Planning & Reports Branch

ST. FRANCIS RIVER PROJECT

MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

1939

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE MEMPHIS, TENN.

HYDRAULIC STUDY OF THE MARKED TREE SIPHON.

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1. The Marked Tree Siphon is a unit of the St. Francis River Project, authorized by Congress in 1936, for the control of floods along the St. Francis and Little Rivers. The structure (see Map, Fig. 1) is located about 6 miles northwest of Marked Tree, in Poinsett County, Arkansas, at the foot of St. Francis Lake (River Mile 155).

The siphon replaces a concrete culvert constructed by local interests under War Department permit in 1923, to pass water from St. Francis Lake into the St. Francis River Channel for navigation purposes. The original culvert, floating on a sand foundation, was damaged by undercutting of the outlet end in 1936 but temporarily repaired. However, in May 1938, the adjoining levee crevassed while more or less permanent repairs were being made on the culvert. It settled vertically and was damaged beyond repair.

Construction of the siphon began December 1, 1938, and the unit was officially placed in operation June 7, 1939. The completed works consist (see Fig. 2 and Plate 1) of an excavated inlet channel, reinforced concrete inlet basin, the siphon, reinforced concrete outlet basin, an excavated outlet channel, a trestle bridge over the siphon pipes, concrete pipe supports on the compacted levee fill, a concrete cutoff wall at the crown of the levee, an operating house, and the necessary pumps, piping, motors and valves.

The siphon proper is composed of three electrically welded steel tubes, each 9 feet inside diameter and 228 feet in length with expanded inlet and outlet transition bells. The 9-foot sections are built of 3/8-inch steel, the inlet and outlet bells of 1/2-inch steel. Each tube is supported at intervals by footings equipped with sliding seats so as to care for expansion or contraction due to temperature changes. Each of the siphon tubes is also equipped with an 8-inch vacuum breaker valve and is connected by means of a 6-inch exhaust line to a 6-inch water-sealed vacuum pump installed in the operating house.

Testing apparatus installed on the siphons consists of a Bourdon-type pressure-vacuum dial gage installed on each of the three 6-inch exhaust lines inside the operating house, a glass water column located on the side of each siphon near the invert for determining the depth of flow in the siphon, 33 piezometer tubes for measuring pressures inside the west pipe, and 6 pitot tube openings located at two different sections of the west pipe. These devices will be described more fully in connection with their use in tests.

2. Purpose: It was hoped that such tests as were made would give qualitative data with respect to (A) Coefficient of discharge; (B) Hydraulic gradient; (C) Patterns and velocities of flow through the siphon. While data were obtained on all three phases enumerated above, only that pertaining to the coefficient of discharge is believed to warrant any substantial consideration.

The results of the measurements with the pitot tubes and piezometers were so variable that their proper interpretation became questionable, if not impossible, and, for that reason, an analysis of them is not included, although, for purposes of information, the experimental methods employed and the data secured are included in the body of the report. While the failure to draw any conclusions under B and C above has somewhat lessened the value of the experiment, nevertheless, it is believed to be of definite interest to the Department as a whole and certainly gives a new conception of discharge through large pipes.

3. Scope: This report covers the studies carried on at the siphon during the months of July and August, 1939. During this period, the upper lock gage in St. Francis Lake dropped from 213.4 to 208.26; the lower lock gage ranged from 208.00 to 204.8; the maximum observed discharge with two pipes running was 2,098 c.f.s. under a head of 4.35 feet, while the minimum with only one pipe in operation was 869 c.f.s. under head of 3.46 feet; the head through the siphon ranged from 2.40 to 7.00 feet.

The experiment was conducted during a period of comparatively moderate and low stages in the St. Francis Lake with a small differential between the intake and tailwater elevation of the siphon and with a correspondingly high lift.

A. DETERMINATION OF THE COEFFICIENT OF DISCHARGE.

1. Introduction.

In designing the Marked Tree Siphon conservative computations indicated that the total losses of head which might be expected were:

(1) Center pipe, $H = 1.508\ V^2/2g$

$V = \sqrt{\frac{1}{1.576}}\sqrt{2gH}$

(2) Outside pipes, $H = 1.576\ V^2/2g$

where H = difference in head and tailwater and V = mean velocity in 9' section. From these equations it can be readily seen that the discharge coefficients are:

$$C \text{ middle} = \sqrt{\frac{1}{1.508}} = .815$$

$$C \text{ outside} = \sqrt{\frac{1}{1.576}} = .797$$

The siphon discharge, Q, is measured by the formula, $Q = CAV = CA\sqrt{2gH}$, and the values of C derived above may therefore be considered as the design coefficients of discharge. The coefficient C is the ratio of the design discharge of the siphon to the flow if the water were falling freely with the same head (H).

While the design coefficient of discharge is somewhat higher than that for a circular submerged orifice (0.60) it does compare very favorably with the coefficient for short pipes with square-edged entry (0.82) and for concrete culverts (approximately 0.70). (See Merriman's "Treatise on Hydraulics"). However, the data from which these coefficients were derived were taken under conditions far different from those existing at the Marked Tree Siphon, and numerous assumptions were made as to the probable magnitude and distribution of the various losses of head.

It is essential then for the proper evaluation of the siphon, to determine the actual coefficient of discharge. Such a determination of the coefficient is particularly important in view of the meager information available as to the efficiency of siphons, and the results should be of considerable importance in future design work.

In computing the coefficient of discharge, two factors must be considered: (1) The actual discharge of the siphon; and (2) the head which produces that discharge. The problem, then, lies in the measurement of the head and the discharge.

2. Equipment.

Little equipment was needed for the determination of the discharge coefficient. Ordinary staff gages were used for the measurement of the head (H). The discharge was measured by small Price current meters on an established range.

3. Procedure.

In measuring the head through the siphon, the staff gages mentioned above were read to the nearest 1/100th foot, and these readings were frequently checked with level and rod.

Figure 2A shows the various locations of the gages. For the purpose of this study in determining the head, only Gages 5 and 7 were used; that is, the inlet basin gage and the outlet basin riprap gage. Readings were taken on all gages, but it was felt that the two actually used were the most logical and the ones representing most nearly the difference in elevation of the water surface. To obtain the total or effective head producing flow we added to the above mentioned difference in elevation the velocity of approach across the lip of the inlet basin. While the values of the velocity heads were based on a theoretical computation of discharge, it was found later that the actual value was so small as to make its inclusion in the results insignificant.

Discharge measurements were taken at a range located approximately 200 feet downstream from the lip of the outlet basin. The channel here was straight and the turbulence noted at the outlet basin had, for the most part, disappeared.

Soundings to determine the channel cross section were taken with an ordinary level rod, and later with a standard wading rod, every five feet and at any abrupt break. Meter stations were established every 10 feet.

A small Price current meter, calibrated by the Bureau of Standards in Washington and checked periodically with two other similar meters, was used to determine the velocity in the vertical section. Readings were taken at 0.2, 0.6 and 0.8, the depth and the revolutions at each point were counted for 120 seconds.

In calculating the discharge, the mean of the velocity at 0.2 and 0.8 was used and the discharge figured for each partial area. For this same area the velocity at 0.6 the depth was used in arriving at a second discharge figure and the mean of the two values was considered to be the discharge for the partial area under consideration. As a further refinement, several sets of vertical velocity measurements were taken at every tenth of the depth, and from these a correction coefficient for the 0.2, 0.6 and 0.8 depth measurements obtained and applied in solving for the final discharge.

As the experiment progressed and the results were calculated, it was noted that the discharges were very high when compared with the original design assumption. Although we felt that these data were reasonably correct, we did realize it gave results of a nature not commonly encountered or expected in general hydraulics, and so to establish beyond reasonable doubt the validity of these results, it was decided to adopt even more refinements. Accordingly, a range 1,000 feet below the first was set up and the discharge at both ranges measured at as near the same time as possible. This second range, it was believed, would eliminate a possible source of error because of faulty sounding with the meter due to the slightly turbulent flow existing at the first range. Checks on the measurements were also made by using different Price meters. However, the variation in results, regardless of method used, was so slight as to be insignificant in interpreting results. The upper range was adopted and the channel bottom along it was filled with a layer of gravel 10 feet wide and approximately 4 inches thick. This was done with the hope that it would eliminate to a large extent the irregularities in the bottom, and so further increase the accuracy of our soundings.

4. Results.

Experimental data at its best are subject to error. While the writer makes no claim that this work is an exception to the rule, it is felt that the Survey Section of the Memphis District did an exceptionally fine job in their discharge measurements. The extra precautions, not common to the ordinary discharge survey, and employed on this experiment, indicate to some extent the precision that went into the work. While realizing that these data are bound to reflect the unavoidable experimental errors, nevertheless, it is felt that the discharges are correct to within the limits of current meter measurements believed to be about 2%.

Table I shows the complete tabulation of results insofar as discharge is concerned. The table appears to be self-explanatory with the exception perhaps of Column 14. The "Q" shown there is the theoretical discharge based on $Q = A\sqrt{2gH}$ where H = difference in water elevation plus velocity head of approach (Column 12) and A equals the area of the 9-foot section.

Conclusions.

In the final analysis, flow takes place in the siphon because of an unbalanced force, namely the difference in total head between the inlet and outlet basin. The fact that we have created a vacuum or near vacuum does not enter into the picture insofar as the computations concerning discharges are concerned and if there were no losses in the pipe at all then the theoretical discharge would be equal to $A\sqrt{2gH}$.

The ratio of the measured discharge to this theoretical gives the coefficient of discharge for the siphon. Column 19, Table I, shows the results of this last mentioned computation. Immediately the reader will notice the excellent coefficients ranging from a low of 90.8 to a high of 100.

In any experiment of this nature it is impossible to arrive at results that give the same coefficients for each measurement. To more or less arrive at an average figure for the value, the discharge was plotted against the head. The graph indicated a parabolic function and in order to facilitate obtaining the equation of this curve, the logarithm of the two functions was plotted and a representative straight line drawn through the points. (See Fig.3). The equation of the line was then computed to be $Q = 495.38\ h^{1/2}$. Equating this to $Q = AV$ and solving for H, the equation becomes $H = 1.062\ \frac{V^2}{2g}$ and the coefficient of discharge is equal to $\sqrt{\frac{1}{1.062}}$ or 0.97. During this period the heads ran from 3.4 to 7.0 and the lift varied from a low of 22.6 to a high of 26.7.

This coefficient pertains only to the middle pipe and must be considered as an approximate value. Actually it is very probable that the coefficient decreases to some extent with higher heads, and the plotted points in Fig.3 indicate a slight curve might be more nearly correct than a straight line function. However, insufficient data at the higher heads make it impracticable to attempt any comprehensive deductions as to just what might happen. For the purposes of the study it is sufficient to say that our work indicates a coefficient of discharge for the center pipe of 0.97 within the range of head and lift found during the experiments.

Unfortunately, only six measurements were taken when the outside pipes were working alone, and with these data it is virtually impossible to write any reasonably sound equation for flow. However, an average of the six measurements gives a coefficient of discharge equal to 0.979. These were all taken with relatively low heads and do not represent as valuable a figure as does the coefficient for the middle pipe. It is probably safe to say that the few results we do have indicate that the coefficients will be very similar in value.

Three major factors are probably responsible for this high coefficient of discharge. First, the inlet basin was designed to bring the water to the siphon lip and through the transition section with a gradual, accelerated flow, without any abrupt changes in velocity. Secondly, the entire length of intake was streamlined and conducive to streamlined flow. Thirdly, the outlet basin was designed to have sufficient capacity to let the siphon discharge freely with no tendency for the lower pool to build up.

These remarks pertain to the siphon in general. For a very comprehensive study, confined to the effect of a properly designed orifice, the reader is referred to an article published by Professor Stewart in "The Engineering Record", September 28, 1907. The article covers the subject in a very excellent manner and shows how the coefficient for an orifice can be increased from the customary 0.6 to 0.94 by proper design.

B. DETERMINATION OF HYDRAULIC GRADIENT.

1. To date there are very little data concerning losses of head in large pipes and practically no information regarding losses of head in large siphons. Consequently, the design of the Marked Tree Siphon was of a pioneer nature based on sound hydraulic principles, rather than precedent. In the hope of obtaining definite information regarding the distribution of losses within the siphon, piezometers were installed in the siphon, and a considerable number of readings taken under various operating conditions. However, the hydraulic gradients as drawn from these data were so variable as to preclude, at this time, a sound analysis. It is believed further study along these lines might be of value. For record, there is included below a resume' of the testing methods employed and the results obtained.

2. Testing equipment: After consultation with the U. S. Waterways Experiment Station at Vicksburg, eleven points were selected for the location of

the piezometer openings.

As originally planned, the piezometer tubes consisted of 1-inch iron pipes, electrically welded into the side of the siphon, and ground flush with the inside surface of the siphon tube. The 1-inch tubes extended from the pressure openings at the siphon to a mercury U-tube located inside the operating house. The U-tube, or manometer, and the piezometer tubes were joined through a vertical header tube into which the manometer and the 11 piezometer tubes were connected. The individual piezometer tubes, as well as the manometer tube, were equipped with small gate valves for regulating the various tubes. An additional opening provided for exhausting the air from the system by use of the siphon exhaust pump. It was thus planned that the exhausting and the reading of the various piezometer tubes could be accomplished from inside the operating house.

The system as above explained was, with the assistance of Mr. Guy Arbuthnot of the U. S. Waterways Experiment Station, installed and first read on July 13, 1939.

While the original system facilitated the collection of data it soon became apparent that it lacked sufficient accuracy, and consequently, an entirely new setup was installed. Acting on the advice of Messrs. A.B. Woods and Wade Barnett, members of the Board of Consultants on the siphon design, it was decided to use a portable manometer at the site of the piezometer openings rather than in the operating house. Such a step made possible the elimination of the long tubes and further decreased possibilities of outside influence affecting the experimental data. As a further refinement, 1-inch brass plugs with 1/8-inch openings were driven in flush with the ends of certain piezometer tube openings inside the siphon. These smaller openings helped to materially reduce the surging previously observed in the mercury column and gave far more accurate reading. Unfortunately, all openings were not equipped in this manner. No doubt, with the larger openings our data reflect to some degree the effect of the water impinging against the open end of the piezometer inside the siphon. While the smaller openings did not eliminate this, they did seem to reduce the magnitude of its effect.

After taking several sets of readings it was believed that 11 pressure openings were insufficient to yield a satisfactory determination of the hydraulic gradient and, accordingly, 22 additional piezometer openings, 1/4" in diameter were located at various points along the axis, top and bottom of the pipe making in all 33 openings. The piezometer system as finally completed is described in Table No. 2 and shown in Fig. 4.

3. Procedure: Although the procedure of taking the piezometer readings was relatively simple, it was important to use extreme care in reading the heights of the mercury columns. In some instances the columns surged two or three inches, and it then became necessary to estimate to the best of the observer's ability the mean of the column heights.

Using the Vicksburg system (all piezometer tubes inside the operating house), one of the piezometer tubes and the manometer were cut into the vertical header pipe. The remaining piezometer tubes were cut off from the header pipe, and the exhaust pump started. Air was exhausted from the system until water was drawn from the siphon into the header pipe and, finally, over into the manometer. When all the air was thus exhausted and the system filled with water, the exhaust line was closed, and the differences between the mercury levels and the zero of the manometer were read. This procedure was repeated for each of the 11 piezometer tubes.

In practically every case there was considerable fluctuation in the mercury columns, and accurate readings were extremely difficult. In addition, there could be no absolute certainty that all the air had been exhausted from the long piezometer tubes. Somewhat better results were obtained by pumping air back into the piezometer system and reading the pressures while the piezometer tubes were filled with air only. It is believed that such an air-filled tube gives more accurate results due to the elimination of any irregularities caused by air bubbles trapped in a water-filled tube.

However, the most satisfactory results were obtained with the portable manometer. When using it, one limb of the manometer tube and the short length of rubber tubing connecting it to the piezometer opening were filled with water, and all air exhausted from the apparatus. The petcock on the piezometer tube was then opened, and air under atmospheric pressure allowed to bleed through the petcock, thereby clearing any sand or silt from the piezometer. After a few seconds of this air bleeding, the rubber tubing from the manometer was slipped over the end of the petcock, and the manometer was left stationary until the movements of the mercury columns were at a minimum. The heights of the mercury columns were then recorded, and the elevation of the manometer zero was measured to the nearest 1/100 of a foot.

4. Results: The results of the above observations are set forth in Tables IV, V and VI and shown graphically in part in Figures 5, 6, 7 and 8. Table No. IV gives the hydraulic gradient as derived from observations taken with the system installed inside the operating house. It is not felt that these measurements give sufficiently accurate or uniform results to warrant a continuation of this method.

Table No. V is a tabulation of the results obtained by using the system inside the operating house when the piezometer tubes are filled only with air rather than with water as in Table No. IV above. An examination of these data indicates a more continuous and reasonable form of hydraulic gradient, but the lack of sufficient readings renders the information too weak to warrant its unqualified acceptance.

Table No. VI sets forth the data obtained by using the portable manometer at the side of the siphon. The first few runs were taken with only the original 11 piezometer openings being used. The later tests were made with the piezometer system in its entirety. In every case where Piezometer No. 11 was read the reading was made from inside the operating house, since this piezometer was under water and inaccessible for use with the portable manometer. Figures 5-8, inclusive, are graphical representations of a portion of these results.

Unfortunately, discharge measurements and piezometer readings were not generally taken the same day. Consequently, to arrive at the energy gradient, it was necessary to compute the discharge based on the observed head and using the discharge coefficient as computed in "A" of this report. Theoretically, we would expect that the discharge divided by the area would give the mean velocity in the section, and when converted to velocity head and added to the absolute pressure at the section would give us a point on the energy gradient curve. However, when plotted, such results formed a false energy curve; i.e., one in which there appeared a gain of energy between certain sections. The cause for this phenomena as advanced by previous experimenters is (1) barrel is partly occupied by eddies, (2) by accelerating water, (3) by entrained air greatly expanded under the vacuum, and (4) the inaccuracies of obtaining mean pressures with the piezometer.

