CITY OF KYLE, TX
Engineering Department

01/09/2023

The City of Kyle (COK) has adopted the City of Austin Drainage Criteria Manual (DCM) for drainage design criteria. A few distinctions are made to address the specific needs of the COK. Following are the changes adopted effective December 12, 2022.

1. Freeboard for Stormwater Management (SWM)/ detention pond: City of Kyle requires 1.0' of minimum freeboard for all SWM / detention ponds. This modifies the DCM Section 8.3.3, which does not require freeboard for ponds serving basins with a drainage area less than 25.0 acres.

2. The COK has adopted Atlas 14 rainfall depths on June 16, 2021 but was following DCM table for Intensity Duration Frequency (IDF) curve coefficients. Table 5 of Attachment 1– COK IDF curve coefficients shall be used to replace DCM Table 2-2A (zone 1), IDF curve coefficients. **Attachment 1** of this notice includes the technical memorandum explaining IDF coefficients.

3. Based on review capacity of the COK at this time, only most current HEC HMS and Rational method models for Hydrologic analysis are accepted. For Hydraulic analysis most current HEC RAS is the only acceptable model.

4. A drainage report is required for all the projects. The drainage report format outlined in **Attachment 2** shall be utilized.

5. The Floodplain Development Permit (FDP) application shall be completed prior to submittal; **Attachment 3**.

Floodplain Administrator

Keshav Raj Gnawali, PE

City Engineer, City of Kyle

Leon Barba, PE

ATTACHMENT 1

The City of Kyle Drainage Criteria

Technical Memorandum

(Supplement to the ordinance changes on 6-16-2021)

Background

The City of Kyle (COK) adopted the City of Austin Drainage Criteria Manual (DCM), as amended, and updated from time to time. The DCM requires that peak discharge rates not be increased when evaluating 2-year, 10-year, 25-year and 100-year average recurrence intervals. The DCM allows for peak flows to be evaluated in one of two ways: the Rational Method and the Natural Resources Conversation Service (NRCS) method. Using Rational Method requires information about the area's rainfall intensity, while the NRCS method requires depth of rainfall over the storm duration.

In the winter of 2018, the National Oceanic and Atmospheric Administration (NOAA) released the Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 11, Version 2.0, Texas (Atlas 14). This publication documented increased rainfall precipitation frequency estimates for the Austin Metro Area (and elsewhere in the state) due in part to more available rain gauges, two decades of additional data, and improved methods of analysis.

On January 13, 2020, the City of Austin adopted updates to its DCM that incorporate the new rainfall depth and intensity data as well as changing the rainfall distribution. The City of Austin has two sets of rainfall depths and relevant coefficients for both zones (zone 1 and zone 2) to match the Atlas 14 rainfall depth. However, the COK is close to zone 1, according to NOAA website, the rainfall depths observed in COK are higher than the City of Austin zone 1 rainfall depths. The COK adopted drainage criteria changes in June 16, 2020 to match rainfall depths specific to the city. This technical memorandum provides additional coefficients necessary for drainage analysis specific to COK. Updating the rainfall characteristics will require all development and new infrastructure to be designed per the best available data.

NOAA's Hydrometeorological Design Studies Center (HDSC) has provided Point Precipitation Frequency Estimates Mapping tool*, which is the primary data source for Engineering's revision of COK's rainfall criteria. After reviewing the rainfall values from NOAA's mapping tool for various locations throughout the City, it was noted that the variance in the data was small, and therefore choosing one set of criteria to represent all of COK is a reasonable simplification. The Depth-Duration-Frequency (DDF) and Intensity-Duration-Frequency (IDF) tables for the City of Kyle city limits & ETJ are below. All data is partial duration series.

**The mapping tool provides data for rainfall durations from 5-min to 60 days at recurrence intervals ranging from 1-year to 1,000 years. Discussions in memorandum will be limited to duration from 5-min to 24 hours and recurrence intervals from 2-years to 100-years to match the design storms in DCM.*

Table 1 – Atlas 14 DDF Data for the City of Kyle (Replaces Table 2-3 in the Austin DCM)

Depth-Duration-Frequency Table					
Depth of Precipitation (inches)					
Duration	Average recurrence interval (years)				
	2	10	25	100	500
5-min	0.527	0.795	0.972	1.26	1.64
10-min	0.838	1.27	1.55	2.02	2.59
15-min	1.06	1.59	1.94	2.51	3.25
30-min	1.5	2.24	2.72	3.49	4.56
60-min	1.97	2.97	3.63	4.72	6.29
2-hr	2.44	3.8	4.78	6.55	9.18
3-hr	2.73	4.33	5.55	7.84	11.3
6-hr	3.22	5.24	6.82	9.92	14.7
12-hr	3.69	6.09	7.97	11.6	17.4
24-hr	4.19	6.97	9.11	13.2	19.8

