STEUBEN COUNTY

ORDINANCE

FOR

STORM DRAINAGE

AND

EROSION CONTROL

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STEUBEN COUNTY, INDIANA
ORDINANCE FOR
STORM DRAINAGE AND
EROSION CONTROL

Ordinance No. 673

1. Purpose

The purpose of this ordinance is to reduce the hazard to public health and safety caused by excessive stormwater runoff, to enhance economic objectives, and to protect, conserve and promote the orderly development of land and water resources within the regulatory area.

This ordinance regulates:

a. Stormwater drainage improvements related to development of lands located within Steuben County, Indiana.

b. Drainage control systems installed during new construction and grading of lots and other parcels of land.

c. Erosion and sediment control systems installed during new construction and grading of lots and other parcels of land.

d. The design, construction and maintenance of stormwater drainage facilities and systems.

2. Conflicting Ordinances

The provisions of this ordinance shall be deemed as additional requirements to minimum standards required by other ordinances of Steuben County, Indiana. In the event of conflicting requirements, the most restrictive shall apply.

3. Compliance with This and Other Ordinances

In addition to the requirements of this ordinance, compliance with the requirements set forth in the Zoning Ordinance of Steuben County, Indiana and other applicable ordinances with respect to submission and approval of preliminary and final Subdivision Plats, improvement plans, building and zoning permits, construction, inspections, appeals and similar matters, and compliance with applicable State of Indiana statues and regulations shall be required. No Improvement Location Permit shall be issued for the construction, extension, remodeling, alteration or repair of any proposed or existing building in Steuben County, until the plans for such construction, extension, remodeling, alteration or repair have been approved in writing by the Steuben County Surveyor.

4. Definitions and Abbreviations

For the purpose of this ordinance, the following definitions and abbreviations shall apply. Although not all of the definitions and abbreviations listed below are used in this ordinance, the additional terminology is provided to assist ordinance administrators, other community officials, and residents and permit applicants in understanding technical terminology associated with the subject matter of this ordinance.

a. Definitions

Antecedent Runoff Condition. The index of runoff potential before a storm event. The index, developed by the Soil Conservation Service (SCS), is an attempt to account for the variation of the SCS runoff curve number (CN) from storm to storm.

Acre-Foot (AF). A measure of water volume equal to the inundation of a flat one-acre area to a depth of one foot (43,560 cubic feet).

Amortization Period. The length of time used to repay a debt or mortgage or to depreciate an initial cost.

Backflow Preventer. A device that allows liquids to flow in only one direction in a pipe. Backflow preventers are used on sewer pipes to prevent a reverse flow during flooding situations.

Backwater. The rise in water surface elevation caused by some obstruction such as a narrow bridge opening, buildings or fill material that limits the area through which the water shall flow.

Base Flood Elevation (BFE). The water surface elevation corresponding to a flood having a one percent probability of being equaled or exceeded in a given year.

Basement. Any area of the building having its floor sub grade on all sides.

Benchmark. A marked point of known elevation from which other elevations may be established.

Best Management Practices. Design, construction, and maintenance practices and criteria for stormwater facilities that minimize the impact of stormwater runoff rates and volumes, prevent erosion, and capture pollutants.

Board. The County Drainage Board of Steuben County, Indiana and any subordinate employee to whom they shall specifically delegate a responsibility authorized by this ordinance.

Building. See "structure".

Capacity of a Storm Drainage Facility. The maximum flow that can be conveyed or stored by a storm drainage facility without causing damage to public or private property.

Centerline of Channel. The middle point or baseline of a channel.

Channel. A natural or artificial watercourse which periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. It has a defined bed and banks which serve to confine water.

Channel Modification. Alteration of a channel by changing the physical dimensions or materials of its bed or banks. Channel modification includes damming, rip-rapping or other armoring, widening, deepening, straightening, relocating, lining and significant removal of bottom or woody vegetation. Channel modification does not include the clearing of dead or dying vegetation, debris, or trash from the channel. Channelization is a severe form of channel modification typically involving relocation of the existing channel (e.g., straightening).

Compensatory Storage. An excavated volume of storage within a floodplain used to balance the loss of natural flood storage capacity when fill or substructures are placed within the floodplain. Such excavated volume has to be available for inundation by and accessible to the flood waters.

Contiguous. Adjoining or in actual contact with.

Contour. Imaginary line on the earth's surface which connects points of equal elevation.

Contour Line. Line on a map which represents a contour or points of equal elevation.

Control Structure. A structure designed to control the rate of flow that passes through the structure, given a specific upstream and downstream water surface elevation.

Convolution. The process of translating precipitation excess into a runoff hydrograph.

Crawl Space. Low space below first floor of a house where there has not been excavation deep enough for a basement, but where there is often access for pipes, ducts and utilities.

Crown of Pipe. The elevation of top of pipe.

Cross-Section. A graph or plot of ground elevation across a stream valley or a portion of it, usually along a line perpendicular to the stream or direction of flow as it would be viewed in an upstream direction.

Cubic Feet per Second (CFS). Used to describe the amount of flow passing a given point in a stream channel. One cubic foot per second is equivalent to approximately 7.5 gallons per second.

Culvert. A closed conduit used for the conveyance of surface drainage water under a roadway, railroad, canal or other impediment.

Curve Number (CN). The Soil Conservation Service index that represents the combined hydrologic effect of soil, land use, land cover, hydrologic condition and antecedent runoff condition.

Dam. All obstructions, wall embankments or barriers, together with any abutments and appurtenant works, constructed to store, direct water or create a pool (not including underground water storage tanks).

Damage. Measurable rise in flood heights on buildings currently subject to flooding, flooding of buildings currently not subject to flooding and increases in volume or velocity to the point where the rate of land lost to erosion and scour is substantially increased.

Datum. Any level surface to which elevations are referred, usually using Mean Sea Level.

Depressional Storage Areas. Non-riverine depressions in the earth where stormwater collects. The volumes are often referred to in units of acre-feet.

Design Storm. A selected storm event, described in terms of the probability of occurring once within a given number of years, for which stormwater or flood control improvements are designed and built.

Detention Facility. A facility designed to detain a specified amount of stormwater runoff assuming a specified release rate. The volumes are often referred to in units of acre-feet.

Detention Storage. The temporary detaining of storage of stormwater in storage facilities, on rooftops, in streets, parking lots, school yards, parks, open spaces or other areas under predetermined and controlled conditions, with the rate of release regulated by appropriately installed devices.