If we assume the energy gradient elevation at the inlet equals the water elevation plus one atmosphere plus the approach velocity head and at the outlet basin to be the water elevation plus one atmosphere plus the exit velocity head, then the two points may be connected with a straight line and this line called the energy gradient. While it is true that the actual gradient line should not be straight, it is believed that plotted as such it will not be seriously inaccurate and, furthermore, obviates the necessity of making even greater assumptions concerning the losses that exist. Figures 9 to 11 illustrate the results of these plottings. The differences between this energy line and the absolute pressure line or hydraulic gradient represent the approximate velocity head from which we are able to obtain the velocity of the flowing water. Dividing the known or computed flow by these velocities should give us the useful areas. These results are tabulated in Table 7. It will be noted that in many cases this type of interpretation gave results inconsistent with facts as we knew them to be, or, in other words, the results indicated cross-sectional areas of greater size than actually furnished by the pipe. It is believed that such results may be blamed on the large openings of the piezometer pipes which as has been heretofore stated reflects to a certain extent the effect of water impinging against the opening, to faulty installation, and to a large extent improper interpretation of the energy gradient. Sections 7, 8, and 9 gave consistently poor results and should not be given much consideration in the final analysis. Likewise, the openings at Sections 1 and 11 gave false results. However, since these openings were at points where turbulence is considered to be a maximum, it is not strange that peculiar readings were obtained. In all probability the piezometer readings there represented surges in flow and were unduly high. On the whole, the results showed that the siphon tube flowed nearly full and irregularities must be blamed on inherent difficulties attending the experiment.

5. <u>Remarks</u>: In the event further experimental data are deemed worthwhile, it is recommended that piezometer openings be placed at the top, bottom, and both sides of the siphon tube in any one cross-section. It is believed that with a four-tube system such as this, better results will be obtained and the chances of error due to a single faulty opening be minimized if not eliminated. The attention of the reader is invited to Table VI showing results under dates August 9, 11 and 12. On these three dates readings were made in openings located at both the top and the bottom of the pipe at Sections 8 and 9. In nearly all cases, the average of the upper and lower openings was higher than the reading for the middle section. The differences ranged from a few tenths to almost a foot.

C. FLOW PATTERN THROUGH SIPHON.

1. As a final part of the experiment an attempt was made to gather some data relative to the flow through the siphon. Strictly speaking, a proper determination of the flow pattern required information both as to the direction and velocities. Needless to say, any attempt to secure data as to the direction of flow was impossible as the experiment was confined to the determination of velocities with special attention being given to their distribution in section.

2. Equipment: The pitot tube was the proper device for such determination. However, most of them available were considered too fragile to withstand the high velocities, and still another objection was the lack of a suitable method for their installation and manipulation without having to shut down the siphon. It was decided, therefore, to design and build a tube at the Memphis Office which would more nearly meet the requirements. It consists of a pitot tube machined from a 6" by 1-1/2" brass rod which is screwed into the end of a six-foot, double strength 1-1/2" iron pipe. The pipe slides through a packing box in the side of the siphon and in this way it was possible to traverse the cross-section of the siphon. In order that it might be possible to insert or withdraw the tube without first shutting down the siphon, the overall width of the pitot tube was limited to the outside diameter of the supporting pipe (and the packing box opening). Preliminary studies were made with various style tips but the most satisfactory results were obtained through fitting the upstream opening with a streamlined tip, and placing the pressure opening at the point of maximum width in the side of the brass tube.

The upstream, or velocity, opening of the pitot tube was connected by means of brass tubing and rubber hose to one leg of a differential U-gage, while the side, or pressure, opening was similarly connected to the other leg of the differential gage. This gage was filled with mercury, and each leg was equipped with a funnel and petcock for the admittance of priming water.

The use of the pitot tube necessitated the making of openings through the walls of the siphon tube. As has already been stated, the pitot tube was mounted on a 1-1/2" pipe sliding through a packing box. This packing box was machined from a brass casting having a minimum outside diameter of 3", and was threaded and screwed into a 3/4" steel collar welded onto the side of the siphon. Regular dry packing was used in the packing box and acted as an effective seal against the entrance of outside air. The box, 8" in overall length, served as one rigid support for the 1-1/2" pipe, while a steel collar and bracket welded to the siphon acted as a second support. Whenever the pitot tube was not in use the openings were plugged by 3" pipe plugs screwed into the steel collars.

It was desired that velocities be measured at two cross-sections of the west tube as indicated on Fig.4. At each of these sections there were located three openings, one on top, one in the side, and one in the bottom of the tube. The pitot tube would be traversed halfway across the pipe from each of the openings and an average of the readings computed.

3. Procedure: When taking pitot tube readings, the plug was removed from the opening in the side of the siphon, and the packing box was substituted therefor. This operation could be accomplished, if quickly executed with the

siphon in operation and without breaking the siphon prime. The 3" plug was next temporarily placed over the opening in the packing box. The pitot tube itself was then primed by admitting water through the funnels and stop-cocks in the differential gage until all air bubbles were removed and water was running freely from the 1/8" openings in the pitot tube. The stop-cocks were now closed, and the pitot tube and supporting pipe were passed through the bracket support on the side of the siphon. Having removed the plug from over the packing box opening, the pitot tube was pushed through the packing box and into the siphon. Additional priming water was then admitted, if needed, to the pitot tube, and the process of reading the velocities was begun.

A mark on the 1-1/2" supporting pipe indicated the direction of the pitot tube opening, and enabled the observer to keep the opening pointed upstream. This direction was more exactly obtained by turning the supporting pipe until the indicated velocities were a maximum. Markings on the support pipe located at points for taking readings every 0.5' across the pipe. The mercury column fluctuated at all times and especially when near the walls of the siphon. It was necessary, therefore, to take their mean as the proper reading. Near the center of the pipe, the oscillation of the mercury was less pronounced and readings could be more accurately made. A considerable reduction in the fluctuations of the mercury columns was noticed when using the more streamlined tube from the Waterways Experiment Station, but this tube could not be inserted into the siphon without first completely shutting down the flow. A great deal of vibration was noticed in the supporting pipe but the packing box and bracket collar supported the pipe without difficulty even with an extension pipe covering the entire 9' diameter of the siphon tube.

4. Results and computations: Theoretically, the upstream opening of the pitot tube should be subjected to a pressure equivalent to the velocity head $\left(\frac{V^2}{2g}\right)$ plus the pressure head at the observed point, while the pressure opening in the side of the pitot tube should indicate only the pressure head. Since these two openings are connected through a differential gage, then, the reading of the gage should measure the velocity head, the theoretical difference in the pressures at the two openings. Because both legs of the gage were filled with a liquid, either mercury or water, the difference in head between the mercury in the two legs must not be considered as the weight of the mercury column, but as of the mercury column less the weight of the corresponding water column in the opposite leg. In converting the mercury head to feet of water, then, it is correct to figure the effective weight of mercury not as 13.596 W but as (13.596-1) or 12.596 W. An additional correction is necessary to convert the observed readings from millimeters of mercury to feet of water. The correction is, therefore, as follows: $H \text{ in ft. of } H^2O = \frac{12.596 \times h \text{ in mm of Hg}}{10 \times 2.54 \times 12} - .0413 \text{ H.}$

The value of H thus derived was used in the equation. $V = \sqrt{2gH}$ for determining the theoretical velocity of flow at the observation point in question. In practice, however, the actual velocity is generally somewhat lower than the velocity thus derived, and equals $C \sqrt{2gH}$, where C is a coefficient depending upon the design of the pitot tube.

The tube borrowed from the Waterways Station had been calibrated for high velocities, and "C" was determined as 0.96. A comparison of measurements taken under the same conditions indicated that "C" for the Memphis pitot tubes is approximately 0.91 when the upstream tip was not streamlined and 0.93 when it was.

Table VIII is a compilation of the results from pitot tube observations on the west pipe and Fig. 12 shows the plotting of the velocity curves. The arrows and figures show the position and velocity of the mean thread in each section.

5. Discussion: Hydraulics tell us that because of surface roughness the velocities within a pipe are not of a uniform character but tend to distribute themselves in a somewhat parabolic curve with the maximum at the center and the minimum at the surface of the pipe. That such a condition should exist in the siphon was a reasonable supposition and Fig. 12 indicates that there is a tendency for this parabolic distribution. On the whole, however, the plotted results are very erratic and fail to show any pronounced continuity of pattern.

The accurate measurement of these velocities was a task made extremely difficult by the pulsations of the water and the unusually high velocities encountered. It will be observed that for measurements taken at very nearly the same time and in the same section the results indicate a variance of as much as six feet in the center velocity. When we realize that the discharge is nearly constant, it becomes apparent that these pitot tube measurements represent results greatly disturbed by pulsating flow and impracticable to analyze. It is suggested that no further attempt be made to gather data with the pitot tube.

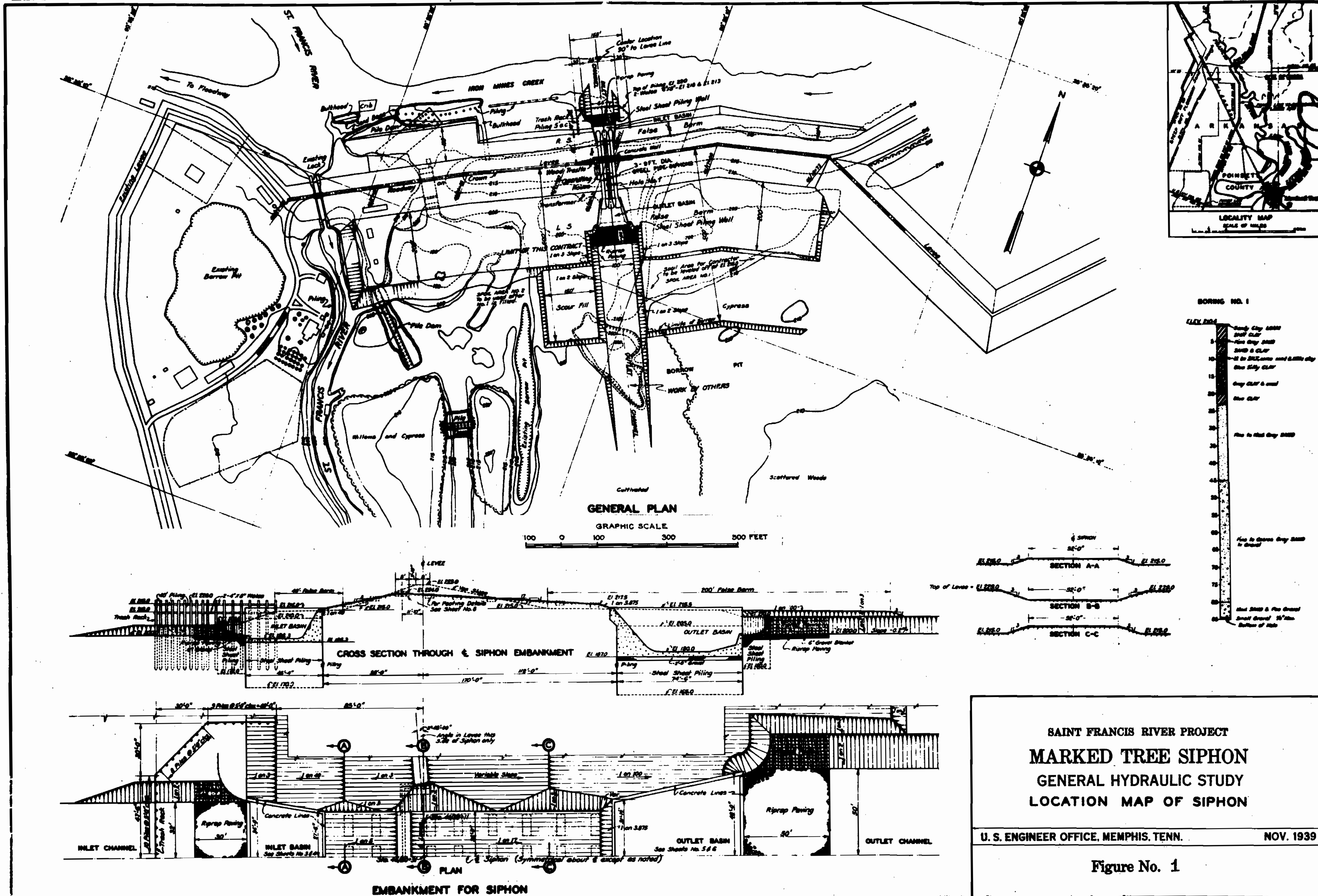
D. SUMMARY AND RECOMMENDATIONS.

The experiment was only partially successful. Insofar as the discharge measurements are concerned, considerable valuable information was obtained. The results are believed to be correct within the limits of current meter accuracy, and establish the fact that a rather high discharge coefficient can be obtained by proper design of the structure. That a discharge coefficient of 0.97 is possible in a structure of this type should be of valuable information to the engineering world and may be responsible for economic savings in future hydraulic work.

From a technical point of view, it would be highly desirable to obtain further data relative to the hydraulic gradient, and it is recommended that additional study be given to the possibility of obtaining worthwhile data.

The results of the pitot tube measurements were so poor, and because of the difficulties attending such measurements, it is recommended that no further attempt be made to secure data in this manner.

U. S. Engineer Office,
Memphis, Tennessee,
November, 1939.



SAINT FRANCIS RIVER PROJECT

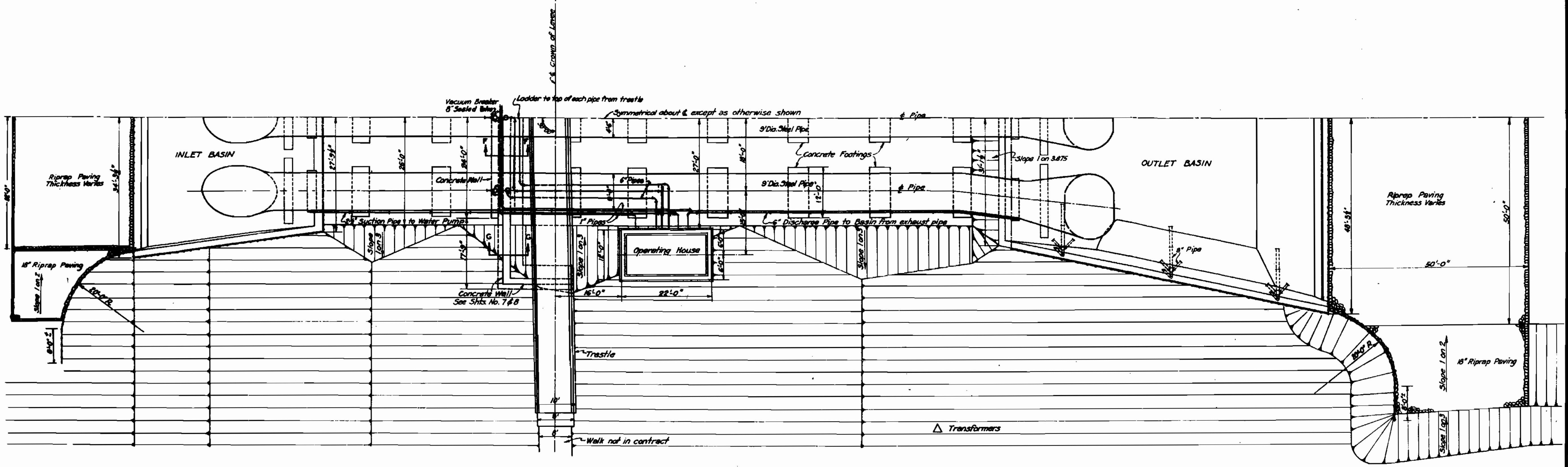
MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

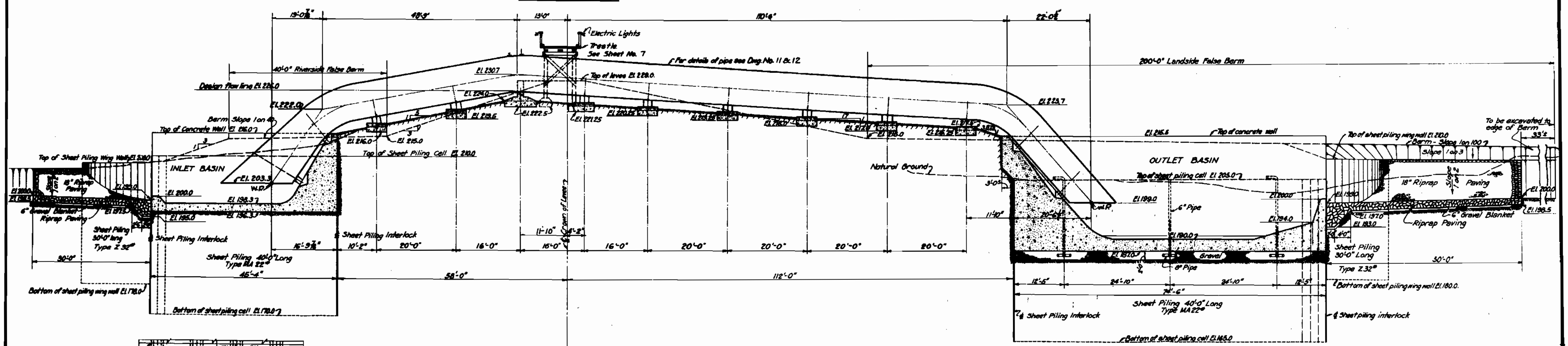
LOCATION MAP OF SIPHON

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

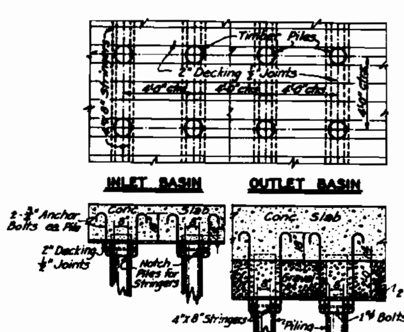
Figure No. 1



GENERAL PLAN



SECTION THROUGH CENTER LINE



PILE AND TIMBER FOUNDATION
ALTERNATE DESIGN

Pile and Timber Foundation will not be installed unless directed by contracting officer after excavation is carried to indicated level of basins.

Gravel blanket for Outlet Basin may be omitted if directed by the contracting officer and foundation for the Outlet Basin made the same as Inlet Basin.

GRAPHIC SCALE

10 0 10 30 50 FEET

GENERAL NOTES

Gravel blanket shall be the same gravel as used for coarse aggregate of concrete.

Steel sheet piling marked on the plans as MA 22# shall be medium arch type pile weighing 22# per sq. ft., with a section modulus of 5.4 in.^{3} per foot of wall, and an interlock strength of 8000# per lin. inch.
Steel sheet piling marked on the plans as Z 32# shall be Z type pile weighing 32# per sq. ft., with a section modulus of 38.3 in.^{3} per foot of wall, a strength of 8000# per lin. inch.