Table 2 – Atlas 14 IDF Data for the City of Kyle (Replaces Table 2-4 in the Austin DCM)

Intensity-Duration-Frequency Table					
Intensity of Precipitation (inches per hour)					
Duration (min)	Atlas 14 Intensity, i (in/hr)				
	2 yr	10 yr	25 yr	100 yr	500 yr
5	6.32	9.56	11.7	15.2	19.8
10	5.03	7.63	9.35	12.2	15.6
15	4.26	6.38	7.78	10.1	13
30	3.00	4.48	5.45	7.00	9.16
60	1.97	2.97	3.64	4.73	6.32
120	1.22	1.91	2.4	3.28	4.6
180	0.909	1.45	1.85	2.62	3.77
360	0.538	0.876	1.14	1.66	2.45
720	0.307	0.506	0.662	0.965	1.44
1440	0.175	0.291	0.380	0.55	0.823

National Resources Conservation Service (NRCS) Analysis

The City of Austin DCM previously designated the NRCS 24-hours storm duration with Type III rainfall distribution for use with the NRCS method. This rainfall distribution was created over 30 years ago by the NRCS and is applied broadly to regions along the Gulf and Atlantic coasts. The NRCS has indicated in their technical paper titled "Design Rainfall Distributions based on NOAA Atlas 14 Rainfall Depths and Durations" that the NRCS is replacing the use of legacy rainfall distributions, including the Type III rainfall distribution applied in the DCM, with rainfall distributions constructed from the location-specific NOAA Atlas 14 precipitation frequency data.

The January 2020 DCM update incorporates the NRCS recommendations by adopting a 24-hour storm duration with frequency storm distribution as generated by HEC-HMS software package. HEC HMS is freely available from the US Army Corps of Engineers Hydrologic Engineering Center and is widely used for hydrologic analysis in capital projects and land development. **At this point COK will accept only HEC HMS model for hydrologic analysis.**

Rational Method Analysis

Unlike NRCS Method, the Rational Method assumes the design storm duration is equal to the site's time of concentration which can range from a minimum of 5 minutes to multiple hours. This often results in a need to interpolate between the data given by an IDF table such as Table 2 above. The City of Austin DCM has adopted the equation below for calculating this interpolation.

$I = a/(t+b)^c$ (Eq. 2-1)

I = Average rainfall intensity, per hour

t = Storm duration, minutes

a, b, & c = coefficients chosen to fit the curve to observed data

The IDF coefficients a, b, & c above are provided in DCM Tables 2-2A and 2-2B but required revision to fit City of Kyle's data set. The following performance criteria were determined for new coefficients:

a. Produce a level of accuracy greater than or equal to that of the legacy (pre-Atlas 14) DCM design criteria for most prevalent time of storm duration applicable to Rational Method Analysis.
b. Produce calculated intensities for the 5-minute duration that are equivalent to observed data so that an average of zero difference between observed and calculated value is maintained.

The IDF data in Table 2 was entered into a Microsoft Excel spreadsheet. A duplicate of this table (Table 3 below) was then created, and the data replaced with formulas based on Equation 2-1

so that trial IDF coefficients could be entered, and the resulting rainfall intensity would be output. The accuracy of each calculated data point was then evaluated as a percent of the observed data in a third table (Table 4 below), which present proximity of the observed versus calculated data.

Table 3 – Calculated IDF data from Manually – Iterated coefficients

Duration (min)	IDF Table via Eqn. 2-8			
	2 yr	10 yr	25 yr	100 yr
5	6.35	9.67	11.9	15.4
10	5.07	7.66	9.36	12.1
15	4.26	6.42	7.84	10.1
30	2.96	4.46	5.47	7.09
60	1.92	2.92	3.61	4.76
120	1.190	1.84	2.30	3.11
180	0.888	1.39	1.75	2.41
360	0.532	0.852	1.09	1.55
720	0.315	0.517	0.673	0.986
1440	0.186	0.313	0.414	0.627

Table 4 – Relative Accuracy and Variance of Manually Iterated Constants

Duration (min)	% change between observed value to calculated value			
	2 yr	10 yr	25 yr	100 yr
5	101	101	101	102
10	101	100	100	99
15	100	101	101	100
30	99	100	100	101
60	97	98	99	101
120	98	97	96	95
180	98	96	95	92
360	99	97	96	93
720	103	102	102	102
1440	106	107	109	114
average	100	100	100	100.00

The IDF coefficients were then iterated using a solver function with the goal of minimizing the variance in accuracy. As an additional constraint, the average accuracy was held to a constant value of 100% to prevent a zero solution. The results of this iteration produced calculated values that closely matched the observed values.

The greatest variance in accuracy occurred with the 100-year frequency with the storm duration of 1440 minutes. Even with highest percentage of variance, the difference in data is less than 0.08 inches per hour. This exercise resulted in accuracy values ranging from 8% to 14%. The final IDF coefficients are given below in Table 5.