Development. Any man-made change to improved or unimproved real estate including but not limited to:

1. Construction, reconstruction, or placement of a building or any addition to an existing building, with a market value of more than $1,000;

2. Installing a manufactured home on a site, preparing a site for a manufactured home or installing a recreational vehicle on a site for more than 180 days;

3. Installing utilities, erection of walls and fences, construction of roads, or similar projects;

4. Construction of flood control structures such as levees, dikes, dams, channel improvements, etc.;

5. Mining, dredging, filling, grading, excavating, or drilling operations.

6. Construction and/or reconstruction of bridges or culverts;

7. Storage of materials; or

8. Any other activity that might change the present direction, height, or velocity of flood or surface waters.

"Development" does not include activities such as the maintenance of existing buildings and facilities such as painting, re-roofing; resurfacing roads; or gardening, plowing, and similar agricultural practices that do not involve filling, grading, excavation, or the construction of permanent buildings. In addition, "Development" does not include the reconstruction or maintenance of regulated drains or replacement of existing stream crossings by Steuben County.

Discharge. Normally the rate of flow out of a sewer, stormwater storage facility, or from a land surface. Discharges are customarily measured in cubic feet per second (cfs).

Drainage Area. The area from which water is carried off by a drainage system, a watershed or catchment area.

Drop Manhole. Manhole having a vertical drop pipe connecting the inlet pipe to the outlet pipe. The vertical drop pipe shall be located immediately outside the manhole.

Dry Bottom Detention Facility. A facility designed to be completely dewatered after having provided its planned detention of runoff during a storm event.

Duration. The time period of a rainfall event.

Elevation Certificate. A form published by Federal Emergency Management Agency that is used to certify the 100-year or base flood elevation and the lowest elevation of usable space to which a building has been constructed.

Elevation Reference Mark (ERM). Elevation benchmark tied to the National Geodetic Vertical Datum of 1929 and identified during the preparation of a Flood Insurance Study prepared for the Federal Emergency Management Agency.

Energy Dissipater. A device to reduce the erosion from the velocity or direction of flowing water.

Erosion. Wearing away of the land by running water and waves, abrasion, temperature changes, ice and wind.

Extraterritorial Jurisdiction (ETJ). Areas located outside the corporate limits of a community over which the community has statutory development authority.

Farm or Field Tile. A small diameter clay, concrete or plastic pipe installed in an agricultural area to allow drainage of farmland.

Flood or Flood Waters. A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow, the unusual and rapid accumulation, or the runoff of surface waters from any source.

Flood Boundary and Floodway Map (FBFM). A map prepared by the Federal Emergency Management Agency that depicts the FEMA designated floodways within a community. This map also includes the delineation of the 100-year and 500-year floodplain boundaries and the location of the Flood Insurance Study cross-sections.

Flood Crest. The maximum stage or elevation reached or expected to be reached by the waters of a specific flood at a given location.

Flood Duration. The length of time a stream is above flood stage or overflowing its banks.

Flood Easement. Easement granted to identify areas inundated by the 100-year flood and prohibit or severely restrict development activities.

Flood Elevation. The elevation at all locations delineating the estimated maximum level of high waters for a flood of given return period.

Flood Fighting. Actions taken immediately before or during a flood to protect human life and to reduce flood damages such as evacuation, emergency sandbagging and diking.

Flood Forecasting. The process of predicting the occurrence, magnitude and duration of an imminent flood through meteorological and hydrological observations and analysis.

Flood Frequency. A statistical expression of the average time period between floods equaling or exceeding a given magnitude. For example, a 100-year flood has a magnitude expected to be equaled or exceeded on the average of once every hundred years; such a flood has a one-percent chance of being equaled or exceeded in any given year. Often used interchangeably with "recurrence interval".

Flood Hazard Boundary Map. A map prepared by the Federal Emergency Management Agency that depicts Special Flood Hazard Areas as a "Zone A" within a community. There are no study texts, base flood elevations or floodways associated with this map.

Flood Insurance Rate Map (FIRM). A map prepared by the Federal Emergency Management Agency that depicts Special Flood Hazard Areas within a community. This map also includes the 100-year or Base Flood Elevation at various locations along the watercourses. More recent versions of the FIRM may also show the FEMA designated floodway boundaries and the location of the Flood Insurance Study cross-sections.

Flood Insurance Study (FIS). A study prepared by the Federal Emergency Management Agency to assist a community participating in the National Flood Insurance Program in its application of the program regulations. The study consists of a text which contains community background information with respect to flooding, a floodway data table, summary of flood discharges, flood profiles, a Flood Insurance Rate Map, and a Flood Boundary and Floodway Map.

Floodplain. The channel proper and the areas adjoining any wetland, lake or watercourse which have been or hereafter may be covered by the regulatory or 100-year flood. Any normally dry land area that is susceptible to being inundated by water from any natural source. The floodplain includes both the floodway and the floodway fringe districts.

Floodplain Management. The operation of a program of corrective and preventive measures for reducing flood damage, including but not limited to flood control projects, floodplain land use regulations, flood proofing of buildings, and emergency preparedness plans.

Floodplain Regulations. General term applied to the full range of codes, ordinances and other regulations relating to the use of land and construction within floodplain limits. The term encompasses zoning ordinances, subdivision regulations, building and housing codes, encroachment laws and open area (space) regulations.

Flood Profile. A graph showing the relationship of water surface elevation to a specific location, the latter generally expressed as distance above the mouth of a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific magnitude of flooding, but may be prepared for conditions at any given time or stage.

Flood Protection Grade (FPG). The elevation of the regulatory or 100-year flood plus two (2) feet at any given location in the Special Flood Hazard Area or 100-year floodplain.

Flood Resistant Construction (Flood Proofing). Additions, changes or adjustments to structures or property that are designed to reduce or eliminate the potential for flood damage.

Flood Storage Areas. Depressions, basins, or other areas that normally stand empty or partially empty, but fill with rainfall runoff during storms to hold the runoff and reduce downstream flow rates. The volumes are often referred to in units of acre-feet.

Floodway. The channel of a river or stream and those portions of the floodplains adjoining the channel which are reasonably required to carry and discharge efficiently the peak flow of the regulatory flood of any river or stream.

Floodway Fringe. Those portions of the floodplain lying outside the regulatory floodway.