SAINT FRANCIS RIVER PROJECT

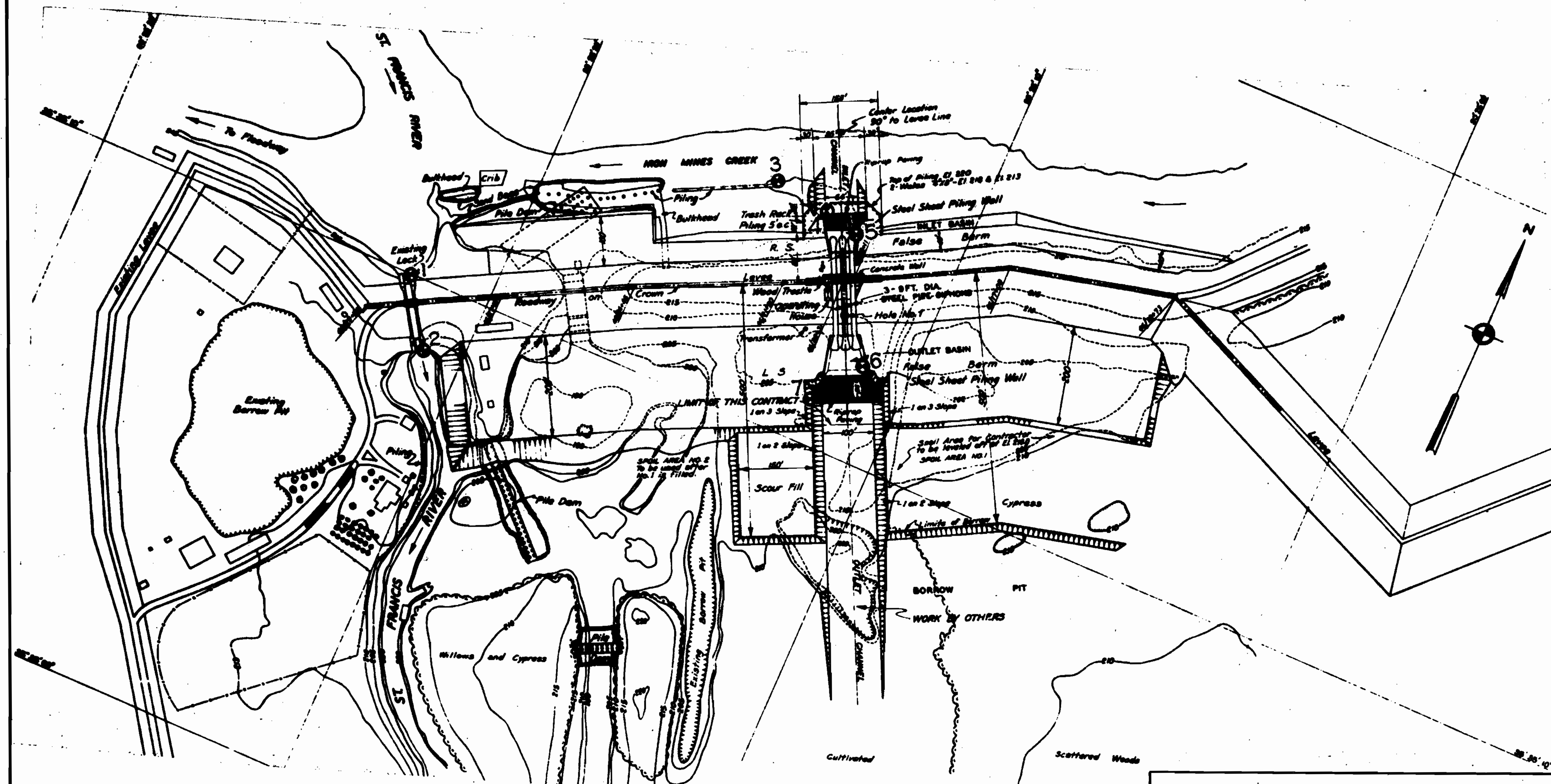
MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

PLAN AND SECTION

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 2



Key
1. Upper Lock Gage
2. Lower Lock Gage
3. Trash Rack Gage
4. Inlet Basin Riprap Gage
5. Inlet Basin Wall Gage
6. Outlet Basin Wall Gage
7. Outlet Riprap Gage

GRAPHIC SCALE
100 0 100 300 500 FEET

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MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

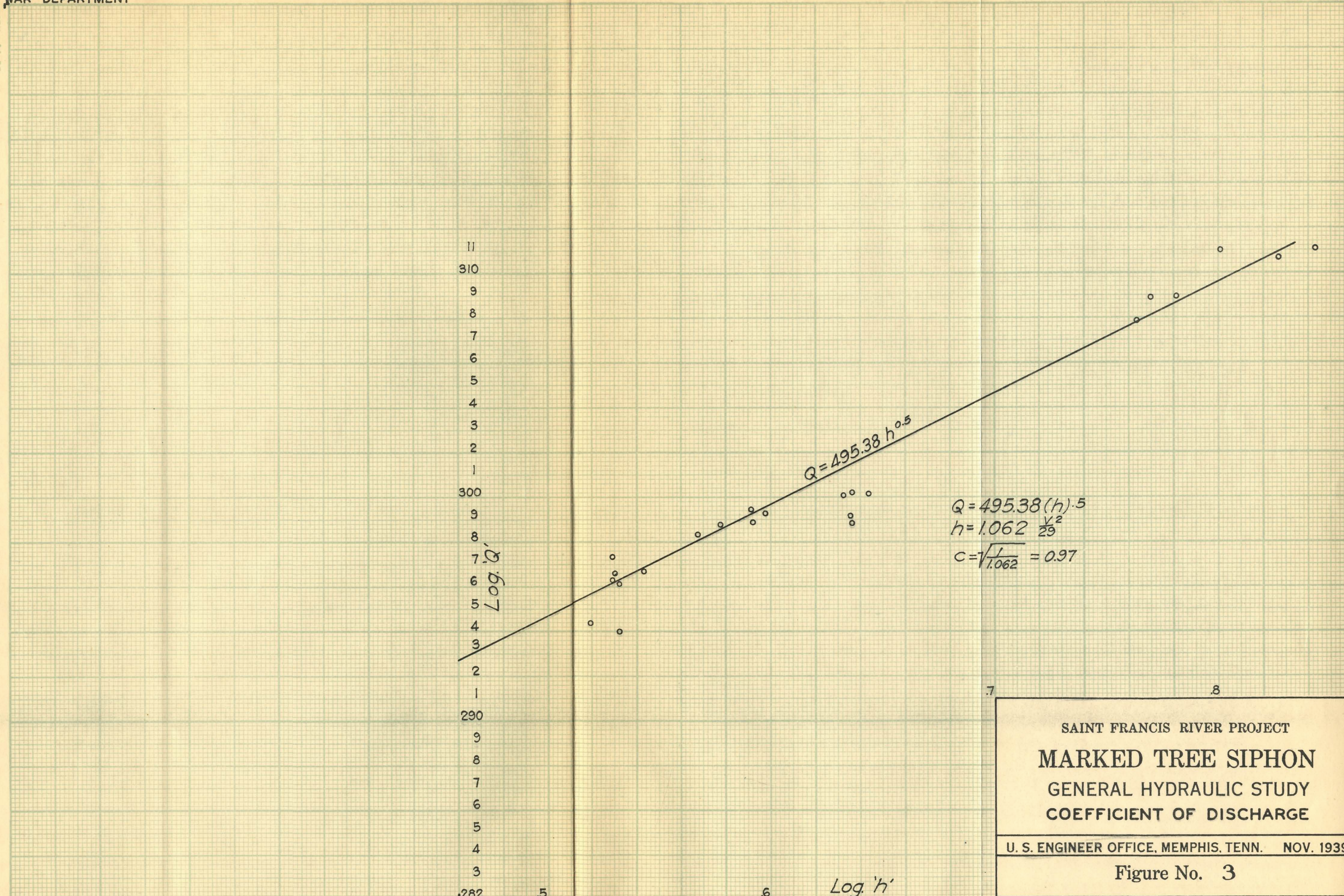
LOCATION OF STAFF GAGES

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 2A

WAR DEPARTMENT

CORPS OF ENGINEERS U.S. ARMY



SAINT FRANCIS RIVER PROJECT

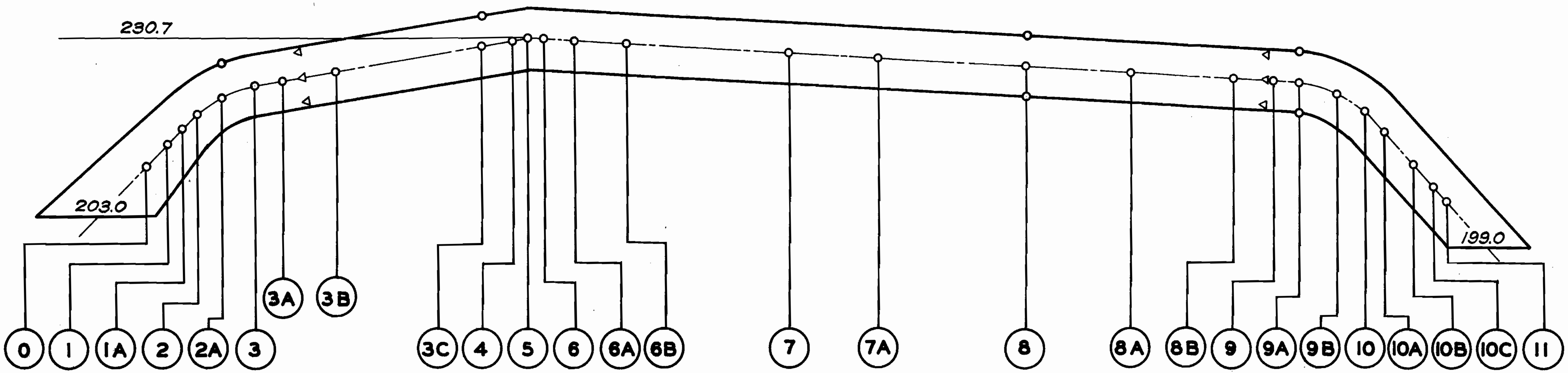
MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

COEFFICIENT OF DISCHARGE

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 3



KEY
- o *Piezometer Tubes*
- ▽ *Pitot Tubes*

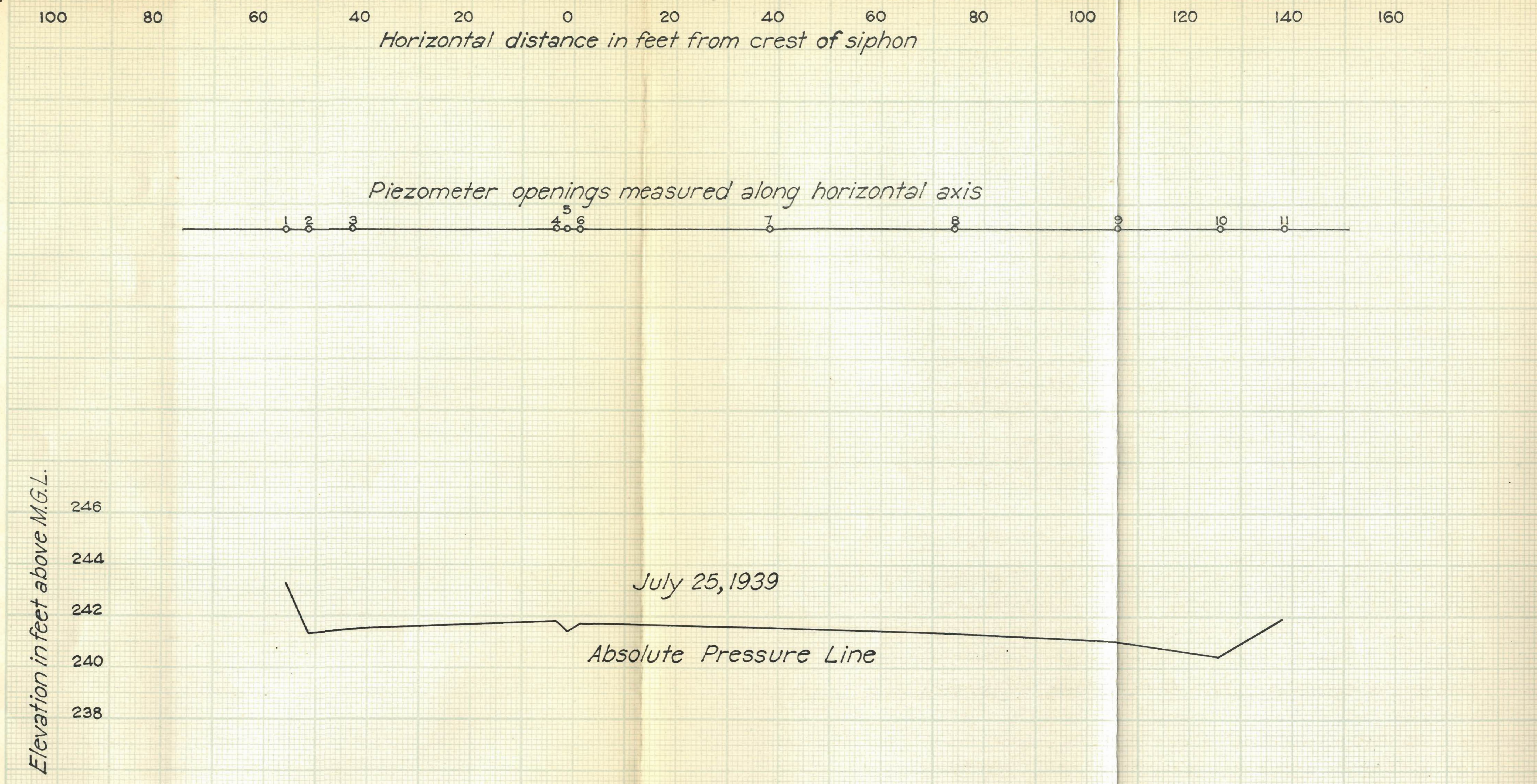
Scale
1/16" Inch = 1 Foot
16' 12' 8' 4' 0 16' 32'