Table 5 – City of Kyle IDF curve coefficients

Year	a	b	c
2	50.2	9.70	0.769
10	64.4	8.33	0.732
25	71.0	7.56	0.707
100	74.7	6.02	0.657

ATTACHMENT 2

City of Kyle Drainage Report Outline

A drainage report is required to be submitted by the property owner or its agent according to the requirements of this manual. The Engineering Department prior to issuance of a permit, must approve the report. Type of development and report shall be based on the location and additional impervious cover of the development as shown in following table.

Table: Development Categories

Category	***Criteria***
Type 1 Development	Less than one acre of land; and < 1,000 sf additional impervious cover
Type 2 Development	Less than one acre of land; and 1,000-4,999 sf additional impervious cover; or Agricultural development (not including feedlots)
Type 3 Development	≥ 5,000 sf additional impervious cover; or Development within FEMA designated Special Flood Hazard Area.

If any onsite and offsite stormwater structure related to the development is known to be at or above design capacity, the development will be considered a Type 3 Development.

Drainage report requirements are outlined below. Signed and Sealed electronic copy of the report is sufficient for the submission.

Type 1 Development Drainage Report:

A Type 1 Development is any development or redevelopment that disturbs less than one acre of land and creates less than 1,000 square foot of additional impervious cover. The Type 1 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

A. Applicant contact information (e.g., name, address, phone number, and email address)
B. Site location map
C. Detailed site drawing or sketch showing any existing features or infrastructure and purposed disturbance
D. Temporary erosion control plan

Type 2 Development Drainage Report:

A Type 2 Development is any development or redevelopment that disturbs less than one acre of land and creates more than 1,000 but less than 5,000 square foot of additional impervious cover. The Type 2 Development Drainage Report shall be prepared by the property owner or its agent, and consist of the following*:*

A. Applicant contact information (e.g., name, address, phone number, and email address)

B. Site location map
C. Detailed site drawing or sketch of the affected area scaled to 1" = 50' (or less) on minimum 11"X17" paper showing the following:
    1. Existing drainage ways and easements
    2. Runoff flow directions
    3. Floodplain boundaries
    4. Proposed grading and development
    5. Proposed drainage and erosion control facilities
    6. A copy of the survey plat showing the lot layout, streets, and utility and drainage easements
D. Temporary erosion control plan
E. If any on-site and off-site stormwater structure related to this development is known to be at or above design capacity, the development will be considered Type 3 Development

Type 3 Development Drainage Report:

A Type 3 Development is any development or redevelopment that disturbs more than 5,000 sf of additional impervious cover; or Development within FEMA designated Special Flood Hazard Area. A Type 3 Development Drainage reports shall provide an appropriate level of detail to address drainage issues, the overall design, and the horizontal and vertical locations for all proposed improvements. The report shall be based on the following outline and shall include the appropriate background information including: supporting data, subsections, calculations, and plan drawing(s).

Everything included within this outline shall allow one to recreate both the existing and proposed design analysis. If any of these relevant details are missing, the drainage report will not be accepted and require resubmittal.

The following variables and equations are intended to be an aid to development, but if a novel method is utilized, then it shall be explained with the proper explanation of its inputs. Any method other than HEC HMS, Rational method and HEC RAS will require written pre-approval from the City of Kyle (COK).

I. TITLE PAGE

a. Type of Report
b. Project Name
c. Prepared for
d. Prepared by
e. Date
f. P.E. Seal and Signature

II. TABLE OF CONTENTS

The drainage report shall include all the following chapters and major sections of the report, with page numbers for charts, figures, and tables included in the drainage report.

III. INTRODUCTION

a. State the objective of the report and provide appropriate background information for the project. Include project location description, project location map, an overall watershed map.
b. Explain which areas will be affected from the improvements detailed within the report. This shall include off-site features that will influence the site or be affected by the project as well.
c. Identify the surrounding developments, natural drainage paths, and/or landmarks.

IV. DATA COLLECTION

a. Provide all sources of data collection including topographic data, as-builts, Flood Insurance Rate Maps, GIS Data, and any previous studies.

V. ASSUMPTIONS AND METHODS USED FOR HYDROLOGIC AND HYDRAULIC ANALYSIS

a. Provide a table and state the rainfall intensities/recurrence frequencies, coefficients, constants etc. utilized for the analysis.
b. Describe overview of analysis methodology for the project including design & mitigation criteria.
    i. Hydrologic Methods
    ii. Hydraulic Methods

VI. EXISTING CONDITIONS AND DRAINAGE SYSTEM ANALYSIS

a. Description of the existing conditions of the site and watershed basin.
    i. Provide pertinent details or an appendix with these relevant details and reference them here. In this paragraph, call out the key details utilized to conduct the drainage analysis.
b. Existing Drainage System
    i. Discuss and provide relevant details for the project: type of ground cover, curve number, existing land uses, slope, key topographical features (such as existing relevant off-site features), natural channels, ponded areas, FEMA affected flood areas within the site, or anticipated areas to be affected by the site development.
    (1) Area in Acres and Square Miles for HEC-HMS models

