EXHIBIT A

Certification of Compliance with Storm Water Management Plan (Developer)

I, ________________________, developer of ______________________________ (development) located __________________________ in the City of Cameron, Missouri, do hereby certify that all activities on the above stated development will be carried out in accordance with the approved storm water management plan for the development, and that all individual lot owners will be made fully aware of any requirements or stipulations on their individual lot or for the development as a whole due to storm water management.

Signed: ______________________________

____
Name & Title (Printed)

Date: ______________________________

Must Be Notarized.

EXHIBIT B

Certification of Compliance with
Storm Water Management Plan
(Individual Lot Owner)

I, ______________________, owner of lot ______ in the ____________________ development located _________________________ in the City of Cameron, Missouri, do hereby certify that all activities carried out on my property will comply with the approved storm water management plan for the above mentioned development. I have been made fully aware of any requirements or stipulations on my individual lot or the development as a whole, and I am aware of any easements on my property, the stipulations of these easements on my property and that these stipulations are stated within my deed of property.

Signed: ____________________________

____
Name & Title (Printed)

Date: ____________________________

Must Be Notarized.

EXHIBIT C

Certification of Authority over
Storm Water Management Plan

I, ____________________, (Name) ____________ (Title -- ie developer, contractor) do hereby certify that I am the person(s) responsible for assuring that all land disturbing activities for the __________________ development located ______________________ in the City of Cameron, Missouri will comply with the approved storm water management plan, and any requirements by DNR, and that responsible personnel will be assigned to the project. I am aware that any and all project site grading or construction permits may be revoked at any time during the construction if storm water management facilities are not in strict accordance with approved plans.

Signed: __________________________

____
Name & Title (Printed)

Date: __________________________

Must Be Notarized.

EXHIBIT D

Certification for City to
Conduct On-Site Inspections

I, __________________________, (Name) ____________________ (Title) do hereby grant access to ___________________________ development located ______________________ in the City of Cameron, Missouri to the City of Cameron in order to conduct on-site inspections for compliance with the storm water management plan.

Signed: ______________________________

____
Name & Title (Printed)

Date: ______________________________

Must Be Notarized.

EXHIBIT E

Certification for Right of Entry
for Emergency Maintenance
(Developer)

I, ______________________, (Name) developer of __________________ development in the City of Cameron, Missouri do hereby certify that the City of cameron has the right for emergency maintenance of any privately owned storm water management facility and the right of entry for inspections of any privately owned facility and that all individual lot owners within this development have been made aware of the City's rights.

Signed: ____________________________

____
Name & Title (Printed)

Date: ____________________________

Must Be Notarized.

EXHIBIT F

Certification for Right of Entry for Emergency Maintenance (Individual Lot Owner)

I, ____________________________, owner of lot ____________ in the ______________________ development located ____________________ in the City of Cameron, Missouri do hereby certify that I am aware the City of Cameron has the right for emergency maintenance of any privately owned storm water management facility and the right of entry for inspections of any privately owned facility within this development.

Signed: ________________________________

____
Name & Title (Printed)

Date: ________________________________

Must Be Notarized.

EXHIBIT G

Correction Notice

NOTIFICATION TO:________________________

We, the City of Cameron, Missouri, do hereby notify you that ___________________ activity on ______________________ development does not comply with the approved storm water management plan and that if corrections are not started within ________ (hours, days) you will be subject to a stop work order until corrective measures can be made.

Violations Include:

Corrective Measures Required:

Signed: ____________________________

____

Name & Title (Printed)

Date: ____________________________

EXHIBIT H

Stop Work Order

ISSUED TO:________________________

We, the City of Cameron, Missouri, do hereby issue a Stop Work Order for _____________ _development located _____________________ in the City of Cameron for violation to the storm water management plan. No further work can be implemented at the above stated development until the following violations are corrected. Failure to correct these violations within _______ calendar days will result in a $200 per day fine or jail sentence up to 30 days.

Violations Include:

Corrective Measures Required:

Signed: ___________________________

____

Name & Title (Printed)

Date: ___________________________

EXHIBIT I

Maintenance Agreement

The inspection and maintenance of the storm water management facilities for the __________ _______ development located _______________ in the City of Cameron, Missouri will be the responsibility of those stated below:

Facility Type & Location	Responsible Party for Inspection	Responsible Party for Maintenance

All individual lot owners are made aware of this agreement and the requirements by individual lot owners, development as a whole,, developer, and the City. Agreed this ______ day of _____ month in the year ________.

Developer: ____________________ City: ________________________

Date: ____________________ Date: ________________________

This agreement shall be recorded by the Owner in the Recorder of Deeds prior to the final inspection and approval.

