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1.0 INTRODUCTION

This is the first major revision or update of the Fort Bend County Drainage District (FBCDD) Drainage Criteria Manual which was originally dated 1987 with minor revisions in April 1999. Since the 1987 manual was published and adopted, experience with criteria and with constructed facilities and changes in community preferences necessitated updating policy and criteria.

Transition Plan:

The plan for transitioning from the current 1987 FBCDD criteria manual to the updated FBCDD criteria manual dated 2011 is listed in the summary below (all dates apply to the time from adoption by Commissioners' Court):

- New Projects – all new criteria apply
- Drainage or Design Report (feasibility or planning phase)
 - Coordination meeting held but report not yet submitted – Six months
 - Submitted – One year
- Construction Drawings
 - Coordination meeting held but drawings not yet submitted – Three months
 - Submitted – One year
 - Previously approved but construction not commenced – Two years
 - Previously approved and construction commenced – Not applicable
- Construction – Not applicable
- Acceptance – Not applicable

1.1 CREATION AND AUTHORITY OF THE DRAINAGE DISTRICT

The Fort Bend County Drainage was created by Act 1949 of the 51st Legislature of the State of Texas, Page 550, Chapter 303, paragraphs 1 to 6 inclusive, which said Act became effective June 2, 1949; and which said Act became valid and in full force and effect under the laws of the State of Texas on June 2, 1949; and which said Act reads as follows:

“Section 1: That, pursuant to authority conferred by Section 59 of Article XVI of the Constitution of Texas, there is hereby created within the State of Texas, in addition to the districts into which the State has heretofore been divided, a district to be known as “Fort Bend County Drainage District” (hereinafter called the ‘District’) and shall include therein all of the territory situated within Fort Bend County, Texas, the boundaries of said District to be co-terminus with the boundaries of said county.

Said District is hereby created for the purpose of reclamation and drainage of its over-flowed lands and other lands needing drainage.

Said District shall be a governmental agency and body politic and corporate, with the powers of government and with the authority to exercise the rights, privileges and functions hereinafter specified, the creation and establishment of such District being essential to the accomplishment of the purpose of Section 59 of Article XVI of the Constitution of Texas.

Section 2: The Commissioner’s Court of Fort Bend County, Texas, is hereby designated as the governing body of such District and the agency through which the management and control of said District shall be administered; and said Court is hereby empowered to do any and all things necessary to carry out the aims and purposes of this Act. Within Thirty days after this Act becomes effective, said Court shall call an election for the purpose of submitting to a vote of the duly qualified resident electors of the District who are qualified to vote in bond elections the questions of whether or not the creation of the District shall be confirmed. The cost of such an election shall be paid by Fort Bend County out of the county general fund. If a majority of the qualified voters voting at such election vote against confirmation of the District, the District hereby created shall be abolished and this Act shall be of no further force or effect. If a majority vote in favor of the confirmation, said District shall be permanently created. In such case, all other drainage districts situated in Fort Bend County shall be abolished and the order of the Commissioner’s Court declaring the result of such election shall, in such case, recite that all such districts are abolished. Title and possession of all property and assets of the abolished districts shall thereupon pass to and be vested in the District hereby created and said District shall assume all functions, duties and obligations of the abolished districts.

Section 3: (A) In addition to the general powers herein granted, said Fort Bend County Drainage District shall be authorized to exercise the following powers, privileges and functions;

(1) To acquire within the District easements, right-of-ways, and any other character of property needed to carry on the work of the District by way of gift, devise, purchase, leasehold or condemnation; and to acquire without the District easements and right-of-ways by condemnation or otherwise; provided, however, such acquisition of easements or right-of-ways acquired without the District by way of condemnation shall be first unanimously approved by the entire Commissioners Court of the County wherein such easements and right-of-ways sought to be condemned, may be situated. The right of eminent domain is hereby expressly conferred on said District and the procedure with reference to condemnation, the assessment of and estimating of damages, payment, appeal, the entering upon the property pending appeal and all other procedure prescribed in Title 52, of the Revised Civil Statutes of Texas, 1925, as heretofore or hereafter amended, shall apply to said District

(2) To dispose of property or rights therein when the same are no longer needed for the purposes for which the District was created or to lease same for purposes which will not interfere with the use of such property by the District.