(2) Tc Calculations as per the City of Austin Drainage Criteria Manual (DCM) 2.4.2 and Equation 2-3
   (a) For Sheet Flow
      (i) T_t = Travel time as per 2.4.2 (A) of DCM and equation 2-4
      (ii) L = length of reach as per 2.4.2 (A) of DCM,
      (iii) n = manning's n value as per 2.4.2 (A) and table 2-4 of DCM,
      (iv) P2 = shall match per COK Atlas-14 Drainage Technical Memo
      (v) s = slope in ft/ft as per 2.4.2 (A) of DCM,
   (b) For Shallow Concentrated Flow
      (i) T_t = Travel Time as per 2.4.2 (B) of DCM and equation 2-5 or 2-6
      (ii) L = length of reach as per 2.4.2 (B) of DCM
      (iii) s = slope in ft/ft as per 2.4.2 (B) of DCM
   (c) For Channel or Storm Drain Flow
      (i) V = (velocity) as per 2.4.2 (C) of DCM and equation 2-7
      (ii) Q = (design discharge) as per 2.4.2 (C) of DCM
      (iii) A = (cross sectional area) as per 2.4.2 (C) of DCM
      (iv) L_i = The ith channel segment as per 2.4.2 (B) of DCM and Equation 2-8
         1. V_i = The average flow velocity within the ith channel segment in ft/s, as per 2.4.2 of DCM
         2. T_t = as per 2.4.2 (C) of DCM
(3) If the rational method equation is utilized as per DCM 2.4.0 equation 2-2
   (a) I: will be per COK Atlas-14 Drainage Technical Memo
   (b) A: will be the area of the watershed in acres as per DCM 2.4.1
   (c) C: will be the composite runoff number as per DCM 2.4.0

c. State/Discuss methods/Software Used for Analysis. *(Note: only Rational method, HEC HMS and HEC RAS models are accepted for review)*
   i. HEC-HMS models
      (1) Shall have user inputs detailed, such as areas and other calculated items such as lag time and impervious area. These may be shown within a chart. Any calculated input shall provide its basis of calculation within the report.
   ii. HEC-RAS models
      (1) Inputs shall be proven and/or tied to another model within the report.
   iii. State/discuss any relevant assumptions used for analysis.
   iv. Discuss in detail, previous phases of the development, along with future phases of the development, to the extent needed to establish the continuum of the drainage designs impacted by the project.
   v. Provide references to major drainage way planning studies such as flood hazard delineation reports, major drainage way planning reports, and flood insurance rate maps.
   vi. Major basin drainage characteristics and structures and existing land uses within the basin.

vii. Summary of off-site and on-site basin characteristics impacting the project and run-off rates from the project.

viii. Discuss the point(s) of analysis existing within and off-site that contribute to the project area. Ensure they are labelled clearly in exhibits and plans.

ix. Discuss any previous drainage studies.

VII. PROPOSED CONDITION DRAINAGE SYSTEM ANALYSIS

a. Description of proposed conditions of the site/watershed basin.
   i. Provide pertinent details or provide an appendix with relevant details and reference them here, in addition to explaining if there is to be major changes from the existing conditions, please explain these.
      (1) All factors identified in section V(b) of this outline.

b. Proposed Drainage System
   i. Discuss in detail all proposed changes and improvement to the site and its impact on off-site features.
   ii. For Curb Opening Inlets
      (1) L = length of curb opening as per 4.3.1 (A) of DCM,
      (2) W = width of lateral depression as per 4.3.1 (A) of DCM,
      (3) d = depth at curb measured from normal cross slope as per 4.3.1 (A) of DCM,
      (4) h = height of curb opening inlet (ft) as per 4.3.1 (A) of DCM,
      (5) a = depth of depression as per 4.3.1 (A) of DCM,
      (6) S_x = cross slope of the street in ft/ft as per HEC 22-4.3.1,
      (7) S_L = longitudinal slope in ft/ft as per HEC 22-4.3.1,
      (8) T = width of flow (spread) in ft as per HEC 22-4.3.1
      (9) If an inlet is at pass over point, and this pass over crosses a street intersection, these inlets will be required to have less than 3 cfs of flow.
   iii. Grate inlets:
      (1) P = perimeter of the grate in ft, disregarding the side against the curb as per 4.3.1 (B) of DCM,
      (2) d = average depth across the grate (ft) as per 4.3.1 (B) of DCM,
      (3) A_g = clear opening area of the grate (ft^2) as per 4.3.1 (B) of DCM,
   iv. Inlets on Grade with gutter depression
      (1) L_t = Curb opening length required to intercept 100% of the gutter flow as per 4.3.2 (A) of DCM
      (2) S_L = longitudinal slope in ft/ft as per 4.3.2 (A) of DCM
      (3) Q = gutter flow in ft^3/s as per 4.3.2 (A) of DCM
      (4) L = length of curb opening as per 4.3.2 (A) of DCM
      (5) S'w = Cross slope of the gutter measured from the cross slope of the pavement as per 4.3.2 (A) of DCM
      (6) S_x = in ft/ft as per 4.3.2 (A) of DCM

