☐ Annexation
☐ Disannexation
☒ Code of Ordinances
☐ Other

ORDINANCE # 2009-04-00644
[PLANNING & DESIGN CRITERIA FOR STORMWATER RUN-OFF]

THE CITY COUNCIL OF LUCAS, TEXAS APPROVES THE ADOPTION OF A PLANNING AND DESIGN DRAINAGE CRITERIA FOR STORM WATER RUN-OFF TO BE MAINTAINED ON FILE IN THE OFFICE OF THE CITY SECRETARY; PROVIDING A SEVERABILITY CLAUSE; PROVIDING A REPEALING CLAUSE; PROVIDING FOR A PENALTY OR FINE NOT TO EXCEED THE SUM OF TWO THOUSAND DOLLARS ($2,000) FOR OFFENSES; AND PROVIDING AN EFFECTIVE DATE.

WHEREAS, the City Council has determined an urgent need for the adoption of guidelines for storm water run-off;

WHEREAS, the City Council desires to adopt the Planning and Design Drainage Criteria for storm water run-off attached hereto as Exhibit "A."

NOW, THEREFORE, BE IT ORDAINED THAT THE CITY COUNCIL OF THE CITY OF LUCAS THAT:

SECTION 1. The City Council hereby approves and adopts the Planning and Design Drainage Criteria ("Criteria") attached as Exhibit "A." The City commits to the implementation of the requirements and guidelines set forth in the adopted Criteria. A copy of the Criteria will be maintained on file in the office of the City Secretary.

SECTION 2. If any section, paragraph, subdivision, clause, phrase or provision of this ordinance shall be judged invalid or unconstitutional, the same shall not affect the validity of this ordinance as a whole or any portion thereof other than that portion so decided to be invalid or unconstitutional.

SECTION 3. That all provisions of the Ordinances of the City of Lucas in conflict with the provisions of this Ordinance be, and the same are hereby repealed and all other provisions of the Ordinances of the City of Lucas not in conflict with the provisions of this Ordinance shall remain in full force and effect.

SECTION 4. That an offense committed before the effective date of this ordinance is governed by the prior law and the provisions of the Code of Ordinances, as amended, in effect when the offense was committed and the former law is continued in effect for this purpose.

SECTION 5. Any person, firm or corporation violating any of the provisions or terms of this Ordinance shall be subject to the same penalty as provided for in the Code of Ordinances, as

amended, and upon conviction in the municipal court shall be punished by a fine not to exceed the sum of Two Thousand Dollars ($2,000) for each offense, and each and every day such violation shall continue shall be deemed to constitute a separate offense.

SECTION 6. This ordinance shall take effect immediately from and after its passage as the law in such case provides.

DULY PASSED BY THE CITY COUNCIL OF THE CITY OF LUCAS, COLLIN COUNTY, TEXAS ON THIS THE 2nd DAY OF APRIL, 2009.

DULY PASSED BY THE CITY COUNCIL OF THE CITY OF LUCAS, COLLIN

APPROVED:

Bill Carmickle, Mayor

ATTEST:

Kathy Wingo, TRMC, City Secretary

CITY OF LUCAS, TEXAS SEAL

APPROVED AS TO FORM:

Joe Gorfida, Jr., City Attorney
(JJG/cgo/35057)

WATER RUN-OFF MANUAL

PLANNING AND DESIGN DRAINAGE CRITERIA

A. General

The Drainage Criteria included in this section are for the purpose of providing a set of guidelines for planning and designing storm drainage facilities in the City of Lucas, Texas and within its extraterritorial jurisdiction. These criteria will be used by the Department of Public Works, other City Departments, consulting engineers employed by the City, and engineers for private developments in the City.

B. Rational Method for Peak Storm Flows

The formula to be used for calculating peak storm flows for drainage areas less than 200 acres shall be the Rational Method, in which:
Q = CIA, where
Q - is the peak storm flow at a given point in cubic feet per second (cfs)
C - is the runoff coefficient that is equal to the ratio that the peak rate of runoff bears to the average rate (intensity)of rainfall;
I - is the average intensity of rainfall in inches per hour for a storm duration equal to the time of travel for run off to flow from the farthest point of the drainage area to the design point in question;
A - is the drainage area tributary to the design point, in acres.
Note: For drainage areas greater than 200 acres, peak storm flows shall be determined based on a flow routing analysis using detailed hydrographs such as the Soil Conservation Service hydrologic methods that are available in such computer programs as TR-20, HEC-1, etc.