SAINT FRANCIS RIVER PROJECT
MARKED TREE SIPHON
GENERAL HYDRAULIC STUDY
LOCATION OF PIEZOMETER AND PITOT TUBE OPENINGS

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 4

WAR DEPARTMENT CORPS OF ENGINEERS. U. S. ARMY



SAINT FRANCIS RIVER PROJECT

MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

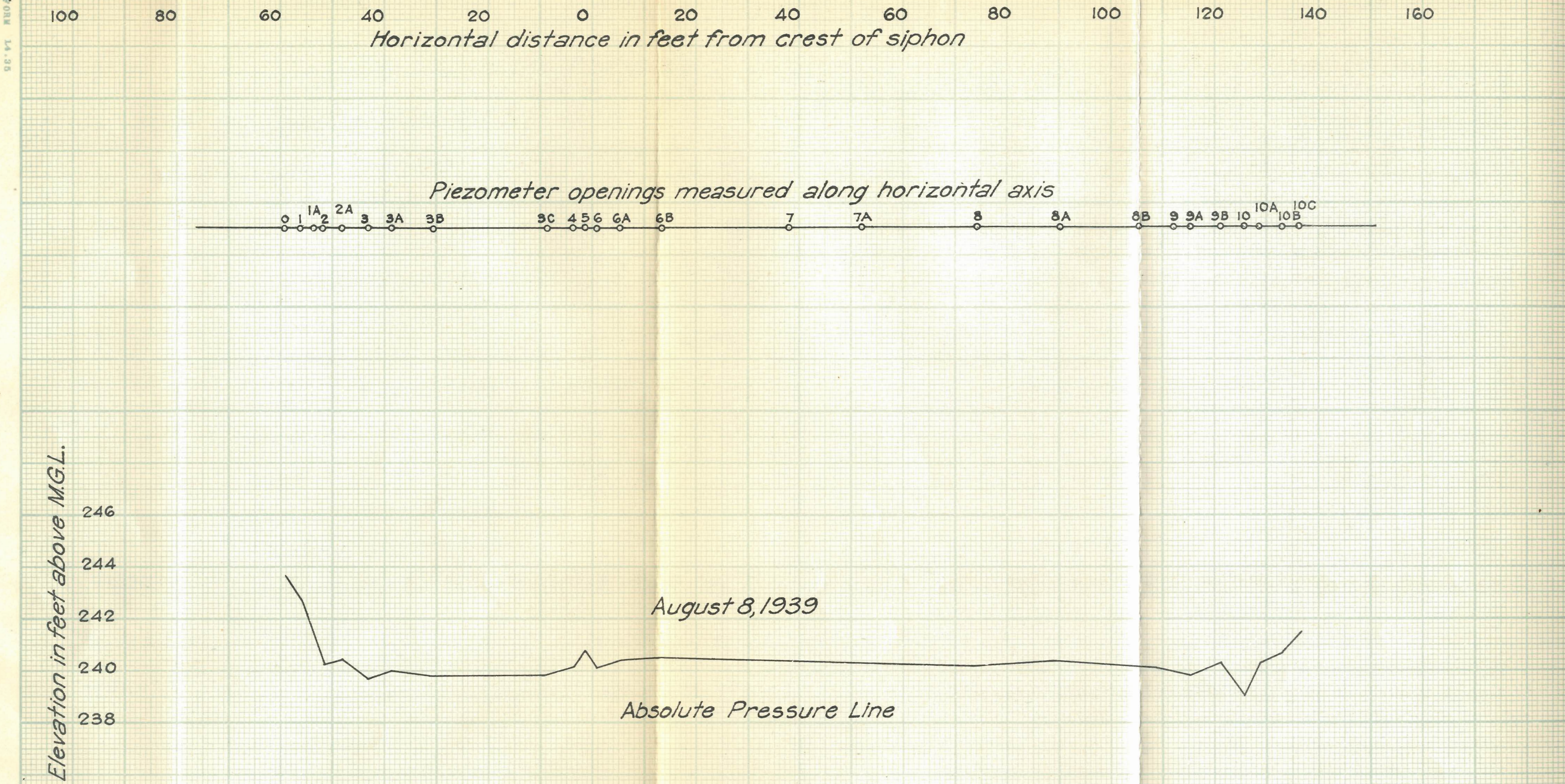
GRAPH OF ABSOLUTE PRESSURE LINE AS DETERMINED FROM PIEZOMETER READINGS

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 5

WAR DEPARTMENT

CORPS OF ENGINEERS. U.S. ARMY



SAINT FRANCIS RIVER PROJECT

MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

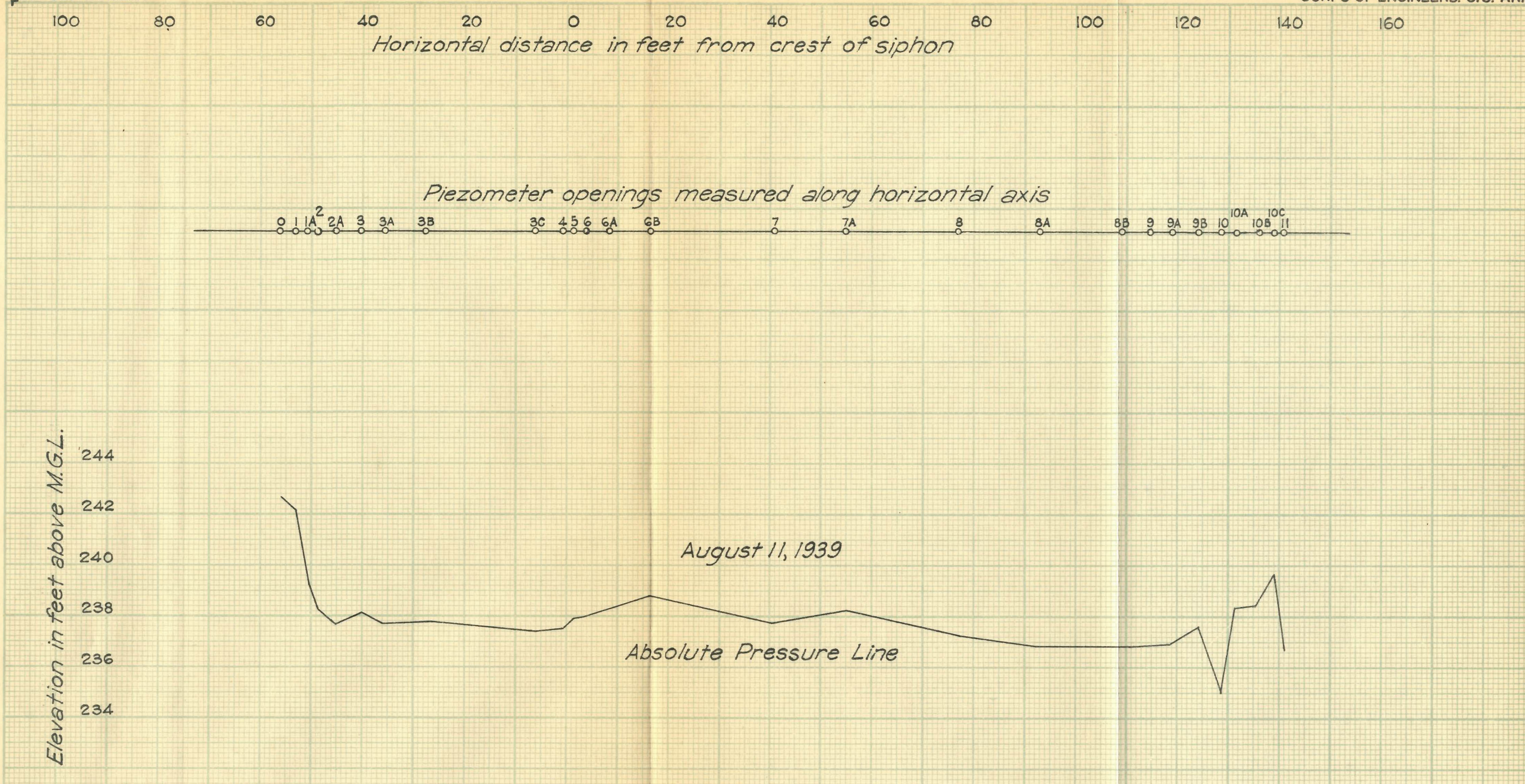
GRAPH OF ABSOLUTE PRESSURE LINE AS DETERMINED FROM PIEZOMETER READINGS

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 6

WAR DEPARTMENT

CORPS OF ENGINEERS. U.S. ARMY



SAINT FRANCIS RIVER PROJECT

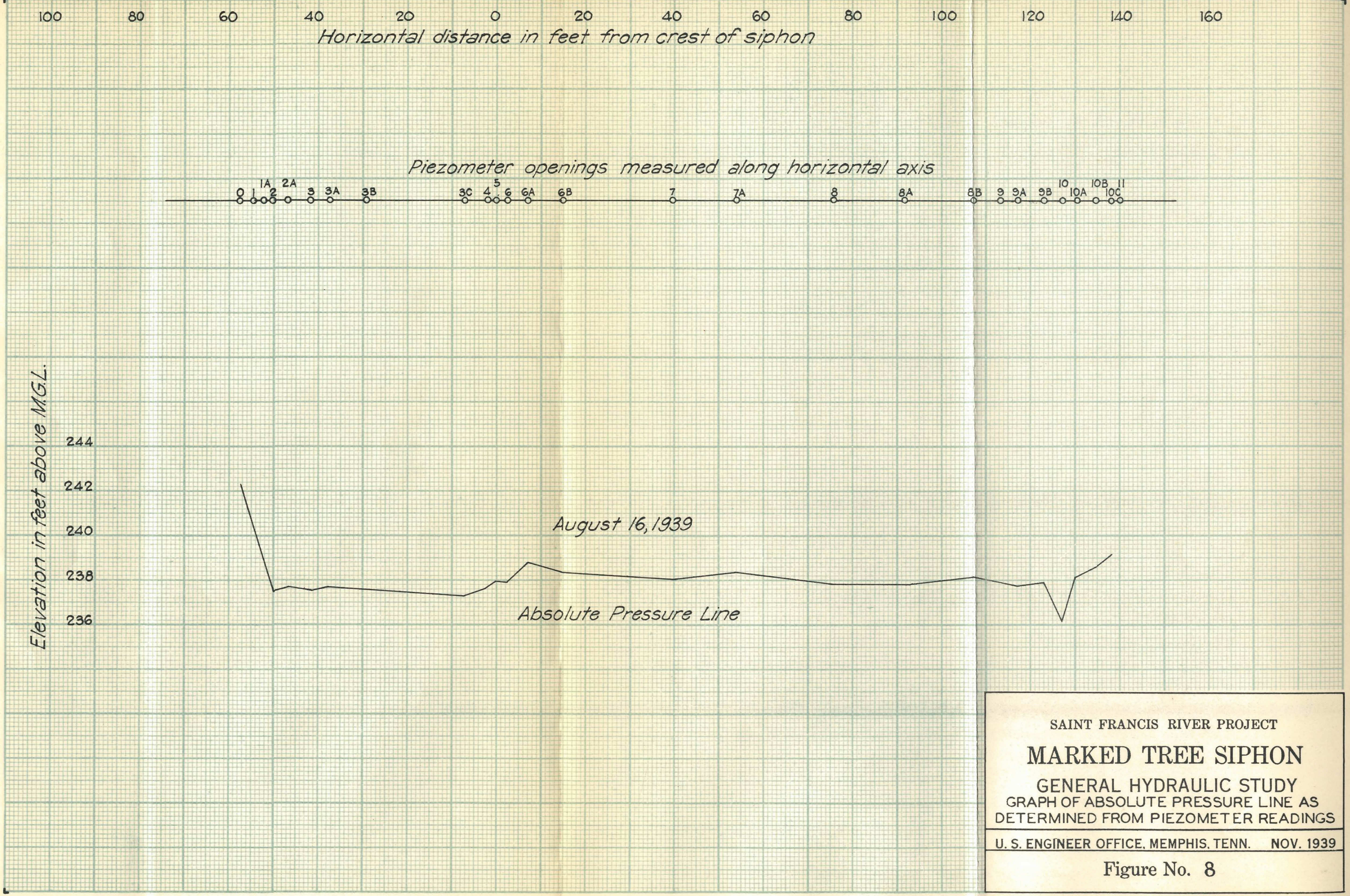
MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