EXHIBIT J

Storm Water Management Facility
Inspection Report

Date: ______________________

Location: ______________________

Storm Water Management Facility:

Approved plan properly implemented? YES NO

Any approved plan violations? YES NO

If YES, what actions need to be taken to correct violation(s)?

____

____

____

____

Time period granted to correct violation: ______________________________

Copy: Developer
Adjacent Land Owner

EXHIBIT K

Written Notice of Appeal

To: City of Cameron, Missouri

With this notice we are appealing the following decision concerning the storm water management plan for ______________________ development located __________________ in the City of Cameron, Missouri.

Appealed Decision:____

____

____

Decision Made:____

____

____

Reason for Appeal:____

____

____

Signed: ____________________________

____
Name & Title (Printed)

Date: ____________________________

STORM WATER MANAGEMENT DESIGN GUIDE

Liability

This design criteria and guidelines establishes minimum elements of design which must be implemented with sound engineering and good workmanship. Use of the information contained herein for placement of any structure or use of land shall not constitute a representation, guarantee, or warranty of any kind by the City of Cameron, its officials or employees, of the practicability, adequacy or safety and shall not create liability upon or cause action against any such public body, official or employee for any damages that may result pursuant thereto.

Developer may request for a variance in design procedure for special conditions.

Design Criteria

<u>Plan Hydrologic Criteria</u>

The hydrologic criteria to be used for the storm water concept and storm water management plans shall be as follows:

1. 25-year design storm for all cross-drain culverts and drainage designs.

2. 10-year design storm for all interior culverts and drainage designs.

3. 2- and 10-year design storms for all detention and retention basins using procedures contained herein, or approved by the Municipality.

4. All drainage designs shall be checked using the 100-year storm for analysis of local flooding, and possible flood hazards to adjacent structures and/or property.

5. All hydrologic analysis will be based on land use conditions as specified in Section II F 2.

6. For the design of storage facilities, a secondary outlet device or emergency spillway shall be provided to discharge the excess runoff in such a way that no danger of loss of life or facility failure is created. The size of the outlet device or emergency spillway shall be designed to pass the 100-year storm as a minimum requirement.

Storm water detention facilities shall be kept within the development property lines. The allowable discharge rate can not exceed the pre-development discharge rate for the design storm. This rate may need to be restricted, if the receiving storm water facility is incapable of handling the discharge rate or if erosion needs to be minimized. If not all of the post development discharge drains into the detention facility, the outlet structure must be sized to limit the discharge to the pre-development discharge rate minus the post-development discharge rate bypassing the detention facility.

All proposed developments may be evaluated by the Rational Method for developments less than 200 acres. Other methods such as SCS Hydrologic Methods may be used, but are not discussed here.

Differential runoff rates between the proposed post-development and the pre-development tract must be considered. Rainfall duration is to be equal to or greater than the time of concentration.

The Rational method may be used for determining storm water runoff when designing on-site detention.

Rational Method

Step 1: Estimate t_c. This is the sum of the overland flow and conduit flow times t_c will increase the farther you get from the drainage area.

Step 2: Choose a value of **C**. If more than one area contributes to the runoff, **C** is weighted by areas.

Step 3: Select a frequency or return period for the storm.

Step 4: Calculate or determine the average storm intensity from intensity equation or IDF curves.

Step 5: Calculate peak flow using the Rational Formula.

The Rational Formula:

$$Q = C_f \, CIA$$

Where:
Q = Peak Discharge, cfs
C = Runoff Coefficient = Percentage of rain that appears as direct runoff.
I = Rainfall Intensity, in/hr.
A = Drainage Area, acres
C_f = Frequency Factor

FREQUENCY FACTOR	
Recurrence Interval	C_f
2	1
5	1
10	1
25	1.1
50	1.2
100	1.25

When using the Rational Method the following assumptions must be made:

1. Q_{MAX} occurs when rainfall duration $\geq$ time of concentration (t_c)

   t_c = time required for water to flow from the most distant point of a drainage area to the point of flow measurement.

2. Q_{MAX} is proportional to I.

3. Frequency of occurrence of Q_{PEAK} = I from which it was calculated.

4. Q_{PEAK} / Unit Area decreases as drainage area increases. **I** decreases as duration increases.

5. Runoff Coefficient (**C**) remains constant for all storms in a given watershed. Theoretically **C** increases as design year increases.

Runoff Coefficients (**C**) are given below which should be a weighted average of individual land uses within the watershed.

