across the outlet structure on temporary suspension bridges, one above, the other below the weir. The pipe lines are so arranged that material can still be pumped into the west section of the dam if necessary.

The method of handling the earth is that of "hydraulic fill." The material is washed down from the pit face in the hillside by powerful water jets into a "sump" or cistern, whence it is pumped by big centrifugal dredge pumps through pipes to the dam summit and there deposited. (See Bulletin for February, 1920.) See also the pictures in this issue. Swiftly whirling paddles in the pumps suck the mixed earth and water from the "sump" into a cast iron shell, and whirl it out again into the "dredge pipes" at high velocity, on the same principle by which a stone is whirled from a sling. These pumps, driven by electric motors, consume up to a maximum of 450 horse power, the combination being very simple and efficient.

All the Taylorsville material is transported from the pits to the dam through pipes as just explained, there being here no possibility of directly "sluicing" the earth from the hill to embankment as was done last season at the north end of the Conservancy dam at Huffman. The direct sluicing, if available, would be cheaper. On the other hand, "pumping the mud" at Taylorsville is a little cheaper than transporting it by train and locomotive as must be done at Englewood and with most of the material at Huffman. The Conservancy dams at Taylorsville and Lockington are both fortunate having excellent material for the embankments close at hand on the hillsides, permitting excavation by "monitors," (water jets) which is a cheaper method than excavation by drag-line or steam shovel, and eliminating also the expense of railway tracks, cars and locomotives for getting the excavated earth to the dams. This fortunate proximity of hillside material had of course something to do with the selection of these dam sites in the first place.

The principle difficulty at Taylorsville has been due to a thick layer of very tough "blue clay" 10 to 50 feet thick which underlies the surface ma-

terial all along the east bank of the Miami in the neighborhood of the damsite. This material is so hard to "jet down" that it is necessary to "shake it up" first with dynamite. A well drill, (seen in Fig. 318) standing on the top of the bank, drills holes 60 feet deep, reaching to the level of the pit bottom, the holes being spaced 20 feet apart and 10 feet back from the bank edge. These holes are then "sprung" (enlarged) at the bottom by a small charge of dynamite, following which a charge of 500 pounds of "30 per cent dynamite" (30 per cent of it nitro-glycerine) is placed in the enlargement, and exploded, a number of holes being "shot" at once. This has a shattering effect on the entire mass, and makes the work of jetting it down by the "monitors" much easier.

As already stated, the speed of operation in pushing up the river section of the dam embankment is being accelerated by opening a second borrow pit. When this section has reached a safe height, (about 30 feet from the dam summit) one of these pits will be abandoned, and the remainder of the embankment finished with the other alone. That pit will be retained which is cheapest and easiest to operate—i. e., that which the previous working has shown to contain the least of the tough blue clay.

The original pit was opened by pushing out the excavation for the new concrete river channel, in a direction north and east, the sump and pumps being now about 500 feet north of the concrete inlet. See map, Fig. 324. Exploration by drilling has proved that some 700,000 cubic yards of earth material is within reach by extending this pit. This would probably be sufficient by itself to finish the dam embankment. The second pit, which is a little south of the concrete outlet, is known to contain also an abundance of material, so that whichever pit is used, there will be no lack in this regard.

Paying for the Flood Prevention Project

Tax Levies Made Approximately Equal Each Year. Bond Indebtedness Will Be Wiped Out Gradually, Last Payment Being Made in 1949

Stated in its simplest terms, the general scheme for obtaining the necessary money for the carrying out of the flood prevention project was to borrow it in such sums and at such times as it was needed, pledging the benefits to property as security for the repayment of the borrowed sums. The total amount thus borrowed has been \$33,890,909.83, and it is expected that this amount will be sufficient to entirely complete the work. The total benefit to the property of the valley by protecting it from future floods, has been determined, after careful appraisal by men who were experts in the valuation of real estate, as being in round numbers \$77,000,000.00. Thus the cost of carrying out the work, exclusive of interest payments on borrowed money, is expected to be less than half the benefit derived by the safeguarding of property alone, to say nothing of the far more important benefit in saving human life, and the freeing of the minds of the people from terror in seasons of floods.

The Miami Conservancy District, organized under a special "Conservancy Law" of the state of Ohio for the purpose of carrying out the project, is a

political division of the state, comprised within land boundaries, after the analogy of a county or a town. Legally, like them, it is a public corporation, armed with all necessary powers to levy taxes, borrow money, take land by condemnation, and in general to do whatever may be necessary to the accomplishment of the work of flood prevention. The supreme authority is vested in a court made up of the common pleas judges of the several counties in the District. Executive direction is in the hands of a board of three directors appointed by this court, and reporting to it.