(7) a = gutter depression as per 4.3.2 (A) of DCM
(8) E_o = Ratio of flow in the depressed section to total gutter flow determined by the gutter configuration upstream of the inlet as per 4.3.2 (A) of DCM
(9) Each inlet shall be identified by its type (such as S-1 or G-1) as defined in 4.3 of the DCM

v. Pipe Outlets
(1) Velocity of the water flow at the exit of the pipe/culvert as per 7.3.0 of DCM.
(2) The type of soil that the outlet is intended to drain onto (ex. if unsupported/vegetated soil then 2.5 ft/s is the maximum velocity of flow allowed to flow over it). Standard values for vegetation and soil types can be found with "Soil and Water Conservation Engineering", "Department of the Army: EM 1110-2-1601" or a similar commonly accepted source as per 7.3.0 of DCM
(a) If an energy dissipation method is proposed, provide detailed design as per the HEC-14 manual.
(3) If riprap is proposed, it shall detail both the start and end of flow over the riprap unless just the beginning flow is to be utilized to size the rocks within the riprap 1.4.6 (D) of City of Austin Environmental Criteria Manual (ECM) and the equation provided in section (D)
(a) D the depth of average channel flow in ft as per 1.4.6 (D) of ECM
(b) D_{50} median rock diameter for which 50% of the gradation is comprised of rocks of equal or smaller size in ft 1.4.6 (D) of ECM

vi. Flow equation method for storm drains
(1) Q = A*V as per 5.4.1 of DCM and Eq. 5-1
(2) Q = (1.49/n)*A(R^2/3)*(S^1/2) as per 5.4.1 of DCM Eq. 5-2
(3) Q = Pipe Flow in ft^3/s as per 5.4.1 of DCM
(4) A = Cross-sectional area of flow in ft^2 as per 5.4.1 of DCM
(5) V = Velocity of flow in ft/sec as per 5.4.1 of DCM
(6) n = Coefficient of roughness of pipe as per 5.4.1 of DCM
(7) R = Hydraulic radius = A/W p in ft as per 5.4.1 of DCM
(8) S = Friction slope in pipe in ft/ft as per 5.4.1 of DCM
(9) Wp = Wetted perimeter in ft as per 5.4.1 of DCM

vii. Friction Losses
(1) Hf = (29n 2 /R 1.33)(V 2 /2g)L as per 5.5.1 of DCM and Eq. 5-3
(2) Hf = Friction loss in ft as per 5.5.1 of DCM
(3) n = Manning's Coefficient as per 5.5.1 of DCM
(4) L = Length of pipe in ft as per 5.5.1 of DCM
(5) R = Hydraulic radius in ft as per 5.5.1 of DCM
(6) V = Velocity of flow in ft/sec as per 5.5.1 of DCM
(7) g = Acceleration due to gravity in 32 ft/sec2 as per 5.5.1 of DCM

viii. Open Channels
   (1) Q = (1.49/n) A R 2/3 S ½ as per 6.2.1 of DCM and Eq. 6-1
   (2) Q = Total discharge in cfs as per 6.2.1 of DCM
   (3) n = Roughness coefficient as per 6.2.1 of DCM
   (4) A = Cross-sectional area of channel in ft^2 as per 6.2.1 of DCM
   (5) R = Hydraulic radius of channel in feet (R=A/P) as per 6.2.1 of DCM
   (6) S = Slope of the frictional gradient in ft/ft as per 6.2.1 of DCM
   (7) Wp = Wetted perimeter in ft as per 6.2.1 of DCM

ix. Culverts
   (1) Must have 100yr flow upstream/headwater as per 7.1.0 of DCM
   (2) Headwater in elevation in ft as per 7.1.0 of DCM
   (3) Tailwater in elevation in ft as per 7.1.0 of DCM
   (4) Plans verifying pipe n value, length of pipe in ft, and slope in ft/ft as DCM
   (5) Water Flow in gutters
      i. Y = water depth in the gutter in ft as per 3.2.0 of DCM and equation 3-1
      ii. W = Street width ft as per 3.2.0 of DCM
      iii. H = crown height in feet as per 3.2.0 of DCM
      iv. S = Spread on one side of the street in feet as per 3.2.0 of DCM

x. Provide relevant equations and factors used in the design.

xi. Provide detail on impact of off-site existing features and their capacity analysis if necessary.

xii. Changes to floodplains, discuss in detail if any FEMA application(s) (CLOMR or LOMR etc.) are required. Additionally, address if there is to be a floodplain change, reference the floodplain development permit here.

xiii. All proposed system improvements shall be documented. Their calculations shall be included in the report. When there is large amount of calculated data, provide the important detailed summaries. Include the remainder of the data within an appendix, which shall include the appendix referenced here. This shall include any on-site or off-site systems influenced by the project.

xiv. Models utilized for these deliberations
   1. HEC-RAS
      i. Shall have user inputs detailed.
      ii. Shall show the relation of how other models contribute to the inputs of the model.