GRAPH OF ABSOLUTE PRESSURE LINE AS DETERMINED FROM PIEZOMETER READINGS

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 7



SAINT FRANCIS RIVER PROJECT

MARKED TREE SIPHON

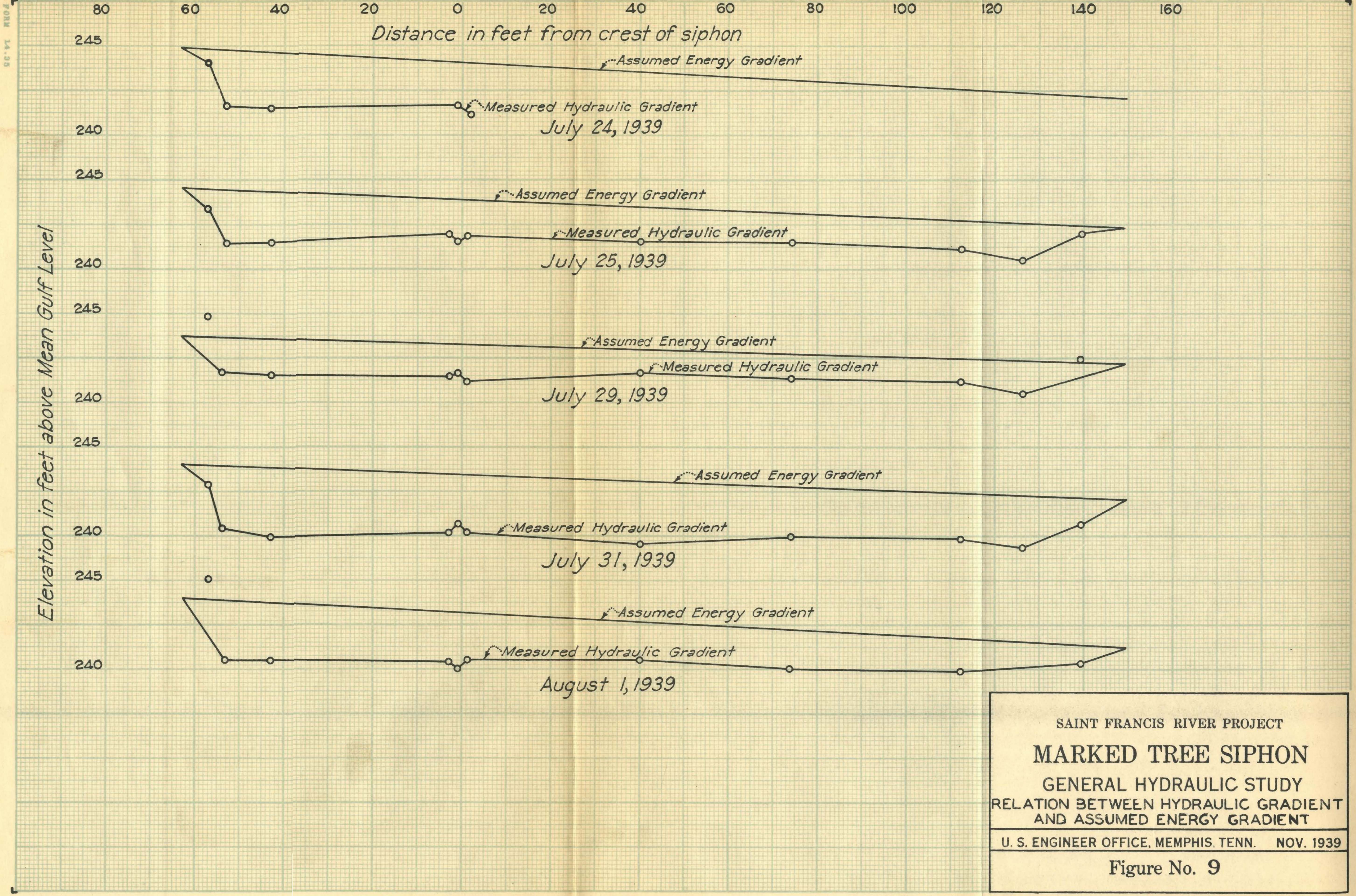
GENERAL HYDRAULIC STUDY

GRAPH OF ABSOLUTE PRESSURE LINE AS DETERMINED FROM PIEZOMETER READINGS

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 8

WAR DEPARTMENT CORPS OF ENGINEERS U.S. ARMY



SAINT FRANCIS RIVER PROJECT

MARKED TREE SIPHON

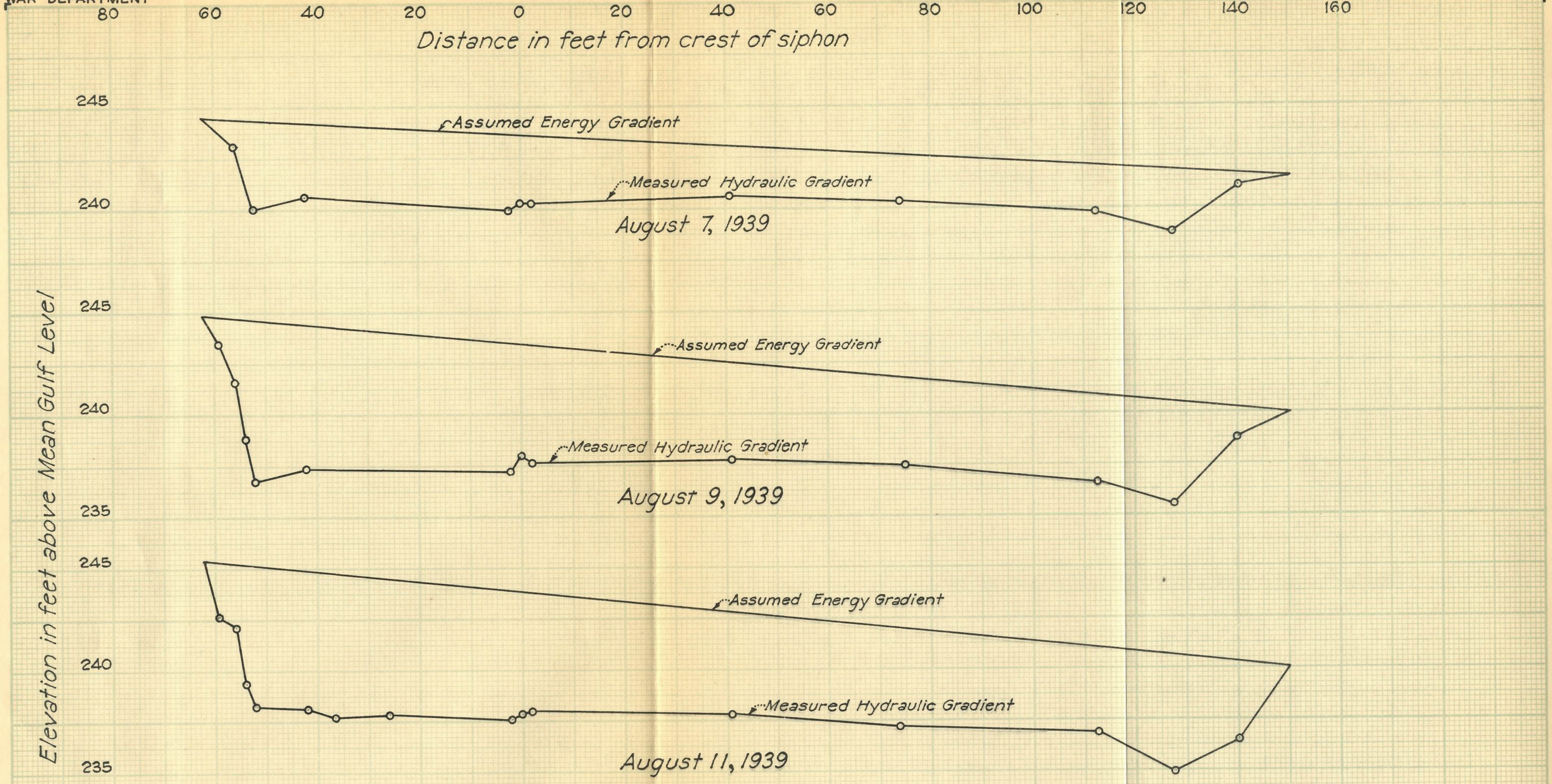
GENERAL HYDRAULIC STUDY

RELATION BETWEEN HYDRAULIC GRADIENT AND ASSUMED ENERGY GRADIENT

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 9

WAR DEPARTMENT CORPS OF ENGINEERS U.S. ARMY



SAINT FRANCIS RIVER PROJECT

MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

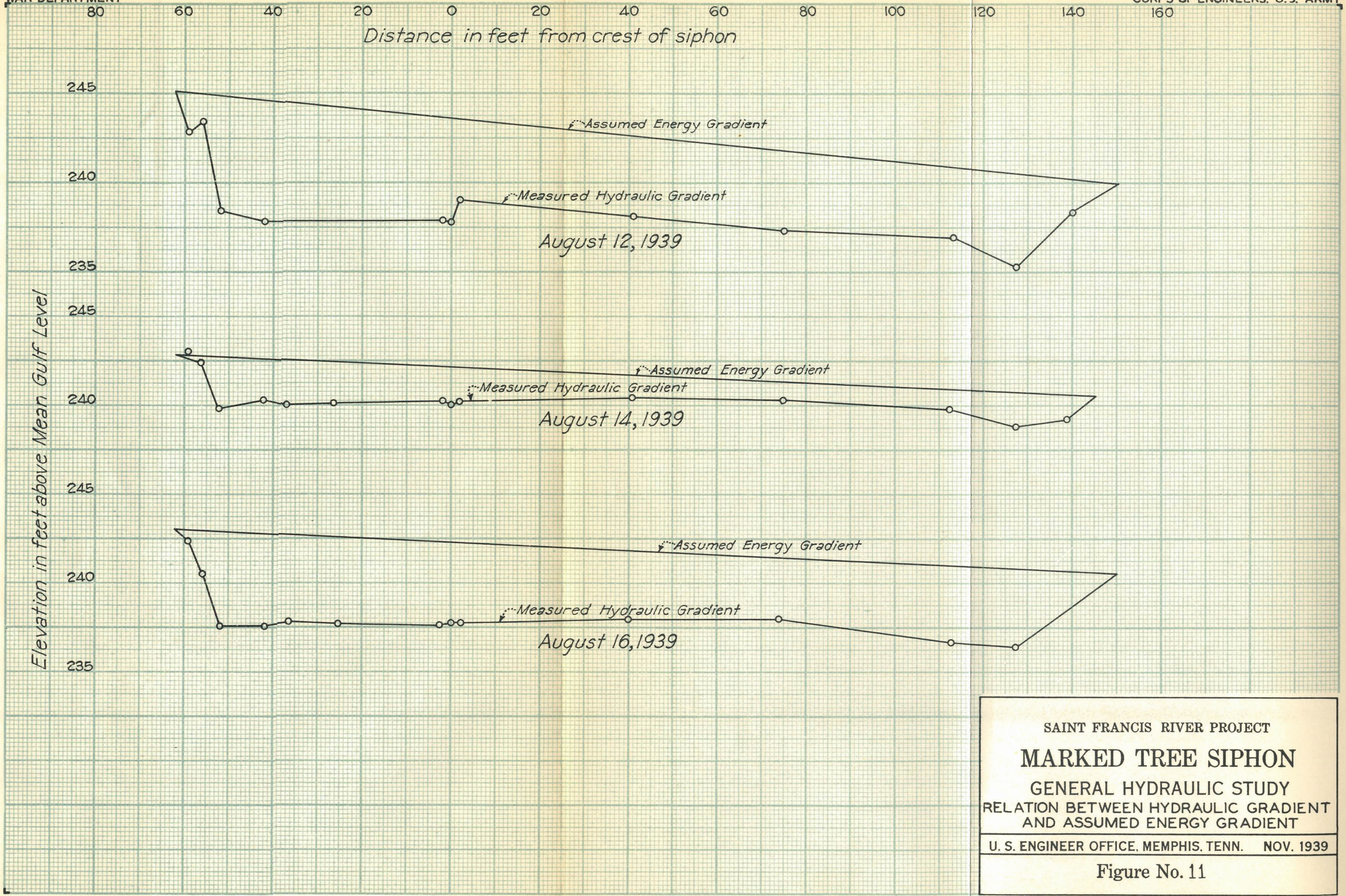
RELATION BETWEEN HYDRAULIC GRADIENT AND ASSUMED ENERGY GRADIENT

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 10

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY



SAINT FRANCIS RIVER PROJECT

MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

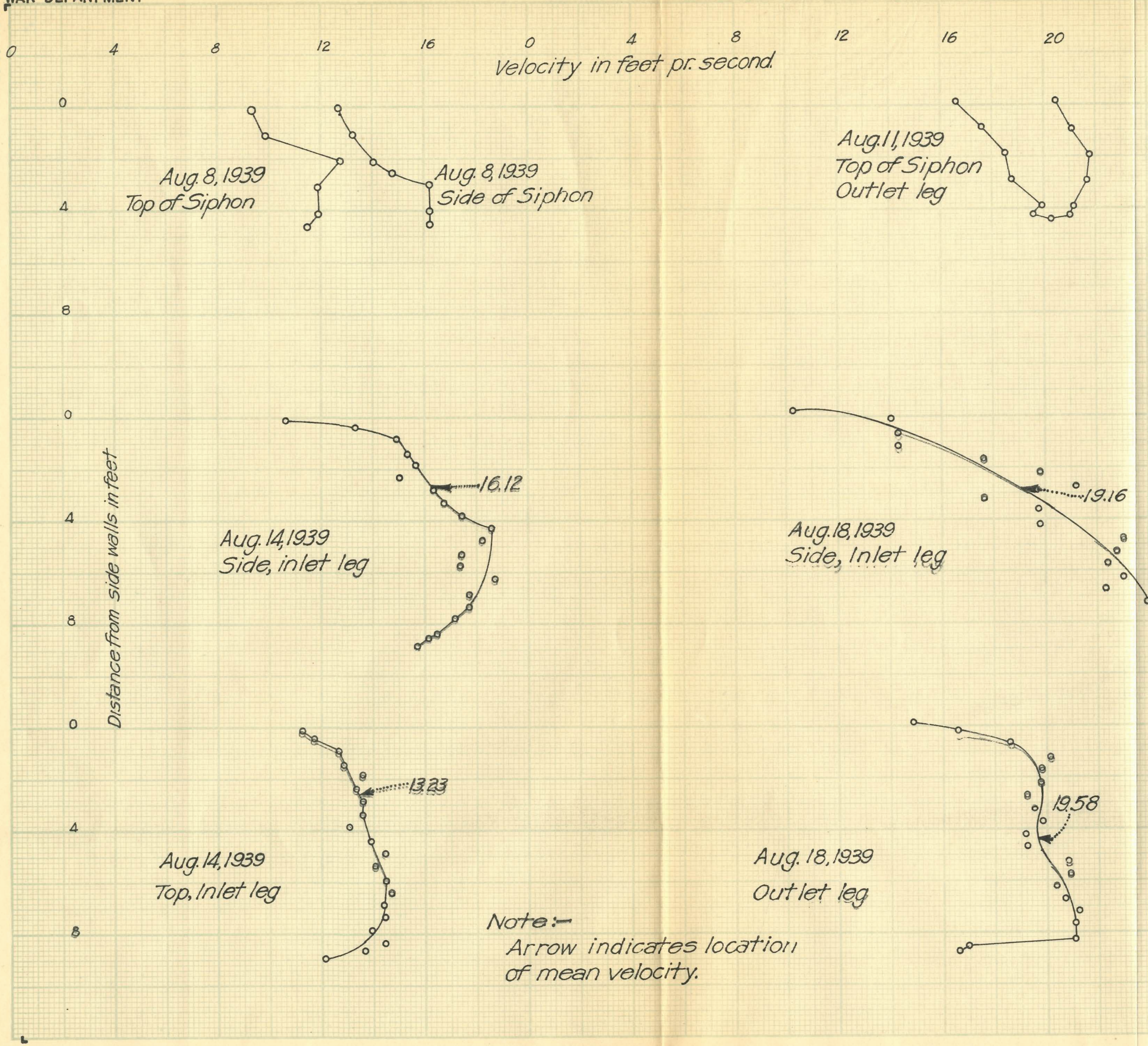
RELATION BETWEEN HYDRAULIC GRADIENT AND ASSUMED ENERGY GRADIENT

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 11

WAR DEPARTMENT

CORPS OF ENGINEERS. U. S. ARMY



SAINT FRANCIS RIVER PROJECT

MARKED TREE SIPHON

GENERAL HYDRAULIC STUDY

VELOCITY DETERMINATIONS
BY PITOT TUBE

U. S. ENGINEER OFFICE, MEMPHIS, TENN. NOV. 1939

Figure No. 12

RESULTS OF DISCHARGE OBSERVATIONS AT MARKED TREE SIPHON

TABLE I

DATE	Number of Pipes Flowing	Vacuum in Mercury	WATER SURFACE IN MEAN GULF LEVEL		DISCHARGE CROSS SECTION			VELOCITY IN FEET PER SECOND		Measured Discharge in c.f.s.	H Col. 4–Col. 5 Feet	$H + HV_1$ HV_1 = Vel. Head Inlet Feet	Q c.f.s.	COEF. of DISCHARGE Col. 11 ÷ Col. 14
			Inlet Basin	Outlet RipRap	Area in Sq. Ft.	Width in Feet	Mean Depth in Feet	Max. Obs.	Mean					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
June 12	1-M	25	213.28	206.56	731	128	5.71	2.20	1.746	1,276	6.72	6.76	1,326	.962
June 13	2-W & M	25	212.80	208.55	1,015	133	7.63	2.57	2.067	2,098	4.25	4.35	2,128	.986
June 16	1-M	25	212.70	206.38	679	127	6.35	2.36	1.895	1,287	6.32	6.36	1,287	1.000
June 20	1-M	25	212.59	205.63	628	125	5.02	2.49	2.053	1,289	6.96	7.00	1,350	.955
June 22	1-M	25	212.25	206.20	665	128	5.20	2.29	1.842	1,225	6.05	6.09	1,259	.973
June 23	1-M	25	212.18	206.29	667	128	5.21	2.31	1.837	1,225	5.89	5.93	1,242	.986
June 23										*1,190				
June 27	1-M	25	212.00	206.19	639	125	5.11	2.36	1.873	1,197	5.81	5.85	1,234	.970
June 27										*1,182				
June 30	2-E & W	23–24	211.54	208.08	890	130	6.85	2.70	2.145	1,909	3.46	3.56	1,925	.992
July 13	2-M & E	25–23	211.50	207.91	923	132	7.06	3.15	2.033	1,876	3.59	3.70	1,963	.956
July 13										*1,860				
July 21	2-E & W	23–23½	210.86	207.76	861	132	6.52	2.61	2.111	1,818	3.10	3.20	1,825	.996
Aug. 1	2-E & W	25–24	209.73	207.25	771	130	5.93	2.70	2.117	1,632	2.48	2.58	1,638	.996
Aug. 1	2-E & W	24½–24	209.69	207.25	724	130	5.57	2.52	2.182	1,580	2.44	2.54	1,626	.972
Aug. 2	2-E & W	24½–24	209.66	207.30	746	130	5.74	2.61	2.070	1,544	2.36	2.46	1,600	.965
Aug. 8	2-E & W	23½–24	210.01	207.34	817	131	6.24	2.46	2.026	1,655	2.67	2.77	1,698	.975
Aug. 10	1-W	25	211.09	205.81	609	124	4.91	3.63	1.929	1,175	5.28	5.32	1,176	.999
Aug. 15	2-E & W	24–24	209.24	206.88	812	129	6.29	2.37	1.887	1,532	2.36	2.47	1,604	.955
Aug. 18	1-M	24½	209.55	205.14	589	121	4.87	2.13	1.701	1,002	4.41	4.46	1,077	.930
Aug. 21	1-M	25	209.70	205.37	596	124	4.81	2.09	1.628	970	4.33	4.38	1,068	.908
Aug. 21	1-M	25	209.71	205.37	520	123	4.23	2.46	1.927	1,002	4.34	4.38	1,068	.938
Aug. 22	1-M	25½	209.68	205.35	594	124	4.79	2.14	1.645	977	4.33	4.38	1,068	.915
Aug. 22	1-M	25½	209.67	205.38	604	126	4.79	2.15	1.657	1,001	4.29	4.33	1,061	.943
Aug. 25	1-M	25	209.20	205.29	587	124	4.73	2.00	1.656	972	3.91	3.96	1,015	.958
Aug. 25	1-M	25	209.18	205.27	512	124	4.13	2.59	1.924	985	3.91	3.96	1,015	.970
Aug. 26	1-M	26	209.24	205.28	592	125	4.74	2.09	1.694	1,003	3.96	4.01	1,021	.982
Aug. 26	1-M	26	209.23	205.32	519	124	4.19	2.59	1.900	986	3.91	3.96	1,015	.972
Aug. 28	1-M	Not Read	209.03	205.24	585	125	4.68	2.07	1.658	970	3.79	3.84	1,000	.970
Aug. 28	1-M	Not Read	208.99	205.29	512	123½	4.15	2.59	1.877	961	3.70	3.74	986	.975
Aug. 29	1-M	26	208.61	205.11	558	125	4.46	2.02	1.656	924	3.50	3.55	961	.961
Aug. 29	1-M	26	208.58	205.17	482	123	3.92	2.59	1.967	869	3.41	3.46	949	.961
Aug. 30	1-M	Not Read	208.50	205.10	553	124	4.46	2.03	1.667	922	3.40	3.45	948	.973
Aug. 30	1-M	Not Read	208.49	205.10	499	122	4.09	2.55	1.892	915	3.39	3.44	946	.967
Aug. 30	1-M	26	208.48	205.09	557	124	4.49	2.07	1.686	939	3.39	3.44	946	.993
Aug. 30	1-M	26	208.49	205.08	498	122	4.08	2.59	1.831	912	3.41	3.46	949	.961

*Rod Floats

TABLE II

DESCRIPTION OF PIEZOMETER TUBES AS FINALLY INSTALLED

Piez. No.	*Elev.*	*Axial Distance From Crown*	*REMARKS*
0	212.05	L 66.7	*1/4" drilled hole near lower end and on top of inlet bell.*
1	212.74	L 61.4	*1" pipe in side of bell near lower end.*
1 A	215.42	L 57.2	*1/4" drill hole in side of inlet bell.*
2	217.98	L 53.5	*1" pipe at end of bell and beginning of bend.*
2 A	221.45	L 47.15	*1/4" drill hole in middle of bend.*
3	223.34	L 42.0	*1" pipe at termination of bend.*
3 A	224.00	L 37.7	*1/4" drill hole 1/2 siphon diameter beyond bend.*
3 B	225.29	L 29.6	*1/4" drill hole approx. 1-1/2 diameters from bend.*
3 C	229.35	L 7.0	*1/4" drill hole 1/2 diameter before bend at crown.*
4	230.28	L 2.3	*1" pipe, plugged with brass plug having 1/8" opening.*
5	230.62	0.0	*1" pipe, plugged as #4, at crown of siphon.*
6	230.54	R 2.3	*1" pipe, plugged as #4, at end of bend .*
6 A	230.25	R 7.1	*1" pipe, approx. 1/2 diameter below bend .*
6 B	229.92	R 15.0	*1" pipe, approx. 1-1/2 diameters below bend.*
7	228.38	R 39.8	*1" pipe in straight portion of outlet leg.*
7 A	227.57	R 53.2	*1" pipe, same as #7.*
8	226.38	R 75.8	*1" pipe.*
8 A	225.36	R 91.8	*1" pipe.*
8 B	224.47	R 107.3	*1" pipe, approx. 2/3 tube diameter above bend.*
9	224.12	R 113.2	*1" pipe, plugged as #4, at beginning of bend.*
9 A	223.66	R 117.2	*1" pipe, in bend.*
9 B	220.82	R 124.3	*1" pipe, in bend.*
10	217.70	R 129.0	*1" pipe, at termination of bend, beginning of outlet bell.*
10 A	214.82	R 133.4	*1" pipe, in outlet bell.*
10 B	209.97	R 140.1	*1" pipe, in outlet bell.*
10 C	209.53	R 144.4	*1/4" drill hole, in top side of outlet bell.*
11	204.70	R 147.5	*1" pipe in outlet bell - always under water so that readings were taken from manometer in operating house.*
			NOTE: All distances were taken along axis of tube - openings not on axis were located at their axial distance from adjacent openings.
2 A Top	225.71	L 47.15	*1/4" drill hole.*
3 C Top	233.91	L 7.0	*1/4" drill hole.*
8 Top	230.75	R 75.8	*1" pipe.*
8 Bot	221.73	R 75.8	*1" pipe.*
9 A Top	227.96	R117.2	*1" pipe.*
9 A Top	219.23	R117.2	*1" pipe.*

(2 A Top through 9 A Top:) These openings were spotted in the same pipe cross-section as those tubes located in the side of the siphon and bearing corresponding numbers. It was intended to employ them as checks on the piezometer tubes in the side of the siphon.

TABLE III

ESSENTIAL DIMENSIONS

*Section**	*Area in Square Feet*
0	103.8
1	83.8
1 A	76.6
2	63.6
2 A	63.6
3	63.6
3 A	63.6
3 B	63.6
3 C	63.6
4	63.6
5	63.6
6	63.6
6 A	63.6
6 B	63.6
7	63.6
7 A	63.6
8	63.6
8 A	63.6
8 B	63.6
9	63.6
9 A	63.6
9 B	63.6
10	63.6
10 A	65.9
10 B	84.7
10 C	96.3
11	103.9

* *Section number refers to number of piezometer opening shown in Figure* 3.

TABLE IV

0	1	2	3	4	5	6	7	8	9
Pz.No.	*El. Pz.*	*El. Man.*	H_1 Col 2–Col 1	*Man. Read. Ft. Hg.*	*2wg Hg*	*Hg + h_1* Col 3 + Col 4	*Pz. = w(Hg + h_1) – 2(wg Hg) + Pa* Col 6 – Col 5+34	*Gradient* Col 1+Col 7	*REMARKS*
						JULY 13, 1939			
1	212.74	230.00	17.26	0.77	20.90	18.03	31.13	243.87	*Inlet Basin* – 211.89
2	217.98	230.00	12.02	0.85	23.10	12.87	23.77	241.75	*Outlet Basin* – 207.85
3	223.34	230.00	6.66	0.88	23.95	7.54	17.59	240.93	*Used Manometer installed*
4	230.28	230.00	–0.28	0.93	25.25	0.65	9.40	239.68	*inside operating house,*
5	230.62	230.00	–0.62	0.91	24.75	0.29	9.54	240.16	*primed with H_2O*
6	230.54	230.00	–0.54	0.91	24.75	0.37	9.62	240.16	
7	228.38	230.00	1.62	0.90	24.45	2.52	12.07	240.45	
8	226.38	230.00	3.62	0.91	24.75	4.53	13.78	240.16	
9	224.12	230.00	5.88	0.92	25.00	6.80	15.80	239.92	
10	217.70	230.00	12.30	0.94	25.55	13.24	21.69	239.39	
11	204.70	230.00	25.30	0.86	23.40	26.26	36.76	241.46	
						JULY 19, 1939			
1	212.74	230.00	17.26	.820	22.30	18.080	29.780	242.520	*Trash Rack Gage* 211.18
2	217.98	230.00	12.02	.935	25.40	12.955	21.555	239.535	*Inlet Basin* 210.90
3	223.34	230.00	6.66	.905	24.60	7.565	16.965	240.305	*Outlet Basin* 207.82
4	230.28	230.00	– 0.28	.925	25.15	.645	9.495	239.775	
5	230.62	230.00	– 0.62	.860	23.40	.240	10.840	241.460	*Two outside pipes running –*
6	230.54	230.00	– 0.54	.889	24.15	.349	10.199	240.739	*Vac. = 23.5" Hg*
7	228.38	230.00	1.62	.900	24.45	2.520	12.070	240.450	
8	226.38	230.00	3.62	.895	24.30	4.515	14.215	240.595	
9	224.12	230.00	5.88	.900	24.45	6.780	16.330	240.450	
10	217.70	230.00	12.30	.950	25.85	13.250	21.400	239.100	
11	204.70	230.00	25.30	.950	23.10	26.15	37.050	241.750	

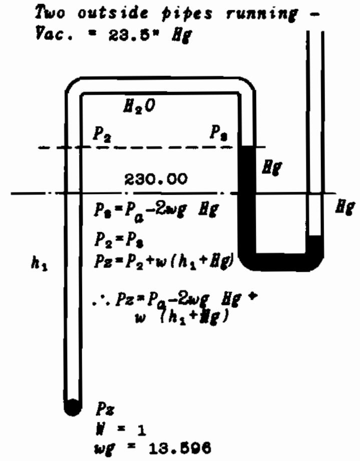


Table IV
Sheet # 1

TABLE IV - CONTINUED

0	1	2	3	4	5	6	7	8	9
Pz.No.	*El. Pz.*	*El.Man*	H_1 Col 2-Col 1	*Man. Read. Ft. Hg.*	*2wg Hg*	$Hg + h_1$ Col 3+Col 4	*Pz.* = $w(Hg. + h_1) - 2(wg\ Hg) + Pa$ Col 6 - Col 5+34	*Gradient* Col 1+Col 7	*REMARKS*
						JULY 20, 1939			
1	212.74	230.00	17.26	.82	22.30	18.080	29.780	242.520	*Trash Rack Gage* 211.21
2	217.98	230.00	12.02	.954	25.90	12.974	21.074	239.050	*Inlet Basin* 210.95
				.89	24.20	12.910	22.710	240.690	
3	223.34	230.00	6.66	.845	22.95	7.505	18.555	241.895	*Outlet Basin* 207.81
				.89	24.20	7.550	17.350	240.690	
4	230.28	230.00	-0.28	.935	25.40	.655	9.255	239.535	*Barometer* - 30.06" *Air Temp*-88°F
5	230.62	230.00	-0.62	.875	23.80	.255	10.455	241.075	*Two outside pipes running* -
									Vac.= 23.5" *Hg*
6	230.54	230.00	-0.54	.895	24.30	.355	10.055	240.595	
7	228.38	230.00	1.62	.860	23.45	2.480	13.230	241.610	
				.895	24.30	2.515	12.215	240.595	
8	226.38	230.00	3.62	.895	24.30	4.515	14.215	240.595	
9	224.12	230.00	5.88	.905	24.60	6.785	16.185	240.305	
10	217.70	230.00	12.30	.945	25.70	13.245	21.545	239.245	
11	204.70	230.00	25.30	.855	23.20	26.155	36.955	241.655	
						JULY 21, 1939			
1	212.74	230.00	17.26	.865	23.50	18.125	28.625	241.365	*Trash Rack Gage* 211.16
2	217.98	230.00	12.02	.960	26.10	12.980	20.880	238.860	*Inlet Basin* 210.86
3	223.34	230.00	6.66	.922	25.05	7.582	16.532	239.872	*Outlet Basin* 207.76
4	230.28	230.00	-0.28	.925	25.10	.645	9.545	239.825	*Barometer* - 30.15" *Air Temp*-87°F
5	230.62	230.00	-0.62	.890	24.20	.270	10.070	240.690	*Water Temp*-81°F.
6	230.54	230.00	-0.54	.885	24.05	.345	10.295	240.835	*Two outside pipes running full*
7	228.38	230.00	1.62	.894	24.25	2.514	12.264	240.544	*vacuum* = 23.5" *Hg*
8	226.38	230.00	3.62	.913	24.80	4.533	13.733	240.113	
9	224.12	230.00	5.88	.886	24.10	6.766	16.666	240.786	
10	217.70	230.00	12.30	.915	24.85	13.215	22.365	240.065	
11	204.70	230.00	25.30	.845	22.95	26.145	30.805	241.895	