The security for the borrowed money was, of course, in the form of bonds, these bonds constituting a lien on the benefits to the property of the District and being paid off by taxes levied upon it. These bonds are arranged so that a certain number mature and are paid off each year, beginning in 1922 and ending in 1949, the debt of the District being thus gradually wiped out. Two bond issues were made, one in 1917, the other in 1920. The first covered the original estimated cost of the project. The second supplied the estimated necessary additional

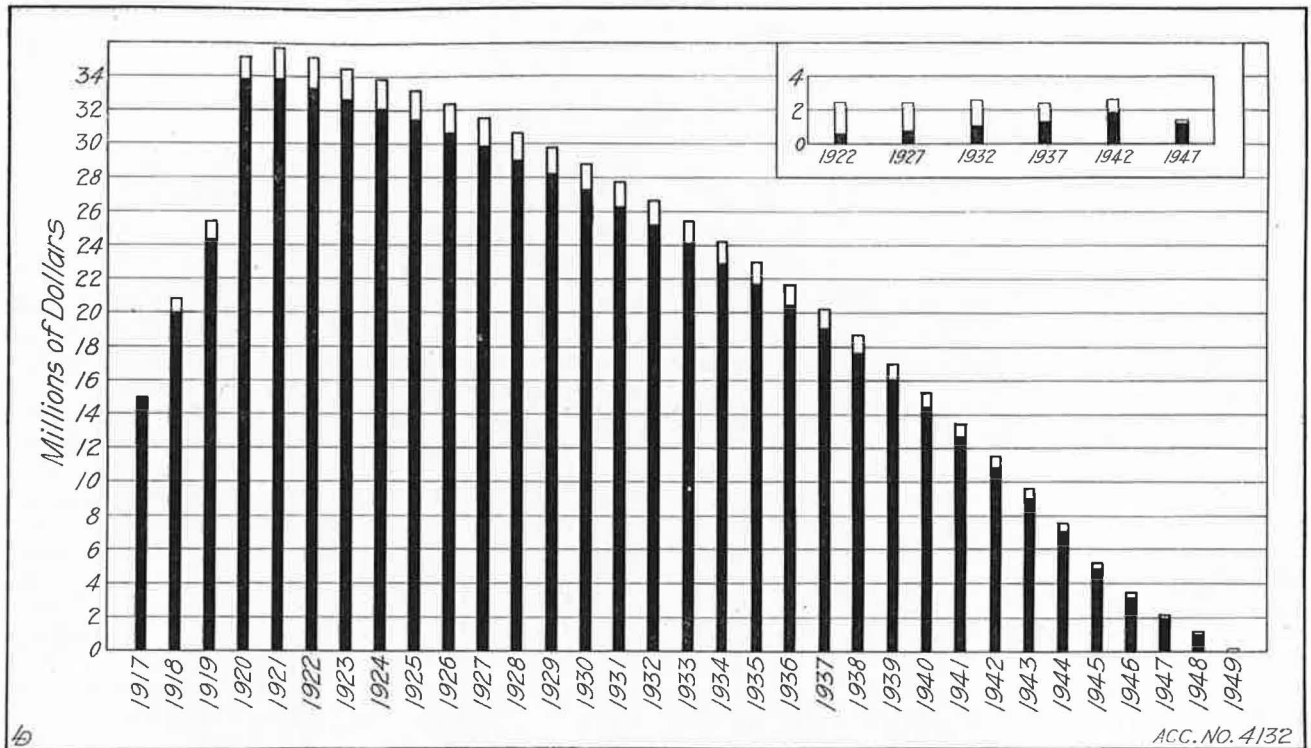


FIG. 325.—DIAGRAM SHOWING THE OUTSTANDING INDEBTEDNESS BY YEARS

This figure illustrates the successive borrowings of money through bond sales, and the proposed gradual repayment through tax levies. Any one of the series of black vertical strips represents the total indebtedness of the Conservancy District on December 1st of the year marked beneath. The little white blocks on top of the black strips represent in a similar way the interest paid during the year given beneath.

money to complete it, the original estimate having proved insufficient, due to the advance in all costs brought about by the war. The first issue was for \$24,340,690.53; the second for \$9,550,219.30; the two totalling \$33,890,909.83. This will be the total indebtedness assumed by the District, the entire actual cost of the work of flood prevention, covering all features and items.

To save interest charges, these bonds were not sold in a lump, but from time to time as money was needed, in four installments, as follows:

Dec. 1, 1917.....	\$15,000,000.00
Jan. 13, 1919.....	5,000,000.00
Jan. 3, 1920.....	4,340,690.53
Nov. 3, 1920.....	9,550,219.30

Total\$33,890,909.83

None of these have been yet retired. The total then represents the present debt of the District.

The monies thus borrowed must be repaid, as stated, by taxation on the benefited property (including, of course, the cities, counties, etc.). Interest on the borrowed sums must also be paid in the same way. The intention is to make the tax levy as nearly uniform as possible year by year, a part of each levy being applied to paying the interest and the remainder to wiping out the principal, bit by bit, the process extending over a long period of time in order to reduce the levy to a reasonable sum each year. The reductions of the principal are made, of course, by paying off the sold bonds, these being arranged accordingly, a certain number calling for redemption each year. With this steady reduction of the principal, the annual interest to be met be-

comes likewise less and less; and since the total tax levy is to be kept the same each year, that part of it applied to reduce the principal becomes correspondingly greater and greater. Thus the debt is reduced faster and faster, till it is finally wiped out in full.

It should be added that the entire tax is applied as just explained, no portion whatever being directly used to pay for the work on the flood prevention project. The work is carried on entirely with the money obtained from the bond sales.

The facts regarding the successive borrowings of money through bond sales, and the proposed gradual repayment through tax levies are shown in Fig. 325. Any one of the series of black vertical strips in this diagram represents the total indebtedness of the Conservancy District on December 1 of the year marked beneath; that is, the amount of the yet unredeemed bonds. The bigger the debt the longer the strip, the scale being given at the left, in millions of dollars.