Type of Discharge Area	Runoff Coefficient C
Business:	
Downtown Areas	0.70-0.95
Neighborhood Areas	0.50-0.70
Residential:	
Single-family Areas	0.30-0.50
Multi-units, Detached	0.40-0.60
Multi-units, Attached	0.60-0.75
Suburban	0.25-0.40
Apartment Dwelling Areas	0.50-0.70
Industrial:	
Light Areas	0.50-0.80
Heavy Areas	0.60-0.90
Parks, Cemeteries	0.10-0.25
Playgrounds	0.20-0.35
Railroad-yard Areas	0.20-0.40
Unimproved Areas	0.10-0.30
Streets:	
Asphaltic	0.70-0.95
Concrete	0.80-0.95
Brick	0.70-0.85
Drives and Walks	0.75-0.85
Roofs	0.75-0.95
Lawns:	
Sandy Soil, Flat 2%	0.05-0.10
Sandy Soil, Avg. 2-7%	0.10-0.15
Sandy Soil, Steep 7%	0.15-0.20
Heavy Soil, Flat 2%	0.13-0.17
Heavy Soil, Avg. 2-7%	0.18-0.22
Heavy Soil, Steep, 7%	0.25-0.35

Rainfall Intensity (I)

I can be calculated from Steel formula: $I = \frac{K}{t+b}$

for Cameron: $I_2 = \frac{140}{t+21}$ $I_{10} = \frac{230}{t+29}$

$I_{25} = \frac{260}{t+32}$ $I_{100} = \frac{375}{t+36}$

Where: t = storm duration, min. or time of concentration, min. whichever is greater (if $t_c \leq 5$, $t = 5$)

IDF curves may also be used.

Time of Concentration (t_c) Is the time required for water to flow from the hydraulically most remote point of the drainage area to the outlet point (point under investigation).

t_c = overland flow + channel flow expressed in **minutes**

For natural basins with well defined channels, bare earth overland flow or flow in mowed channels use:

$$t_c = (11.9\ L^3/H)^{0.385} \times 60$$

Where: t_c = time of concentration, **minutes**
L = Length of longest drainage path, **miles**
H = difference in elevation between basin ridge and the outlet, **feet**

The above formula can be adjusted as follows for other conditions:

- o For general overland flow and flow in natural grassed channels multiply t_c by 2.
- o For concrete or asphalt surfaces multiply t_c by 0.4
- o For concrete channels multiply t_c by 0.2

For overland flow (Kerby (1959)):

$$t_c = 0.83(N_k L/(S^{0.5}))^{0.467}$$

Where:
t_c = time of concentration, minutes
L = straight line length from the top of the basin to the point of a defined channel, ft.
S = Slope of the flow path from the most remote part of the drainage area to the point of a defined channel divided by the horizontal distance between the two points, ft/ft

N_k = a coefficient of roughness given below:

N_k	Surface Type
0.02	Smooth impervious surface.
0.10	Smooth bare packed soil, free of stones.
0.20	Poor grass, cultivated row crops or moderately rough bare surfaces.
0.40	Pasture or average grass cover.
0.60	Deciduous timberland.
0.80	Conifer timberland, deciduous timberland with deep forest litter or dense grass cover.

For channel flow use Manning's equation:

$$t_c = \frac{L}{60V}$$

Where:
- t_c = time of concentration, minutes
- L = Length, ft.
- V = Average velocity, (ft/s) from Manning's Equation
- 60 = Conversion factor from seconds to minutes

$$V = [1.49(r)^{2/3}(S)^{1/2}]/n$$

Where:
- V = Average velocity, ft/s
- r = Hydraulic radius (equal to a/p_w), ft
- a = Cross sectional flow area, ft^2
- p_w = Wetted perimeter, ft
- s = Slope of the hydraulic grade line, ft/ft
- n = Manning's roughness coefficient for open channel flow.

NOTE: Average flow velocity is usually determined for bank-full elevation.

Other equations for t_c may be used.

Storage & Detention Facility Design

Storage facilities should be designed and analyzed using reservoir routing calculations.

Detention/Retention facilities are to be sized from the 10-year post-development storm. The outlet structure is to be designed for the 2-year pre-development storm.

The volume of storage potential provided in detention facilities shall be sufficient to control the excess storm water runoff, as determined to be the difference between the storm water quantity from the site in its developed state and the storm water quantity from the site in its pre-developed state.

At no time during the design storm shall the storm water release rate exceed the allowable release rate. Change in release rate with increasing depth in basin must be considered.

Storm water shall be released at a non-erosive rate. Open channels shall be protected by the use of rock blanket to reduce entering velocities to a non-erosive rate. In subsurface channels, the energy gradient shall not be increased beyond the slope of the channel.

