

DESIGN STANDARDS FOR STORMWATER AND SUBSURFACE DRAINAGE

PART 1 - GENERAL

1.1 GENERAL

- A. The major water transporting components of the stormwater management system, such as storm sewers, grassed waterways and detention basins, shall be constructed at the same general time as the initial street construction.
- B. It shall be illegal for sump pumps, downspouts, or foundation drains to outlet directly to the street or into the right-of-way of the street, or to be connected to the sanitary sewer. Provisions shall be made for sump pumps to be connected to the subsurface drainage system described in Paragraph 1.2.
- C. These standards are to be used in conjunction with the Subdivision Control Ordinance.

1.2 SUBSURFACE DRAINS

- A. The subdivider shall direct his engineer to design a subsurface drainage system to be placed along both sides of the subdivision streets and wherever else within the subdivision that it is determined to be necessary. The purpose of the subsurface piping system is to provide drainage for the street subbase and to create an outlet for foundation drains, and sump pump drains from residences. The subsurface drainage system shall discharge to the storm sewer system or to the surface drainage system upon approval from the City's authorized representative. No subsurface drainage system connections will be permitted to the sanitary sewer system.
- B. Capped, plugged, or exposed connections, terminated at the property line, shall be provided for each subdivided parcel along the subsurface drainage system. The location of each connection termination shall be adequately marked so that it can be field located when the corresponding parcel is developed.
- C. Subsurface drains are required for any grass waterway which drains three (3) acres or more.
- D. Minimum size subsurface drains at the street curb and back yard swales (grassed waterways) serving more than one (1) lot shall be six (6) inches in diameter.

1.3 STORMWATER DETENTION FACILITIES

Plans for stormwater drainage shall include details for stormwater detention. Detention facilities shall be designed using the following guidelines to limit the peak discharge from a development.

- A. For development with drainage areas (tributary to stormwater detention facilities) equal to or greater than ten (10) acres, peak discharge from the detention facility shall be limited to the five (5) year frequency storm peak discharge for the twenty-four (24) hour duration storm.
- B. For developments with drainage areas (tributary to detention facilities) less than ten (10) acres, peak discharge from the detention facility shall be limited to the ten (10) year frequency storm peak discharge for the twenty-four (24) hour duration storm.
- C. The five (5) year/ten (10) year peak discharge shall be based on land use conditions prior to development, using corresponding runoff characteristics and other basin parameters.
- D. Inflow (runoff) to all stormwater detention facilities shall be determined using a one hundred (100) year twenty-four (24) hour storm to develop an inflow hydrograph.
- E. The one hundred (100) year twenty-four (24) hour peak discharge (and inflow hydrograph) shall be based on land use conditions representing fully developed conditions, using corresponding runoff coefficients, travel times, and other basin parameters.
- F. A routing procedure shall be used to demonstrate that the stormwater detention facility will reduce the one hundred (100) year peak discharge, from the developed area, to a peak discharge equal to or less than five (5) year/ten (10) year peak discharge using the pre-development conditions.
- G. The results of the routing procedure shall demonstrate that adequate storage volume has been provided. The detention facility shall not be overtopped from the one hundred (100) year twenty-four (24) hour storm event, and shall have a minimum freeboard of two (2) feet between the maximum routed pool elevation and the top of the facility embankment.
- H. An emergency spillway shall be provided to discharge flow resulting from pool elevations greater than the one hundred (100) year-twenty-four (24) hour pool elevation. The spillway shall have a minimum size adequate to pass the routed one hundred (100) year twenty-four (24) hour storm (assuming that the primary spillway is plugged and non-functional)

without overtopping the detention facility embankment. The elevation of the emergency spillway shall not be placed lower than the routed one hundred (100) year twenty-four hour pool elevation.