VIII. PROPOSED DETENTION AND /OR WATER QUALITY POND SYSTEM

a. Description of any existing detention pond affected by the project.
   i. Provide hydrologic model for the entire contributing area with Atlas 14 COK specific rainfall depth.

a. Follow V(a) of this outline regarding inputs.

ii. Discuss and show the existing pond capacity, inflow, outflow, and available free board, as it relates to the analysis using Atlas 14 COK specific rainfall depth, for entire contributing area.

b. Description of the Proposed Detention and/or Water Quality Pond System(s)
    a. Provide the hydrologic model digitally for the entire contributing area with Atlas 14 COK specific rainfall depth.
    i. HEC-HMS
        (1) Detail the user inputs utilized within the model. If an input is a pre-calculated value, provide these calculated inputs, basis of calculation within this paragraph.
        (2) Indicate which inputs of the model have evolved because of the proposed conditions of the project.
    b. Discuss and show the proposed pond capacity, inflow, outflow, and available free board, in relation to the analysis using Atlas 14 COK specific rainfall depth for entire contributing area.
    c. Water quality ponds will be analyzed for overflow erosion and safety impacts.
    d. Discuss the concept applied to the design and typical drainage patterns.
    e. Discussion of any off-site runoff considerations.
    f. Discussion of proposed drainage patterns and improvements: including streets, storm sewer, culverts, open channels, and detention.

IX. DISCUSSION AND SUMMARY (INCLUDE MINIMUM OF FOLLOWING ITEMS)

a. Comparison of existing and proposed flow rates at the same point of analysis.
b. Summary of offsite condition affected by this design.
c. Summary and impact on any downstream conveyance systems such as inlets, culverts, channels, bridges and other.
d. Summary of proposed improvements such as storm sewers, culverts, open channels, etc..
e. Summary of any changes in floodplain boundaries.
f. Summary of any impacts on any neighboring property.
g. Summary of any mitigation design.
h. Confirmation of compliance with applicable City, State, and Federal regulations and standards. A statement confirming applicant has already obtained approval from all relevant authority or will obtain prior to full approval of the project.

X. REFERENCES

a. Reference all criteria, plans, and technical information used in support of the project, in relation to the drainage design.

ATTACHMENT 3

CITY OF KYLE FLOODPLAIN DEVELOPMENT PERMIT (FDP) APPLICATION / CHECKLIST

Project Name: _____

File No.: _____
(City will assign)

INSTRUCTIONS:

- Fill out the following application and checklist completely prior to submission.
- Current applications can be found at https://www.cityofkyle.com/cityengineer.
- City ordinances can be found at https://library.municode.com/tx/kyle/codes/code_of_ordinances.
- Place a check mark on each line if you have complied with that item. Indicate with N/A if the item does not apply to your project.
- This checklist is only a guide. All state and local subdivision requirements cannot be reflected on this checklist. If there are any questions regarding subdivision regulations, the applicant should consult the City of Kyle Code of Ordinance or other relevant regulation. City ordinances can be obtained at our website.

REQUIRED ITEMS FOR SUBMITTAL PACKAGE:

1. Electronic copy of this application/checklist is required to be submitted.

2. Hard copy of following documents are not necessary for FDP application. Include the title of each sheet and appropriate section (i.e., site plan, landscape plan, grading plan, etc.). Construction plan sets can be used if the floodplain development permit and construction plan review is processed concurrently. Plan set submitted shall comply with city requirements for plan set.

3. Submitted plan set/ application, must show following items
    a. Drawings showing cross sections with Water Surface Elevation (WSEL) for both existing and proposed condition)
    b. Drawings showing 100 yr and 500 yr floodplain boundary (existing and proposed condition)
    c. Drawings showing basin analysis with point of analysis (POA) clearly labeled (existing and proposed condition.
    d. Drainage report matching the City of Kyle requirement (see https://www.cityofkyle.com/cityengineer for accepted format).
    e. HEC- HMS / HEC-RAS model for existing and proposed condition.

3. Copy of deed showing current ownership. Proof of signatory authority for corporations is required.

4. Tax certificates or other evidence that all applicable property taxes have been paid for the subject property.

5. Recent Title Commitment (dated within one year)

7. Proof of Filing Fee (calculation listed below)

FILING FEE CALCULATION:

Filing Fee:	$ 500.00
Administrative Fee:	+ $ 250.00
TOTAL FEE (due at the time of application submission):	**$750.00**

RESUBMITTAL FEES:

- A resubmittal fee in the amount of $500 is due for each submittal after the 3rd review.

