A Report On
THE CITY AND COUNTY OF DALLAS LEVEE IMPROVEMENT DISTRICT
AND
DALLAS COUNTY LEVEE IMPROVEMENT DISTRICT NO. 5

A thesis submitted to the faculties of
The School of Engineering and the Graduate School of
The University of Kansas

For

THE DEGREE OF CIVIL ENGINEER

By

John Clifford Bisset

1928
PREFACE

In preparing this thesis, it has been the intention of the writer to present a complete report on the necessity for and the design of "The City and County of Dallas Levee Improvement District, and also to show in a small way what this District will mean to the future development of the City of Dallas.

This District, when completed, will straighten the Trinity River through Dallas, and protect thousands of acres of land from overflow. Much of this land lies within the heart of the city, and when protected from flood, will be accessible from every railroad and thorofare for industrial and residential purposes.

The writer wishes to express his thanks to the firm of Myers, Noyea & Forrest, District Engineers, for assistance in allowing the use of maps and data from their office. He has been in the employ of this firm for about four years, the majority of this time helping in the promotion of the work.

Dallas, Texas.
March 1, 1928.

J. C. Bisset.
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GENERAL DESCRIPTION OF RECLAMATION PLAN
The City of Dallas is situated on the Trinity River about 510 miles above its mouth. Above Dallas the drainage area of the river is about 6,000 square miles, this area being largely made up of open country. The elevation of the valley at Dallas is 400 feet above mean Gulf level, while a large portion of the business area is on a bench, having an elevation varying from 410 to 440 feet.

The City of Dallas is separated into two sections by this river valley, that portion on the west being known as Oak Cliff and having a population of possibly 60,000, while the main business section of the city lies on the east side of the river with a population of approximately 250,000 people. The main residence section of the city lies to the north, east and southeast of the business section.

The valley of the Trinity River through Dallas has a width varying from one to three miles, the greatest width being northwest of the business section where Elm Fork and West Fork of the Trinity join. The bottom lands are not available for use except for farming and gardening on account of frequent overflows, and the greater floods enter the business and manufacturing district of the city. This division of the city by the wide unoccupied valley has to a certain extent, hampered a thorough cooperation between the two sections of the city, and the barrier has also retarded the proper expansion of the business and manufacturing districts.

In 1918, Dallas County Levee Improvement District No. 5 was organized for the purpose of reclaiming 5,000 acres of land lying northwest of the city, and levees ranging in height from 20 to 25 feet were constructed, and the land cleared, and placed under cultivation. These levees have so far protected this land from overflow, with the result that this is now
one of the richest farms in the State.

In 1920, a movement was started to construct a levee system to protect about 4,000 acres in the valley, through the city and above, at an estimated cost of $5,000,000. It was found upon investigation that the distribution of cost would work too great a hardship on the land owners, and the plan was temporarily abandoned. This district, known as No.10, necessarily had to take into account the levees of District No.5, as a consequence of which it was necessary to leave unprotected several thousand acres of well located land which would have an enormous potential value if reclaimed from overflow.

Rapid development of the City of Dallas in the past few years, as a distributing center for the southwest, and the increasing demand for industrial and residential areas, has been the cause for developing an entire revision of the reclamation plan of Districts Nos. 5 & 10, which revision is shown on the district map.

Under the present plan of reclamation it is proposed to divert Elm Fork of the Trinity River toward the hills at the west side of the valley, beginning at a point opposite Bachman's Lake, and carrying it south along the western hills to a junction with West Fork at the southwest corner of the present District No.5. West Fork of the Trinity River is to be held to the north of a levee starting from the hills on the south side of the valley at Eagle Ford, swinging north and then east to the junction with Elm Fork. From this point the river is to be carried between parallel levees in a southerly and southeasterly direction through the city to the Santa Fe railroad where the levees diverge and tie into high ground.

The above plan will necessitate the abandonment of several miles of levee in District No.5 and will require the construction of approximately 25 miles of new levee. The new levees are designed with a floodway of from 2000 to 3000 feet in width, and high enough to carry the greatest known
floods with a large factor of safety.

A complete system of interior drainage will carry the surface water to several pump plants which are to be constructed as hereinafter discussed.

The City and County of Dallas Levee Improvement District includes within its boundaries 9,314 acres of land, all lying within the business area and industrial limits of the City of Dallas. Of this area, 7,217 acres will be reclaimed, in addition to 3,336 acres of land in District No. 5 which will also be protected.

That portion of land in the valley opposite the city is at present of very low value, except in a speculative sense, on account of the frequent floods which cover it. It is held at a price ranging upward to $1,000 per acre, but immediately upon being protected this value should increase to as high as $1.00 per square foot or $40,000 per acre. This is particularly true of about 1700 acres on the east side, extending from the Santa Fe railroad on the south to Turtle Creek Pump Station on the north. North of the pump station the values range from $75 to $300 for that which is protected by the levees of District No. 5.

The 270 acres reclaimed on the Oak Cliff side is now being developed for cheap residences. This area has a present value of possibly $1,000 per acre, and should be worth from $6,000 to $8,000 when protected. The 2150 acres of land lying along the Texas and Pacific railroad, which can well be called the T & P industrial district, has values at present ranging from $75 to $750 an acre. As soon as this land is made safe from overflow, it will be in good demand at industrial property prices.