Footing Drain. A drain pipe installed around the exterior of a basement wall foundation to relieve water pressure caused by high groundwater elevation.

Freeboard. An increment of height added to the base flood elevation to provide a factor of safety for uncertainties in calculations, unknown local conditions, wave actions and unpredictable effects such as those caused by ice or debris jams. (See Flood Protection Grade).

French Drain. A drainage trench backfilled with a coarse, water-transmitting material; may contain a perforated pipe.

Gabion. An erosion control structure consisting of wire cage filled with rocks.

Grade. The inclination or slope of a channel, canal, conduit, etc. or natural ground surface usually expressed in terms of the percentage the vertical rise (or fall) bears to the corresponding horizontal distance.

Groundwater Recharge. The infiltration of water into the earth. It may increase the total amount of water stored underground or only replenish supplies depleted through pumping or natural discharge.

High Water. Maximum designed, permitted, or regulated water level for an impoundment.

Hydraulics. A branch of science that deals with the practical application of the mechanics of water movement. A typical hydraulic study is undertaken to calculate water surface elevations.

Hydraulic Grade Line (HGL). For open channel flow, the HGL is equal to the water surface whereas for pressure flow it is the piezometric surface.

Hydrodynamic Loads. A force imposed on structures by floodwaters due to the impact of moving water on the upstream side of the structure, drag along its sides, and eddies or negative pressures on its downstream side.

Hydrograph. For a given point on a stream, drainage basin, or a lake, a graph showing either the discharge, stage (depth), velocity, or volume of water with respect to time.

Hydrology. The science of the behavior of water, its dynamics, composition and distribution in the atmosphere, on the surface of the earth, and underground. A typical hydrologic study is undertaken to compute flowrates associated with specified flood events.

Hydrometeorologic. Water-related meteorological data such as rainfall or runoff.

Hydrostatic Loads. Those loads or pressures resulting from the static mass of water at any point of floodwater contact with a structure. They are equal in all directions and always act perpendicular to the surface on which they are applied. Hydrostatic loads can act vertically on structural members such as floors, decks, and roofs, and can act laterally on upright structural members such as walls, piers, and foundations.

Impact Areas. Areas defined or mapped by the Steuben County Drainage Board which are unlikely to be easily drained because of one or more factors including but not limited to any of the following: soil type, topography, land where there is not adequate outlet, a floodway or floodplain, land within 75 feet of each bank of any regulated drain or within 75 feet from the center line of any regulated tile ditch.

Impervious Surface. Any hard-surfaced, man-made area that does not readily absorb or retain water, including but not limited to building roofs, parking and driveway areas, graveled areas, sidewalks and paved recreation areas.

Infiltration. Passage or movement of water into the soil.

Infiltration Swales. A depressed earthen area that is designed to promote infiltration.

Inlet. An opening into a storm sewer system for the entrance of surface stormwater runoff, more completely described as a storm sewer inlet.

Invert. The bottom or lowest point of flow in a conduit or channel.

Junction Chamber. A converging section of conduit, usually large enough for a

person to enter, used to facilitate the flow from one or more conduits into a main conduit.

Land Surveyor. A person licensed under the laws of the State of Indiana to practice land surveying.

Lateral Storm Sewer. A sewer that has inlets connected to it but has no other storm sewer connected.

Life Cycle Cost Cost based on the total cost incurred over the system life including research, development, testing, production, construction, operation, and maintenance. Costs are normally determined on present worth or equivalent annual cost basis.

Low Entry Elevation. The elevation in a structure where overbank flooding can enter the structure.

Lowest Floor. Refers to the lowest of the following:

1. The top of the basement floor;

2. The top of the garage floor, if the garage is the lowest level of the building;

3. The top of the first floor of buildings constructed on a slab or of buildings elevated on pilings or constructed on a crawl space with permanent openings; or

4. The top of the floor level of any enclosure below an elevated building where the walls of the enclosure provide any resistance to the flow of flood waters unless:

    i. The walls are designed to automatically equalize the hydrostatic flood forces on the walls by allowing for the entry and exit of flood waters, by providing a minimum of two openings (in addition to doorways and windows) having a total area of one (1) square foot for every two (2) square feet of enclosed area subject to flooding. The bottom of all such openings shall be no higher than one (1) foot above grade.

    ii. Such enclosed space shall be usable only for the parking of vehicles or building access.

Major Drainage System. Drainage system carrying runoff from drainage area of one (1) or more square miles.

Manhole. Storm sewer structure through which a person may enter to gain access to an underground storm sewer or enclosed structure.

Manning Roughness Coefficient or Manning's "n" Value. A dimensionless coefficient ("n") used in the Manning's equation to account for channel wall frictional losses in steady uniform flow.

Minor Drainage System. Drainage system carrying runoff from a drainage area less than one (1) square mile.

National Flood Insurance Program (NFIP). The NFIP is a Federal program enabling property owners to purchase flood insurance. The Federal Emergency Management Agency administers the NFIP in communities throughout the United States. The NFIP is based on an agreement between local communities and the Federal government which states that if a community will implement floodplain management measures to reduce future flood risks to new construction and substantially improved structures in flood hazard areas, the Federal government will make flood insurance available within the community as a financial protection against flood losses that do occur.

National Geodetic Vertical Datum of 1929 (NGVD 1929). The nationwide, Federal Elevation datum used to reference topographic elevations to a known value and based on mean sea-level.

National Pollution Discharge Elimination System (NPDES). Permit system under the authority of the U.S. Environmental Protection Agency regarding point and non-point sources of water pollution.

Nonpoint Source Pollution. Pollution that enters a water body from diffused origins on the watershed or drainage basin and does not result from discernible, confined, or defined conveyances or discharge points.

Off-site. Everything not located at or within a particular site.

Off-site Land Areas. Those areas which by virtue of existing topography must outlet through the developing property, or vice versa.

100-Year Frequency Flood. See "regulatory flood".

On-Site. Located within the controlled or urbanized area where runoff originates.

Open Channels. Open channels include not only those which are completely open overhead, but also closed conduits which are flowing partly full. Examples of such closed conduits are tunnels, storm sewers, sanitary sewers, and various types of pipelines. Flow in open channels involves a free surface.

Orifice. A device which controls the rate of flow from a detention basin.

Outfall. The point or location where storm runoff discharges from a sewer or

drain. Also applies to the outfall sewer or channel which carries the storm runoff to the point of outfall.