C. Runoff Coefficient

The runoff coefficient (C) shall consider the slope of the terrain, the character of the land use, the length of overland flow and the imperviousness of the drainage area and shall be determined based on ultimate land development. The run-off coefficient for the appropriate land used shall be as follows:
Commercial 0.90
Industrial 0.70
Single Family Residential 0.55
Multi-Family 0.75
Parks and Open Space 0.35
Schools, Churches, etc. 0.75

D. Rainfall Intensity-Frequency

The rainfall intensity-frequency curves should be platted from data from TXDOT or other government sources in our area. The intensity (I) in the formula Q = CIA, is determined from the curves by arriving at a time of concentration for the subject drainage area and adapting a storm frequency upon which to base the design of drainage improvements.

1. Time of Concentration The time of concentration, which is the longest time of travel for runoff to flow from any point of the subject drainage area to the design point, consists of the time required for runoff to flow overland plus the time required to flow in a street gutter, storm drain, open channel or other conveyance facility. A minimum time of concentration of fifteen (15) minutes shall be used for Single Family Residential, Parks and Open Space areas and a minimum time of concentration of ten (10) minutes shall be used for Commercial, Industrial, Multi-Family Residential, School and Church areas. A nomograph, is attached for estimating the time of concentration.

2. Storm Frequency

Required design storm frequencies for storm drainage improvements in the City of Lucas are shown in the following table.

Type of Facility	Design Frequency (years)
*Storm Sewer Systems	25
*Culverts, Bridges,	100

* The drainage system shall be designed to carry those flows greater than the 25-year frequency up to and including a 100-year frequency within defined rights-of-way or drainage easements.

E. Area

The drainage area used in determining peak storm flows shall be calculated by subdividing a map into the watersheds within the basin contributing storm water runoff to the system. Areas shall be determined by planimetering or digitizing.

F. Spread of Water

During the design storm, the quantity of storm water that is allowed to collect in the streets before being intercepted by a storm drainage system is referred to as the "spread of water". In determining the limitations for carrying storm water in the street, the ultimate development of the street shall be considered. The use of the street for carrying storm water shall be limited to the following:

SPREAD OF WATER

Major thoroughfares (divided) - One traffic lane on each side to remain clear.
Thoroughfares (not divided) - Two traffic lanes to remain clear.

Collector streets - One traffic lane to remain clear.
Residential streets - Six-inch depth of flow at curb and One traffic lane to remain clear.

G. Storm Sewer Design

Storm water in excess of that allowed to collect in the streets shall be intercepted in inlets and conveyed in a storm sewer system. Storm sewer capacity shall be calculated by the Mannings-formula --

Q = AV, and
Q = 1.486 AR2/3S1/2n
where
Q is the discharge in cubic feet per second;
A is the cross-sectional area of the conduit in square feet;
V is the velocity of flow in the conduit in feet per second;
R is the hydraulic radius in feet, which is the area of flow divided by the wetted Perimeter.
S is the slope of the hydraulic gradient in feet per foot;
n is the coefficient of roughness.
The recommended roughness coefficients to use in the design of a storm
sewer system are as follows:
Type of Storm Drain Manning's Coefficient
Concrete Box Culvert 0.015
New Concrete Pipe 0.013
Standard, unpaved, with or without
bituminous coating corrugated
metal pipe 0.024
Paved invert, 25% of periphery paved
corrugated metal pipe 0.021
Paved invert, 50% of periphery paved
corrugated metal pipe 0.018
100% paved and bituminous coated
corrugated metal pipe 0.013

In the design of the storm sewer system, the elevation of the hydraulic gradient of the storm sewer shall be a minimum of 0.5 feet below the elevation of the adjacent street gutter. Storm sewer pipe sizes shall be so selected that the average velocity in the pipe will not exceed 15 feet per second nor less than 3 feet per second. The minimum grade recommended for storm sewer pipe is 0.30%. Closed storm sewer systems shall be installed in all areas where the quantity of storm runoff is 300 cubic feet per second, or less at the discretion of the city. A closed storm sewer system may be constructed when the quantity exceeds 300 cfs, at the discretion of the City. Hydraulic gradients shall be calculated and lines drawn for each storm sewer.

H. Intentionally left blank for future use

I. Open Channel Design

Storm water runoff in excess of that allowed to collect and be conveyed in the streets in developed areas and runoff in undeveloped areas may be carried in grass lined, concrete lined or weathered rock open channels. Earthen, non-vegetated or unlined open channels are not acceptable. Open channel capacity shall be calculated by the Manning's Formula, and roughness coefficients shall be as follows:

Type of Lining	Roughness Coefficient "n"	Maximum Permissible Mean Velocity
Earth (Bermuda grass)	0.035	6 ft. per sec.
Concrete Lined	0.015	15 ft. per sec.
Weathered Rock	0.030	10 ft. per sec.