PROJECT INFORMATION:

Street Address/Location Description: _____

Subdivision Name: _____ Section, Lot, Block: _____

Zoning District: _____ PUD Ordinance No: _____

Land Use Category (as identified on the most recent Land Use Map): _____

Total Gross Sq. Ft. of Building(s): _____ Total Impervious Cover Sq. Ft: _____
(Pavement and building)

Proposed Number of Multi-Family / Condo Units: _____

Brief Summary of Work: _____

APPLICANT INFORMATION:

Please Note: The signature of owner authorizes city staff to visit and inspect the property for which this application is being submitted. The signature also indicates that the applicant or his/her agent has reviewed the requirements of this checklist and all items on this checklist have been addressed and complied with. If there are multiple property owners, one notarized form per owner is required. Approval of this application and the related plat or plans does not constitute the approval of variances or waivers to ordinance requirements. Applicant is responsible for compliance with all applicable ordinance unless a variance, waiver, or exception has been specifically approved.

The agent is the official contact person for this project and the single point of contact. All correspondence and communication will be conducted with the agent. If no agent is listed, the owner will be considered the agent.

(Check One):

☐ *I, the owner, will represent this application with the City of Kyle.*

☐ *I, the owner, hereby authorize the person named below to act as my agent in processing this application with theCity of Kyle.*

OWNERSHIP INFORMATION:

Owner Name (Company or Individual): _____

Contact Name: _____

(If property ownership is in the name of a partnership, corporation, joint venture, trust or other entity, please list the official name ofthe entity and the name of the managing partner.)

Phone: _____

Address: _____ City: _____ State: _____ Zip: _____

Email: _____ Mobile: _____

By signing this form, the owner of the property authorizes the city to begin proceedings in accordance with the city review process. Owner further acknowledges that submission of an application does not in any way obligate the City to approve the application. By signing this form, the owner of the property authorizes the City of Kyle to enter upon the property to perform all necessary inspections and acknowledges that the construction will be in accordance with the city standards and the approved construction documents.

By indicating an agent on the application, the property owner authorizes the agent to represent the owner and allofficial contact will be between the City of Kyle and the agent.

Owner's Signature: _____ **Date:** _____

THE STATE OF _____ **§**

§ KNOW ALL MEN BY THESE PRESENTS

COUNTY OF _____ **§**

Before me, _____, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that heor she executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this _____ day of _____.

Notary Public's Signature _____

My Commission Expires: _____

AGENT INFORMATION:

If an agent is representing the owner of the property, please complete the following information:

Project Agent: _____ **Company:** _____

Phone: _____ Fax: _____

Address: _____ City: _____ State: Zip: _____

Email: _____ Mobile: _____

I hereby attest that I prepared this application/checklist and that all information shown hereon is correct and complete to the best of my knowledge:

Agent Signature: _____ **Name (printed):** _____ **Date:** _____

GENERAL PROVISIONS:

1. No work of any kind may begin until permit is issued.
2. The permit may be revoked if any false statements are made within.
3. If revoked, all work must cease until permit is re-issued.
4. Development shall not be used and/or occupied until a Certificate of Occupancy is issued or construction hasbeen accepted by the City.
5. The permit will expire if no work has commenced within six months of issuance.
6. Applicant is hereby informed that other permits may be required to fulfill local, state, and federal regulatoryrequirements (refer to Exhibit A). By submitting this application, the owner or an authorized agent certifies, all the state, federal and regulations are met.
7. Applicant hereby gives consent to the City Floodplain Administrator or his/her representative to make reasonable inspections required to verify compliance.

DESCRIPTION OF WORK (CHECK ALL APPLICABLE BOXES):

1. Structural Development
   a. Activity

      ☐ New Structure

      ☐ Addition

      ☐ Alteration

      ☐ Relocation Demolition

   b. Structure Type

      ☐ Residential (Single-Family)

      ☐ Non-Residential (Includes Multi-Family)

      ☐ Combined Us

      ☐ Manufacture Home.

   c. Estimated Cost of the Project $ _____

   d. Estimated current market Value of the Property $ _____

2. Other Development Activities

   ☐ Clearing

   ☐ Cut/Fil

   ☐ Mining

   ☐ Drilling

   ☐ Grading

   ☐ Excavation (except for structural development above)

   ☐ Watercourse Alteration (including dredging and channel modifications)

   ☐ Drainage Improvements (including culverts)

   ☐ Road, Street, or Bridge Construction

   ☐ Subdivision – Acreage?_____ac.

   ☐ Utility Improvement

   ☐ Other (specify) _____

FLOODPLAIN INFORMATION (TO BE COMPLETED BY APPLICANT):

The proposed development is located on FIRM Panel No._____, Dated_____.