Thus in December, 1917, the District borrowed by bond sale to an amount of \$15,000,000, represented by the left-hand black strip. In December, 1918, it borrowed \$5,000,000 more, making \$20,000,000 in all; represented by the second strip. December, 1919, it borrowed \$4,340,690.53 more, making a total of \$24,340,690.53; represented by the third strip. And in 1920 it borrowed \$9,550,219.30 more, raising the total to \$33,890,909.83; represented by the fourth strip. There will be no borrowings in 1921, therefore the fifth strip will be the same height as the fourth. In 1922, on the other hand, the debt will diminish by redeeming \$600,000 worth of bonds; therefore the sixth strip is a little shorter than

the fifth. And each year thereafter, as more and more bonds are redeemed, the debt diminishes and the strips grow shorter, till in 1949 the last bond is redeemed—the debt wiped out.

The little white blocks on top of the black strips represent in a similar way the interest paid during the year given beneath. The first strip has no white cap, no interest being paid during 1917. The white block on top of the second strip represents the interest on the \$15,000,000 during 1918; that on the third strip is the interest on the \$20,000,000 during 1918, and so on. After 1922, when the debt begins to decrease, the interest also begins to decrease, and the white blocks grow shorter, along with the black strips.

But although the interest, after 1922, will steadily decrease as shown, the tax levy will not necessarily decrease, as already stated, since it is considered best for all concerned to make the total tax levy about the same each year. The effect of this in speeding the diminution of the debt is shown in Fig. 325 in the small diagram above and to the right of the main figure. A series of black blocks is there shown, each with a white block above it. Each black block represents the bond principal paid off during the year noted below, and the white block on top of it represents the interest paid during the same year. The total height of the two blocks, black and white, for any year, thus represents the total tax levy for that year, as applied to interest and principal. Note that this total height remains about the same for all the years shown, (except the last). The black blocks, however, grow higher as the years go on, and the white blocks shorter, showing the greater and greater proportion of the levy applied to principal, and the less and less proportion applied to interest. Thus in 1922 the black block is about one-fourth the total height, and the white block about three-fourths; while for 1942, the black block is about three-fourths and the white block about one-fourth, of the total. The diminished height of the black block in 1947 is due to the fact that in 1946 the entire first bond issue will have been paid off, leaving only the due fraction of the much smaller second issue to meet.

In what has been said, the tax levy, for simplicity, has been treated as if it were immediately and entirely applied to the debt, to pay principal and interest. But since there are always some people who fail to bring in their taxes, the levy must be made large enough to cover this shortage, and make the actual cash from the levy sufficient. To make sure of this, the levy is made large enough so that ten per cent of it can be set aside as a so-called "contingent account," leaving 90 per cent to be applied on the debt. As this contingent account grows larger, it will be used to pay off the bond principal, or to maintain the flood protection works in proper repair; in either case reducing the later tax levies. At least ten per cent of the tax levy for the current year, however, must be always kept in reserve to insure payments on the bonds in accordance with the schedule.

The taxes levied to pay for the project may be conveniently divided into two main classes, although in principle there is no actual difference, as all benefits are special benefits. The first includes the taxes

levied upon the various political divisions of the District—upon each city, county, etc., because of the general benefit received by the city, county, etc., as a whole. In Dayton, for instance, various bridges and public buildings will be protected from flood damage. The city as a whole receives the benefit, and as a whole should be taxed to pay for it. Such benefits to a political division as a whole may be conveniently called general benefits.

But besides these general benefits, many houses and pieces of land on lower ground, in heretofore flooded areas, will receive a special private benefit. These special benefits will vary with the location. House-holders who were driven into the second story or onto the roof in 1913 will receive a greater benefit than the owner who suffered only from a flooded front yard and cellar. The taxes on these specially benefited properties constitute the second main class. This class carries a little more than one half the total load; the first class mentioned carries the remainder. Thus the owner of specially benefited property pays twice, once for his general benefit, and once for his special—which is fair.

The amounts of total benefits, both special and general, were determined in 1916, after a very thorough-going examination of the property of the District by experts in real estate valuation; and the benefits as so determined were made the basis of a just distribution of Conservancy taxation between the two classes just discussed, and between the several political divisions of the District on which the first class are assessed. The findings of these experts were approved by the Court, and the distribution of the benefits, as given by them, and so approved, is the basis on which the actual Conservancy taxes are calculated and levied.

The tax levy for general benefits—that made through the political divisions—is collected by the several cities, counties, etc., and paid into the Conservancy treasury. It is assessed as a general Conservancy tax, so many mills to the dollar of property as carried on the regular tax list of each political division. Since the various cities, counties, etc., receive different degrees of benefits from the protection works, according to their varying degrees of liability to flood damage, this general mill levy will vary with each political division. In Dayton, in 1918, this levy was 2.845 mills to the dollar, to be added to the general city tax. In 1919, it was 2.39 mills; and in 1920, it was 2.993 mills. Its amount in 1921—the current levy—has not yet been determined.

The taxes on the specially benefited property have to be handled, naturally, in a different way, since the special benefit to each particular property will vary with the depth of flooding, etc., to which the property would be subject but for the flood protection works. For such properties a special tax list is kept in the District offices, on which each piece of property, with its benefit, is entered. The tax levy on each of these properties is calculated each year, as a percentage of the total levy to be laid on the particular property to carry out the project. This total levy is laid in proportion to the benefit to that property, and the percentage of it levied for any year is the same all over the District. Each year's levy, as well as the total levy, is therefore proportional to benefit. The county tax list thus made

out is sent each year to each county auditor, to be collected with the other county taxes.