Detention facilities should be designed to drain all detention volume within 72 hours.

Detention facilities shall be provided with obvious and effective control structures. Plan view and sections of the structure with adequate details shall be included in the plans. The design discharge shall not exceed the stipulated pre-developed runoff rate.

Sizing of the discharge pipe may be by inlet control or hydraulic gradient requirements, as published by the U.S. Department of Transportation. Federal Highway Administration's "Hydraulic Charts for the Selection of Highway Culverts", Hydraulic Engineering Circular No. 5, December 1965, or other approved design standards.

The discharge pipe shall not be less than six (6) inches in diameter, for minimizing operation and maintenance requirements. A bar screen on a minimum 2:1 slope shall be provided to reduce blockage by debris. Further safety measures may be required on large culverts.

Storage Facility Design Criteria

Vegetated embankments must be less than 20 feet in height with side slopes no steeper than 3:1 (horizontal to vertical). Rip rap protected embankments shall be no steeper than 2:1.

Emergency spillways shall be provided as a part of the detention basin to permit the safe passage of runoff generated from a high frequency rainfall. Spillways shall be either seeded, fertilized and mulched, sodded or paved. Emergency spillways must be designed for a 100 year storm.

Detention facilities shall have adequate capacity to contain the storage volume required, with at least one (1) foot of vertical freeboard above the maximum spillway water surface elevation. The freeboard shall also be at an elevation of at least one (1) foot above the FEMA designated 100-year flood elevation.

Impoundment depths greater than 20-feet are subject to the requirements of the Safe Dam Act, unless the facility is excavated to this depth.

In no case shall the limits of maximum ponding elevation be closer than thirty (30) feet horizontally from any building and less than two (2) feet vertically below the lowest sill elevation. The entire reservoir shall be seeded, fertilized and mulched, sodded or paved. Any area susceptible to, or designed as, overflow by a higher design intensity rainfall shall be sodded or paved.

Areas above the normal high water elevations of storage facilities should be sloped toward the facilities to allow drainage and to prevent standing water.

The bottom area of the storage facilities should be sloped towards the outlet to prevent water from standing.

A low flow or pilot channel constructed across the facility bottom from the inlet to the outlet is recommended to convey low flows and prevent standing water conditions.

Channel routing calculations shall proceed downstream to a point where the controlled land area is less than ten percent of the total drainage to that point, as needed.

Detention is permitted in parking lots to a maximum depth of twelve (12) inches for unrequired parking areas only. In no case shall the maximum limits of ponding be designed closer than twenty (20) feet from a building unless waterproofing of the building and pedestrian accessibility are properly documented.

Storm Water Channel Location

Generally acceptable locations of storm water channels in the design of a subdivision may include but are not limited to the following:

1. Adjacent roadways.
2. In a depressed median of a double roadway, street or parkway provided the median is wide enough to permit slopes of one-foot drop in six-feet horizontal or flatter, and maximum depth not to exceed 1 foot.
3. Centered on lot lines or entirely within the rear yards of a single row of lots or parcels.
4. In each of the foregoing cases, a drainage easement with sufficient width to facilitate maintenance and design flow shall be provided and shown on the plat.

Whenever the plans call for the passage and/or storage of storm water runoff along lot lines, the grading of all such lots shall be prescribed and established for the passage and/or storage of waters, and no structure or vegetation which would obstruct the flow of storm water shall be allowed, nor shall any change be made to the prescribed grades and contours for the specified storm water channels.

All utility sewer manholes constructed in an area designed for the storage or passage of storm water, shall be provided with either a water-tight manhole cover or be constructed with a rim elevation of a minimum of one (1) foot above the high water elevation of the design storm.

General Design Procedure for Storage Routing

- o Inflow hydrograph for all selected design storms.
- o Stage-storage curve for proposed storage facility.
- o Stage-discharge curve for all outlet control structures.

Stage-Storage Curve

Stage-storage curve defines the relationship between the depth of water and storage volume in a reservoir.

Stage-Discharge Curve

A stage-discharge curve defines the relationship between the depth of water and the discharge or outflow from a storage facility: The stage-discharge curve should take into account the discharge characteristics of both the principal and emergency spillways.

General Procedure

Step 1: Compute inflow hydrograph for runoff from the 2-, 10-, and 100-year design storms. Both pre- and post-development hydrographs are required for the 2-and 10-year design storms. Only the post-development hydrograph is required for runoff from the 100-year design storm.

Step 2: Perform preliminary calculations to evaluate detention storage requirements for the hydrographs from Set 1. If storage requirements are satisfied for runoff from the 2- and 10-year design storms, runoff from intermediate storms is assumed to be controlled.