- I. Erosion protection shall be provided for the primary outlet and emergency spillway so that the detention facility embankment will be adequately protected. Location of the emergency spillway shall be in undisturbed material, unless otherwise approved by the City's authorized representative.
- J. The minimum allowable size for the primary outlet conduit from the detention facility shall be twelve (12) inches. If further restriction of the outlet conduit is required, the restriction shall be made to the inlet end of the conduit. Restrictions smaller than 12 inches need to have appropriate measures, such as a grate or an inverted elbow, to prevent clogging.
- K. In those instances where the discharge velocity from the primary outlet or emergency spillway is excessive in the opinion of the City's authorized representative, energy dissipation may be required.
- L. Detention facilities, which are designed to have dry bottoms, must be designed to include underdrains to drain the bottom of the detention facility so that the facility can be maintained. Also, the bottom of the facility shall be designed to have longitudinal and transverse grade to the outlet so that the facility will empty leaving no ponded water. See Section (P) below for wet detention facility requirements.
- M. Methodology for developing peak discharges and runoff hydrographs shall be the Natural Resources Conservation Service (NRCS) TR-55 procedure or another comparable procedure approved by the City's authorized representative.
- N. Peak discharge calculations shall be submitted for the five (5) year/ten (10) year pre-development and one hundred (100) year post-development conditions. The calculations shall show the drainage area, the NRCS runoff curve numbers, the time of concentrations, and other basin parameters used to develop the appropriate peak discharges.
- O. Calculations shall be submitted which show stage-discharge relationships (rating curves) for the primary outlet and emergency spillway, the stage-storage relationship for the detention facility, the inflow hydrograph for the one hundred (100) year twenty-four (24) hour storm, and the routed one hundred (100) year-twenty-four (24) hour discharge hydrograph.
- P. Wet Detention Basin Design Requirements – Refer to Indiana Storm Water Quality Manual: Planning and Specification Guide for Effective

Erosion and Sediment Control and Post-Construction Water Quality, IDEM, October 2007.

- Q. Maintenance Plan and Responsible Party Designation - A maintenance plan is required for all detention facilities. All cost for detention pond maintenance and inspection is the responsibility of the owner of the detention facility. The City will not participate in such cost. The maintenance plan shall include:
1. Identification of the responsible party for the operation, maintenance and documentation of the plan. The funding source for these activities shall be identified. A signed letter from the responsible party stating that they agree to maintain the detention facility (or facilities) shall be submitted to the City. If the property is sold, the new owner must resubmit a letter of responsibility.
 2. Inspection for damage to insure structural integrity of spillway and embankments and proper function of inlet and outlet structures. Inspections shall be done quarterly, at a minimum, and accumulated debris shall be removed. All inspection reports shall be done using the form at the end of this section and completed inspection forms shall be submitted to the City Street Superintendent.
 3. Establishment of grass or other suitable vegetative cover throughout the entire basin area, except in the permanent pool area for a wet detention basin. Grass should be cut regularly at approximately monthly intervals during the growing season or as required.
 4. Removal of debris and trash in the facility, especially from inlet and outlet structures and the emergency overflow to assure continued operation in conformance with the design. This should be done during the quarterly inspections or as necessary.
 5. Clearing embankments of woody vegetation, and providing access to perform the operation and maintenance activities annually or as needed
 6. Repair of undercut or eroded areas as needed

For wet detention facilities:

7. Monitoring for sediment accumulation in the wet detention facility and sediment forebay area
8. Removal of sediment from the forebay every five (5) to seven (7) years or more often if needed
9. Removal of sediment from the permanent pool when sediment reaches two (2) feet below the normal water level or it becomes eutrophic. This should be done about every twenty (20) to twenty-five (25) years or as appropriate for the individual facility

10. If a wetland component is present, inspect for invasive vegetation and remove semiannually

1.4 STORMWATER SEWER SYSTEM

- A. The subdivider shall provide the subdivision with an adequate stormwater sewer system whenever curbs and gutters are installed and whenever the evidence available to the City indicates that natural surface drainage is inadequate. When the surface drainage is adequate, easements for such surface drainage shall be provided. Curbs and gutters along streets are required; however, if the City finds it necessary to waive this requirement, a shallow swale with its low point at least three (3) feet below the elevation of the subgrade of the pavement shall be installed. In this case, one of the following types of improvements shall be furnished by the developer / owner at driveway crossings:
 1. A corrugated metal pipe, at least twelve (12) inches in diameter and fourteen (14) feet in length, to be placed where required for each driveway; or
 2. A properly dipped or swaled concrete pavement, twenty-four (24) feet in length, six (6) feet in width, and six (6) inches thick, designed so as not to create a hazard to the under parts of automobiles, at the entrance of each driveway.
- B. The stormwater drainage system shall be separate and independent of any sanitary sewer system.
- C. Storm drainage facilities shall be located in the street right-of-way, where feasible, or in perpetual, unobstructed easements in accordance with the details on the Construction Plans provide by the subdivider's engineer. The following easement widths shall apply:

<u>Area or Situation</u>	<u>Easement Width</u>
Storm Sewer (up to 24")	25 feet
Storm Sewer (24" or larger)	25 feet
Grassed Waterways (including equivalent sized lined channels)	Width of channel plus 15 feet
Subsurface Drain	20 feet
Open Outlet Channel (including equivalent sized lined channels)	20 feet from top of each bank
Detention Basins	Elevation of the emergency spillway design flow, plus 20 feet horizontally

- D. Storm sewer inlets shall be provided so that surface water is not carried across or around any intersection and does not travel a distance of more

than 600 feet in the gutter. In addition, the following spread requirements shall be met:

Type of Facility	Design Frequency	Allowable Spread
Multilane Non-Freeway	10-year	Across one-half travel lane
All Two-lane Facilities	10-year	4 ft onto travel lane
Bridge Deck (Non-Freeway)		
V ≥ 50 mi/h	10-year	Edge of travel lane
V < 50 mi/h	10-year	3 ft onto travel lane

Adopted from the Indiana Department of Transportation Design Manual, August 1999, Figure 36-7A

- E. It is the responsibility of the subdivider to keep all major watercourses, drainage systems, etc., not under the jurisdiction of any public agency, open and free flowing.

- F. Drainage facilities shall be capable of accommodating a one hundred (100) year rainfall intensity without endangering the public safety and health or causing significant damage to property as determined by the City. In addition;
 - 1. Open channels within public drainage easements shall be capable of accommodating a fifty (50) year rainfall intensity within the drainage easement; and,
 - 2. Culverts shall be capable of accommodating a twenty-five (25) year rainfall intensity (no road overtopping) when crossing under a road which:
 - a. Carries a higher volume of traffic than other adjacent routes, or has the potential for carrying such volumes; and
 - b. Is a part of a pattern of arterial routes for the entire urban area; and,
 - c. Is oriented primarily to moving traffic rather than serving abutting land use.
 - 3. Minimum pipe size shall be twelve (12) inches reinforced concrete or fifteen (15) inches corrugated metal pipe.

- G. Any alteration of an existing open outlet channel, traversing a development, shall be sized to contain a minimum twenty-five (25) year frequency storm or the capacity of the existing channel, whichever is greater.

H. Design Calculations. Design calculations are required as part of the drainage plan and shall specifically include:

1. Estimate of stormwater runoff:
 - a. Drainage area map, including indication of drainage patterns for lots and blocks.
 - b. Weighted runoff coefficient computations.
 - c. Time of concentration computation indicating overland flow time and flow time in the swale, gutter, pipe, or channel.

Runoff coefficients and rainfall intensity-duration-frequency values to be used for the analysis are provided in Table II-A, II-B, II-C and II-D below.

TABLE II-A – Values Used to Determine a Composite Runoff Coefficient ⁽¹⁾

<u>Type of Surface</u>	<u>Runoff Coefficient “C”</u>
Asphalt	0.82
Concrete	0.85
Roof	0.85
<u>Lawns (Sandy)</u>	
Flat (0-2% Slope)	0.07
Rolling (2-7% Slope)	0.12
Steep (greater than 7%)	0.17
<u>Lawns (Clay)</u>	
Flat (0-2% Slope)	0.16
Rolling (2-7% Slope)	0.21
Steep (greater than 7%)	0.30

The coefficients of this tabulation are applicable to storms of 5 to 10 year frequencies. Coefficients for less frequent higher intensity storms shall be modified as follows:

<u>Return Period (years)</u>	<u>Multiply “C” by</u>
25	1.1
50	1.2
100	1.25

⁽¹⁾ Adopted from Jasper County Indiana Drainage Specifications, 1997, Table 1

TABLE II-B – Rural Runoff Coefficients⁽¹⁾

Type of Surface	Runoff Coefficient “C”
Woodland (Sandy)	
Flat (0-5% Slope)	0.10
Rolling (5-10% Slope)	0.25
Steep (greater than 10%)	0.30
Woodland (Clay)	
Rolling	0.30
Steep	0.35
Steep	0.50
Pasture (Sandy)	
Flat	0.10
Rolling	0.16
Steep	0.22
Pasture (Clay)	
Flat	0.30
Rolling	0.36
Steep	0.42
Cultivated (Sandy)	
Flat	0.30
Rolling	0.40
Steep	0.52
Cultivated (Clay)	
Flat	0.50
Rolling	0.60
Steep	0.72

The coefficients of this tabulation are applicable to storms of 5 to 10 year frequencies. Coefficients for less frequent higher intensity storms shall be modified as follows:

<u>Return Period (years)</u>	<u>Multiply “C” by</u>
25	1.1
50	1.2
100	1.25

⁽¹⁾ Adopted from Jasper County Indiana Drainage Specifications, 1997, Table 1A

(1)

TABLE II-C – Runoff Coefficients “C” by Land Use and Typical Inlet Times

Land Use	Runoff Coefficients			Inlet Times (minutes)
	Flat	Rolling	Steep	
Commercial (CBD)	0.75	0.83	0.91	5
Commercial (Neighborhood)	0.54	0.60	0.66	5 – 10
Industrial	0.63	0.70	0.77	
Garden Apartments	0.54	0.60	0.66	
Churches	0.54	0.60	0.66	
Schools	0.31	0.35	0.39	10 – 15
Semi Detached Residential	0.45	0.50	0.55	
Detached Residential	0.40	0.45	0.50	
Quarter Acre Lots	0.36	0.40	0.44	
Half Acre Lots	0.31	0.35	0.39	
Parks	0.18	0.20	0.22	To Be Computed

General Notes:

1. Flat terrain is 0 – 2% slopes
2. Rolling terrain is 2 – 7% slopes
3. Steep terrain is greater than 7% slopes
4. Interpolation, extrapolation and adjustment for local conditions shall be based on engineering experience and judgment.
5. The coefficients of this tabulation are applicable to storms of 5 to 10 year frequencies. Coefficients for less frequent higher intensity storms shall be modified as follows:

<u>Return Period (years)</u>	<u>Multiply “C” by</u>
25	1.1
50	1.2
100	1.25

(1) Adopted from Jasper County Indiana Drainage Specifications, 1997, Table 2

Table II-D – Rainfall Intensities for Various Return Periods and Storm Durations						
Intensity (Inches/Hour)						
Duration	Return Period (Years)					
	2	5	10	25	50	100
5 Min.	5.04	6.24	7.08	8.16	9.00	9.84
10 Min.	3.84	7.74	5.46	6.24	6.90	7.50
15 Min.	3.20	3.96	4.52	5.16	5.72	6.20
20 Min.	2.85	3.51	4.02	4.59	5.10	5.55
30 Min.	2.22	2.74	3.12	3.58	3.96	4.32
40 Min.	1.85	2.28	2.61	2.99	3.30	3.60
50 Min.	1.60	1.97	2.24	2.57	2.83	3.10
1 Hr.	1.40	1.73	1.97	2.25	2.49	2.72
1.5 Hrs.	1.13	1.39	1.59	1.82	2.02	2.20
2 Hrs.	0.86	1.06	1.21	1.38	1.53	1.67
3 Hrs.	0.61	0.76	0.87	0.99	1.10	1.20
4 Hrs.	0.52	0.64	0.73	0.83	0.92	1.00
5 Hrs.	0.43	0.53	0.61	0.70	0.77	0.84
6 Hrs.	0.37	0.46	0.52	0.60	0.66	0.72
7 Hrs.	0.33	0.41	0.47	0.53	0.59	0.64
8 Hrs.	0.29	0.36	0.42	0.47	0.53	0.57
9 Hrs.	0.27	0.33	0.38	0.43	0.48	0.52
10 Hrs.	0.25	0.31	0.35	0.40	0.44	0.48
12 Hrs.	0.22	0.27	0.30	0.35	0.38	0.42
14 Hrs.	0.19	0.24	0.27	0.31	0.34	0.37
16 Hrs.	0.17	0.21	0.24	0.28	0.31	0.34
18 Hrs.	0.16	0.19	0.22	0.25	0.28	0.31
20 Hrs.	0.14	0.18	0.20	0.23	0.26	0.28
24 Hrs.	0.13	0.15	0.18	0.20	0.22	0.24