Up to the present year, the total levy on this class of property has been 36 per cent of its benefit; corresponding with the 36 per cent of total benefit levied on all the property of the District. It was this which produced the credit necessary to borrow the \$24,340,690.53 constituting the first bond issue, and covering the original estimate of the cost of the project. The per cent of the total levy actually assessed for 1918 was 6.8 per cent; for 1919, 5.6 per cent, and for 1920, 7.7 per cent.

To show just what this meant to the individual property holder, take the case of a house and lot on land, worth, with flood protection, \$5,000. Without protection it would be liable to flood damage and its value would drop, say to \$4,000. Its benefit from flood protection is therefore \$1,000. The total levy upon it to finish the project, heretofore placed at 36 per cent of the total benefit, as just explained, would be 36 per cent of the \$1,000 or \$360. The 6.8 per cent of this total levy, laid in 1918, would have been \$24.48 (6.8 per cent of \$360). In the same way the 1919 levy upon it would have been 5.6 per cent of \$360, or \$20.16; and the 1920 levy would have been 7.7 per cent of \$360, or \$27.72.

The total levy, in dollars, including both the classes of benefited property discussed, was in 1918, \$1,804,308.00; in 1919, \$1,492,638.77, and in 1920, \$2,058,231.78.

With the increased cost of the project over the original estimate, due to advance in all costs on account of the war, an addition to the total levy on benefits was made necessary in November of last year, amounting to 14 per cent of total benefits. This makes the total levy at present 50 per cent of the total benefits, and this levy must hereafter be made on each separate piece of benefited property. Applied to the property just considered, with a benefit of \$1,000, it will make the total levy on that property \$500. Thus the annual tax levy in future on that property would have to be reckoned on this \$500 instead of \$360 as before.

On the political divisions of the District the same additional 14 per cent will be levied on their total benefit.

This advance will first appear on the tax list for the present year, 1921. The amount asked for is \$3,418,598.28. In this is included the balance needed for paying the bonds which mature December 1, 1922, as well as interest for one year on the full amount of the first issue of bonds, and interest for two years on the second issue. The designations "first" and "second" are for convenience, as the issues are in all respects on a parity. In the above figure is also included a sum for maintenance of works for the year 1922, when they will have reached substantial completion.

Collecting the above facts for convenient inspection, we get the table shown below.

May and June Progress on the Work

GERMANTOWN

The only work now remaining to be done is the placing of a 2-inch Tarvia surface layer on the concrete floor of the highway bridge spanning the spillway structure.

It is expected to complete this surfacing at an early date.

A. L. Pauls, Division Engineer.

June 30, 1921.

ENGLEWOOD

During May the hydraulic fill operations were continued in the gap between cross dam No. 2 and the permanent spillway, using sump No. 3 until May 4th when sump No. 4 was put into use. During June the gap was brought up to the level of the remainder of the dam and sluicing operations were started over the entire length of the fill and will be continued in this manner until the dam is finished. Up to the end of June a total of 2,781,450 cubic yards have been placed. The record for a single shift was advanced to 615 cars, for a two-day shift run (day and night) to 1040 cars, and for a week's run to 5730 cars.

Concreting at the permanent spillway was begun April 19, and is making satisfactory progress. By the end of June the floor and side walls were well advanced towards completion and preparations were begun to place the weir.

Rock too large to go through the pumps have been screened out of the material coming from the borrow pit and have been placed on the upstream face of the dam.

The contract has been let for the construction of road No. 7 near West Milton and the contractor is preparing to start at an early date.

H. S. R. McCurdy, Division Engineer.

June 30, 1921.

LOCKINGTON

During the last two months fair progress has been made in placing the hydraulic fill, and on June 30 only about 50,000 cubic yards remained to be placed. As a result of the operations of the last two months, it appears that the dam can be completed without resorting to the help of a booster pump in either dredge-pipe line. The pump house that was burned on the night of April 16 was in operation on the morning of April 25, resulting in a loss of an even week's time.

The operations on the spillway weir with the two conduits and bridge over the spillway, were started. By June 30 about 1200 cubic yards had been placed and the conduits were completed and work is in progress on the weir. The screening and mixing plant in its original location is being used to supply concrete. A gasoline dinkie with buckets on flat cars transports the concrete from the mixer to the derrick over a 36-inch-gauge track built on a low trestle in the entrance channel. A derrick, with a 120-foot mast and a 105-foot boom, with a steam hoist, has been set between the walls of the outlet structure on the timber frame about eight feet above the water. This derrick is hoisting the concrete buckets to the forms. Gravel is being supplied to the screening plant by a steam dragline which dumps the gravel directly into the hopper of the gravel plant.

The roadway on top of the west 3000 feet of the dam, which was built by dragline the last year, has been graded and partly graveled. The slopes on this portion of the dam have been trimmed and partly seeded in grass.

The work on road No. 11 has been completed. The earth in the large fill on road No. 9 has been placed and the road will be reggraded after settlement before the gravel roadbed is placed. Within a few days the road will be opened to light traffic.

Barton M. Jones, Division Engineer.

June 30, 1921.