Open channels shall be constructed with a trapezoidal cross-section and shall have side slopes no steeper than 3:1 when grass lined and 1.5:1 when lined with concrete. A right-of -way for all channels of sufficient width shall be dedicated to provide for excavation of the open channel of proper width, plus ten feet on each side to permit ingress and egress for maintenance. Additional width may be considered if sanitary sewer mains are proposed to follow the channel alignment.

J. Culvert Design

At locations of stream or open channel crossings with proposed roadway improvements, it is sometimes necessary to receive and transport storm water under the roadway in culverts. The quantity of flow shall be determined by the appropriate method, and the friction loss through of the culvert shall be calculated by Manning's Formula.
Design of culverts shall include the determination of upstream backwater conditions as well as downstream velocities and flooding conditions. Consideration shall be given to the discharge velocity from culverts, and the limitations specified culverts shall not be less than 18". A headwall is required at exposed ends. Under private drives concrete or steel culverts, under public road concrete culverts are required.

K. Stormwater Detention Pond Design

The basic concept underlying the use of stormwater detention ponds (SDP) involves providing temporary storage of stormwater runoff so that peak rates of runoff can be reduced. Runoff is released from storage at a controlled rate which cannot exceed the capacities of the existing downstream drainage systems or the pre developed peak runoff rate of the site, whichever is less. Stormwater detention ponds may be of two (2) basic types: On-site and Regional. In general, on-site ponds are those which are located off-channel and provide stormwater detention for a particular project of development. Regional ponds are designed to provide stormwater detention in conjunction with other improvements on a watershed-wide basis. The performance and safety criteria in this section apply to all ponds which provide management of peak rates of stormwater runoff, regardless of type.

PERFORMANCE CRITERIA FOR ON-SITE SDP's

1. On-site SDP's are further classified as either small or large, as follows:

ON-SITE SDP
POND CLASS DRAINAGE AREA
Small <25 acres
Large 25-64 acres
For design purposes, any pond with a drainage area larger that 64 acres shall be classified as a regional pond.

2. On-site SDP ponds shall be designed to reduce post-development peak rate of discharge to existing pre-development peak rates of discharge for the 2-, 10-, 25- and 100-year storm events at each point of discharge from the project or development site. In addition, the capacity of the existing downstream systems must be considered in determining the need for managing the 100-year storm event. For the post-development hydrologic analysis, any offsite areas which drain to the pond shall be assumed to remain in the existing developed condition.

3. The Rational Method (RM) may be used for the design of small on-site ponds only. The maximum contributing drainage area to a pond designed with the RM is 50 acres when using this equation.

4. A design method approved by the City Engineer.

PERFORMANCE CRITERIA FOR REGIONAL SDP's

1. Regional SDP's are classified as small or large, based on the following criteria:

REGIONAL IMPOUNDED
POND CLASS VOLUME, AC-FT
Small 0-150
Large >150
Any regional pond with a height of dam over 15 feet shall be classified as a large regional pond.
2. Performance criteria for regional detention ponds shall be determined by the City on a project-by-project basis. The determination shall be based on a preliminary engineering study prepared by the project engineer.

SAFETY CRITERIA FOR SDP's

All ponds shall meet or exceed all specified safety criteria. Use of these criteria shall in no way relieve the engineer of the responsibility for the adequacy and safety of all aspects of the design of the SDP.

1. The spillway, embankment, and appurtenant structures shall be designed to safely pass the design storm hydrograph with the freeboard shown in the table below. All contributing drainage areas, including on-site and off-site area, shall be assumed to be fully developed. Any

orifice with a dimension smaller than or equal to twelve (12) inches shall be assumed to be fully blocked.

DETENTION DESIGN STORM FREEBOARD TO TOP
POND CLASS EVENT OF EMBANKMENT, FT.
On-site: Small 100 year 0
Large 100 year 1.0
Regional: Small 100 Year 2.0
Large 100 year *
*Design storm event and required freeboard for large regional ponds shall be determined in accordance with Chapter 299 of the Texas Administrative Code (Dam Safety Rules of the Texas Natural Resource Conservation Commission).

2. All SDP's (except small on-site ponds) shall be designed using a hydrograph routing methodology. The Rational Method (RM) may be used only for contributing drainage areas less than fifty (50) acres.