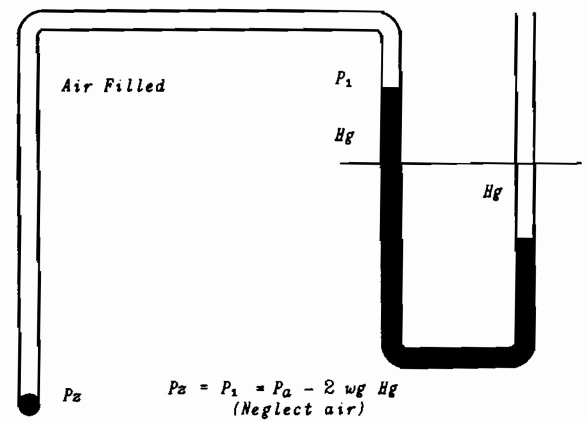
TABLE V

0	1	2	3	4	5
Pz. No.	Pz. El.	Man. Read. Ft. Hg.	2wg Hg.	$P_z = P_a - 2wg$ Hg. 34-Col. 3	Gradient Col 1+Col 4
				JULY 19, 1939	
1	212.74	.149	4.05	29.95	242.69
2	217.98	.439	11.90	22.10	240.08
3	223.34	.595	16.20	17.80	241.14
4	230.28	.865	23.50	10.50	240.78
5	230.62	.845	22.98	11.02	241.64
6	230.54	.810	22.05	11.95	242.49
7	228.38	.790	21.50	12.50	240.88
8	226.38	.743	20.20	13.80	240.18
9	224.12	.688	18.70	15.30	239.42
10	217.70	.505	13.74	20.26	237.96
11	204.70	.050	1.36	32.64	237.34

6 — REMARKS

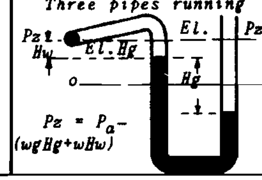
Trash Rack Gage - 211.18
Inlet Basin - 210.90
Outlet Basin - 207.82
Two Outside Pipes Running - Vac.=23 1/5 *Hg.*

This test made with manometer in operating house.
Piezometer tubes were pumped full of air prior to reading.



$P_z = P_1 = P_a - 2\ wg\ Hg$
(Neglect air)

TABLE VI

0	1	2	3	4	5	6	7	8	9	10	11	
Pz. No.	*Man. Elev*	*Hg In. Left Leg*	*Hg In. Right Leg*	*El. Hg* (Col 1+ Col 2)	*El. Pz*	H_w = (Col 5 - Col 4)	*Hg In.* = (Col 2 + Col 3)	*wgHg* = (1.133 Col.7)	*(wgHg+wHw)* = -(Col 8 + Col 6)	*Pz = Pa* -*(wgHg+wHw)* (34+Col 9)	*Hydraulic Gradient* (Col 5 + Col 10)	*REMARKS*
							JULY 24, 1939					
1	213.80	+2.20	- 1.25	213.98	212.74	- 1.24	3.45	3.91	- 2.67	31.33	244.07	*Trash Rack* - 210.98 *Inlet Basin*- 210.79
2	215.67	4.25	- 3.10	216.02	217.98	1.96	7.35	8.34	-10.30	23.70	241.68	*Outlet Basin*-207.91 *Barometer* - 30.05"
3	219.19	5.95	- 4.80	219.69	223.34	3.65	10.75	12.19	-15.84	18.16	241.50	*Air Temp.* - 85°F
4					230.28							H_2O *Temp.* - 82°F
5	227.00	9.55	- 8.25	227.80	230.62	2.82	17.80	20.18	-23.00	11.00	241.62	*Three pipes running* *Vacuum* = 24" *Hg*
6	226.58	9.40	- 8.15	227.36	230.54	3.18	17.55	19.90	-23.08	10.92	241.46	*(See sketch below for manometer)* *Broke manometer*
							JULY 25, 1939					
1	213.80	-0.10	- 4.00	213.72	212.74	- .98	3.9	4.42	- 3.44	30.56	243.30	*Trash Rack* - 210.60 *Inlet Basin*- 210.27
2	215.61	+1.80	- 5.60	215.76	217.98	2.22	7.40	8.39	-10.61	23.39	241.37	*Outlet Basin*-208.12
3	219.19	3.45	- 7.10	219.48	223.34	3.86	10.55	11.96	-15.82	18.18	241.52	*Barometer* - 30.18"
4	226.66	6.95	-10.22	227.24	230.28	3.04	17.17	19.43	-22.47	11.53	241.81	*Air Temp.* - 90.5°F
5	226.67	7.05	-10.40	227.26	230.62	3.36	17.45	19.79	-23.15	10.85	241.47	*Water Temp.*-82°F
6	226.31	6.75	-10.15	226.87	230.54	3.67	16.90	19.15	-22.82	11.18	241.72	*Three pipes running* *Vacuum* = 22.5"
7	224.14	8.15	- 7.10	224.82	228.38	3.56	15.25	17.30	-20.86	13.14	241.52	*Using portable manometer*
8	221.97	7.15	- 6.25	222.57	226.38	3.81	13.40	15.19	-19.00	15.00	241.38	
9	219.67	6.225	- 5.40	220.19	224.12	3.93	11.625	13.19	-17.12	16.88	241.00	
10	214.32	3.80	- 3.20	214.64	217.70	3.38	7.00	7.94	-11.32	22.68	240.38	
11	230.00	.845	- .845		204.70		*		+ 3.195	37.195	241.895	
							JULY 29, 1939					
1	213.78	1.40	- 1.20	213.90	212.74	- 1.16	2.60	2.95	- 1.79	32.21	244.95	*Trash rack* - 209.93 *Inlet Basin*- 209.59
2	215.55	3.90	- 3.30	215.87	217.98	2.11	7.20	8.17	-10.28	23.72	241.70	*Outlet Basin*-208.06
3	219.08	5.75	- 4.85	219.56	223.34	3.78	10.60	12.02	-15.80	18.20	241.54	*Barometer* - 30.08"
4	226.53	9.40	- 8.10	227.31	230.28	2.97	17.50	19.84	-22.81	11.19	241.47	*Air Temp.* - 81°F
5	227.15	9.70	- 8.30	227.96-	230.62	2.66+	18.00	20.40	-23.06	10.94	241.56	*Water Temp.* - 78°F *Three pipes running*
6	227.15	9.80	- 8.40	227.96+	230.54	2.58	18.20	20.62	-23.20	10.80	241.34	
7	224.28	8.25	- 7.15	224.97	228.38	3.41	15.40	17.45	-20.86	13.14	241.52	
8	221.97	7.20	- 6.30	222.57	226.38	3.81	13.50	15.30	-19.11	14.89	241.27	
9	219.68	6.20	- 5.35	220.20	224.12	3.92	11.55	13.10	-17.02	16.98	241.10	
10	214.30	3.95	- 3.45	214.63	217.70	3.07	7.40	8.39	-11.46	22.54	240.24	$Pz = P_a - (wgHg+wHw)$
11	230.00	0.825	- .825	230.825	204.70	-26.125	19.8	22.45	+ 3.675	37.675	242.375	

* *Pz. #11 read from manometer inside operating house.*

Table VI
Sheet # 1

TABLE VI - CONTINUED

0	1	2	3	4	5	6	7	8	9	10	11	
Pz.No.	*Man. Elev.*	*Hg In. Left Leg*	*Hg In. Right Leg*	*El.Hg* (Col 1+ Col 2)	*El. Pz*	*Hw* = (Col 5 - Col 4)	*Hg In.*= (Col 2 + Col 3)	*wgHg* = (1.133 Col.7)	*(wgHg+wHw)*= -(Col 8 + Col 6)	*Pz* = *Pa* -*(wgHg+wHw)* (34+Col 9)	*Hydraulic Gradient* (Col 5 + Col 10)	*REMARKS*
							JULY 31, 1939					
1	213.79	2.5	-2.1	214.00	212.74	- 1.26	4.6	5.22	- 3.96	30.04	242.78	*Trash Rack - 210.23*
2	214.65	4.68	-4.18	215.04	217.98	2.94	8.86	10.04	-12.98	21.02	239.00	*Inlet Basin -209.86*
3	219.12	6.3	-5.4	219.64	223.34	3.70	11.7	13.25	-16.95	17.05	240.39	*Outlet Basin-207.26*
		6.8	-5.6	219.66	223.34	3.68	12.1	13.70	-17.38	16.62	239.96	*Air Temp. - 91°F*
												Water Temp.-79°F
4	227.02	10.25	-8.85	227.88	230.28	2.40	19.10	21.63	-24.03	9.97	240.25	*Barometer - 30.16"*
5	227.15	10.15	-8.75	228.00	230.62	2.62	18.90	21.41	-24.03	9.97	240.59	*Two pipes running*
6	227.15	10.35	-8.95	228.01	230.54	2.53	19.30	21.88	-24.41	9.59	240.13	
7	224.19	8.70	-8.55	224.91	228.38	3.47	17.15	19.44	-22.91	11.09	239.47	
8	221.99	7.90	-6.85	222.65	226.38	3.73	14.75	16.71	-20.44	13.56	239.94	
9	219.72	6.80	-5.90	220.29	224.12	3.83	12.70	14.40	-18.23	15.77	239.89	
10	214.11	4.30	-3.80	214.47	217.70	3.23	8.10	9.19	-12.42	21.58	239.28	**Read inside operating house.*
11	230.00		*		204.70				+ 1.875	35.875	240.575	
							AUGUST 1, 1939					
1	213.86	1.55	-1.05	213.99	212.74	-1.25	2.60	2.94	- 1.69	32.31	245.05	*Trash Rack - 210.00*
2	215.62	4.50	-3.80	215.99	217.98	+1.99	8.30	9.40	-11.39	22.61	240.59	*Inlet Basin- 209.73*
3	219.25	6.35	-5.30	219.78	223.34	3.56	11.65	13.20	-16.76	17.24	240.58	*Outlet Basin-207.25*
4	227.04	10.20	-8.80	227.89	230.28	2.39	19.00	21.52	-23.91	10.09	240.37	*Air Temp. - 95°F*
5	227.04	10.40	-8.92	227.91	230.62	2.71	19.32	21.89	-24.60	9.40	240.02	*Barometer - 30.17"*
6	227.15	10.30	-8.80	228.01	230.54	2.53	19.10	21.61	-24.14	9.86	240.40	*Two outside pipes*
7	224.25	8.75	-7.45	224.98	228.38	3.40	16.20	18.35	-21.75	12.25	240.63	*running*
8	221.94	7.85	-6.70	222.59	226.38	3.79	14.55	16.50	-20.29	13.71	240.09	
9	219.69	6.85	-5.75	220.26	224.12	3.86	12.60	14.28	-18.14	15.86	239.98	
10	No Read			214.45	217.70							
11	230.00			*	204.70				+ 1.695	35.695	240.395	
							AUGUST 7, 1939					
1	213.78	2.30	-2.10	213.97	212.74	-1.23	4.40	4.98	- 3.75	30.25	242.99	*Trash Rack - 210.53*
2	218.19	6.10	-5.10	218.70	217.98	-0.72	11.20	12.68	-11.96	22.04	240.02	*Inlet Basin- 210.27*
3	219.25	6.30	-5.40	219.78	223.34	+3.56	11.70	13.25	-16.81	17.19	240.53	*Outlet Basin-207.43*
4	227.13	10.60	-8.90	228.01	230.28	2.27	19.50	22.10	-24.37	9.63	239.91	*Air Temp. - 86°F*
5	227.13	10.50	-8.80	228.005	230.62	2.615	19.30	21.85	-24.465	9.535	240.155	*Water Temp.- 81°F*
6	227.13	10.50	-8.80	228.005	230.54	2.535	19.30	21.85	-24.385	9.615	240.155	*Barometer - 30.00"*
7	224.30	8.75	-7.55	225.03	228.38	3.35	16.30	18.45	-21.80	12.20	240.58	*Two outside pipes*
8	221.88	7.70	-6.70	222.52	226.38	3.86	14.40	16.31	-20.17	13.83	232.21	*running*
9	219.87	7.00	-6.00	220.45	224.12	3.67	13.00	14.73	-18.40	15.60	239.72	
10	214.26	4.50	-4.20	214.63	217.70	3.07	8.70	9.86	-12.93	21.07	238.77	
11	230.00			*	204.70		*		+ 2.47	36.47	241.17	

Table VI
Sheet #2

TABLE VI - CONTINUED

0	1	2	3	4	5	6	7	8	9	10	11	
Pz.No.	Man. Elev	Hg In. Left Leg	Hg In. Right Leg	El. Hg (Col 1+ Col 2)	El. Pz	H_w = (Col 5- Col 4)	Hg In. = (Col 2+ Col 3)	wgHg = (1.133 Col. 7)	(wgHg+wHw)= -(Col 8 + Col 6)	Pz = Pa +(wgHg+wHw) (34+Col 9)	Hydraulic Gradient (Col 5+ Col 10)	REMARKS
							AUGUST 8, 1939					
0	213.46	1.60	-1.85	213.59	212.05	-1.54	3.45	3.91	- 2.37	31.63	243.68	Trash Rack - 210.33
1	213.78	2.20	-2.40	213.96	212.74	-1.22	4.60	5.22	- 4.00	30.00	242.74	Inlet Basin - 210.01
1A	215.42	3.80	-3.70	215.74	215.42	-0.32	7.50	8.50	- 8.18	25.82	241.24	Outlet Basin- 207.34
2	217.98	5.70	-5.10	218.45	217.98	-0.475	10.80	12.23	-11.755	22.245	240.225	Two Outside pipes
2A	221.45	7.20	-6.50	222.05	221.45	-0.60	13.70	15.52	-14.92	19.08	240.53	Running
3	223.34	8.60	-7.60	224.06	223.34	-0.72	16.20	18.36	-17.64	16.36	239.70	
3A	224.00	8.80	-7.70	224.73	224.00	-0.73	16.50	18.70	-17.97	16.03	240.03	
3B	225.29	9.50	-8.40	226.08	225.29	-0.79	17.90	20.28	-19.49	14.51	239.80	
3C	229.35	11.50	-10.10	230.31	229.35	-0.96	21.60	24.48	-23.52	10.48	239.83	
4	230.28	11.90	-10.30	231.27	230.28	-0.99	22.20	25.15	-24.16	9.84	240.12	
5	230.62	11.80	-10.20	231.60	230.62	-0.985	22.00	24.95	-23.865	10.135	240.755	
6	230.54	12.00	-10.40	231.54	230.54	-1.00	22.40	25.39	-24.39	9.61	240.15	Correct for ¼" H_2O
6A	230.25	11.70	-10.20	231.22	230.25	-0.975	21.90	24.80	-23.825	10.175	240.425	in Right leg of man-
6B	229.92	11.50	-10.00	230.88	229.92	-0.96	21.50	24.40	-23.44	10.56	240.48	ometer correction = .04
7	228.38	10.80	- 9.40	229.28	228.38	-0.90	20.20	22.90	-22.00	12.00	240.38	for gradient.
7A	227.57	10.40	- 9.10	228.44	227.57	-0.87	19.50	22.10	-21.23	12.27	240.34	
8	226.38	9.90	- 8.60	227.21	226.38	-0.825	18.50	20.98	-20.155	13.845	240.225	
8A	225.36	9.20	- 8.20	226,13	225.36	-0.77	17.40	19.72	-18.95	15.05	240.41	
8B	224.47	8.90	- 7.90	225.21	224.47	-0.74	16.80	19.05	-18.31	15.69	240.16	
9	224.12	8.80	- 7.80	224.85	224.12	-0.73	16.60	18.80	-18.07	15.93	240.05	
9A	223.66	8.70	- 7.70	224.38	223.66	-0.72	16.40	18.59	-17.87	16.13	239.79	
9B	220.82	7.00	- 6.30	221.40	220.82	-0.58	13.30	15.08	-14.50	19.50	240.32	
10	217.70	6.00	- 5.60	218.20	217.70	-0.50	11.60	13.13	-12.63	21.37	239.07	
10A	214.82	3.90	- 3.90	215.15	214.82	-0.33	7.80	8.84	- 8.51	25.49	240.31	
10B	209.97	1.30	- 1.70	210.08	209.97	-0.11	3.00	3.40	- 3.29	30.71	240.68	
10C	209.53	0.60	- 1.30	209.58	209.53	-0.05	1.90	2.15	- 2.10	31.90	241.43	
11	204.70				204.70							
							AUGUST 9, 1939					
*0	213.46	1.60	- 2.10	213.59	212.05	-1.54	3.70	4.20	- 2.66	31.34	243.39	Trash Rack - 210.74
1	213.78	2.70	- 3.00	214.00	212.74	-1.26	5.70	6.47	- 5.21	28.79	241.53	Inlet Basin - 210.68
1A	215.42	5.10	- 4.80	215.84	215.42	-0.42	9.90	11.20	-10.78	28.22	238.64	Outlet Basin- 205.90
2	217.98	7.20	- 6.80	218.58	217.98	-0.60	14.00	15.89	-15.29	18.71	236.69	West Siphon running
2A	221.45	8.80	- 8.00	222.18	221.45	-0.73	16.80	19.05	-18.32	15.68	237.13	