Source: Jasper County Indiana Drainage Specifications, 1997, Table 5A

2. Closed conduit and open channel design computations:
 - a. Size of pipe or channel cross section.
 - b. Pipe or channel invert slope in percent.
 - c. Roughness coefficient.
 - d. Flowing velocities in feet per second.
 - e. Design capacity in cubic feet per second.
 3. Head loss computations in manholes and junction chambers.
 4. Hydraulic gradient computation, wherever applicable.
- I. On-site drainage facilities shall be sufficient to accept:
1. The stormwater runoff from the parcel after development; and
 2. The present stormwater runoff from developed areas upstream; and
 3. The present stormwater runoff from undeveloped areas upstream; and
 4. The part of the stormwater runoff attributable to future development in undeveloped areas upstream, which is not reasonably likely to be accommodated in such upstream areas as determined by the City:
- J. Each applicant, person, corporation, or other entity which makes any surface changes shall be required to:
1. Collect on-site surface runoff and springs and dispose of it to the point of discharge into an adequate outlet approved by the City.
 2. Handle existing and potential off-site runoff through the development by designing to adequately handle storm runoff from a fully developed area upstream.
 3. Pay his proportionate share of the total cost of offsite improvements to the common natural watercourse, based on a fully developed drainage area.
 4. Provide and install at his expense, in accordance with the requirements of the Ordinance, all drainage and erosion control improvements.
- K. When a proposed drainage system shall carry water across private lands outside the subdivision, appropriate drainage rights must be secured by the subdivider and indicated on the plat as determined by the City.
- L. The approval of the Indiana Department of Natural Resources and the U.S. Army Corps of Engineers must be obtained and their requirements must be followed for all areas within their jurisdiction.

1.5 SURFACE GRADING FOR DRAINAGE

- A. In order to provide more suitable sites of building and other uses, improve surface drainage, and control erosion, the following requirements shall be met:
1. The locations, grading, and placement of subgrade (base) material of all street, public driveway, and public parking areas shall be accomplished as 'the first work done on a development plan.
 2. All lots, tracts, or parcels shall be graded to provide for proper drainage away from the buildings and for proper disposal without ponding, and all land within the development shall be graded to drain and dispose of surface water without ponding, except where approved by the City. Around each permanent building foundation there shall be a slope with a minimum vertical fall of six (6) inches for the area measured from the foundation to a point ten (10) feet from the building foundation or to the property line, whichever is closer.
 3. All drainage provisions shall be of such design to adequately handle the surface runoff and carry it to the nearest suitable outlet such as a curbed street, storm drain, or natural watercourse. Where drainage swales are used to divert surface waters away from buildings, they shall be sodded or planted, as required, and shall be of such slope, shape, and size as to conform with the requirements of the City.
 4. Concentration of surface water runoff shall only be permitted in swales or watercourses.
 5. Land alteration shall be accomplished in such a way that the grades left at the time that the work is completed will be permanent and stable.
 6. Excavation and Fills
 - a. Cut and fill slopes shall not be steeper than three to one (3:1), unless stabilized by a retaining wall or cribbing as approved by the City when handled under special conditions.
 - b. Provisions shall be made to prevent surface water from damaging the cut face of excavations or the sloping surfaces of fills, by installation of temporary or permanent drainage across or above this area.
 - c. Cuts and fills shall not endanger adjoining property.
 - d. Fill shall be placed and compacted so as to prevent sliding or erosion of the soil.
 - e. Fills shall not encroach or impede flows of natural watercourses or constructed channels.