This proposed levee district is the only area in the vicinity of Dallas which is served by all of the railroads which enter the city. The Rock Island crosses the District on the north end and borders it on the east. This road is used jointly by the Burlington, Southern Pacific and Frisco lines. The Texas and Pacific crosses the district at about the center, extending through
what has been called the T & P industrial district for about three miles. The Santa Fe borders the district on the south, and is preparing to construct an industrial track parallel to the Texas and Pacific through its industrial district. The Cotton Belt and the Katy railroads border the district on the east, and all enter the Union Terminal Passenger Station which is just below Commerce Street on the east side of the valley. The accessibility of these railroad facilities makes this district the ideal area for development into a modern industrial section for the city.

Revised plans for the new district greatly simplify the railroad revision necessary over the old plan of District No. 10. On the south the Santa Fe railroad can meet the district plans at a very small expense. The Rock Island and Texas and Pacific railroads cross the new river channel and it will be necessary to construct trestles over the floodway and steel spans across the new channel.

The Dallas Street Railway viaduct crossing the river bottoms is also used by five interurban lines entering the city. The Street Railway Company is under contract with the city to rebuild this viaduct at such time as demanded. Under present conditions the viaduct would have a length of about 6,000 feet, while after the construction of the new levees, this length will be reduced to 2,000 feet, thereby effecting a considerable saving.

The present highway system of the county carries four main roads across this district as follows: Commerce Street Pike, extending to the west, one branch leading to Fort Worth, and one branch known as Eagle Ford Pike, extending the full length of the T & P industrial district, as a hard surface highway leading to Irving, Fort Worth, and the territory north and west of the city. The Record Crossing road and Grawyler road run west from the northerly portion of the city across the district and serve the territory to the northwest. The Dallas-Oak Cliff viaduct crosses the district
at a point about a mile south of the Commerce Street Pike. This is the main trafficway between the business section of Dallas and the residence section of Oak Cliff. It also serves all of the cities lying south of Dallas, and is the only trafficway serving the two sections of Dallas in time of high flood, Commerce Street being inundated. With the construction of the levees, a number of new river crossings are contemplated, and will be discussed under the heading of "Future Development".

All of the public utilities serve the reclaimed area with very little adjustment. The Water Filtration Plant and main pumping station of the city is located within the district, and large mains touch the district at various points throughout its length. With the completion of Garza Dam on Elm Fork, an ample supply of water will be assured the city for a number of years to come. The main Interceptor Sewers serving the eastern and western portion of the city, lie within the lower portion of the district, and will be available at once. The power plant of the Dallas Power & Light Co. is located at the east side of the district. This plant is now going under an enlargement to meet future needs of the city and in order to insure a supply of electric power in case of a breakdown of the Dallas plant, it is interconnected with the main system of the Texas Power & Light Co., whose high lines traverse the district throughout its entire length. A number of oil and gas pipe lines also cross the district at various locations.
PART NUMBER TWO

FLOODWAY AND LEVEE DESIGN
Hydraulic Design

In the design of levees and channel improvements, it is of first importance to determine the magnitude of the greatest flood likely to occur. Unfortunately, flood flows in rivers are difficult to measure accurately. They come suddenly and at infrequent intervals, and in most of the Dallas floods of the past, no one has been sufficiently interested to make accurate measurements. However, for the past eight or ten years, the State Reclamation Department has maintained a stream guaging party, and from now on more complete records will be available. The U.S. Weather Bureau maintains a guaging station on the Commerce Street Viaduct, and from these records, together with stream guagings taken by the Government Geological Survey, a good rating curve for most of the floods is available.

The drainage area of the Trinity River above Dallas is 6,050 square miles. The drainage area of Elm Fork 2,684 sq.mi. and that of West Fork is 3,366 sq.mi. The watersheds of these two branches of the river come together at a point about three miles above Dallas, as shown on the District Map. The characteristics of the drainage areas are similar and the runoff factors have been assumed as equal on the two forks of the river.

The report on "The Watershed of the Trinity River", by Mr. E.N. Noyes, Dallas, Texas, copies of which are on file at the University of Kansas, gives a complete account of the various storms on the watershed, so that only a general discussion of the 1908 flood which served as a basis of design for this district will be used.

The maximum flood of which there is any authentical record, occurred in 1908 and reached a crest elevation of 420.6, U.S.G.S. Datum. Floods of nearly the same magnitude occurred in 1822, 1844, 1866, 1871, and 1890 but no exact records have been kept. However it is a fairly certain fact that all of them were higher than elevation 413.0 U.S.G.S. While current meter guagings have been taken of floods at Dallas up to an elevation of approximately 408.0, the volume passing at a stage above 408.0 must necessarily be determined from slopes of
Flood Stage Curve showing Number of Times River Stage Has Reached a Given Elevation in Last 21 Years.

City & County of Dallas
Levee Improvement District
Myers & Noyes, District Engineers
Dallas, Texas, July 31, 1926.

Note: Zero of U.S.W.B equals Elev. 368.0 of U.S.G.S.
the water surface, cross sections of the valley and assumed factors of roughness.

After a thorough study of the subject by the Engineers of the United States Geological Survey, the State Board of Water Engineers, the State Reclamation Engineer and the Engineers for the District, the general consensus of opinion is that the flow of 1908 approximated 250,000 c.f.s., and the computations for the design of the levee structures are based on this assumption. Some authorities have determined a flood flow of 180,000 c.f.s. for this flood, and for basis of comparison this figure is also mentioned.