Table

TABLE VI - CONTINUED

0	1	2	3	4	5	6	7	8	9	10	11	
Pz.No.	*Man. Elev.*	*Hg In. Left Leg*	*Hg In. Right Leg*	*El.Hg* (Col 1+ Col 2)	*El. Pz.*	*Hw* = (Col 5- Col 4)	*Hg In.*= (Col 2+ Col 3)	*wgHg*= (1.133 Col 7)	*(wgHg+wHw)*= -(Col 8 + Col 6)	*Pz = Pa -(wgHg+wHw)* (34+Col 9)	*Hydraulic Gradient* (Col 5+ Col 10)	*REMARKS*
							AUGUST 9, 1939					
3	223.34	9.70	- 8.70	224.15	223.34	- 0.81	18.4	20.85	- 20.04	13.96	237.30	*Correct for ½" H_2O in Right leg*
3A	224.00	10.20	- 9.00	224.85	224.00	- 0.85	19.2	21.78	- 20.93	13.07	237.07	*of manometer*
3B	225.29	10.60	- 9.40	226.17	225.29	- 0.88	20.0	22.65	- 21.77	12,23	237.52	*Correction* = .04
3C	229.35	12.70	-11.20	230.41	229.35	- 1.06	23.9	27.10	- 26.04	7.96	237.31	
4	230.28	13.30	-11.60	231.39	230.28	- 1.11	24.9	28.20	- 27.09	6.91	237.19	
5	230.62	13.20	-11.40	231.72	230.62	- 1.10	24.6	27.90	- 26.80	7.20	237.82	
6	230.54	13.20	-11.40	231.64	230.54	- 1.10	24.6	27.90	- 26.80	7.20	237.74	
6A	230.25	13.00	-11.20	231.33	230.25	- 1.08	24.2	27.42	- 26.34	7.66	237.91	
6B	229.92	12.80	-11.10	230.99	229.92	- 1.07	23.9	27.10	- 26.03	7.97	237.89	
7	228.38	12.10	-10.60	229.39	228.38	- 1.01	22.7	25.70	- 24.69	9.31	237.69	
7A	227.57	11.70	-10.20	228.55	227.57	- 0.98	21.9	24.80	- 23.82	10.18	237.75	
8	226.38	11.30	- 9.80	227.32	226.38	- 0.94	21.1	23.90	- 22.96	11.04	237.42	
8A	225.36	10.60	- 9.30	226.24	225.36	- 0.88	19.9	22.55	- 21.67	12.38	237.69	
8B	224.47	10.40	- 9.10	225.34	224.47	- 0.87	19.5	22.10	- 21.23	12.77	237.24	
9	224.12	10.50	- 9.20	224.995	224.12	- 0.875	19.7	22.30	- 21.425	12.575	236.695	
9A	223.66	10.10	- 8.90	224.50	223.66	- 0.84	19.0	21.52	- 20.68	13.32	236.98	
9B	220.82	8.30	- 7.50	221.51	220.82	- 0.69	15.8	17.90	- 17.21	16.79	237.61	
10	217.70	7.80	- 7.10	218.35	217.70	- 0.65	14.9	16.95	- 16.30	17.70	235.40	
10A	214.82	4.90	- 4.80	215.23	214.82	- 0.41	9.7	11.00	- 10.59	23.41	238.23	
10B	209.97	2.00	- 2.50	210.14	209.97	- 0.17	4.50	5.10	- 4.93	29.07	239.04	
10C	209.53	1.60	- 2.80	209.66	209.53	- 0.13	3.8	4.30	- 4.17	29.83	239.36	
11	204.70	*	*						0.00	34.00	238.70	
2A T	227.92	10.40	- 9.40	228.79	225.71	- 3.08	19.80	22.43	- 19.35	14.65	240.36	
3C T	236.13	15.00	-13.10	237.38	233.91	- 3.47	28.10	31.80	- 28.33	5.67	239.58	
8 T	232.97	14.20	-12.40	234.15	230.75	- 3.40	26.60	30.10	- 26.70	7.30	238.05	
8 B	221.69	8.90	- 8.10	222.43	221.73	- 0.70	17.00	19.25	- 18.55	15.45	237.18	
9A T	230.18	12.20	-11.80	231.20	227.96	- 3.24	24.00	27.20	- 23.96	10.04	238.00	
9A B	219.19	9.00	- 8.20	219.94	219.23	- 0.71	17.20	19.50	- 18.79	15.21	234.44	
							AUGUST 11, 1939					
*0	214.26	2.60	- 2.60	214.48	212.05	- 2.43	5.20	5.90	- 3.47	30.53	242.58	*Trash Rack* - 211.19
*1	212.79	1.90	- 2.40	212.95	212.74	- 0.21	4.30	4.87	- 4.66	29.34	242.08	*Inlet Basin* - 211.09
1A	215.42	4.60	- 4.70	215.80	215.42	- 0.38	9.30	10.52	- 10.14	23.86	239.28	*Outlet Basin* - 205.89
2	217.98	6.50	- 6.20	218.52	217.98	- 0.54	12.70	14.40	- 13.86	20.14	238.12	
2A	221.45	8.50	- 7.80	222.16	221.45	- 0.71	16.30	18.50	- 17.79	16.21	237.66	
3	223.34	9.20	- 8.50	224.11	223.34	- 0.77	17.70	20.05	- 19.28	14.72	238.06	
3A	224.00	9.80	- 8.90	224.82	224.00	- 0.82	18.70	21.20	- 20.38	13.62	237.62	
3B	225.29	10.40	- 9.40	226.16	225.29	- 0.87	19.80	22.45	- 21.58	12.42	237.71	
3C	229.35	12.60	-11.30	230.40	229.35	- 1.05	23.90	27.10	- 26.05	7.95	237.30	

TABLE VI - CONTINUED

0	1	2	3	4	5	6	7	8	9	10	11	
Pz.No.	*Man. Elev.*	*Hg In. Left Leg*	*Hg In. Right Leg*	*El. Hg* (Col 1+ Col 2)	*El. Pz.*	H_w = (Col 5- Col 4)	*Hg In.*= (Col 2+ Col 3)	*wgHg*= (1.133 Col 7)	*(wgHg+wHw)*= -(Col 8 + Col 6)	*Pz = Pa* -*(wgHg+wHw)* (34+Col 9)	*Hydraulic Gradient* (Col 5+ Col 10)	*REMARKS*
							AUGUST 11, 1939					
4	230.28	13.00	-11.60	231.36	230.28	-1.08	24.60	27.90	-26.82	7.18	237.46	
5	230.62	13.00	-11.60	231.70	230.62	-1.08	24.60	27.90	-26.82	7.18	237.80	
6	230.54	12.90	-11.50	231.61	230.54	-1.07	24.40	27.65	-26.58	7.42	237.96	
6A	230.25	12.70	-11.30	231.32	230.25	-1.07	24.00	27.20	-26.13	7.87	238.12	
6B	229.92	12.20	-10.90	230.94	229.92	-1.02	23.10	26.20	-25.18	8.82	238.74	
7	228.38	12.00	-10.70	229.38	228.38	-1.00	22.70	25.70	-24.70	9.30	237.68	
7A	227.57	11.30	-10.20	228.51	227.57	-0.94	21.50	24.40	-23.46	10.54	238.11	
8	226.38	11.20	-10.10	227.30	226.38	-0.92	21.30	24.15	-23.23	10.77	237.15	
8A	225.36	11.00	- 9.80	226.28	225.36	-0.92	20.80	23.60	-22.68	11.32	236.68	
8B	224.47	10.50	- 9.50	225.35	224.47	-0.88	20.00	22.70	-21.82	12.18	236.65	*Correct for 1" H_2O in Right leg of manometer*
9	224.12	10.20	- 9.30	224.98	224.12	-0.86	19.50	22.10	-21.24	12.76	236.88	
9A	223.66	10.00	- 9.10	224.49	223.66	-0.83	19.10	21.65	-20.82	13.18	236.84	
9B	220.82	8.20	- 7.60	221.50	220.82	-0.68	15.80	17.95	-17.27	16.73	237.55	
10	217.70	7.90	- 7.50	218.36	217.70	-0.66	15.40	17.45	-16.79	17.21	234.91	
10A	214.82	4.80	- 5.10	215.22	214.82	-0.40	9.90	11.20	-10.80	23.20	238.02	
10B	209.97	2.10	- 2.90	210.14	209.97	-0.17	5.00	5.66	- 5.49	28.51	238.48	
10C	209.53	1.40	- 2.30	209.65	209.53	-0.12	3.70	4.20	- 4.08	29.92	239.45	
11	204.70	*	*						- 2.13	31.87	236.57	
2A T	227.92	9.80	- 9.20	228.73	225.71	-3.02	19.00	21.50	-18.48	15.52	241.23	
3C T	236.13	14.90	-14.30	237.37	233.91	-3.46	29.20	33.05	-29.59	4.41	238.32	
8 T	232.97	13.80	-12.40	234.12	230.75	-3.37	26.20	29.65	-26.28	7.72	238.47	
8 B	221.69	8.30	- 8.20	222.38	221.73	-0.65	16.50	18.69	-18.04	15.96	237.69	
9A T	230.18	11.40	-10.30	231.13	227.96	-3.17	21.70	24.60	-21.43	12.57	240.53	
9A B	219.19	8.60	- 8.50	219.91	219.23	-0.68	17.10	19.38	-18.70	15.30	234.53	
							AUGUST 12, 1939					
*0	213.46	1.50	- 2.80	213.58	212.05	-1.53	4.30	4.88	- 3.35	30.65	242.70	*Trash Rack* - 211.18
*1	213.78	1.40	- 2.60	213.90	212.74	-1.16	4.00	4.54	- 3.38	30.62	243.36	*Inlet Basin* - 210.98
1A	215.42	4.40	- 5.10	215.79	215.42	-0.37	9.50	8.38	- 8.01	25.99	241.41	*Outlet Basin*- 205.90
2	217.98	6.20	- 6.40	218.50	217.98	-0.52	12.60	14.28	-13.76	20.24	238.22	*West Pipe Running*
2A	221.45	7.80	- 8.10	222.10	221.45	-0.65	15.90	18.01	-17.36	16.64	238.09	
3	223.34	9.10	- 8.90	224.10	223.34	-0.76	18.00	20.40	-19.64	14.36	237.70	
3A	224.00	9.50	- 9.30	224.79	224.00	-0.79	18.80	21.30	-20.51	13.49	237.49	
3B	225.29	9.90	- 9.70	226.12	225.29	-0.83	19.60	22.20	-21.37	12.63	237.92	
3C	229.35	12.10	-11.60	230.36	229.35	-1.01	23.70	26.85	-25.84	8.16	237.51	
4	230.28	12.50	-11.80	231.32	230.28	-1.04	24.30	27.50	-26.46	7.54	237.82	
5	230.62	12.60	-11.90	231.67	230.62	-1.05	24.50	27.80	-26.75	7.25	237.87	
6	230.54	11.90	-11.40	231.53	230.54	-0.99	23.30	26.40	-25.41	8.59	239.13	
6A	230.25	12.20	-11.70	231.27	230.25	-1.02	23.90	27.10	-26.08	7.92	238.17	
6B	229.92	12.10	-11.60	230.93	229.92	-1.01	23.70	26.85	-25.84	8.16	238.08	

TABLE VI - CONTINUED

0	1	2	3	4	5	6	7	8	9	10	11	
Pz.No.	*Man. Elev.*	*Hg In. Left Leg*	*Hg In. Right Leg*	*El. Hg* (Col 1+ Col 2)	*El. Pz.*	*H_w* = (Col 5- Col 4)	*Hg In.*= (Col 2+ Col 3)	*wgHg*= (1.133 Col 7)	*(wgHg+wHw)*= -(Col 8 + Col 6)	*Pz = Pa +wgHg+wHw)* (34+Col 9)	*Hydraulic Gradient* (Col 5+ Col 10)	*REMARKS*
							AUGUST 12, 1939					
7	228.38	11.5	-10.9	229.34	228.38	-0.96	22.4	25.40	-24.44	9.56	237.94	*Correct for 1" H_2O*
7A	227.57	11.2	-10.6	228.51	227.57	-0.94	21.8	24.75	-23.81	10.19	237.76	*in Right leg of man-*
8	226.38	10.9	-10.3	227.29	226.38	-0.91	21.2	24.05	-23.14	10.86	237.24	*ometer*
8A	225.36	10.3	- 9.8	226.22	225.36	-0.86	20.1	22.80	-21.94	12.06	237.42	
8B	224.47	10.1	- 9.7	225.31	224.47	-0.84	19.8	22.45	-21.61	12.39	236.86	
9	224.12	9.9	-9.6	224.95	224.12	-0.83	19.5	22.10	-21.27	12.73	236.85	
9A	223.66	9.8	- 9.5	224.48	223.66	-0.82	19.3	21.85	-21.03	12.97	236.63	
9B	220.82	7.9	- 8.1	221.48	220.82	-0.66	16.0	18.04	-17.38	16.62	237.44	
10	217.70	7.4	- 7.7	218.32	217.70	-0.62	15.1	17.10	-16.48	17.52	235.22	
10A	214.82	4.6	- 5.3	215.20	214.82	-0.38	9.9	11.20	-10.82	23.18	238.00	
10B	209.97	1.8	- 3.2	210.12	209.97	-0.15	5.0	5.67	- 5.52	28.48	238,45	
10C	209.53	1.6	- 3.1	209.66	209.53	-0.13	4.7	5.32	- 5.19	28.81	238.34	
11	204.70				204.70							
2A T	227.92	8.4	- 8.6	228.62	225.71	-2.91	17.0	19.25	-16.34	17.66	243.37	
3C T	236.13	13.8	-13.0	237.28	233.91	-3.37	26.8	30.04	-26.67	7.33	241.24	
8 T	232.97	13.1	-12.5	234.06	230.75	-3.31	25.6	29.00	-25.69	8.31	239.06	
8 B	221.69	8.4	- 8.6	222.39	221.73	-0.66	17.0	19.25	-18.59	15.41	237.14	
9A T	230.18	11.6	-11.2	231.15	227.96	-3.19	22.8	25.85	-22.66	11.34	239.30	
9A B	219.19	8.0	- 8.1	219.86	219.23	-0.63	16.1	18.24	-17.61	16.39	235.62	
							AUGUST 14, 1939					
0	213.46	2.10	- 1.90	213.64	212.05	-1.59	4.00	4.54	-2.95	31.05	243.10	*Trash Rack* - 210.04
1	212.74	2.10	- 1.90	212.92	212.74	-0.18	4.00	4.54	-4.36	29.64	242.38	*Inlet Basin* - 209.78
1A	215.42	4.40	- 3.70	215.79	215.42	-0.37	8.10	9.20	-8.83	25.17	240.59	*Outlet Basin*- 207.32
2	217.98	6.10	- 5.10	218.49	216.98	-0.51	11.20	12.70	-12.19	21.81	239.79	*Air Temp.* - 90°F
2A	221.45	7.70	- 6.40	222.09	221.45	-0.64	14.20	15.95	-15.31	18.69	240.14	*H_2O Temp.* - 78°F
3	223.34	8.60	- 7.10	224.06	223.34	-0.72	15.70	17.80	-17.08	16.92	240.26	*Barometer* - 30.05"
3A	224.00	9.10	- 7.40	224.76	224.00	-0.76	16.50	18.70	-17.94	16.06	240.06	*Two Outside Pipes*
3B	225.29	9.70	- 8.00	226.10	225.29	-0.81	17.70	20.01	-19.20	14.80	240.09	*Running*
3C	229.35	11.80	- 9.80	230.34	229.35	-0.99	21.60	24.48	-23.49	10.51	239.86	*Vac.= 25" Hg*
4	230.28	12.10	- 10.10	231.29	230.28	-1.01	22.20	25.15	-24.14	9.86	240.14	
5	230.62	12.30	- 10.30	231.65	230.62	-1.03	22.60	25.60	-24.57	9.43	240.05	
6	230.54	12.25	- 10.20	231.56	230.54	-1.02	22.45	25.75	-24.43	9.57	240.11	
6A	230.25	11.90	- 9.90	231.24	230.25	-0.99	21.80	24.70	-23.71	10.29	240.54	
6B	229.92	11.80	- 9.80	230.91	229.92	-0.99	21.60	24.50	-23.51	10.49	240.41	
7	228.38	11.05	-9.10	229.30	228.38	-0.92	20.15	22.80	-21.88	12.12	240.50	
7A	227.57	10.60	- 8.80	228.46	227.57	-0.89	19.40	22.00	-21.11	12.89	240.46	
8	226.38	10.10	- 8.40	227.22	226.38	-0.84	18.50	20.95	-21.11	13.89	240.27	
8A	225.36	9.50	- 8.00	226.15	225.36	-0.79	17.50	19.85	-19.06	14.94	240.30	
8B	224.47	9.30	- 7.80	225.25	224.47	-0.78	17.10	19.35	-18.57	15.43	239.90	