TAYLORSVILLE

During May the north sluicing plant made good progress pumping into the section of the dam west of the river. By the end of the month this section was up to elevation 821, or 3 feet above the spillway, and 16 feet below the dam crest. The last of the month pumping into the river section was started in earnest, as the river bottom had been cleared out and prepared to receive the filling. During June rapid progress was made on the river section, using in the main material from the north sluicing plant. Very little material from the south sluicing plant was deposited in the dam during May, as the motor from the dredge pump was used on the dredge pump operating in the river bottom, while the river work was being done. Better results were obtained during June from the south borrow pit than

heretofore, but work was delayed at this point somewhat, by the lack of dumping space for the dragline.

Roberts Bros. made excellent progress on the up-stream rock slope. The fill was extended across the old river channel, widened out and sloped, and the plant was removed to the down-stream side by the last of June.

The grading of Road 12 has been finished by C. H. Crampton, and the graveling of the road has been almost completed. The same sub-contractor has a contract to build that part of the dam embankment east of the outlet works. This work is also nearing completion.

O. N. Floyd, Division Engineer.

June 30, 1921.

HUFFMAN

The building of the earth embankment has been the major operation during the past two months. 97,000 cubic yards of material were placed in this embankment during the month of May and 88,000 cubic yards during June, bringing the total embankment in place on July 1, to 1,012,000 cubic yards, leaving a balance of 298,000 cubic yards to be put in.

The outer slopes of the main post of the dam, north of the outlet works, are up to elevation 826 or 24 feet below the top of the dam. About 75% of the material being placed in this section of the dam is excavated by the dragline in the borrow pit in the valley above the dam and the balance is sluiced from the hillside at the north end of the dam.

On June 1, work was begun on the section of the embankment south of the outlet works. The yardage in this section is only 38,000 cubic yards and the height of the embankment comparatively low, so this material is being placed with teams and compacted by the sprinkling and rolling method.

The concrete plant is being put in shape and other preparations made in order to commence building the concrete conduit pier and spillway weir, about August 1.

C. C. Chambers, Division Engineer.

June 30, 1921.

DAYTON

Dragline D-16-8 has completed the levee embankment on the right bank of the Miami river below the Big Four railroad and has crossed to the left bank where it is excavating the cut-off channel which will eliminate the long curve in the present alignment. D-16-15 is continuing channel excavation below Stewart street, throwing material toward the right bank to be later placed in the levee. D-16-16 has completed the channel excavation between Fifth street and the D. U. railroad bridge and has passed under the bridge. That operation necessitated the construction of a coffer-dam and pumping in order to permit the machine to travel on a grade low enough to afford sufficient clearance. The next work for D-16-15 will be the lowering of a water main opposite Columbia street. D-16-19 is making good progress with channel excavation and levee construction along Wolf Creek. It has completed the work above Summit street bridge and is now working between Summit street and Broadway bridges. Surplus material is being hauled to a spoil bank at Orth dump with 4-cubic-yard-capacity dump cars and gasoline locomotives.

Since the report of April 21, walls have been completed along the Miami river at Beach avenue, at First street, and north of Helena street, on the south bank of Mad river east of Taylor street, and on the south bank of Wolf Creek both east and west of Williams street. The wasteway culvert on the south bank of Mad river and that at Apple street has been completed.

Construction is under way on river walls at the Platt Iron Works, at the First Baptist Church west of Main street bridge, opposite DeKalb street, at the southwest wing wall of Dayton View bridge, and at the southeast wing wall of Fifth street bridge. Land walls are in course of construction at the Platt Iron Works, at Backus street, and at Edgewater avenue. About one hundred feet west of Summit street bridge, a small concrete dam is being constructed, to serve as a "regulating barrier."

J. C. McCann has nearly completed the levee embankment east of Keowee street on Mad river and is about to undertake the work from Keowee street to Webster street.

Up to the end of June, 80,160 cubic yards of sand and gravel had been issued from the Sunrise avenue plant.

C. A. Bock, Division Engineer.

June 30, 1921.

HAMILTON

The electric dragline D-16-18 worked during May and June on the west side of the river at the lower end of the improvement. The excavated material has been hauled across the trestle to the spillway bank in Peck's Addition. The small Marion dragline has finished grading the tracks for this work and is now stacking up gravel for use on the concrete slope revetment.

During May the class 14 Bucyrus dragline piled up a sufficient amount of gravel to finish concreting the Black street bridge. It was then moved to the west side of the river and is now working on the levee between Main street and the Champion Coated Paper Mill.

Arches 1, 2, 3, and part of arch 7 of the Black street bridge have been concreted during the past two months. Forms for the spandrel walls and cantilever walks are now being built on arches 1, 2, and 3.

The Black-Clawson wall has been completed except for the cleaning up.

During May, grading was in progress for the revetment south of Main street, and during June rapid progress was made with the laying of blocks and slope revetment between Main street and the Columbia bridge.

C. H. Eiffert, Division Engineer.

June 30, 1921.

UPPER RIVER WORK

Piqua. During May the levee was constructed from the north end southward to within 1200 feet of the Main street bridge. The material for this part of the levee was obtained from the river channel. During June the levee was extended southward to a point below the Main street bridge, and the machine was moved out to the island below the bridge where it will cut a channel 250 feet wide through the bar. A contract for hauling and spreading top soil and grassing slopes of the levees has been let to Wells and Woods, contractors, at Piqua. These contractors have started work and have placed top soil for a considerable distance on the levee above Main street.

Albert Schroeder, Assistant Engineer.

June 30, 1921.