3. The minimum embankment top width of earthen embankments shall be as follows:

TOTAL HEIGHT OF MINIMUM TOP EMBANKMENT, FT. WIDTH, FT.
0-6, 4'
6-10, 6'
10-15, 8'
15-20, 10'
20-25, 12'
25-35, 15'

4. The constructed height of an earthen embankment shall be equal to the design height plus the amount necessary to ensure that the design height will be maintained once all settlement has taken place. This amount shall in no case be less than five (5%) percent of the total fill height. All earthen embankments shall be compacted to 95% of maximum density.

5. Earthen embankment side slopes shall be no steeper than three (3) horizontal to one (1) vertical. Slopes must be designed to resist erosion, to be stable in all conditions and to be easily maintained. Earthen side slopes for regional facilities shall be designed on the basis of appropriate geotechnical analyses.

6. Detailed hydraulic design calculation shall be provided for all SDP's. Stage-discharge rating data shall be presented in tabular form with all discharge components, such as orifice, weir, and outlet conduit flows, clearly indicated. A stage-storage table shall also be provided.

7. When designing SPD's in a series (i.e., when the discharge of one pond becomes the inflow to another), the engineer must submit a hydrologic analysis which demonstrates the system's adequacy. This analysis must incorporate the development of hydrographs for all inflow and outflow components.

8. No outlet structures from SDP's, parking detention, or other concentrating structures shall be designed to discharge concentrated flow directly onto arterial or collector streets. Such discharges shall be conveyed by a closed conduit to the nearest existing storm sewer. If there is no existing storm sewer within 300 feet, the outlet design shall provide for a change in the discharge pattern from concentrated flow back to sheet flow, following as near as possible the direction of the gutter.

9. Stormwater runoff may be detained within parking lots. However, the engineer should be aware of the inconvenience to both pedestrians and traffic. The location of ponding areas in a parking lot should be planned so that this condition is minimized. Stormwater ponding depths (for the 100-year storm) in parking lots are limited to an average of eight (8") inches with a maximum of twelve (12") inches.

10. All pipes discharging into a public storm sewer system shall have a minimum diameter of twelve (12"). In all cases, ease of maintenance and/or repair must be assured.

11. All concentrated flows into a SDP shall be collected and conveyed into the pond in such a way as to prevent erosion of the side slopes. All outfalls into the pond shall be designed to be stable and non-erosive.

OUTLET STRUCTURE DESIGN

There are two (2) basic types of outlet control structures: those incorporating orifice flow and those incorporating weir flow. Weir flow is additionally broken down into two (2) categories: rectangular and V-notch. In each type, the bottom edge of the weir over which the water flows is called the crest. Sharp-crested and broad-crested weirs are the most common types. Generally, if the crest thickness is more than 60% of the nappe thickness, the weir should be considered broad-crested. The coefficients for sharp-crested and broad-crested weirs vary. The respective weir and orifice flow equations are as follows:

1. Rectangular Weir Flow Equation
   $Q = CLH\ 3/2$
   where
   Q = Weir discharge, cubic feet per second
   C = Weir coefficient
   L = Horizontal length, feet
   H = Head on weir, feet
   2. V-notch Weir Flow Equation \\
   $Q = Cv \tan (O/2)H\ 2.5$
   where
   Q = Weir Flow, cubic feet per second
   Cv = Weir Coefficient
   O = Angle of the Weir notch at the apex (degrees)
   H = Head on Weir, feet

3. Orifice Flow Equation
   $Q = Co\ A\ (2gH)\ 0.5$
   Where
   Q = Orifice Flow, cubic feet per second
   Co = Orifice Coefficient (use 0.6)
   A = Orifice Area, square feet
   g = Gravitation constant, 32.2 feet/sec^2
   H = Head on orifice measured from centerline, feet

Analytical methods and equations for other types of structures shall be approved by the City prior to use.

DETENTION POND STORAGE DETERMINATION

The method to be used for determining detention pond volume requirements is governed initially by the size of the total contributing drainage area to the pond.
For contributing areas up to fifty (50) acres, the Rational Method (RM) may be used.
For contributing areas greater than fifty (50) acres, a flow routing analysis using detailed hydrographs must be applied. The Soil Conservation Service hydrologic methods (available inTR-20, HEC-1) can be used. The engineer may use other methods but must have their acceptability approved by the City engineer. These methods may also be used for the smaller areas.

DETENTION POND MAINTENANCE AND EQUIPMENT ACCESS REQUIREMENTS

1. Silt shall be removed and the pond returned to original lines and grades when standing water conditions occur or the pond storage volume is reduced by more than 10%.