The accumulated rainfall, over a period of several days, causing the flood of 1908, varied from 7" at Decatur to 17" at Gainesville, and the runoff from the 6,050 sq. mi. watershed equalled 41 c. f. s. per sq. mi. One of the heaviest rainfalls recorded in the Southwest, fell on the Little River at Leon Junction in September, 1921. The accumulated rainfall recorded varied from 11" to 16" over the watershed, while the runoff amounted to 62.6 c. f. s. per sq. mi. (See U.S. Water Supply Paper #488, U.S.G.S.)

The levees at Dallas are designed for 85 C.F.S. per sq.mi. runoff, or a total of 500,000 c.f.s. Bases upon the assumption that the runoff of the 1908 flood was 180,000 c.f.s. there is a factor of safety of 180%. On the basis of design, i.e. using 250,000 c.f.s., as the record runoff of 1908, there is a factor of safety of 100%. Based on the assumption that a storm similar to that of the Little River in 1921 should fall on the Trinity River drainage area above Dallas, there would still be a factor of safety of 33-1/3%. In other words the general design is amply safe to take care of any flood which might be possible from the greatest rainfall of record in this territory.

The floodway of Elm Fork has been designed to take care of 240,000 c.f.s. and that on West Fork of 300,000 C.F.S. in proportion to the drainage area of the two branches, while the main floodway, as stated above, will
GRAPHICAL TABULATION OF FLOOD RUN-OFF RECORDS AND THEIR RELATION TO SUGGESTED RUNOFF FORMULAS

LEGEND
Northeastern United States
Southeastern
Southwestern
Northwestern
Mississippi Valley
Rocky Mountains
Great Basin
Expected Peaks \( \mathcal{C} \) or \( \mathcal{F} \) or \( \mathcal{S} \)
Alaska
Canada
Hawaii
Mexico
Panama
Foreign Rivers
carry the total of 500,000 c.f.s.

The design of levee heights and floodway widths have been based on Kutters Formula. A complete set of hydraulic calculations for this design are included in this report, along with the resultant levee profiles.

In addition to taking care of maximum floods, the effect of minor floods in backing up water on West Fork and Elm Fork have been taken into consideration, and the levees and channels have been so designed that no greater backing up of water will take place than exists at present, while particularly on Elm Fork back water from small floods will be relieved, due to the effect of Record Crossing Dam.
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## Floodway Calculations

**Determination of Crown Grade**

**Trinity River**

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### Floodway Calculations

**Determination of Crown Grade**

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**Required Capacity 300,000 c.f.s.**
<table>
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<th>Length of Sec. in Sta.</th>
<th>Length of Sec. in Ft.</th>
<th>Elevation Fall of Sec. in Thousand Ft.</th>
<th>Slope per Thousand Ft.</th>
<th>A</th>
<th>p</th>
<th>x</th>
<th>n</th>
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<td>33-600</td>
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<td>247.000</td>
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</table>
## Floodway Calculations

### Determination of Crown Grade

<table>
<thead>
<tr>
<th>Station</th>
<th>Length of Sec.</th>
<th>Water Surface</th>
<th>Floodway</th>
<th>Channel</th>
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<tr>
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<td>0.12</td>
<td>0.00006</td>
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<tr>
<td>35-640</td>
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<tr>
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<td>440.36</td>
<td>0.12</td>
<td>0.00006</td>
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### Required Capacity: 240,000 c.f.s.
Levee Design

The levees are designed with a crown width of 6 feet and a slope of 2:1 on the land face and 3:1 on the floodway face. All slopes are to be dresses and well sodded with Bermuda grass, the sodding on the floodway side to extend over the berm and down into the borrow pits. In general, one third of the earth for the levees will be obtained from the borrow pits on the floodway side and two thirds on the land side. (See typical cross section.)

Where the existing levees of the Dallas County Levee Improvement District No. 5 are incorporated in the new levee system, these existing levees will be increased in height and cross section to the standard shown on the print. These portions of the No. 5 levees not incorporated in the new system will be abandoned and where they interfere with the new floodway, will be removed.
CITY & COUNTY OF DALLAS LEVEE IMPROVEMENT DISTRICT
DALLAS COUNTY LEVEE IMPROVEMENT DISTRICT PROFILES
NORTHWEST LEVEE & SECTIONS 1-2 & 3 OF WEST LEVEE
MOTHERS-ROSES & FORREST DISTRICT ENGINEERS
SCOTT & WHITE, 2000, VOLUME 2
EXHIBIT D
Channel Construction

The location of the floodway does not follow the present channel of the stream. For this reason it will be necessary to excavate a new channel for the low water flow. The grade and alignment are shown on the accompanying prints. It is proposed to waste the excavation of the new channel parallel with this channel so as to reduce the obstruction to the flow of water.

All of the floodway will be cleared of underbrush, roadway fills, timber and other obstructions; the timber clearing to extend approximately one and one-half miles below the district. Where the floodway is crossed by railroads, highways, etc., a revision of the grade of these structures will be necessary to bring them up to the grade of the levees, and the character of the structures will be changed to meet the requirements of the open floodway.

In the vicinity of Mountain Creek there will be a certain amount of channel revision on West Fork, while on the new Elm Fork branch a new low water channel will be constructed down to a junction with the low water channel of West Fork. From this point the new channel will follow approximately the center of the floodway to a connection with the present channel at the lower end of the District at the Santa Fe railroad.

Where the new channel passes under the Dallas-Oak Cliff viaduct, special treatment will be required to protect the pier foundations of the viaduct. At the junction of the levee with the Santa Fe railroad, it is contemplated that sufficient waterway will be made available so that no change in the grade of these tracks will be necessary.