TABLE VI - CONTINUED

0	1	2	3	4	5	6	7	8	9	10	11	
Pz. No.	*Man. Elev.*	*Hg In. Left Leg*	*Hg In. Right Leg*	*El. Hg* (Col 1+ Col 2)	*El. Pz.*	H_w= (Col 5– Col 4)	*Hg In.*= (Col 2+ Col 3)	*wgHg*= (1.133 Col 7)	(*wgHg+wHw*)= –(Col 8 + Col 6)	*Pz* = *Pa* +(*wgHg+wHw*) (34+Col 9)	*Hydraulic Gradient* (Col 5+ Col 10)	*REMARKS*
							AUGUST 14, 1939					
9	224.12	9.10	-7.80	224.88	224.12	- .76	16.90	19.15	-18.39	15.61	239.73	
9A	223.66	8.80	-7.50	224.39	223.66	- .73	16.30	18.45	-17.72	16.28	239.94	
9B	220.82	7.10	-6.40	221.41	220.82	- .59	13.50	15.30	-14.71	19.29	240.11	
10	217.70	6.30	-5.60	218.23	217.70	- .53	11.90	13.49	-12.96	21.04	238.74	
10A	214.82	4.10	-3.80	215.16	214.82	- .34	7.90	8.95	- 8.61	25.39	240.21	
10B	209.97	1.30	-1.60	210.08	209.97	- .11	2.90	3.28	- 3.17	30.83	240.80	
10C	209.53	1.00	-0.80	209.61	209.53	- .08	1.80	2.04	- 1.96	32.04	241.57	
11	230.00	*			204.70			*	+ 0.50	34.50	239.20	
							AUGUST 16, 1939					
0	213.46	2.50	-2.20	213.67	212.05	-1.62	4.70	5.33	- 3.71	30.29	242.34	*Trash Rack* - 209.17
1	212.74	3.10	-2.70	213.00	212.74	- .26	5.80	6.57	- 6.31	27.69	240.43	*Inlet Basin* - 208.79
1A	215.42	5.20	-4.50	215.85	215.42	- .43	9.70	11.00	-10.57	23.43	238.85	*Outlet Basin* - 206.53
2	217.98	7.20	-6.10	218.58	217.98	- .60	13.30	15.08	-14.48	19.52	237.50	*Air Temp.* -
2A	221.45	9.00	-7.30	222.20	221.45	- .75	16.30	18.49	-17.74	16.26	237.71	*Barometer* -
3	223.34	10.00	-8.20	224.17	223.34	- .83	18.20	20.65	-19.82	14.18	237.52	H_2O *Temp.* -
3A	224.00	10.25	-8.40	224.85	224.00	- .85	18.65	21.15	-20.30	13.70	237.70	*West Pipe Running,*
3B	225.29	10.90	-9.00	226.20	225.29	- .91	19.90	22.55	-21.64	12.36	237.65	*Vac.* = 25.5" *Hg*
3C	229.35	13.10	-10.80	230.44	229.35	-1.09	23.90	27.10	-26.01	7.99	237.34	
4	230.28	13.40	-11.10	231.40	230.28	-1.11	24.50	27.80	-26.695	7.31	237.59	
5	230.62	13.45	-11.10	231.74	230.62	-1.12	24.55	27.81	-26.69	7.31	237.93	
6	230.54	13.45	-11.10	231.66	230.54	-1.12	24.55	27.81	-26.69	7.31	237.85	
6A	230.25	12.90	-10.60	231.32	230.25	-1.07	23.50	26.61	-25.54	8.46	238.71	
6B	229.92	12.90	-10.60	230.99	229.92	-1.07	23.50	26.61	-25.54	8.46	238.38	
7	228.38	12.30	-10.10	229.40	228.38	-1.02	22.40	25.40	-24.38	9.62	238.00	
7A	227.57	11.75	- 9.60	228.55	227.57	- .98	21.35	24.20	-23.22	10.78	238.35	
8	226.38	11.40	- 9.30	227.33	226.38	- .95	20.70	23.45	-22.50	11.50	237.88	
8A	225.36	10.95	- 9.00	226.27	225.36	- .91	19.95	22.60	-21.69	12.31	237.67	
8B	224.47	10.30	- 8.40	225.33	224.47	- .86	18.70	21.20	-20.34	13.66	238.13	
9	224.12	10.20	- 8.40	224.97	224.12	- .85	18.60	21.10	-20.25	13.75	237.87	
9A	223.66	10.10	- 8.30	224.50	223.66	- .84	18.40	20.85	-20.01	13.99	237.65	
9B	220.82	8.50	- 7.10	221.53	220.82	- .71	15.60	17.66	-16.95	17.05	237.87	
10	217.70	7.70	- 6.40	218.34	217.70	- .64	14.10	15.98	-15.34	18.66	236.36	
10A	214.82	5.20	- 4.60	215.25	214.82	- .43	9.80	11.11	-10.68	23.32	238.14	
10B	209.97	2.60	- 2.30	210.19	209.97	- .22	4.90	5.56	- 5.34	28.66	238.63	
10C	209.53	2.10	- 1.90	209.70	209.53	- .17	4.00	4.54	- 4.37	29.63	239.16	
11												

TABLE VII

Section	$\frac{V^2}{2g}$	V^2	V	Computed Effective Area	Actual Area of pipe	
			JULY 24, 1939			
1	0.75	48.2	6.96	123	83.3	Q = 856
2	3.12	201	14.19	60.4	63.6	H = 3.00
3	3.12	201	14.19	60.4	63.6	
4					63.6	
5	2.35	151	12.30	69.6	63.6	
6	2.75	177	13.31	64.4	63.6	
			JULY 25, 1939			
1	1.00	64.4	8.03	92.6	83.3	Q = 742
2	2.90	187	13.69	54.4	63.6	H = 2.25
3	2.75	177	13.31	55.7	63.6	
4	1.82	117	10.82	68.6	63.6	
5	2.25	145	12.05	61.5	63.6	
6	2.00	129	11.38	65.3	63.6	
7	1.85	119	10.91	68.1	63.6	
8	1.60	103	10.18	73.0	63.6	
9	1.50	96.6	9.84	75.4	63.6	
10	2.00	129	10.38	71.6	63.6	
11	0.37	23.8	4.88	152.2	103.9	
			JULY 29, 1939			
1	1.40	90.5	9.52	65.9	83.3	Q = 627
2	2.00	129	11.38	55.2	63.6	H = 1.50
3	2.00	129	11.38	55.2	63.6	
4	1.75	113	10.61	59.1	63.6	
5	1.75	113	10.61	59.1	63.6	
6	2.00	129	11.38	55.2	63.6	
7	1.50	96.6	9.84	63.8	63.6	
8	1.40	90.5	9.52	65.8	63.6	
9	1.40	90.5	9.52	65.8	63.6	
10	1.80	116	10.78	58.2	63.6	
11	.80	51.6	7.18	87.4	103.9	
			JULY 31, 1939			
1	1.25	80.6	8.96	90.9	83.3	Q = 815
2	3.50	226	15.05	54.2	63.6	H = 2.70
3	3.75	242	15.59	52.4	63.6	
4	3.25	210	14.51	56.1	63.6	
5	2.90	188	13.71	59.4	63.6	
6	3.25	210	14.51	56.1	63.6	
7	3.50	226	15.05	54.2	63.6	
8	2.75	177	13.31	61.2	63.6	
9	2.50	161	12.70	64.2	63.6	
10	2.87	185	13.61	59.8	63.6	
11	1.75	113	10.62	76.7	103.9	
			AUGUST 1, 1939			
1	2.00	129	11.38	71.7	83.3	Q = 816
2	3.25	210	14.50	56.4	63.6	H = 2.58
3	3.25	210	14.50	56.4	63.6	
4	2.75	177	13.31	61.2	63.6	
5	3.25	210	14.50	56.4	63.6	
6	2.65	171	13.09	62.4	63.6	
7	2.10	135	11.61	70.2	63.6	
8	2.20	142	11.92	68.6	63.6	
9	1.75	113	10.62	76.8	63.6	
10					63.6	
11	1.00	61.4	8.03	101.5	103.9	

TABLE VII - CONTINUED

Section	$\frac{V^2}{2g}$	V^2	V	Computed Effective Area	Actual Area of pipe	
			AUGUST 7, 1939			
1	1.37	88.2	9.40	90.60	83.3	Q = 851
2	4.25	274	16.59	51.30	63.6	H = 2.95
3	3.67	236	15.38	55.40	63.6	
4	3.67	236	15.38	55.40	63.6	
5	3.50	226	15.04	56.40	63.6	
6	3.50	226	15.04	56.40	63.6	
7	2.50	161	12.70	67.10	63.6	
8	2.25	145	12.05	70.60	63.6	
9	2.25	145	12.05	70.60	63.6	
10	3.00	193	13.80	61.60	63.6	
11	.67	43.2	6.58	129	103.9	
			AUGUST 8, 1939			
1	1.30	83.6	9.14	90.50	83.3	Q= 827
2	3.60	232	15.24	54.20	63.6	H= 2.77
3	4.20	271	16.50	50.10	63.6	
4	3.40	219	14.80	55.80	63.6	
5	2.60	168	12.98	63.50	63.6	
6	3.40	219	14.80	55.80	63.6	
7	2.40	155	12.47	66.40	63.6	
8	2.20	142	11.91	69.40	63.6	
9	1.90	123	11.10	74.50	63.6	
10	2.70	174	13.20	62.60	63.6	
11						
			AUGUST 9, 1939			
0	1.25	80.5	8.96	121	103.8	Q = 1085
1	3.12	202	14.22	76.1	83.3	H = 4.80
2	7.75	500	22.39	48.5	63.6	
3	7.00	451	21.25	51.2	63.6	
4	6.00	396	19.91	54.4	63.6	
5	5.50	354	18.82	57.6	63.6	
6	5.75	371	19.27	56.4	63.6	
7	4.87	314	17.71	61.3	63.6	
8	4.25	274	16.58	65.4	63.6	
9	4.25	274	16.58	65.4	63.6	
10	5.00	322	17.98	60.3	63.6	
11	1.50	96.6	9.83	110.5	103.9	
			AUGUST 11, 1939			
0	2.50	161	12.69	90.4	103.8	Q = 1145
1	2.90	187	13.69	83.6	83.3	H = 5.30
2	6.75	435	20.85	54.9	63.6	
3	6.75	435	20.85	54.9	63.6	
4	6.25	402	20.10	57.0	63.6	
5	6.00	386	19.65	58.3	63.6	
6	5.90	380	19.50	58.7	63.6	
7	7.40	476	21.85	52.4	63.6	
8	4.50	290	17.05	67.1	63.6	
9	3.75	242	15.58	73.6	63.6	
10	5.50	352	18.78	61.0	63.6	
11	3.75	242	15.58	73.5	103.9	
3A	6.75	435	20.85		63.6	

Table VII
Sheet # 2

TABLE VII - CONTINUED

Section	$\frac{V^2}{2g}$	V^2	V	Computed Effective Area	Actual Area of pipe	
			AUGUST 12, 1939			
0	2.25	145	12.04	93.6	103.8	Q = 1128
1	1.70	109	10.42	108.1	83.3	H = 5.08
2	6.60	425	20.61	54.7	63.6	
3	6.85	441	21.01	53.6	63.6	
4	5.80	374	19.38	58.2	63.6	
5	5.80	374	19.38	58.2	63.6	
6	4.50	290	17.05	66.2	63.6	
7	4.50	290	17.05	66.2	63.6	
8	4.50	290	17.05	66.2	63.6	
9	4.00	250	15.81	71.3	63.6	
10	5.25	338	18.41	61.2	63.6	
11	1.80	116	10.78	104.5	103.9	
			AUGUST 14, 1939			
1	0.25	16	4.00	198.00	83.3	Q = 791
2	3.00	192	13.85	57.1	63.6	H = 2.55
3	2.37	152	12.41	63.6	63.6	
3A	2.50	160	12.65	62.6	63.6	
3B	2.40	153	12.38	63.8	63.6	
4	2.10	135	11.61	68.2	63.6	
5	2.12	136	11.62	68.1	63.6	
6	1.87	120	10.97	72.2	63.6	
7	1.25	80.6	8.97	88.2	63.6	
8	1.00	64.4	8.03	98.6	63.6	
9	1.12	72.2	8.44	93.8	63.6	
10	1.87	120	10.97	72.7	63.6	
11	1.25	80.6	8.97	88.3	103.9	
			AUGUST 16, 1939			
0	.50	32.2	5.68	133.8	103.8	Q = 760
1	2.38	153	12.39	61.4	83.3	H = 2.40
2	5.37	347	18.65	40.8	63.6	
3	5.25	338	18.40	41.3	63.6	
3A	5.00	322	17.99	42.3	63.6	
3B	4.87	314	17.71	42.8	63.6	
4	4.87	314	17.71	42.8	63.6	
5	4.66	300	17.32	43.8	63.6	
6	4.60	296	17.21	44.1	63.6	
7	4.00	258	16.10	47.2	63.6	
8	3.50	226	15.05	50.4	63.6	
9	3.20	208	14.45	52.6	63.6	
10	4.50	290	17.05	44.6	63.6	
11	2.10	135	11.61	65.4	103.9	

Table VII
Sheet # 3

TABLE VIII

PITOT TUBE READINGS - MARKED TREE SIPHON

Distance From Wall	Observed Head Mm. Hg	Head Ft. H_2O	Velocity $v = \sqrt{2gH}$	$V' = C\sqrt{2gH}$ C = .91	REMARKS
				AUGUST 8, 1939	
0.20	40.0	1.65	10.32	9.4	Top of siphon outlet leg
1.20	45.0	1.86	10.95	9.95	
2.20	75.0	3.10	14.12	12.85	
3.20	65.0	2.68	13.15	11.95	Pitot tube No. 2
4.20	65.0	2.68	13.15	11.95	
4.70	60.0	2.48	12.65	11.50	
0.20	75.0	3.10	14.12	12.85	Side of siphon outlet leg
1.20	80.0	3.31	14.60	13.30	
2.20	90.0	3.71	15.50	14.10	
2.70	100.0	4.13	16.30	14.82	
3.20	120.0	4.96	17.90	16.28	Pitot tube No. 2
4.20	120.0	4.96	17.90	16.28	
4.70	120.0	4.96	17.90	16.28	
				AUGUST 11, 1939	
0.20	190	7.84	22.50	20.42	Top of siphon inlet leg
1.20	200	8.26	23.10	21.00	
2.20	215	8.87	23.90	21.75	
3.20	210-15	8.75	23.80	21.62	Tube No. 2
4.20	205	8.45	23.35	21.10	
4.50	200	8.26	23.10	21.00	
0.20	125	5.16	18.25	16.55	Top of siphon outlet leg
1.20	140	5.77	19.30	17.55	
2.20	155	6.40	20.33	18.50	
3.20	160	6.60	20.60	18.72	Tube No. 2
4.20	180	7.43	21.90	19.92	
4.50	175	7.22	21.60	19.63	
4.70	185	7.64	22.20	20.20	
				AUGUST 14, 1939	
0.25	50	2.06	11.51	10.50	
0.50	80	3.30	14.60	13.28	Side of siphon inlet leg
1.00	100	4.125	16.30	14.82	
1.50	105	4.33	16.72	15.20	
2.00	110	4.54	17.10	15.55	
2.50	100	4.125	16.30	14.82	
3.00	120	4.95	17.88	16.25	Tube No. 2
3.50	125	5.16	18.26	16.60	
4.00	135	5.57	18.95	17.25	
4.50	152.5	6.29	20.20	18.40	
5.00	147.5	6.08	19.80	18.00	
5.50	135	5.57	18.95	17.25	
6.00	135	5.57	18.95	17.25	
6.50	155	6.40	20.40	18.55	
7.00	140	5.77	19.30	17.56	
7.50	140	5.77	19.30	17.56	
8.00	130	5.36	18.60	16.90	
8.50	120	4.95	17.88	16.28	
8.75	115	4.74	17.50	15.91	
9.00	95	3.92	15.90	14.48	

TABLE VIII - CONTINUED

Distance From Wall	*Observed Head Mm. Hg*	*Head Ft. H_2O*	*Velocity* $v = \sqrt{2gH}$	$V' = C\sqrt{2gH}$ $C = .91$	*REMARKS*
0.25	55	2.27	12.10	11.00	*Top of siphon inlet leg*
0.50	60	2.47	12.61	11.49	
1.00	70	2.89	13.61	12.40	
1.50	72.5	2.99	13.90	12.65	
2.00	80	3.30	14.60	13.30	
2.50	78	3.22	14.40	13.10	*Tube No. 2*
3.00	80	3.30	14.60	13.30	
3.50	80	3.30	14.60	13.30	
4.00	75	3.09	14.10	12.83	
4.50	85	3.51	15.01	13.68	
5.00	90	3.72	15.50	14.10	
5.50	87	3.59	15.20	13.82	
6.00	92	3.80	15.65	14.22	
6.50	95	3.92	15.90	14.46	
7.00	90	3.72	15.50	14.10	
7.50	90	3.72	15.50	14.10	
8.00	85	3.51	15.01	13.[illegible]	
8.50	90	3.72	15.50	14.10	
8.75	80	3.30	14.60	13.30	
9.00	63	2.60	12.95	11.80	

TABLE VIII - CONTINUED

Distance From Wall	Observed Head Mm. Hg	Head Ft. H_2O	Velocity $v = \sqrt{2gH}$	$V' = C\sqrt{2gH}$ $C = .93$	REMARKS
			AUGUST 15, 1939		
0.25	30	1.24	8.94	8.3	
0.50	60	2.47	12.61	11.72	
1.00	55	2.27	12.08	11.25	*Manometer mercury extremely turbulent*
1.50	65	2.68	13.18	12.28	
2.00	70	2.89	13.65	12.70	
2.50	75	3.09	14.10	13.10	
3.00	80	3.30	14.60	13.58	
3.50	85	3.51	15.01	13.96	*Two outside siphons running - Vac. = 24"*
4.00	102	4.21	16.30	15.18	
4.50	107	4.42	16.90	15.70	
5.00	110	4.54	17.10	15.90	*Readings taken through opening in side of inlet leg, using pitot tube # 3.*
5.50	112	4.62	17.30	16.10	
6.00	110	4.54	17.10	15.90	
6.50	110	4.54	17.10	15.90	
7.00	110	4.54	17.10	15.90	
7.50	110	4.54	17.10	15.90	
8.00	110	4.54	17.10	15.90	
8.50	105	4.33	16.72	15.55	
8.75	100	4.125	16.30	15.15	
9.00	85	3.51	15.01	13.96	
			AUGUST 18, 1939		
0.25	95	3.92	15.90	14.80	*Side of outlet leg*
0.50	120	4.96	17.90	16.62	
1.00	150	6.20	20.00	18.60	
1.50	175	7.24	21.60	20.10	*Tube No. 3*
2.00	170	7.02	21.30	19.80	
2.50	170	7.02	21.30	19.80	
3.00	160	6.61	20.62	19.20	
3.50	165	6.82	21.00	19.51	
4.00	170	7.02	21.30	19.80	
4.50	160	6.61	20.62	19.20	
5.00	185	7.65	22.20	19.20	
5.50	190	7.85	22.50	20.93	
6.00	190	7.85	22.50	20.93	
6.50	182	7.52	22.00	20.43	
7.00	187	7.72	22.30	20.72	
7.50	195	8.05	22.80	21.20	
8.00	192	7.94	22.70	21.10	
8.50	192	7.94	22.70	21.10	
8.75	125	5.16	18.25	16.95	
9.00	120	4.96	17.90	16.65	
0.25	45	1.86	10.95	10.20	*Side of inlet leg Tube No. 3*
0.50	85	3.51	15.01	14.00	
1.00	90	3.71	15.45	14.35	
1.50	90	3.71	15.45	14.35	
2.00	135	5.57	18.95	17.65	
2.50	170	7.02	21.30	19.80	
3.00	195	8.05	22.80	21.20	
3.50	135	5.57	18.95	17.65	
4.00	170	7.02	21.30	19.80	
4.50	170	7.02	21.30	19.80	
5.00	230	9.50	24.80	23.05	
5.50	225	9.30	24.50	22.80	
6.00	220	9.10	24.20	22.50	
6.50	230	9.50	24.80	23.05	
7.00	215	8.88	24.00	22.35	
7.50	250	10.32	25.80	24.00	