(3) To devise plans and construct works to reclaim lands in the District; to provide drainage facilities for the reclamation and drainage of the overflowed lands and other lands within the District needing drainage; to acquire or construct properties and facilities beyond the boundaries of the District where in the judgment of the governing body such properties or facilities are necessary to facilitate the drainage and reclamation of lands within the District; and to remove obstructions, natural or artificial, from the streams and water courses, and to clean, straighten, widen and maintain streams, water courses and drainage ditches.

(4) To cooperate with and contract with the United States of America or with any of its departments or agencies now existing, or which may be created hereafter, to carry out any of the powers or to further any of the purposes set forth in this act, and, for such purposes, to receive grants, loans or advancements therefrom; or to contribute to the United States of America or any of its departments or agencies in connection with any project undertaken by it affecting or relating to any of the purposes for which the District is organized.

(5) To cooperate and contract with any department or agency of the State of Texas, or any political subdivision thereof, or any municipal corporation to carry out any purpose for which the District is organized.

(6) To sue and be sued in the name of the District and all courts shall take judicial notice of the establishment of the District.

(7) To construct works, ditches, canals and other improvements over, across and along any public streams, roads, highways, or any lands belonging to the State of Texas, provided that the plans for such improvement on state highways shall be subject to the approval of the State Highway Department and on Prison System lands, shall be subject to the approval of the Texas Prison Board.

(8) To do any and all other acts or things necessary or proper to carry into effect the purposes for which the District is organized.

(B) The County Judge, County Commissioners, the Assessor and Collector of Taxes, the County Treasurer, and the county depository of Fort Bend County are authorized to, and shall be required to, perform all duties in connection with the District required of them by law in connection with official matters for Fort Bend County, and the County Auditor of said county shall be the Auditor for the Fort Bend County Drainage District. Said Court may employ a General Manager for said District and other such agents, attorneys, engineers and employees as may be considered necessary in connection with the purposes of this Act, and all compensation for such persons may be payable from funds herein created for the maintenance and operation of the District.

The governing body shall require the County Tax Assessor-Collector, the County Treasurer and such other officers and employees as the governing body shall designate, to make official bonds payable to the District in such amounts as the governing body shall determine, conditioned upon the faithful performance of their duties and paying over and accounting for all money and other things of value belonging to the District coming into their possession. Such bonds shall be executed by a surety company authorized to do business in Texas and shall be subject to the approval of the governing body and the premiums thereon shall be paid by the District.

Section 4: (A) The Court shall be authorized, from time to time, in behalf of said Fort Bend County Drainage District, to issue the bonds of said District, within the limitations hereinafter stated, for the purpose of acquiring funds with which to accomplish and carry out any one or more of the powers and purposes herein granted to the District, and to provide for the payment of the interest on such bonds as it accrues and to create a sinking fund for the redemption of said bonds as they mature, by levying and causing to be collected a tax on all taxable property within the District, as shown by the then current approved county assessment rolls, sufficient for such purposes. It is expressly provided, however, that the total principal amount of bonds issued by the District at any one time, together with all previously issued bonds then outstanding, shall never exceed a sum equal to five percent (5%) of the assessed valuation of all taxable property within the District, as shown by the then current County Assessment rolls. No such bonds shall be issued until first authorized by a majority of the voters qualified to vote on bond issues under the Constitution of Texas voting at an election called for the purpose of determining whether or not such bonds shall be issued and whether or not taxes shall be levied to pay principal and interest thereon

when due. In the event a majority of the qualified voters at such election shall vote in favor of the issuance of the bonds and the levy of Taxes, the Court shall be authorized to issue, sell and deliver said Fort Bend County Drainage District Bonds and to receive, use and apply the proceeds for the aforesaid purposes of said District, and to levy and assess taxes upon all property subject to taxation in said District, and to arrange for the collection of such taxes. Subject to the limitations contained in this Act, additional bonds may be issued from time to time, in like manner, and under the same procedure. The proposition of the issuance of bonds may be submitted at the election called for confirmation of the creation of said District under Section 2, hereof, or at such later times as the Court shall deem proper. If the proposition of issuing bonds is submitted at the confirmation election, the form of ballot at such first election shall be substantially as follows: "For the confirmation of the District, the issuance of bonds and the levy of taxes in payment thereof", and the contrary of such proposition. The levy of maintenance taxes may be submitted as a further proposition at such election. The provisions of Chapter 1 of Title 22, Revised Civil Statutes of Texas, as amended, shall apply to all bond elections in said District except where in conflict with this Act.

Such bonds shall not be delivered to the purchasers until they have been approved as to legality by the Attorney General of Texas and registered by the Comptroller of Public Accounts of Texas. The cost of issuing, selling and delivering such bonds may be paid out of the proceeds of sale thereof.