Overland Flow. Consists of sheet flow, shallow concentrated flow and open channel flow.

Peak Flow. The maximum rate of flow of water at a given point in a channel or conduit resulting from a predetermined storm or flood.

Planimetric Data. Horizontal measurements involving distances or dimensions on a diagram, map, Plat of Survey or topographic map. Normally in units of feet.

Plat of Survey. A scaled diagram showing boundaries of a tract of land or subdivision. This may constitute a legal description of the land and be used in lieu of a written description.

Probable Maximum Flood. The most severe flood that may be expected from a combination of the most critical meteorological and hydrological conditions that are reasonably possible in the drainage basin. It is used in designing high-risk flood protection works and siting of structures and facilities that shall be subject to almost no risk of flooding. The probable maximum flood is usually much larger than the 100-year flood.

Professional Engineer. A person licensed under the laws of the State of Indiana to practice professional engineering.

Radius of Curvature. Length of radius of a circle used to define a curve.

Rainfall Intensity. The cumulative depth of rainfall occurring over a given duration, normally expressed in inches per hour. In the Rational Formula, this represents the average rainfall intensity over a duration equal to the time of concentration for the catchment.

Reach. Any length of river, channel or storm sewer.

Recurrence Interval. A statistical expression of the average time between floods equaling or exceeding a given magnitude.

Redevelopment. See the definition for "Development".

Regulated Area. All of Steuben County, except for land areas lying within the jurisdiction or incorporated area of any incorporated City or Town.

Regulated Drain. A drain subject to the provisions of the Indiana Drainage Code, I.C.-36-9-27.

Regulatory or 100-Year Flood. The flood having a one percent (1%) probability of being equaled or exceeded in any given year, as calculated by a method and procedure which is acceptable to and approved by the Indiana Department of Natural Resources and the Federal Emergency Management Agency. If a permit from the Indiana Department of Natural Resources - Division of Water (IDNR-DOW) for construction in the floodway is required, then the regulatory flood peak discharge should be calculated by a method acceptable to the Steuben County Drainage Board and IDNR-DOW. The "regulatory flood" is also known as the "base flood".

Regulatory Floodway. See "floodway".

Release Rate. The amount of stormwater released from a stormwater control facility per unit of time.

Reservoir. A natural or artificially created pond, lake or other space used for storage, regulation or control of water. May be either permanent or temporary. The term is also used in the hydrologic modeling of storage facilities.

Retention Facility. A facility designed to completely retain a specified amount of stormwater runoff without release except by means of evaporation, infiltration or pumping. The volumes are often referred to in units of acre-feet.

Return Period. The average interval of time within which a given rainfall event will be equaled or exceeded once. A flood having a return period of 100 years has a one percent probability of being equaled or exceeded in any one year.

Right-of-Way for a County Drain. Land through which a regulated county drain passes and is controlled without restriction or interruption by the property owner.

Riprap. Large rock or other material that when installed along an erodible surface reduces the erosion potential.

Riverine. An area relating to, formed by, or resembling a stream (including creeks and rivers).

Runoff. The waters derived from melting snow or rain falling within a tributary drainage basin that exceed the infiltration capacity of the soils of that basin, flow over the surface of the ground, or are collected in channels or conduits.

Runoff Coefficient. A decimal fraction relating the amount of rain which appears as runoff and reaches the storm sewer system to the total amount of rain falling. A coefficient of 0.5 implies that 50 percent of the rain falling on a given surface appears as stormwater runoff.

Sanitary Backup. The condition where a sanitary sewer reaches capacity and surcharges into the lowest area, normally a basement.

Scour. The clearing and digging action of flowing water.

Sediment. Debris or material of soil and rock origin, transported, carried or deposited by water.

Sedimentation. The process that deposits soils, debris and other materials either on the ground surfaces or in bodies of water or watercourses.

Seepage. The passage of water or other fluid through a porous medium, such as the passage of water through an earth embankment or masonry wall.

Silt Screen Fence. A fence constructed of wood or steel supports and either natural (e.g. burlap) or synthetic fabric stretched across an area of flow during site development designed to trap and retain on-site sediment due to rainfall runoff.

Siphon. A closed conduit or portion of which lies above the hydraulic grade line, resulting in a pressure less than atmospheric and requiring a vacuum within the conduit to start flow. A siphon utilizes atmospheric pressure to effect or increase the flow of water through a conduit. An inverted siphon is used to carry stormwater flow under an obstruction such as a sanitary sewer.

Special Flood Hazard Area (SFHA). Those lands within the jurisdiction of a community which are subject to inundation by the regulatory or 100-year flood. Special Flood Hazard Areas are usually designated on a Flood Hazard Boundary Map as Zone A. After detailed evaluation of local flooding characteristics, the Flood Insurance Rate Map will refine this categorization into Zones A, AE, AH, AO and A1-30.

Spillway. A waterway in or about a hydraulic structure, for the escape of excess water.

Standard Project Flood. A term used by the U.S. Army Corps of Engineers to designate a flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonable characteristics of the geographical area in which the drainage basin is located, excluding extremely rare combinations. The peak flow for a standard project flood is generally 40 to 60 percent of the probable maximum flood for the same location.

Stilling Basin. A basin used to slow water down or dissipate its energy.

Storm Duration. The length of time that water may be stored in any stormwater control facility, computed from the time water first begins to be stored.

Storm Sewer. A closed conduit for conveying collected stormwater.

Stormwater Facility. All ditches, channels, conduits, levees, ponds, natural and manmade impoundments, wetlands, tiles, swales, sewers and other natural or artificial means of draining surface and subsurface water from land.

Stormwater Runoff. The water derived from rains falling within a tributary basin, flowing over the surface of the ground or collected in channels or conduits.

Structure. Refers to a structure that is principally above ground and is enclosed by walls and a roof. The term includes a gas or liquid storage tank, a manufactured home or a prefabricated building. The term also includes recreational vehicles to be installed on a site for more than 180 days.

Structural Engineer. A person licensed under the laws of the State of Indiana to engage in the designing or supervising of construction, enlargement or alteration of structures or any part thereof, for others, to be constructed by persons other than himself or herself.

Structural Floodplain Management Measures. Those physical or engineering measures employed to modify the way floods behave, e.g., dams, dikes, levees, channel enlargements and diversions.