- f. Fills placed adjacent to natural watercourses or constructed channels shall have protection against erosion during this period of construction as required by the City and State.
- g. Grading shall not be done in such a way so as to divert water onto the property of another land owner without the expressed consent of the land owner and the City.
- h. During grading operations, necessary measures for dust control shall be exercised.
- i. Grading equipment shall not be allowed to cross live streams. Provision shall be made for the installation of temporary or permanent culverts or bridges.

1.6 RESPONSIBILITY FOR DRAINAGE AND EROSION CONTROL

- A. Whenever sedimentation is caused by stripping of vegetation, regrading, or other development activities, it shall be the responsibility of the applicant, person, corporation, or other entity causing such sedimentation to remove it from all adjoining surfaces, drainage systems, and watercourses, and to repair any damage at his expense within seven (7) days.
- B. Maintenance of all driveways, parking areas, drainage facilities, and watercourses within any development plan area is the responsibility of the applicant or developer, provided that said facilities have not been dedicated to the public and accepted by the appropriate authority for public maintenance.
- C. It is the responsibility of the applicant and any person, corporation, or other entity doing any action on or across a communal stream, watercourse, or swale, or upon the flood plain or floodway of any watercourse during the period of development, to return these areas to their original or equal conditions upon completion of said activities.
- D. No applicant or person, corporation, or other entity shall block or impede the flow, construct any structure or alteration, deposit any material or thing, or commit any act which will affect normal or flood flow, in any communal stream or watercourse without having obtained prior approval from the County Drainage Board and/or the Indiana Department of Natural Resources, Division of Water, whichever is applicable.

City of Rensselaer
Storm Water Detention Facility Quarterly Inspection Form

SUBMIT FORM WITHIN 30 DAYS OF THE END OF EACH QUARTER TO THE CITY
(Form due dates: January 1, April 1, July 1, and October 1)

Detention Facility Property Owner: _____
Detention Facility Structure Responsible Party (if different than Owner): _____
Detention Facility Location: _____
Phone Number of Owner or Responsible Party: _____
Detention Facility/ Structure Type (circle one): Wet Detention Dry Detention
Name of Person Conducting the Inspection: _____
Signature: _____
Inspection Date: _____

QUARTERLY INSPECTION ITEMS
CIRCLE "YES" OR "NO" FOR ALL ITEMS BELOW

- | | | |
|---|-----|----|
| A. Has debris or trash accumulated in the basin or at the inlet, outlet or emergency spillway structures? | YES | NO |
| B. Are noxious weeds present that prevent the desired vegetation from growing properly? | YES | NO |
| C. Is woody vegetation growing on the embankments? | YES | NO |
| D. Is there adequate access to perform operations and maintenance activities? | YES | NO |
| E. Is there exposed soil not covered with vegetation, mulch, or other non-erodable material? | YES | NO |
| F. Is algae or stagnant moisture present in the detention facility? | YES | NO |
| G. Are unpleasant odors emerging from the detention facility? | YES | NO |
| H. Has sediment accumulated in the detention facility? | YES | NO |
| I. Is soil erosion present along standing or moving surface water? | YES | NO |
| J. Is soil erosion present at the basin sides, inlet, or outlet? | YES | NO |
| K. Are there any signs of damage to the inlet, outlet or emergency spillway structures? | YES | NO |
| L. Are holes present from animals or undesirable soil loss? | YES | NO |
| M. Are wet or soggy areas present that prevent desired vegetation from growing? | YES | NO |
| N. Is runoff entering or leaving the detention facility in a manner that prevents proper function of its inflow or outflow systems? | YES | NO |
| O. Does flow out of the detention facility occur in a manner that creates erosion or damage to adjacent property? | YES | NO |
| P. Are the detention facility functions impaired? | YES | NO |
| Q. Other items and comments: _____ | | |
| P. Corrective action for all "YES" answers above: | | |

Inspection Item Letter Corrective Action Status or Date Complete

(Attach additional sheets as necessary)