Such bonds shall bear interest at a rate not to exceed five (5%) percent per annum and shall mature serially or otherwise over a period of not to exceed thirty (30) years from their date or dates. They shall be sold for not less than par and accrued interest and, after having been approved by the Attorney General and registered by the Comptroller of Public Accounts and sold for not less than par and accrued interest, such bonds shall be held in any suit or proceeding in which their validity may be questioned to be valid, binding obligations of such district, subject only to the defense of fraud, forgery or constitutional violation. No suit shall be brought attacking the validity of such bonds, except upon the grounds stated, after such bonds have been delivered and the proceeds of sale have been received by the District.

The District shall not be authorized to issue time warrants payable from taxes.

(B) All bonds issued under the provisions of this Act shall be issued in the name of the Fort Bend County Drainage District of Fort Bend County, Texas, and shall be signed by the County Judge, attested by the County Clerk, and the seal of the Commissioner's Court of Fort Bend County, shall be affixed to each of them. Said bonds shall be issued in the denominations of not less than One Hundred Dollars (\$100) nor more than Ten Thousand Dollars (\$10,000), as determined in the order authorizing their issuance, and shall bear interest at a rate not to exceed five (5%) percent per annum to be evidenced by attached coupons which shall bear the facsimile signatures of the County Judge and of the County Clerk.

Payment of principal and interest may be made at such place or places as may be determined by the Commissioners' Court in the order authorizing the issuance of such bonds.

Section 5: In addition to the levy and collection of taxes to pay bonds, as heretofore, provided, said Court may levy and cause to be collected a tax not exceeding twenty-five (25¢) cents on each \$100.00 valuation of taxable property within the District for the purpose of paying the cost of operating the District and maintaining its properties; provided, however, that no such tax shall be levied or assessed, until authorized at an election called for such purpose by said Court, in the manner provided by Section 4, hereof, at which a majority of the qualified electors, qualified to vote under the Constitution, voting at such election, vote in favor of the levy and collection of such tax. The assessed valuation of taxable property for District purposes shall be the same as that for State and County purposes; and the County Tax Assessor-Collector, of Fort Bend County, is hereby named and appointed Tax Assessor-Collector for said District; and the Board of Equalization of Fort Bend County is hereby named, constituted and appointed the Board of Equalization for said District. All laws of the State of Texas relating to the assessing and collecting of State and County taxes are by this Act made available for, and shall be applied to, the assessing of current taxes and to the collection of both current and delinquent taxes of said District, except where the same are in conflict with the provisions of this Act. The County Tax Assessor-Collector shall be paid such sum, not to exceed two (2%) percent of taxes collected for assessing and not to exceed two (2%) percent for collecting, as may be prescribed by the Commissioner's Court.

Section 6: If any section, sentence, phrase or clause, or any part of this Act, shall, for any reason, be held invalid, such invalidity shall not affect the remaining portions of this Act and it is hereby declared to be the intention of this Legislature to have passed each section, sentence, phrase, clause and part hereof irrespective of the fact that any other section, sentence, phrase, clause or part hereof may be declared invalid.

1.2 PURPOSE

The purpose of this drainage manual is to establish standard principles and practices for the design and construction of drainage systems within Fort Bend County to avoid increases in flood risks or flood hazards or create new flood hazard areas, to ensure the constructed infrastructure within FBCDD ROW performs its intended function with normal maintenance and repair, to provide procedures for the review and approval of proposed infrastructure within FBCDD ROW, and to provide procedures for acceptance by FBCDD. The design factors, formulae, graphs and procedures are intended for use as engineering guides in the solution of drainage problems involving determination of the quantity, quality, rate of flow, method of collection, storage and conveyance of storm water.

Methods of design other than those indicated herein may be considered in difficult cases where experience clearly indicates they are preferable. However, there should be no extensive variations from the practices established herein without the express written approval of the Fort Bend County Drainage District.

1.3 SCOPE

The manual presents various applications of accepted principles of surface drainage engineering and is a working supplement to basic information obtainable from standard drainage handbooks and other publications on drainage. It is presented in a format that gives logical development of solutions to the problems of storm drainage.