Step 3: Determine the physical dimensions necessary to hold the estimated volume from Step 2, including freeboard. The maximum storage requirement calculated from Step 2 should be used. From the selected shape determine the maximum depth in the pond.

Step 4: Select the type of outlet and size the outlet structure. The estimated peak stage will occur for the estimated volume from Step 2. The outlet structure should be sized to convey the allowable discharge at this stage.

Step 5: Perform routing calculations using inflow hydrographs from Step 1 to check the preliminary design using the storage routing equations. If the routed post-development peak discharges from the 2- and 10-year design storms exceed the pre-development peak discharges, or if the peak stage varies significantly from the estimated peak stage from Step 4, then revise the estimated volume and return to Step 3.

Step 6: Consider emergency overflow from runoff due to the 100-year design storm and established freeboard requirements.

Step 7: If necessary, evaluate the downstream effects of detention outflow to ensure that the routed hydrograph does not cause downstream flooding problems. The exit hydrograph from the storage facility may need to be routed through the downstream channel system to the confluence point to where the drainage area being analyzed represents ten percent of the total drainage area.

Step 8: Evaluate the control structure outlet velocity and provide channel bank stabilization if the velocity will cause erosion problems downstream.

The 10-year storm volume will determine the size of the pond while the 2-year storm peak control need will determine the size of a minimum outlet structure. Thus the pond is sized for the 10--year storm. Then the 2-year storm is routed through the pond and the 2-year outlet structure is sized.

Orifices

The basic discharge equation for the orifice is:

$$Q = C_d A\ (2gH)^{0.5}$$

Where:

Q	=	Discharge, cfs
A	=	Cross-sectional area of pipe, ft^2
g	=	Acceleration due to gravity, 32.2 ft/s^2
C_d	=	Orifice discharge coefficient
H	=	Head from center of pipe to the water surface, ft.

C_d = 0.6 For sharp square edge entrance conditions for a wide range of sizes for both circular and rectangular orifices.

C_d = 0.8 For sharp edged pipe discharging to the atmosphere downstream.

Multiply C_d by 1.15 if perimeter is leveled or rounded.

If approach velocity is significant the head in the discharge equation must be corrected by adding to it the velocity head of the approaching flow ($V^2/2g$). Pipes smaller than 12" may be analyzed as a submerged orifice if H/D is greater than 1.5. For other conditions the opening operates as a weir up to a certain point and culvert analysis with inlet conditions is appropriate. When in doubt, construct two stage-discharge curves, one for each condition, and use the one yielding the higher stage for a given flow.

For rectangular orifices with low head:

$$Q = 2/3\ C_d\ W(2g)^{0.5}\ (H_2^{3/2} - H_1^{3/2})$$

Where:

W	=	Width of the rectangular orifice, ft.
H_1	=	Distance from top of orifice to water surface, ft.
H_2	=	Distance from bottom of orifice to water surface, ft.

Storm Water Management

The following criteria provides uniform procedures for designing and checking the design of storm drainage systems and facilities. However, it is the responsibility of the owner of the proposed construction to obtain a competent, licensed engineer for the design and preparation of construction specifications and drawings along with other required State and Federal permits.

On November 5, 1996 revisions to the city's Municipal Code, concerning Storm Water Management became effective. **Municipal Code: Chapter 10, Article VI: Storm Water Management.** The entire municipal ordinance and document may be downloaded from http://www.municode.com/Resources/gateway.asp?pid=12023&sid=25

The City of Cameron has adopted the, Standard Specification and Design Criteria, Volume I, Division II, Section 2600, Storm Sewers, as published by the Kansas City Metropolitan Chapter of the American Public Works Association (KC-APWA), except as amended in the following sections. The entire APWA 2600 Document may be downloaded from http://www.kcapwa.net/docs/specs/APWA2600.pdf

The city has also adopted the Division III, Standard Drawings Volume III, Drawing Numbers CI-1, CI-2, CI-3, FI-1,GI-1,and JB-1, as published by the Kansas City Metropolitan Chapter of the American Public Works Association (KC-APWA), except as amended in the following sections. The entire APWA Standard Drawings may be downloaded from http://www.kcapwa.net/docs/specs/APWAStdDwgs.pdf.

The following amendments and additions shall apply to the APWA sections pertaining to storm sewers.

- All castings shall have a Deeter Foundry 2018-A Solid Cover, (or pre-approved equal) with the words Storm Sewer marked in the center. Lids shall have a side open pick slot.
-

Adopted: 11-21-06