All structures crossing the floodway will be planned with a span of 150 feet over the new channel, the balance to be open trestle or pier and girder.
SECTION 5

Elm Fork Diversion Channel

Diversion Channel Area and Grade Combined with Borrow Pit Area and Grade to be adjusted to permit additional discharge at eight feet Stage on River above Upper end of Diversion Channel.

CLASS B

Typical Section of Diversion Channel for Section A.
PART THREE

INTERIOR DRAINAGE
RAINFALL DATA
1906 - 1923 INCLUSIVE

<table>
<thead>
<tr>
<th>Year</th>
<th>Rainfall (inches)</th>
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<td>1906</td>
<td>44.63</td>
</tr>
<tr>
<td>1907</td>
<td>35.87</td>
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<td>1908</td>
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<td>23.84</td>
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<td>1911</td>
<td>30.02</td>
</tr>
<tr>
<td>1912</td>
<td>28.65</td>
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<td>1913</td>
<td>37.81</td>
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<tr>
<td>1914</td>
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<td>1915</td>
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<td>1918</td>
<td>44.40</td>
</tr>
<tr>
<td>1919</td>
<td>42.43</td>
</tr>
<tr>
<td>1920</td>
<td>47.22</td>
</tr>
<tr>
<td>1921</td>
<td>24.57</td>
</tr>
<tr>
<td>1922</td>
<td>38.16</td>
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<tr>
<td>1923</td>
<td>43.03</td>
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</table>

Average Rainfall = 34.85 inches per year

Greatest yearly precipitation = 47.22 inches

Least yearly precipitation = 17.98 inches

Greatest monthly rainfall = 13.04 inches

Least monthly rainfall = zero
### EXTREMES OF PRECIPITATION

1913 - 1924

<table>
<thead>
<tr>
<th>YEAR</th>
<th>MONTH</th>
<th>DAY</th>
<th>GREATEST IN 24 HOURS</th>
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<td>3.83</td>
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<tr>
<td>1915</td>
<td>August</td>
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<td>5.23</td>
</tr>
<tr>
<td>1916</td>
<td>January</td>
<td>26</td>
<td>2.66</td>
</tr>
<tr>
<td>1918</td>
<td>November</td>
<td>7-8</td>
<td>4.44</td>
</tr>
<tr>
<td>1919</td>
<td>October</td>
<td>21-22</td>
<td>3.72</td>
</tr>
<tr>
<td>1919</td>
<td>July</td>
<td>17-18</td>
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<td>1920</td>
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<td>17-18</td>
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<td>April</td>
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<td>1922</td>
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<td>1923</td>
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<td>Maximum</td>
<td>Minimum</td>
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<td>---------</td>
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<tr>
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<td>5.61</td>
<td>0.00</td>
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<tr>
<td>November</td>
<td>2.78</td>
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</tr>
<tr>
<td>December</td>
<td>2.36</td>
<td>6.62</td>
<td>0.04</td>
</tr>
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</table>
RAINFALL AND RIVER STAGE

In 22 years 287 days above flood stage
an average of 13 days per year

In 22 years 170 inches of rain during flood stage,
an average of 7.7 inches per year during flood stage

13 days per year average
0 days minimum
41 days maximum

Calculate on 45 days that river is over flood stage

Total hours of pumping (maximum) = 720 per year
MAXIMUM INTENSITY CURVE

Showing Average and Maximum Rainfall to be Expected in any length of time up to two hours.

This Curve is Applicable to the beginning of a Storm ONLY.

MYERS & NOYES ENGINEERS
DALLAS
RELATION OF RIVER STAGE TO RAINFALL
DALLAS - TEXAS

FLOOD STAGE

1912

1911

1910

ZERO ON RIVER GAGE = 3660 U.S.G.S. DATUM

MYERS NOYES & FORREST ENGINEERS - DALLAS
RELATION OF RIVER STAGE TO RAINFALL
DALLAS - TEXAS

FLOOD STAGE

1918
ZERO ON RIVER GAGE = 3080 USGS. DATUM

FLOOD STAGE

1917

FLOOD STAGE

1916
RESUME' OF ASSUMPTIONS USED IN CALCULATING THE RUNOFF OF THE INTERIOR DRAINAGE AREAS

Amount of Rainfall

From the foregoing compilation of data from the records of the United States Weather Bureau at Dallas, Texas, it is shown that a reasonable maximum amount of rainfall in 24 hours that is to be expected is 5.6 inches. There are one or two rains on record which exceed this amount, but, owing to the long time interval between their occurrence, it was deemed uneconomical to design the pump plants to meet the absolute maximum. Should such a rain occur after the plants are built, it will mean that the storage basins will be flooded for a period of a few hours, but will do no material damage to the surrounding property.

Accumulation of Rainfall

In using the rainfall of 5.6 inches in 24 hours, the amount falling in each hour was taken from actual records of the Weather Bureau, and the amounts tabulated as follows:

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<td>(1) 1.12</td>
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<td>(6) 0.26</td>
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<td>(18) 0.10</td>
<td>(24) 0.10</td>
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<td></td>
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</tbody>
</table>

Method of Calculating Runoff

The runoff was calculated by using the Rational Method, which is generally accepted by engineers.

\[ Q = A \times I \times R \]

- \( Q \) = Quantity of Water in Cubic Feet per Second
- \( A \) = Area of Territory drained in acres.
- \( I \) = Factor of Imperviousness
- \( R \) = Rate of rainfall in inches per hour

In calculating the time of concentration, a uniform velocity of 2 feet per second was used. This velocity is recommended by Folwell as the average velocity of water flowing over the ground surface. In the design of a storm sewer, it would not be correct to use an average velocity, but in this case if the time of concentration should vary an hour or so either
way from that obtained, no material difference would result, as the storage
capacity in each case would take care of the peak load, and the actual quan-
tity of water has more bearing than the actual time of arrival.