The Proposed Development:

☐ Is NOT located in a Special Flood Hazard Area (SFHA) **(no application required).**

☐ Is partially located in the SFHA but building/development is NOT. (Elevation certificate is required prior to final acceptance)

Is in a SFHA.

- ❍ FIRM Zone Designation is_____.
- ❍ BFE at the site is_____ft. NAVD88 (MSL)

☐ Is located or disturbs the floodway. (**CLOMR required**)

☐ Is it zone A or Zone AE without floodway (**Any alteration or change in floodplain requires LOMR**).

☐ If the project is in zone AE, CLOMR shall be applied for any Base Flood Elevation (BFE) increase more than 0.00 ft.

FLOODPLAIN ADMINISTRATOR NOTES:

ADDITIONAL INFORMATION:

THE APPLICANT MUST SUBMIT THE FOLLOWING DOCUMENTS WHICH ARE APPLICABLE TO THE DEVELOPEMENT BEFORE THE APPLICATION WILL BE PROCESSED (CHECK APPLICABLE BOXES)

- ☐ A site plan showing the location of all existing structures, water bodies, adjacent roadways, lot dimensions,utilities, and proposed development improvements.
- ☐ Development plans, drawn to scale, and specification, including where applicable: details for anchoring structures, proposed elevation of lowest floor (including basement), types of water-resistant materials used below the first floor, details of floodproofing of utilities below the first floor, and details of enclosuresbelow the first floor.
- ☐ Subdivision or other development plans. If the subdivision or other development exceeds 50 lots or 5acres, the applicant must provide 100-year flood elevations if they are not otherwise available.
- ☐ Plans showing the extent of watercourse relocation and/or landform alterations
- ☐ Change in water surface elevation (in feet)
- ☐ Floodproofing protection level (non-residential only) ft. NAVD88 (MSL). For floodproofed structures, applicants must attach certification from registered engineer or architect. Please note that for floodproofing of non-residential structures, NFIP requirements will require that insurance companies subtract 1' from the floodproofed elevation to determine if the structure is properly floodproofed to the Base Flood Elevation (BFE).
- ☐ Certification from a registered engineer that the proposed activity within a Special Flood Hazard Area (SFHA) with the BFE established (Zone AE, etc.) but outside the floodway will not result in an increase of more than 1 ft. to the BFE. A copy of all data and hydraulic/hydrologic calculations supporting this finding must also be submitted. Additionally, supporting data must ensure that there will be no adverse impacts to any adjacent properties (both upstream and downstream) of the proposed development without documented landowner approval.
- ☐ Certification from a registered engineer that the proposed activity within a SFHA with both BFE and floodway (no proposed encroachment into the floodway) established will not adversely affect any adjacent properties (both upstream and downstream) without documented landowner approval. A copy of all data and hydraulic/hydrologic calculations supporting this finding must also be submitted.
- ☐ Certification from a registered engineer that the proposed activity in a regulatory floodway will not result in any increase in height of the BFE. A copy of all data and hydraulic/hydrologic calculations supporting this finding must also be submitted.
- ☐ If applicant does not agree with Floodplain Administrator's decision or seeks variance on floodplain regulations, it shall follow the appeal process as described in the City of Kyle Code of Ordinances – Chapter 17, Article II, Section 17-54.
- ☐ After successful approval of FDP, owner or authorized agent should notify Floodplain Administrator three days prior to construction begin date. The owner or an agent shall establish two temporary BFE marks within 50 feet of the proposed development and the floodway boundary shall be marked every 50 ft across the property. The floodway boundary shall be established using the Flood Insurance Rate Map or Flood Boundary and Floodway Map or most recent study.

EXHIBIT A: ADDITIONAL REQUIRED PERMITS

Applicants shall verify that all required permits have been obtained for the work in the floodplain prior to filing a floodplain development permit. The permitting agencies below regulate land and water development activities. They include but are not limited to

- ❑ **Texas Commission on Environmental Quality**
- ❑ **United States Army Corps of Engineers**
- ❑ **Additional federal agencies including United States Fish and Wildlife Service, EnvironmentalProtection Agency, and the United States Coast Guard**
- ❑ **Texas Parks and Wildlife Department**
- ❑ **General Land Office**
- ❑ **Texas Department of Transportation**
- ❑ **Additional local and regional permitting agencies including river authorities**

ADDITIONAL PERMIT(S) CERTIFICATION:

I certify that all additional required permits for the proposed work have been obtained prior to submission of this Floodplain Development Permit Application.

Authorized Signature:_____ **Date:** _____

THE STATE OF_____ **§**

§ KNOW ALL MEN BY THESE PRESENTS

COUNTY OF_____ **§**

Before me,_____, on this day personally appeared_____,

known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he or she executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this_____day of _____, _____.

Notary Public's Signature_____My Commission Expires: _____