2. To limit erosion, no unvegetated area shall exceed 10 sq. ft in extent.

3. Accumulated paper, trash and debris shall be removed every 4 weeks or as necessary to maintain proper operation.

4. Ponds shall be mowed monthly between the months of May and September.

5. Corrective maintenance is required any time a pond does not drain completely within 60 hours of cessation of inflow (i.e., no standing water is allowed).

6. Structural integrity of pond embankments shall be maintained at all times.

7. Upon completion of development the owners/Homeowners association shall be required to maintain the detention basin in its original designed and approved condition.

ORDINANCE 2020-12-00925
[AMENDING ORDINANCE 2009-04-00644, AMENDING ARTICLE J "CULVERTS"

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF LUCAS, TEXAS, AMENDING CITY OF LUCAS ORDINANCE 2009-04-00644, PLANNING & DESIGN CRITERIA FOR STORMWATER RUN-OFF BY AMENDING ARTICLE J TITLED "CULVERTS"; PROVIDING A CONFLICTS CLAUSE; PROVIDING A REPEALING CLAUSE; PROVIDING A SEVERABILITY CLAUSE; PROVIDING A SAVINGS CLAUSE; AND PROVIDING FOR AN EFFECTIVE DATE.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF LUCAS, TEXAS, THAT:

Section 1. City of Lucas, Texas, Ordinance 2009-04-00644 is hereby amended by amending Article J titled "Culverts", to read as follows:

WATER RUN-OFF MANUAL

PLANNING AND DESIGN DRAINAGE CRITERIA

J. Culverts.

At locations of stream or open channel crossings with proposed roadway improvements, it is sometimes necessary to receive and transport storm water under the roadway in culverts. The quantity of flow shall be determined by the appropriate method, and the friction loss through of the culvert shall be calculated by Manning's Formula.

Design of culverts shall include the determination of upstream backwater conditions as well as downstream velocities and flooding conditions. Consideration shall be given to the discharge velocity from culverts, and the limitations specified culverts with the limitation that culvert pipe diameter shall ~~not~~ be a minimum ~~less than~~ 18". A headwall is required at exposed ends. Under private ~~drives~~ driveways, permanent culverts (those with reinforced concrete, asphalt, or AASHTO #3 gravel paving over the culvert) and temporary culverts (those without paving over the culvert) shall be constructed with reinforced concrete or minimum 16 gauge galvanized corrugated steel pipe. Temporary culverts and driveways must be removed within 18 months of permit issuance and the open channel reconstructed to its original design. Under public roads reinforced concrete culverts are required. Permanent culvert design shall include minimum embedment of Class B+ per the North Central Texas Council of Governments (NCTCOG) design manual drawing 3020 dated October 2004.~~concrete or steel culverts, under public road concrete culverts are required.~~

Section 2. To the extent of any irreconcilable conflict with the provisions of this ordinance and other ordinances of the City of Lucas governing the use and development of the Property and which are not expressly amended by this ordinance, the provisions of this ordinance shall be controlling.

Section 3. That all ordinances of the City of Lucas in conflict with the provisions of this Ordinance shall be, and same are hereby, repealed, provided, however, that all other provisions of said Ordinances are not in conflict herewith shall remain in full force and effect.

Section 4. That should any word, sentence, paragraph, subdivision, clause, phrase or section of this Ordinance or of Ordinance 2009-04-00644, as amended hereby, be adjudged or held to be voided or unconstitutional, the same shall not affect the validity of the remaining portions of said Ordinances or Ordinance 2009-04-00644, as amended hereby, which shall remain in full force and effect.

Section 5. An offense committed before the effective date of the Ordinance is governed by prior law and the provisions of the City of Lucas Code of Ordinances in effect when the offense was committed and the former law is continued in effect for this purpose.

Section 6. That this Ordinance shall take effect immediately from and after its passage and publication in accordance with the provisions of the Charter of the City of Lucas, and it is accordingly so ordained

DULY PASSED AND APPROVED BY THE CITY COUNCIL OF THE CITY OF LUCAS, COLLIN COUNTY, TEXAS, ON THIS 3rd DAY OF DECEMBER 2020.

APPROVED:

Jim Olk, Mayor

APPROVED AS TO FORM:

Joseph J. Gorfida, Jr., City Attorney
(10-__-2020:TM 118796)

ATTEST:

Stacy Henderson, City Secretary

CITY OF LUCAS, TEXAS
SEAL