The areas contributing in each hour were obtained by drawing eccentric
circles about the pump plants, with radii of one hour, that is $2 \times 60 \times 60 = 7200$ feet. These different areas were taken as so many hours away from the
plants.

The factors of imperviousness used depended on the character of the
land and the amount that it is improved. These values were checked by those
used by other engineers and were applied to the areas in question.

After the amount of water arriving at the pump plant in each hour
was calculated, a curve was then plotted with vertical ordinates as second
feet, and the time in hours as horizontal ordinates. Thus the area under
the curve represented the accumulated runoff. In case the storage capacity
of the basins were less than the accumulated runoff, this storage capacity
was subtracted from the runoff, giving the required rate of pumping. In
cases where the storage capacity of the basins was ample to care for a
maximum rain, a pump was specified which would empty the storage in a rea-
onable length of time. It will only be necessary to use these pumps at a
time when the river is in flood, as sluice gates and conduits are provided
under the levees to allow the storage basins to empty by gravity when the
river is at low stage.
The Upper East Side Plant is located about one and one-half miles above the Turtle Creek Pumping Station, and will handle the largest area of interior drainage, of any plant in the District. This area includes: North Lamar Street section, Dallas Branch - the upper part of which will be carried through the levee in a pressure storm sewer, Turtle Creek, Knights Branch, Cedar Springs Creek, Nobles Branch, and Trinity Farm. The total drainage area, while comparatively large, is offset to a considerable degree by the immense amount of storm water storage that will be available in the old river channel.

The Lower East Side Pump Plant is located on the east levee and old river channel, between the Dallas-Oak Cliff Viaduct and the Dallas Street Railway Viaduct. This drainage area includes Mill Creek, Town Branch, and Henning Avenue Storm Sewer District. This plant is considerably smaller than originally planned, due to the fact that Mill Creek, which carries a considerable part of the storm water from the whole city, will be put in a pressure sewer through the levee, and the pump plant will handle only that area below the levee grade. The old river channel is not to be filled at the present time below Young Street and will afford considerable storage capacity. The pump house is designed to include additional units at a later date when this storage is reduced.

The Upper West Side Drainage Area is very small compared to the storage capacity available, and the land is not improved to any great extent, consequently the district is not going to build a station there at the present, but will allow the storage to empty by gravity only at low water periods. Later a pump may be installed if found necessary.

The Middle West Side Drainage Area serves practically all of the T & P industrial district, and has ample storage capacity in the old channel of West Fork. This pump plant is located where the old West Fork channel crosses the west levee. Due to a probable immediate development, this plant is to be equipped.
with ample pump capacity to serve that district.

The Lower West Side Pump Plant will be located where the present channel of Coombs Creek crosses the West Levee at Beckley Avenue. Due to the fact that the only storage available in this area is in the land side borrow pits of the levee, it was necessary to take Coombs Creek and Kidd Springs Branch through the levee in a pressure sewer. This area also takes care of Lake Cliff Branch, and the Fleming Avenue storm sewer district. This area will likely develop very rapidly, and provision has also been made in this plant for the addition of extra units as they are needed.
INTERIOR DRAINAGE
UPPER EAST SIDE PUMP PLANT
RUNOFF & PUMP DISCHARGE

5.6 INCHES OF RAIN IN 24 HOURS
DRAINAGE AREA 2752 SQ. MI.

ACCUMULATED RUNOFF

PUMP UNITS - 1: 36" 1: 24" 2: 30"
COMBINED PUMP CAPACITY - 97,000 G.P.M. - 20 HEAD
CONDUITS - 3: 72"

CITY AND COUNTY OF DALLAS, LEVEE IMPROVEMENT DISTRICT
AND
DALLAS COUNTY LEVEE IMPROVEMENT DISTRICT NO. 5

LYERS, NOYES & FORREST
ENGINEERS

STORAGE CAPACITY 95,560,000 CU. FT.

TIME IN HOURS

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
INTERIOR DRAINAGE
LOWER EAST SIDE PUMP PLANT
RUNOFF & PUMP DISCHARGE

5.6 INCHES OF RAIN IN 24 HOURS
STORAGE CAPACITY 41320000 CU. FT.
DRAINAGE AREA 168 SQ. MI.

PUMP UNITS 2: 24''
COMBINED PUMP CAPACITY 33000 G.P.M. - 20' HEAD
CONDUITS 2: 12''

CITY AND COUNTY OF DALLAS LEVEE IMPROVEMENT DISTRICT
AND
DALLAS COUNTY LEVEE IMPROVEMENT DISTRICT NO. 5

MYERS, NOYES & FORREST
ENGINEERS
INTERIOR DRAINAGE
LOWER WEST SIDE PUMP PLANT
RUNOFF & PUMP DISCHARGE

5.6 INCHES OF RAIN IN 24 HOURS
DRAINAGE AREA 2.39 SQ. MI.

CITY AND COUNTY OF DALLAS LEVEE IMPROVEMENT DISTRICT
AND
DALLAS COUNTY LEVEE IMPROVEMENT DISTRICT NO. 5

MYERS NOYES & FORREST
ENGINEERS

PUMP UNITS 1 - 36" 1 - 30"
COMBINED CAPACITY 54500 G.P.M. 20 HEAD
CONDUITS 2 - 72"

STORAGE CAPACITY 10,750,000 CU. FT.