Troy. During May dragline D-16-21 completed 1500 feet of the levee along the Miami and Erie canal and by the middle of the month reached the site of the old headrace. Since then the levee along the Miami and Erie canal has been completed, using the material excavated from the channel above Adams street. The machine has crossed the river to the left bank and continued work on the east levee, having placed so far about 8000 cubic yards in the east levee alone.

T. Daniel & Son have continued their channel excavation below Market street and about the last of June were getting ready to place about 2000 cubic yards in the north approach of the Market street bridge.

Price Bros. completed the north abutment of Market street bridge on May 7, and have completed the sheeting and concrete work on and around the two piers and the south abutment of the Market street bridge, except the up-stream ends which are connected with the S. T. & P. traction piers and abutment. Both spans of the old bridge have been raised about 4½ feet and are now ready to be moved into their new location.

Tippecanoe City. The dragline D-16-4 was erected at Tippecanoe City in record time, one month having elapsed between the start of dismantling at Englewood and the day the machine was ready to operate at Tippecanoe City.

Since May 7 the levee has been completed to a point half way between Walnut street and Main street, a distance of about 2000 feet.

The contract for the sewer known as the Canal Interceptor was let to Glenn Wiley of Tippecanoe City. By the last of June, 400 feet of trench was opened up and work was started on the sewer.

A. F. Griffin, Assistant Engineer.

June 30, 1921.

LOWER RIVER WORK

Miamisburg. During May Cole Bros. built somewhat more than 3000 lineal feet of levee, and during June completed the levee on the east side of the river, south of the Linden avenue bridge, excepting for an 80-foot gap where the gas line crosses the river. The machine was then moved north under the Linden avenue bridge and has built 830 feet of levee complete except for surfacing. Cole Bros. are nearly done with their contract.

The work of paving the Main street elevation has been completed. The old brick which were taken up last

fall were relaid after being cleaned. The pavement between points 200 feet each way from this summit will be 21 feet wide between curbs. To divide the traffic over the hump a concrete marker 12 inches wide has been placed in the center of the pavement flush with the brick.

On Fourth street the District has completed 625 feet of 24-inch sewer from Sycamore Creek to Pearl street.

Franklin. During May the dragline cut away the point of land opposite the spillway, and threw the material back to be used again. The machine then started to build the new hydraulic levee, but did not continue, as this necessitated running in the present site of the hydraulic, where the only material available was so soft and mucky that it was dangerous to move the machine over it. In June the dragline was widening the river channel. Material was being placed in the levee north of the paper mill.

Price Bros. have been making such good progress on the head and tail races that both structures will be completed about the middle of July.

Middletown. Except for a man cutting weeds and filling washes on the levee, there has been no work done in Middletown since the last report.

F. G. Blackwell, Assistant Engineer.

July 30, 1921.

RAILROAD RELOCATION

Big Four and Erie. The Erie passing tracks and team tracks have been ballasted and the salvaging of old rail and material is practically completed. No new work is in progress.

Ohio Electric. The masonry for the extension of the Mad river bridge is completed. Roberts Bros., of Chicago, to whom the contract for laying the track was let, have the rail torn up on the old line around the aviation field and have relaid it for a distance of two miles and have also distributed ballast on the track already laid.

Baltimore and Ohio. Completed.

Albert Larsen, Division Engineer.

July 30, 1921.

RIVER AND WEATHER CONDITIONS

April, 1921

At the Dayton Weather Bureau station the total rainfall during the month of April amounted to 3.42 inches, about 0.52 inches more than normal. At the District's stations the amounts varied from 4.68 inches at Ingomar to 3.63 inches at the Taylorsville dam. No floods of importance occurred, the only rises being two small freshets which caused five-foot stages at Dayton on the 9th and 17th.

At the Dayton Weather Bureau station the mean temperature for the month was 55.6 degrees, or 3.6 degrees greater than normal; there were 12 clear days, 8 partly cloudy days, 10 cloudy days, and 12 days on which the precipitation amounted to .01 of an inch or more; the average wind velocity was 11.3 miles per hour, the prevailing direction being from the southwest; and the maximum velocity for five minutes was 48 miles per hour from the southeast on the 16th.

May, 1921

The rainfall for May was distributed throughout the month in a number of small showers. At the Dayton Weather Bureau station the total amounted to only 2.26 inches or 1.62 inches less than normal. At the District's stations the amounts varied from 4.75 inches at the Englewood dam to 1.74 inches at Ingomar. The rivers were low during the entire month, except for a very slight rise on the 27th which amounted to 3 feet at Dayton.

At the Dayton Weather Bureau station the mean temperature for the month was 64.0 degrees, 1.3 degrees greater than normal; there were 16 clear days, 10 partly cloudy, 5 cloudy days, and 11 days on which the precipitation amounted to .01 of an inch or more; the average wind velocity was 9.6 miles per hour, the prevailing direction being from the northeast; and the maximum velocity for five minutes was 39 miles per hour from the northeast on the 5th.

June, 1921

The rainfall for June was considerably below normal at most stations in the Miami Valley. At the Dayton Weather Bureau station the total amounted to only 1.13 inches, or 2.83 inches less than normal. At the District's stations the amounts varied from 6.24 inches at the Lockington dam to 1.01 inches at Ingomar. The rivers and streams were all very low, except for a small rise on the 23d which amounted to 3 feet at Dayton.

At the Dayton Weather Bureau station the mean temperature for the month was 75.4 degrees, 3.3 degrees greater than normal; there were 14 clear days, 14 partly cloudy days, 2 cloudy days, and 13 days on which the precipitation amounted to .01 of an inch or more; the average wind velocity was 8.6 miles per hour, the prevailing direction being from the northwest; and the maximum velocity for five minutes was 48 miles per hour from the northwest on the 18th.