Subarea/Subbasin. Portion of a watershed divided into homogenous drainage units which can be modeled for purposes of determining runoff rates. The subareas/subbasins have distinct boundaries, as defined by the topography of the area.

Substantial Improvement. Any reconstruction, rehabilitation, addition or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "substantial damage" regardless of the actual repair work performed. The term does not include improvements of structures to correct existing violations of state or local health, sanitary, or safety code requirements or any alteration of a "historic structure", provided that the alteration will not preclude the structures continued designation as a "historic structure".

Sump Failure. A failure of the sump pump that results in inundation or damage of a crawl space or basement.

Sump Pump. A small pump that discharges seepage from foundation footing drains.

Surcharge. Backup of water in a sanitary or storm sewer system in excess of the design capacity of the system.

Tailwater. The water surface elevation at the downstream side of a hydraulic structure (i.e. culvert, bridge, weir, dam, etc.).

Thalweg. The deepest point (or centerline) of a channel.

Time of Concentration (t_c). Is the travel time of a particle of water from the most hydraulically remote point in the contributing area to the point under study. This can be considered the sum of an overland flow time and times of travel in street gutters, storm sewers, drainage channels, and all other drainage ways.

Topographic Map. Graphical portrayal of the topographic features of a land area, showing both the horizontal distances between the features and their elevations above a given datum.

Topography. The representation of a portion of the earth's surface showing natural and man-made features of a give locality such as rivers, streams, ditches, lakes, roads, buildings and most importantly, variations in ground elevations for the terrain of the area.

TP-40 Rainfall. Design storm rainfall depth data for various durations published by the National Weather Services in their Technical Paper 40 dated 1961.

Transition Section. Reaches of the stream or floodway where water flows from a narrow cross-section to a wide cross-section or vice-versa.

Tributary. Based on the size of the contributing drainage area, a smaller watercourse which flows into a larger watercourse.

Underdrain. A small diameter perforated pipe or conduit that allows the bottom of a detention basin to drain.

Unit Hydrograph. A unit hydrograph is the hydrograph that results from one inch of precipitation excess generated uniformly over the watershed at a uniform rate during a specified period of time.

Urbanization. The development, change or improvement of any parcel of land consisting of one or more lots for residential, commercial, industrial, institutional, recreational or public utility purposes.

Watercourse. Any river, stream, creek, brook, branch, natural or man-made drainage way in or into which stormwater runoff or floodwaters flow either regulatory or intermittently.

Watershed. The land area drained by contributing water to a specific point that could be along a stream, lake or other stormwater facilities. Watersheds are often broken down into sub areas for the purpose of hydrologic modeling.

Watershed Area. The total area from which surface runoff is carried away by a drainage system.

Weir. A device which is used to restrict the flow of water thereby limiting the discharge rates. A weir can also facilitate calculation or measurement of the discharge rates. These are often used to control the rate of flow out of stormwater storage facilities.

Wet Bottom Retention Facility. A facility designed to retain a permanent pool of water after having provided its planned detention of runoff during a storm event.

Wetlands. Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions and/or those wetland areas that are under the COE jurisdiction.

b. Abbreviations

BFE	Base Flood Elevation
CFS	Cubic Feet per Second
CLOMR	Conditional Letter of Map Revision (from FEMA)
CLOMR-F	Conditional Letter of Map Revision Based on Fill (from FEMA)
CN	Curve Number
COE	United States Army Corps of Engineers
ERM	Elevation Reference Mark
FBFM	Flood Boundary and Floodway Map
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FPG	Flood Protection Grade
FPS	Feet per Second

HGL	Hydraulic Grade Line
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
LAG	Lowest Adjacent Grade
LOMA	Letter of Map Amendment (from FEMA)
LOMR	Letter of Map Revision (from FEMA)
LOMR-F	Letter of Map Revision Based on Fill (from FEMA)
NFIP	National Flood Insurance Program
NAVD	North American Vertical Datum of 1988
NGVD	National Geodetic Vertical Datum of 1929
NPDES	National Pollution Discharge Elimination System
SCS	Soil Conservation Service, now known as Natural Resources Conservation Service (NRCS).
SFHA	Special Flood Hazard Area
t_c	Time of Concentration

5. Stormwater Control Policy

It is recognized that, with the possible exception of the major watercourses such as the Fawn River, Pigeon Creek, Fish Creek and Turkey Creek, the smaller streams and drainage channels serving Steuben County do not have sufficient capacity to receive and convey stormwater runoff resulting from continued urbanization. Accordingly, the storage and controlled release rate of excess stormwater runoff shall be required for all new business, commercial and industrial developments, residential subdivisions, planned unit development, and any redevelopment or other new construction located within Steuben County.

The release rate of stormwater from developments, and redevelopments may not exceed the peak 5-year return period stormwater runoff from the land area in its present state of development.

The developer shall submit to the Steuben County Drainage Board, detailed computations of runoff before and after development or redevelopment which demonstrates that runoff will not be increased. These computations shall show that the peak runoff rate after development for the 100-year return period storm of 24-hour duration shall not exceed the 5-year return period pre-development peak runoff rate.

Computations for development sites up to and including 5 Acres in size, with a drainage area less than or equal to 50 Acres and no depressional storage, may be based on the Rational Method, typical runoff coefficients listed herein, and 5-year return rainfall data.

For development sites larger than 5 acres in size, or when the contributing drainage area is in excess of 50 Acres or contains significant depressional storage, hydrograph techniques or computer drainage modeling methods shall be used. Hydrograph techniques and computer modeling methods used to determine stormwater runoff shall be proven methods, subject to approval of the Steuben County Drainage Board.

6. Information Requirements

The following information and data prepared by a licensed professional engineer or land surveyor engaged in storm drainage design shall accompany plans of (1) each proposed major or minor subdivision lying within the Regulated Area (as defined in Section 4) prior to Final Plat Approval by the Steuben County Planning Commission, and (2) each building permit application for construction of a commercial or industrial facility which is to be constructed on real estate which lies within the Regulated Area and which has not been subdivided pursuant to the Zoning Ordinance of Steuben County or prior sub-division control ordinances.

a. Topographic Survey Map

A topographic map of the land to be subdivided and such adjoining land whose topography may affect the layout or drainage of the development. The contour intervals shall be one foot when slopes are less than two percent and shall be two feet when slopes exceed two percent. On this map, the following shall be shown:

1. The location of streams and other flood water runoff channels, the extent of the floodplains at the established 100-year flood elevation where available, and the limits of the regulatory floodway, all properly identified and sources noted. NOTE: the regulatory floodway may be measured from the effective FEMA map. However, floodplain boundaries shall be determined based on the 100-year flood elevation/profile and the Topographic Survey Map prepared according to this section.