TIME IN HOURS

RUNOFF RATE - CU. FT. PER SEC.

ACCUMULATED - MILLIONS OF CU. FT.
INTERIOR DRAINAGE
MIDDLE WEST SIDE PUMP PLANT
RUNOFF & PUMP DISCHARGE

5.6 INCHES OF RAIN IN 24 HOURS
DRAINAGE AREA = 10.19 SQ. MI.

STORAGE CAPACITY = 62,540,000 CU. FT.

PUMP UNITS 2 - 24"
COMBINED PUMP CAPACITY 3,000 G.P.M. 20 HEAD
CONDUITS 2 - 12"

CITY AND COUNTY OF DALLAS LEVEE IMPROVEMENT DISTRICT
AND
DALLAS COUNTY LEVEE IMPROVEMENT DISTRICT NO. 5

MYERS, NOYES & FORREST
ENGINEERS
INTERIOR DRAINAGE
UPPER WEST SIDE PUMP PLANT
RUNOFF & PUMP DISCHARGE

5.6 INCHES OF RAIN IN 24 HOURS
DRAINAGE AREA - 3.06 SQ. MI.

STORAGE CAPACITY - 23,700,000 CU. FT.

ACCUMULATED RUNOFF
NO PUMPS REQUIRED
CONDUITS 1/72" IN DIAMETER

CITY AND COUNTY OF DALLAS LEVEE IMPROVEMENT DISTRICT
AND
DALLAS COUNTY LEVEE IMPROVEMENT DISTRICT NO. 5

MYERS, NOVES & FORREST
ENGINEERS

RUNOFF RATE - CU. FT. PER SEC.

ACUMULATED - MILLIONS OF CU. FT.

TIME IN HOURS
Pumps: centrifugal, single stage, double suction, motor driven, remote control.

Motor operated gate valves arranged to operate separately.

Motor-driven gate valves in both discharge lines, all motors remote control.

Motor-operated gate valves in both discharge lines, all motors remote control.

One 6x10 steel pipe each pole.

Distance from bottom of discharge gate to the discharge gate to be not greater than 20 ft.

Diameter of suction line to be not less than 17 in. in each...
PART FOUR

HYDRAULIC FILL AREA

AND

FUTURE DEVELOPMENT
Hydraulic Fill Area

The Plan of Reclamation for the land on the east side of the District, extending from Turtle Creek Pump Station on the north to Young Street on the south and from the East Levee to the Rock Island and Union Terminal tracks on the east, is to receive still further consideration.

This tract of land, having an area of approximately 650 acres, has been designated as the hydraulic fill area. This tract is directly opposite the main business section of the City of Dallas, and upon being reclaimed, will be immediately subject to industrial development.

It is planned to fill this area with dirt dredged from the new floodway. This fill will extend from a point six feet below the crown grade of the levee, dropping on an easy grade until it meets the present level of the valley. The filling of the present river channel is included in this plan. (See fill area sections on accompanying print.)

The subdivision for this area has been carefully planned. Street widths are ample to care for future traffic, and 45 foot alleys are provided for double track switching facilities reaching every block. Lot depths are variable, and will furnish desirable sites for industries of any size.

This area will be tapped by the Northwest Highway which will be discussed in the next section. The streets from the fill area will enter the main business district with underpasses at Jefferson Street, Commerce Street, and West Lamar Street.

A general idea of this section is given by the perspective sketch accompanying this report, in which the artist is looking toward the business district from the west levee, with the proposed fill area in the middle foreground.
Future Development

One of the greatest benefits to the City of Dallas, occasioned by the straightening of the river and the construction of the levees, is the Trafficway Plan of the District. On the accompanying print the trafficways are shown in orange and the boulevards in blue. It is interesting to note how easily the main streets on both sides of the river can be connected after the bottom lands are reclaimed.

As stated under the general description of the plan, the only connections at present between Dallas and Oak Cliff are Forrest Avenue on the south, the main viaduct and Commerce Street; the viaduct being the only connecting link in time of high flood.

With the completion of the District, it is planned to open Corinth Street, Cadiz Street, Jefferson Street, West Lamar, and Turtle Creek Boulevard. Cadiz Street and Corinth Street will connect South Dallas and Oak Cliff; Jefferson Street will carry the street car and interurban traffic as well as to reduce the congestion on the viaduct; Commerce Street will carry the traffic between Dallas and Fort Worth; West Lamar Street (at present Eagle Ford Pike) is the main feeder for the T & P industrial district; and Turtle Creek Boulevard will give a direct connection from North Dallas to Oak Cliff.

The proposed Northwest Highway will serve the Hydraulic Fill Area, and is part of a new State Highway which will give a direct connection with Dallas and Wichita Falls and the Texas Panhandle. The right of way for this highway is 200 feet wide, only a part of which will be used at first, later being widened as warranted by the increased traffic.

Following the print of the Trafficway Plan, is an extract from the Dallas Magazine, published by the Chamber of Commerce, showing a number of photographs, relative to the District.
A Vision of
GREATER DALLAS OF TOMORROW

Told by Dallas of Today
Private Interests Shall Not Stand in the Way of Public Progress
Thus Ruled the United States Supreme Court in the Pacific Avenue Track Removal Case

$15,000,000 of building and real estate development came in this district following the removal of the tracks from Pacific Avenue, the widening and straightening of Harwood and the opening and widening of St. Paul.