Ivan E. Houk, District Forecaster.

June 30, 1921.



FIG. 326.—THE SWINGING TRESTLE AT TAYLORSVILLE.

The Rock Blankets at the Toes of the Dam at Taylorsville

An important question in laying out the original program for the Taylorsville work was what to do with the large quantity of rock which it was necessary to dig out east of the river to reach solid foundation for the new concrete channel. This material was shale rock (Cincinnatian) thickly interleaved with layers of clay, the whole mass sloughing on exposure to such a degree that it was not considered safe to use in building the dam embankment on account of the danger that it might "grease up" and slide when wet. (Like the material in the famous Culebra cut at Panama.) It was therefore rejected as regular embankment material. It would have a real value, however, if placed against the upper and lower toes of the regular embankment, (even if it should slough somewhat), in reinforcing and buttressing the embankment by its weight and mass. It was decided thus to use it. Very little of it, however, could be deposited at once in the river section of the embankment, since this section must be kept open to take the stream flow. It was practically all placed along the toes of the valley section, whence the part for the river section could be moved into place later.

The river section being scheduled for this season, the contract for this necessary second moving of the rock material into the river section was placed with Roberts Bros. early in the year, the same firm which did the track laying on the new B. & O., Big Four and Erie railway lines. This work is now in progress. The total amount originally placed in the valley section was about 335,000 cubic yards. (In its original place as bed rock in the east hillslope it measured 231,000 cubic yards, the difference being due to the breaking up of the solid material into loose pieces.) For the river section, about 80,000 cubic yards will be taken from the upstream toe, and 50,000 cubic yards from the downstream, and moved eastward into its final place. (A small proportion of this in each case will go westward, to cover ground originally inaccessible on account of the interference of the old B. and O. R. R. tracks.) The total rock to be moved is thus about 130,000 cubic yards. The result when complete will be a rock blanket or layer extending the full length of both dam toes, 20 to 25 feet in maximum thickness, its upper part forming a level shelf or "berm" 80 feet wide on the upstream side, and 60 on the downstream, and sloping from these berms on a very flat (4 to 1) slope down to the original valley bottom.

The material is being dug by a 70 ton Bucyrus railroad steam shovel, a machine of a powerful type built to make "play" of that sort of heavy rock work. The power and size of the "business end" of the machine is well shown in Fig. 327, by comparison with the operator, who stands beside the "bucket." (This bucket has a capacity of 3 cubic yards, or wagon loads.) The material is transported to the "dump" by 18 ton "dinkie" locomotives hauling trains of 4 yard side dump cars on a 3 foot gage track.

It was this rock material which was used in building the upstream dike or "cofferdam" enclosing one side of the basin referred to above, preparatory to cleaning out the river bed. The building of such

a dike by dumping from dinkie trains constituted an interesting problem in engineering, the river surface being about 20 feet below the high bank from which the trains must be run out, and the bottom from 7 to 10 feet below that. The problem was solved by "making the train walk a tight rope" stretched across the stream. The operation is shown in Fig. 319 and 326. Really four parallel "tight ropes" were stretched, of $1\frac{3}{8}$ inch steel cable, and about 4 feet apart. Railway ties were laid and fastened across these cables, forming a broad horizontal rope ladder on which the rails were spiked. Upon this structure, built level with the high river bank at this point, the loaded trains are carefully pushed out "hind end to." This was to avoid placing the excessive weight of the locomotive on the structure. Also, the cars being successively dumped just as they ran out on the suspended structure, the latter never had to bear the weight of more than one loaded car, those farther out being empty. The dumped material formed a rock embankment, the smaller upper rocks of which, tamped under the cross ties by trackmen, formed a rock ballast, the whole constituting a track structure amply able to bear the weight of the locomotives and loaded cars.



FIG. 327.—ROBERTS BROTHERS STEAM SHOVEL
JUNE 1, 1921.

Plastic Fill Method Again Used at Taylorsville

East of the outlet structure at Taylorsville is a section of the dam which reaches from the east wall of the outlet to the hillside. It is only about eighty feet long on top, and the profile is triangular in shape, with one point at the hillside at the east end of the dam, another point where the top of the dam intersects the east wall of the outlet structure, and the third where the natural ground intersects the wall, at a point forty-seven feet below the top of the dam. Eight thousand cubic yards of material are in this embankment.

This particular piece of work has just been finished. The work was really back-filling behind the outlet structure wall. It was not economical to install the plant necessary for sluicing the material into place, and so the use of teams and the plastic fill method was decided upon. The material was obtained from the hill just north of the fill. The material was till, similar to the material used in the main dam. It was dug from the borrow pit and loaded into wagons with a Keystone excavator.

The material was placed in the fill in horizontal layers not to exceed five feet in thickness. In order to make the fill around the concrete wall, which was placed first, the loaded wagons had to be taken down the hillside, which is on a two-to-one slope. Horses could not hold the wagons, nor handle them down at the bottom against the wall. Therefore a J. P. caterpillar tractor, shown in Fig. 328, was used to handle the wagons. The wagon tongues were removed and a short, stout wooden block substituted. No trouble was experienced in handling the loaded wagons with this rig. The outfit was able to stop on a two-to-one slope within a few feet, and made the turns in the narrow space between the walls and the hillside without difficulty.