2. The normal shoreline of lakes, ponds, swamps and detention/retention facilities, their floodplains, and direction of inflow and outflow if any.

3. The location of regulated drains, farm drains, tile drain sizes, inlets and outfalls, if any of record.

4. Storm, sanitary and combined sewers and outfalls, if any of record.

5. Septic tank systems and outlet, if any of record.

6. Seeps, springs, flowing and other wells, that are visible or of record.

7. Soil names and their hydrologic classification for the proposed development when hydrologic methods requiring soils information are used.

b. Preliminary Drainage Plans

A comprehensive plan, in preliminary form (or in combined preliminary and final form), designed to safely handle the stormwater runoff and detain the increased stormwater runoff. The plan shall provide or be accompanied by maps or other descriptive material indicating the feasibility of the drainage plan and showing the following:

1. The extent and area of each upstream, off-site watershed tributary to the subject site. Required materials for preliminary review include:

   i. Exhibit showing each upstream, off-site drainage area tributary to the subject site on USGS Quadrangle Maps or other more detailed topographic maps.

   ii. Preliminary plan to convey upstream, off-site runoff through the subject property, shown on the preliminary drainage plan for the site.

2. The capacity of the downstream, off-site receiving system (outlet). Information must be submitted to show that the downstream, off-site drainage system has the capacity to convey the expected runoff from the subject property and any upstream, off-site areas.

3. The general drainage plan for the subject property must include the following items:

   i. The extent and area of each watershed on the subject property in the existing condition. Calculations to determine the allowable release rate from the subject property should also be included.

   ii. The extent and area of each watershed affecting the design of detention facilities as shown on USGS Quadrangle Maps or other more detailed topographic maps as required by the Steuben County Drainage Board.

   iii. Elevations in either NGVD or NAVD.

   iv. The estimated location and percentage of impervious

surfaces expected to be constructed when the development is completed.

v. Existing detention/retention facilities to be maintained, enlarged, or otherwise altered and new ponds or basins to be built and the basis of their design.

vi. The estimated depth and amount of storage required by design of the new facilities.

vii. The preliminary layout and design of street storm sewers, where proposed, and other storm drains to be built, the outfall and outlet locations and approximate elevations, the receiving stream or channel and its 100-year return period water elevation.

viii. The preliminary layout of swales which collect runoff from on-site and/or off-site watersheds.

ix. Proposed culverts and bridges to be built, their materials, elevations, waterway openings and basis of their design.

x. Identification of overland flow routes to detention/retention facilities.

4. Existing streams and floodplains to be maintained and new channels to be constructed, their locations, cross-sections and profiles.

5. Any interim drainage plan which is to be incorporated into the development pending completion of the development and the final drainage plan.

6. A copy of the effective FEMA map, annotated to show the project location and property boundaries in relation to the regulatory floodplain and floodway.

7. The location of any regulatory wetlands on the subject property, as determined by a qualified wetlands specialist or the SCS.

8. A report summarizing the hydraulic design parameters and detailing how this design satisfies this ordinance.

c. Valley Cross-Sections

One or more typical cross-sections of all existing and proposed channels or other open drainage facilities carried into the overbank to a point above the 100-year flood elevation. These shall also show the elevation of the existing land and the proposed changes thereto, together with the high water elevations expected from the 100-year flood under the controlled conditions called for by this ordinance, and the relationship of structures, streets and other facilities. Cross-sections must be represented perpendicular to the expected flow path.

d. Site Engineering Plans

Site engineering plans shall be drawn to scale and show the dimensions and features of the proposed development. The requirements for the site plan contents and format are as follows:

1. The set of plans shall contain the following sheets as a minimum:

    i. Title Sheet, with project name and location map. The title sheet shall also include the name, address, telephone number and seal of the registered professional engineer or the licensed/registered land surveyor preparing the plans.

    ii. Topographic Survey Map.

    iii. Geometric Plan showing all dimensions of existing property boundaries and necessary data to layout the proposed development.

    iv. Grading/Drainage Plan which identifies all existing and proposed drainage characteristics such as swales, drainage break points and storm sewers, detention facilities and erosion facilities.

2. Each plan sheet shall include:

   i. A title block located in the lower right hand corner that includes the project name, job number, sheet title (Geometric, Grading, etc.), sheet number, date of preparation and latest revision date and description.

   ii. North arrow.

   iii. Graph scale (bar scale), preferably with a scale between 1 inch = 20 feet and 1 inch = 100 feet.

   iv. A legend clearly identifying all symbols indicated on that plan sheet.

   v. Plan sheets shall be twenty-four inches (24") by thirty-six inches (36") in size.

   vi. An adequate number of benchmarks shown with elevations referenced to NGVD or NAVD to facilitate checking of elevations without more than one setup of a surveyor's level, except for large development sites where additional setups may be warranted.

   vii. Delineation of all existing and proposed easements for underground and overhead utilities and drainage.

e. Final Drainage Plans

Upon approval of the preliminary drainage plans by the Steuben County Surveyor final drainage plans shall be submitted to the Steuben County Surveyor. In addition to data provided on the preliminary drainage plans, the final plans shall provide or be accompanied by calculations, maps and other descriptive material including the following:

1. A set of plan drawings stamped by an Indiana Registered Professional Engineer or an Indiana Registered Land Surveyor showing all proposed detention areas, storm sewers, inlets, outfall structures, open ditches, culverts (including driveway crossings) and bridges. At the minimum, these plan drawings should show or accompany the following:

   i. The extent and area of each watershed area tributary to the drainage channels in the development.

ii. Elevations in either NGVD or NAVD.

iii. Proposed contours and where they tie into existing contours at the property boundaries.

iv. The street storm sewers and other storm drains to be built, the basis of their design, outfall and outlet locations and invert elevations, receiving stream or channel and its 100-year flood elevations, and the functioning of the drains during 100-year flood conditions.

v. The parts of the proposed street system where pavements are planned to be depressed sufficiently to convey or temporarily store overflow from storm sewers and over the curb runoff resulting from the heavier rainstorms and the outlets for such overflow.