Two Dominant Factors Hampered the Growth and Development of Dallas

As a result of the 1908 flood, Dallas folks did two worth-while things. The first was to build the Oak Cliff Viaduct. The second was to employ Geo. E. Kessler, one of America's greatest city planners, who made a complete survey of Dallas pointing out obstructions which must be removed in order that the city might grow and prosper. Kessler's report showed that there were the two dominant factors hampering the growth and development of Dallas; namely, the railway tracks on Pacific Avenue hampering development to the north and the flood plains of the Trinity hampering development to the west, south and northwest.

Kessler's recommendation, for the removal of the tracks from Pacific Avenue, met at first with derision, and later with active opposition, but it has now been put into execution. It was necessary however to fight the case through the Supreme Court of the United States, on account of contenders who felt that their property rights were being jeopardized. In this case the Supreme Court handed down the now famous dictum: Private Interests Shall Not Stand in the Way of Public Progress.

Today, no one questions the wisdom of the removal of the tracks from Pacific Avenue. Instead of property on the Avenue being damaged, values have increased from 100% to 400%. Dallas as a whole has profited through the creation of new and safer trafficways.

The leveeing and straightening of the Trinity will prove of greater benefit to property owners and to the community as a whole than did the removal of the tracks from Pacific Avenue.

The plans for leveeing and straightening the River and reclaiming the waste lands and building bridges and viaducts connecting two sides of the river have the approval of our County Engineer, our City Engineer, our City Plan Engineer, our State Reclamation Engineer as well as many eminent engineers of other cities who have visited Dallas and given study to the project.
Waste Lands Will Be Reclaimed

According to plans of engineers, the river will be moved half of mile west. Its waters will flow between the two levees shown by the white lines drawn on the photograph below. Thousands of acres of land now practically worthless will be reclaimed. Busy streets lined with fine buildings will cover these reclaimed lands. A wilderness will be converted into a great industrial district.

AERIAL PHOTOGRAPH OF TRINITY VALLEY THROUGH DALLAS.

(Note the many twists and turns now made by the river. The two broad white lines were drawn on the photograph to roughly indicate the location of the two levees. The waters of the river will be confined between the levees. The letter E gives the location of the Union Station. The Texas & Pacific and the Commerce Street crossings are shown. This photograph does not show the Oak Cliff Viaduct nor the Interurban Bridge.)

Brief Description of Plan for Leveeing the River and Reclaiming Waste Lands

NEW CHANNEL will be dredged out between the two levees as indicated on the picture above. These levees will be from 2000 to 3000 feet apart. They will be 30 feet high and will be sodded with Bermuda grass, the dirt required for the construction of the levees as well as the dirt required to fill in behind the levees will be dredged from between the levees, thus giving a new floodway of sufficient depth and width to take care of from 2\(\frac{1}{2}\) to 3 times the volume of the flood waters of the river at its highest flood stage of 1908.

The estimated cost of the construction of the levees is $4,000,000. The estimated cost of filling in land is $2,000,000.
What the Picture Means

The picture above was copied from one drawn by John Knott. Mr. Knott had given careful study to the plans of engineers and the picture here shows how the Trinity Valley will look after the river has been leveed, the waste lands reclaimed, streets and bridges have been built and the whole territory has been covered with business establishments, jobbing houses and manufacturing plants.

In order to get enough dirt to build two levees and to fill in the lowlands behind the levees, a great basin will be dredged out from between the levees, providing a lake from 1000 to 1500 feet wide and from 15 to 20 feet deep. The lake would extend from the present viaduct to the McKinney Avenue-Eagle Ford Road crossing. This will not only afford a splendid park and pleasure lake within the heart of the city but will also provide an auxiliary supply of water for fire fighting purposes.

Solving Our Traffic Problem

The solution of the Dallas Traffic problem has only one answer to provide more trafficways. Leveeing the river, reclaiming the waste lands will afford opportunity for a number of additional crosstown through trafficways. Both to the north and to the south of our present viaduct will be built streets and bridges connecting existing streets on the east and west sections of our city. Dallas will then become one great city. Today, ninety per cent. of the traffic moving across the river is forced through the central business district. This plan giving direct through trafficways will relieve overcrowding in the central business district and by distributing traffic equitably through North Dallas and South Dallas will bring about a revival of values in these two sections.

Dallas Needs Factories

We in Texas and especially in Dallas are largely a bunch of traders. Our trading amounts to from a billion and a quarter to a billion and a half yearly, while the output of our factories runs around a million and a half yearly. The trader is all right, he is a fine fellow and is rendering a real service, but the man who builds is the man who produces. Dallas needs more manufacturers. There are 25 times as many men employed in manufacturing in the Northeastern states as are engaged in manufacturing in the southwest. Manufacturers of the northeast are looking to the southwest for locations. The southwestern city offering best facilities will secure the best and largest of these plants.

The reclamation of the Trinity River valley land will enable Dallas to outbid all other southwestern cities in competing for these desirable manufacturing plants.
Trinity Crossings Wrecked by 1908 Flood

Upper left—Old Commerce Street bridge—west approach gone.
Upper right—Street railway viaduct out of commission.
Lower picture—T. & P. bridge a few minutes after the west approach had gone down the river carrying two men with it. A string of loaded coal cars saved the bridge.