The past procedures and practices that have been used to design drainage facilities in Fort Bend County, along with numerous drainage criteria manuals for other areas, were reviewed to determine the most appropriate techniques and criteria for drainage design for use in Fort Bend County. This was especially true of Harris County's Criteria Manual for the Design of Flood Control and Drainage Facilities, which was used as the primary guide in selecting drainage criteria and in preparing this Criteria Manual for Fort Bend County. This was done in part so as not to "reinvent the wheel" in developing simplified procedures for applying the complex equations dealing with stormwater drainage. Also, there was the desire for consistency in criteria and methodology, where appropriate, to avoid unnecessary difficulty, confusion and expense in the design of drainage systems by engineers who have been or will be working in Fort Bend County. However, while there was obvious benefit for having consistency in the drainage criteria manuals of these two counties, this drainage criteria manual not only had to be an easy-to-use tool for solving drainage problems in Fort Bend County, but needed to contain standards and methodology that would be applicable to the specific problems and objectives of Fort Bend County. As a result, certain criteria and methodology were changed from those used in Harris County as was considered appropriate.

To assist design engineers in dealing with these two county manuals, the following is a list of the more significant differences in their design criteria:

1. the equations for computation of Clarks TC and R coefficients.
2. the loss rate parameters.
3. application of the ponding adjustment factor.
4. rainfall totals (hyetographs) for various events.
5. the drainage area – discharge curves
6. use of the Rational Method for drainage areas smaller than 200 acres
7. requirements for development within leveed areas.

1.4 DRAINAGE POLICY

The basic objective of the Fort Bend County Drainage District is to construct and maintain facilities intended to minimize the threat of flooding to all areas of the County and comply with the requirements of the National Flood Insurance Program. The ultimate goal is intended to be accomplished by the construction and maintenance of 100-year design drainage facilities and flood control measures to provide 100-year flood protection in all areas of Fort Bend County. The 100-year design drainage facilities are defined as all public channels within dedicated rights-of-way approved and accepted by the Drainage District and all other public flood control structures and facilities dedicated to, approved and accepted by the Drainage District. Additionally, it is the District's intent to insure that adequate facilities are constructed to accommodate new development such that existing property will not be subjected to additional flooding and so as not to increase the limits of the flood plains as shown on the flood insurance rate maps for Fort Bend County and other entities (Cities, Levee Improvement Districts, and Municipal Utility Districts).

It is not economically feasible to construct storm sewer facilities, which are large enough to keep the street systems from becoming inundated during severe storm events. The topographic relief of the coastal prairie is too flat to allow for quick runoff during severe storm events. The net effect of the District's policies will be to insure that for new developments the ponding in the street systems will be of minimum depth and duration, and most importantly, that minimum new building or structure slab elevations are set at least 12 inches above the maximum anticipated ponding levels. The intent of this policy is that there should be no street ponding for minor storm events, minor street ponding for larger

events, and major ponding for the 100-year event storms but without water in structures. Every attempt will be made to design major thoroughfares so that they are passable during severe storm events.

To accomplish the goal of eliminating existing flooding conditions and to insure that future drainage problems do not develop, additional drainage improvement measures shall be taken. The measures considered appropriate by the District include further channel improvements to existing watercourses, overflow channels (primarily conveying flood flows directly to the Brazos River), and the construction of storm water detention facilities. The Fort Bend County Drainage District shall be responsible for the review and approval of all plans for 100-year design drainage facilities within Fort Bend County. All new drainage facilities must take into consideration the existing drainage upstream. In addition, new development must provide the ultimate planned right-of-way width to the Fort Bend County Drainage District through the developing property as shown in the various watershed master plans which have been developed by the Fort Bend County Drainage District and are in accordance with the technical criteria contained in this manual for handling the drainage needs of future development upstream. All plans submitted for review and approval will be made available for public inspection.

The District has included in this manual criteria covering the design of storm water systems to serve both existing and new developments. The Fort Bend County Drainage District has quantified the needed improvements for existing development in most of the watersheds in Fort Bend County and is responsible for the approval, and upon acceptance, the maintenance and operation drainage facilities which are in drainage rights-of-way dedicated to the Fort Bend County Drainage District. Upon the completion and acceptance of all new 100-year design drainage facilities the District will maintain, and operate said facilities for flood control purposes as an extension of the District's existing drainage system provided the facilities are constructed in accordance with the requirements of this manual. The Drainage District will not accept storm sewers or detention facilities for maintenance. The criteria in this manual are considered a minimum for Fort Bend County Drainage District approval. Approval from other applicable agencies may be required. Ultimate approval for any variance of the criteria contained in this manual must be given in writing by the Fort Bend County Drainage District.