As the fill was raised, the grade reduced and enough level space made on top of the fill so that the danger of smashing the horses and wagons

against the concrete wall was passed, teams were used to haul the wagons.

The material was placed in horizontal layers not exceeding five feet in thickness. The coarser material was placed on the outer slopes, the finer in the center of the fill. There was not much selection of material necessary, as all of it would make a fill impervious to water. The layers of material were hauled over by the tractor and the teams. To further consolidate the fill, the so-called "plastic fill" method was used. This method was described on page 101 of Volume 2 of the Bulletin, and was there given the name that has stuck to it ever since.

On the fill just finished water under pressure was delivered to the site of the work by a pipe line from the pumps. A hose attached to the pressure line carried the water to the nozzle, which consisted of a long piece of gas pipe. The nozzle was pushed down through the layers of earth, just like a hypodermic syringe is used, introducing the water into the mass by injection. Injections of water were made two to three feet apart. On the outer slopes enough water was introduced to cause consolidation, but not to cause sidewise movement of the mass. In the center of the dam more water was added than on the slopes, so that thorough saturation and consolidation took place. At the junction of the fill with the concrete wall a pool of water was maintained.

Special care was taken to make a good junction with the concrete work by working the dirt into the angles made by the cut-off walls and other irregularities built on the back of the concrete wall for bonding purposes, and by careful wetting down of the material next to the wall.

The work was done in one and one-half months. Chas. Crampton, of R. R. No. 5, had the contract for excavating, transporting, and placing the material. The "plastic fill" operations were conducted by the District's own forces.

The caterpillar tractor was taking a wagon load of earth down a two-to-one slope. A stout block took the place of the ordinary wagon tongue. The east wall of the outlet structure was at the bottom of the slope. Horses could not hold the wagons on the slope, nor prevent them from smashing up against the wall. With the tractor in use, a stop could be made any place in the slope, or a turn made. At the bottom, close to the wall, the short turns were made without smashing a single wagon. The wet grade made by the plastic fill method did not stall the tractor.



FIG. 328.—HANDLING LOADED WAGONS ON A STEEP SLOPE AT TAYLORSVILLE, JUNE 1, 1921.

FOR SALE CONSTRUCTION EQUIPMENT AND SUPPLIES

THE MIAMI CONSERVANCY DISTRICT

is finishing up its work. A small part of its construction plant and supplies are now for sale. By late fall a large part of the \$2,000,000 worth of construction equipment will be released. This includes 20 Draglines in various sizes, 15 Locomotives, 100 12-yard Dump Cars, Concrete Mixers, Electric Motors, Transformers, and other equipment.



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- 1—Gem City 25 H. P. Horizontal Boiler, 100 lb. pressure.
- 1—15 H. P. Brownell Scotch Boiler, 15 lb. pressure, horizontal, mounted on skids, 44 in. x 70 in.

DUMP CARS

- 12—Western air dump standard gauge cars, 50,000 lb. capacity.
- 3—4 yd. 36 gauge Side Dump Cars, wooden body over draft beam.
- 6—1½ yd. Steel V-shape Side Dump Cars.

AIR COMPRESSOR

- 1—Sullivan air compressor, 10 x 10, belt driven, capacity 213 cu. ft. free air per minute at 100 lb.

DRILLS

- 6—Sullivan Class 2, steam or air rock drills, 3¼ cylinder.
- 1—Sanderson Cyclone Class B non-traction well drill, with 24 ft. derrick.
- 8—Ingersoll-Rand E-44 Steam or air rock drills.
- 4—Ingersoll-Rand Butterfly Jack Hammer Drills.
- 4—Sullivan Class D.P. 33, Solid Piston Rotator Type Drills.
- 1—Sullivan Steam Submarine Drill, Class F. V., 14, 5 in. diameter.

DRAGLINES

(Ready for September delivery.)

- 1—Lidgerwood Class M. Electric Dragline Excavator, truck mounted, 100 ft. boom for 3½ to 4 yd. bucket.
- 1—Lidgerwood Class B. Steam Dragline Excavator, truck mounted; 60 ft. boom, 1½ yard bucket.

MISCELLANEOUS

- 7—Buckets, 1½ yard bottom dump, concrete, double bale.
- 4—Spud Hoists for use on dredge or scow, with or without motors.
- 1—3 H. P. International Harvester gas engine, vertical.
- 2—6 H. P. Foss Horizontal gas engine.
- Weinman brass fitted automatic pump with receivers 3½ x 2½ x 5.
- Complete equipment for stern wheel steam tug, including stern wheel steam boat engine, 8¼ x 42 in. and 5 in x 16 ft. Also a 60 H. P. Marine Boiler.
- 2000 ft. 18 in. I. D. Machine, banded wood stave wood pipe for 10 ft. head, complete with couplings and fittings.
- 2—No. 2 Vulcan Steam Pile Hammers, with standard base, weight striking part 3000 lbs.
- 1—No. 4 Vulcan Steam Pile Hammer, with standard base, weight striking part 550 lb.

MOTORS

- 1—5 H. P. Fairbanks-Morse Motor induction, 3 phase, 440 volts.
- 3—20 H. P. Wagner motors for industrial elevator, 3 phase, 440 volt.
- 1—22 H. P. G. E. Motor 440 volt, 3 phase.
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- 1—50 H. P. Westinghouse squirrel cage induction motor, 3 phase, 440 volt.

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