The Trinity has some rather peculiar flood habits. Frequently there will be three or four years in succession when the river will not leave its banks during the entire period. Then it is almost certain to follow that there will be four or five years in each of which the river will overflow to a depth of six to ten feet in the lowlands. Then again at intervals of about eighteen to twenty-two years the river has a habit of having a big flood, when it rises far higher than it does during the usual years.

The biggest flood of recent years was in 1908 when the river reached a gauge height of 52.6 feet. This flood did damage to the amount of $2,500,000. Most of West Dallas was under water. All the railroad tracks and train services in Dallas were out of commission because of the depth of water on the tracks.

Since the flood of 1908, the river flood plain has been changed. The Union Terminal passenger station has been built, and between it and the river, the passenger train yards have been made. All this was under water in 1908, and it may be again. The West Dallas Pike has been built and paved since the flood of 1908. Many acres of the flood plain have been used as a dumping ground, filling up and making smaller the flood water channel. Many acres have been filled in with rock and dirt in order for their owners to use them for business purposes; this is particularly true along the West Dallas Pike. Other similar changes have taken place on both sides of the river further down below the viaduct. All of these changes have in every case narrowed and cut down the flood plain. If as much rain were to fall now as in 1908, and the same volume of water were to come flowing down the Trinity flood valley, the water at Dallas would be even higher at its crest than it was in 1908. It seems probable that a flood like the last big flood will cost Dallas in damage between ten and twelve million dollars, perhaps more.
The Gulf Which Separates Dallas from Oak Cliff and Makes of Them "Two Cities"

Politically, DALLAS and Oak Cliff were united twenty-three years ago. Physically, they are "two cities" today just as truly as they were when Oak Cliff was a separate municipality. They will continue to be "two cities" until this mile-wide gulf which separates them shall have been obliterated through the leveeing of the river and the reclamation of the waste lands.

AERIAL PHOTOGRAPH SHOWING THE GULF SEPARATING DALLAS AND OAK CLIFF AND MAKING "TWO CITIES" OF THEM.

The River was in low flood when this picture was taken. The camera man was flying high. He was almost over Marsalis Park. Lake Cliff and Gardner Park show in the foreground. The Oak Cliff viaduct, the interurban viaduct are seen, stretching across the watery waste. A little farther in the upper left can be seen the Commerce Street and the Texas & Pacific crossings. The Union Station shows between the east ends of the Oak Cliff viaduct and Commerce Street viaduct. Off to the right can be seen the Elm, Main and Commerce and Pacific Avenue business district. Think of it: Seventy thousand Dallas folks living west of the Trinity are connected to this business district by two slender threads. This Gulf must be wiped out. These thousands of acres of waste land must be reclaimed. Many more streets and bridges must be built across the river bringing about the physical union of Dallas, east of the river and Dallas, west of the river. Let's make it one great united city.
OR LOGICAL, healthy development, a city must expand in every direction. For years the development of Dallas to the north was hampered by the tracks on Pacific Avenue, development to the south is hampered by lack of adequate trafficways. Development to the west comes to a dead stop at Broadway. With the straightening and leveeing of the Trinity the channel will be one-half a mile farther to the west. Elm, Main, Commerce, Jackson and other streets passing under the tracks on Broadway will continue on west to the levees. The lowland between Broadway and the levees after filling in will become available for building sites. Many of these streets will be bridged across the river. Instead of viaducts a mile or more in length, bridges one-third as long will span the channel reaching from one levee to the other.

Whereas, today, the jumping off place is at Broadway, then, the commercial and industrial district will extend to the east levee and will begin again at the west levee and will extend on and on as the city grows.

Dallas needs this waste land for the building of a great industrial district.

A couple of years ago, Al Reed was showing an eastern manufacturer over Dallas. The visitor was looking for a site for a big plant he proposed to bring to some Southwestern city. The visitor liked Dallas and liked our people but was not satisfied with any of the sites he had seen. Reed was taking him across the Commerce Street Pike when the visiting manufacturer asked:

"Why do you not reclaim all this waste land? Here you have acres of desirable factory sites right in and next to the heart of your city. Reclaim this and Dallas can offer inducements better than any other Southwestern city. Why do you not do this? What is the matter?"

Reed answered: "Well, I don't know what is the trouble. I believe they say that they do not have enough money."

The visitor shot back at him: "It is not money you need. What you folks need is brains!"

The visitor was only partly right. Dallas folks have the brains. The trouble with us was that we were so busy using our brains on other things that we did not have time to use them on this most important problem.
PART FIVE

COST OF LEVEE DISTRICT
The cost of constructing the new river channel, levees, and hydraulic fill area is approximately $6,000,000. This cost will be paid by the property owners whose land is reclaimed. Bonds, bearing 5.5% interest and maturing in 30 years will be voted in April, 1928. When these are voted, and the election will undoubtedly carry by a large majority, construction will probably start by September 1, 1928.

There are two plans of levee assessment used in Texas, the ad valorem assessment and the assessed benefit plan. Under the ad valorem plan each tract of land is assessed an equal amount per acre. The District Supervisors decided that this plan was not applicable to the Dallas District and adopted the alternate, that of assessing the land according to the benefits received and its value with reference to location. Assessments on this District vary from $75.00 per acre at the upper end to $7500.00 per acre in the hydraulic fill area. A number of disinterested real estate experts have testified that the value of this land will be increased by three times the amount of the taxes.

Detailed estimates are at hand on the cost of the various units, but for the reason that no contracts have been let, it would be unethical to publish the engineering estimates at this time.