vi. Existing streams and 100-year floodplains to be maintained and new channels to be constructed, their locations, cross-sections and profiles.

vii. Proposed culverts and bridges to be built, their materials, elevations, waterway openings and basis of their design.

viii. Existing detention/retention facilities to be maintained, enlarged or otherwise altered and new facilities to be built and the basis of their design.

ix. The estimated location and percentage of impervious surfaces existing and expected to be constructed when the development is completed.

x. The slope, type and size of all sewers and other waterways.

xi. An erosion control plan

2. A written report stamped by an Indiana Registered Professional Engineer or an Indiana Registered Land Surveyor shall be included with each preliminary and final drainage plan. The report will contain a summary description of the following:

i. The significant drainage problems associated with the project.

ii. The analysis and procedure used to evaluate these problems and propose solutions.

iii. Any assumptions or special conditions associated with the use of these procedures, especially the hydrologic or hydraulic methods.

iv. The proposed design of the drainage control system.

v. The results of the analysis of the proposed drainage control system showing that it does solve the project's drainage problems.

vi. As an appendix to the report, a hydraulic report detailing existing and proposed drainage patterns on the subject site. The report should include a description of the present land use as well as proposed land use. Any off-site drainage entering the site should also be addressed. This report should be comprehensive and detail all the steps which the design engineer took during the design process. All hydrologic and hydraulic computations should be included in the submittal. These calculations should include, but not be limited to: development of runoff curve numbers or runoff coefficients; runoff calculations; stage-discharge relationships for detention/ retention facility outfalls; times of concentration; and storage volume. A map showing any drainage subareas used in the analysis shall accompany the report.

vii. Copies of all computer model runs used in the drainage analyses. These computer runs should include both the model inputs and the outputs. A floppy diskette with input files will expedite the review process.

viii. For all detention/retention facilities, a plot or tabulation of storage volumes with corresponding water surface elevations and a plot or tabulation of the facility outflow rates for those water surface elevations.

3. In addition to the criteria and requirements set in this ordinance, the plans and calculations should also meet the following criteria:

i. If roadside ditches are used rather than storm sewers, the bottom of the ditch should be low enough to install adequately sized driveway culverts without creating an irregularity in the average driveway contour ("speed bumps").

ii. Driveway culvert inverts shall be designed to adequately consider upstream and downstream culvert elevations.

iii. Minimum swale and yard slopes are 0.3%.

iv. Maximum yard slopes are 3:1.

v. Top of foundation no less than 0.5 feet above finished grade.

vi. Spot elevations shown at the drainage break points.

vii. Pipes have adequate slope to maintain 2.5 feet per second (fps) velocity (cleaning velocity).

viii. When changing pipe size, match inverts of pipes.

viii. Pipe slope is not so steep that inlets surcharge (i.e. hydraulic grade line below rim elevation).

ix. Inlets are placed such that the tributary flows are in accordance with the grate capacity (i.e. depth of inundation above rim is tolerable in 10-year and 100-year storms).

f. Submittal and Consideration of Plans

Preliminary and final drainage plans and/or construction plans shall be submitted to the Steuben County Drainage Board twenty (20) days prior to their regularly scheduled meeting. All preliminary plans, final plans and construction plans in compliance with the standards of this ordinance shall be approved by the Steuben County Drainage Board. The Steuben County Drainage Board or the Steuben County Surveyor shall stamp such approval on a copy of such plans and deliver the same to the applicant. The Steuben County Drainage Board shall approve or disapprove any preliminary plans, final plans and construction plans within sixty (60) days of submission unless the applicant requests or consents to a continuance or extension. All approvals and disapprovals with written reasons shall be incorporated into the Steuben County Drainage Board Minutes.

The Steuben County Surveyor is authorized to review engineering summaries of projects and based upon the same, grant exemptions from any or all requirements of this ordinance and/or waive any requirements of this ordinance. Any applicant may appeal the decision of the Steuben County Surveyor to the Steuben County Drainage Board which shall also be authorized to grant exemptions from any or all requirements of this ordinance and/or waive any requirements of this ordinance in its discretion.

7. Determination of Runoff Quantities

Runoff quantities shall be computed for the area of the parcel under development plus the area of the watershed flowing into the parcel under development. The quantity of runoff which is generated as the result of a given rainfall intensity may be calculated as follows:

a. Development Sites Less Than or Equal to 5 Acres in Size, With a Drainage Area Less Than or Equal to 50 Acres and No Depressional Storage

The Rational Method may be used for sites meeting the stated criteria. In the Rational Method, the peak rate of runoff, Q, in cubic feet per second (cfs) is computed as:

$$Q = CIA$$

Where: C = Runoff coefficient, representing the characteristics of the drainage area and defined as the ratio of runoff to rainfall.

I = Average intensity of rainfall in inches per hour for a duration equal to the time of concentration (tc) for a selected rainfall frequency.

A = Tributary drainage area in acres.

Guidance to selection of the runoff coefficient "C" is provided by Tables 1A, 1B and 1C which show values for different types of surfaces and local soil characteristics. The composite "C" value used for a given drainage area with various surface types shall be the weighted average value for the total area calculated from a breakdown of individual areas having different surface types.

TABLE 1A

Composite Runoff Coefficients

Type of Surface	Runoff Coefficient "C"
Asphalt & Concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns (Sandy Soil)	
Flat (0%-2% Slope)	0.05 to 0.10
Rolling (2%-7% Slope)	0.10 to 0.15
Steep (7% + Slope)	0.15 to 0.20
Lawns (Clay Soil)	
Flat (0%-2% Slope)	0.13 to 0.17
Rolling (2%-7% Slope)	0.18 to 0.22
Steep (7% + Slope)	0.25 to 0.35

Source: HERPICC Stormwater Drainage Manual, July 1994

TABLE 1B

Urban Runoff Coefficients

Description of Area	Runoff Coefficient "C"
Business	
Downtown	0.70 to 0.95
Neighborhood	0.50 to 0.70
Residential	
Single-Family	0.30 to 0.50
Multi-units, detached	0.40 to 0.60
Multi-units, attached	0.60 to 0.75
Residential (Suburban)	0.25 to 0.40
Apartment	0.50 to 0.70
Industrial	
Light	0.50 to 0.80
Heavy	0.60 to 0.90
Parks, Cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad Yard	0.20 to 0.35
Unimproved	0.10 to 0.30

Source: HERPICC Stormwater Drainage Manual, July 1994.

TABLE 1C

Rural Runoff Coefficients

Description of Area	Soil Texture		
Vegetation and Topography	Open Sandy Loam	Clay and Silt Loam	Tight Clay
Woodland			
Flat: 0-5% Slope	0.10	0.30	0.40
Rolling: 5-10% Slope	0.25	0.35	0.50
Steep: 10-30% Slope	0.30	0.50	0.60
Pasture			
Flat: 0-5% Slope	0.10	0.30	0.40
Rolling: 5-10% Slope	0.16	0.36	0.55
Steep: 10-30% Slope	0.22	0.42	0.60
Cultivated			
Flat: 0-5% Slope	0.30	0.50	0.60
Rolling: 5-10% Slope	0.40	0.60	0.70
Steep: 10-30% Slope	0.52	0.72	0.82

Source: HERPICC Stormwater Drainage Manual, July 1994

Table 2 provides runoff coefficients and inlet times for different land use classifications. In the instance of undeveloped land situated in an upstream area, a coefficient or coefficients shall be used for this area in its present state of development.

Rainfall intensity shall be determined from the rainfall frequency curves shown in Figure 1 or from data shown in Table 5B. The **time of concentration (t_c)** to be used shall be the sum of the inlet time and flow time in the stormwater facility from the most remote part of the drainage area to the point under consideration. The **flow time** in the storm sewers may be estimated by the distance in feet divided by velocity of flow in feet per second. The **velocity** shall be determined by the Manning's Equation (see Section 10). **Inlet time** is the combined time required for the runoff to reach the inlet of the storm sewer. It includes overland flow time and flow time through established surface drainage channels such as swales, ditches and sheet flow across such areas as lawns, fields and other graded surfaces.

All stormwater management projects within Steuben County shall be evaluated using the time of concentration methodology outlined in the U.S. Department of Agriculture (USDA) - Soil Conservation Service (SCS) TR-55 Manual. The SCS TR-55 methodology examines the factors which affect time of concentration including surface roughness, channel shape and flow patterns along with watershed slope. Through the examination of sheet, shallow, concentrated and open channel flows, a more refined time of concentration may be determined. The methodology represents the standardization by the SCS for procedures to calculate the times of concentration.

b. Development Sites Greater Than 5 Acres in Size, or When the Contributing Drainage Area is in Excess of 50 Acres or Contains Significant Depressional Storage

The runoff rate for development sites meeting the stated criteria shall be determined by methods described in Section 5.

TABLE 2

Runoff Coefficients "C" by Land Use and Typical Inlet Times

Land Use	Runoff Coefficients			Inlet Times (Minutes)[4]
	Flat[1]	Rolling[2]	Steep[3]	
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	
Parkland	0.18	0.20	0.22	To Be Computed

Source: HERPICC Stormwater Drainage Manual, July 1994.

1. Flat terrain involves slopes of 0-2%.
2. Rolling terrain involves slopes of 2-7%.
3. Steep terrain involves slopes greater than 7%.
4. Interpolation, extrapolation and adjustment for local conditions shall be based on engineering experience and judgment.

8. Amount of Runoff to be Accommodated by Various Parts of the Drainage Facility

Various parts of a drainage facility shall accommodate runoff water as follows:

a. Minor Drainage System

The minor drainage system such as inlets, catch basins, street gutters, swales, sewers and small channels which collect stormwater shall accommodate, as a minimum, peak runoff from a 10-year return frequency storm. For Rational Method analysis, the duration shall be equal to the time of concentration for the drainage area. In computer-based analysis, the duration is as noted in the applicable methodology associated with the computer program.

These minimum requirements shall be satisfied:

1. The allowable spread of water on Collector Streets is limited to maintaining two clear 10 foot moving lanes of traffic. One lane is to be maintained on Local Roads, while other access lanes (such as a subdivision cul-de-sac) can have a water spread equal to one-half of their total width.

2. Open channels carrying greater than 30 cubic feet per second shall be capable of accommodating peak runoff for a 24-hour, 50-year return frequency storm within the drainage easement.

3. Culverts shall be capable of accommodating peak runoff from a 24-hour, 50-year return frequency storm when crossing under a road which is part of the INDOT rural functional classification system.

4. Rear and side lot swales shall not carry more than 4 cfs and only 2 cfs if a swale crosses a sidewalk.

b. Major Drainage System

Major drainage systems are defined in Section 4 and shall be designed in accordance with IDNR standards.

9. Level of Protection

a. The lowest floor elevations of all residential, commercial or industrial buildings shall be such that all floors, **including basement**, shall be at the flood protection grade and therefore have 2 feet of freeboard above the 100-year flood elevation, as defined by FEMA.

b. The low entry elevation for residential buildings outside the 100-year floodplain shall be based upon the maximum flood of record or upon the 100-year flood, whichever is greater, together with a freeboard of two feet, as applies to ponds and swales. Pad elevations shall be a minimum of 15 inches above an adjacent road elevation.

10. Storm Sewer Design Standards

All storm sewers, whether private or public, and whether constructed on private or public property shall conform to the design standards and other requirements contained herein. The Rational Method will be acceptable for storm sewer design, as long as the SCS TR-55 time of concentration methodology is used. Determination of hydraulic capacity for storm sewers sized by the Rational Method analysis should be done using Manning's Equation. A minimum drop of 0.1 foot through manholes should be provided.

a. Manning's Equation

The hydraulic capacity of storm sewers shall be determined using the Manning's Equation to determine velocity, where:

$$V = 1.486/n \, R^{2/3} \, S^{1/2}$$

V = mean velocity of flow in feet per second

R = the hydraulic radius in feet

S = the slope of the energy grade line in feet per foot

n = Manning's "n" or roughness coefficient

The hydraulic radius, R, is defined as the cross sectional area of flow divided by the wetted flow surface or wetted perimeter. Typical "n" values and maximum permissible velocities for storm sewer materials are listed in Table 3.

b. Minimum Size for Storm Sewers

The minimum diameter of all storm sewers shall be 12 inches. The rate of release for detention storage shall be controlled by an orifice plate or other device, subject to approval of the Steuben County Drainage Board, when the minimum 12 inch diameter pipe will not limit the rate of release to the required amount.

c. Pipe Cover and Grade

Sewer grade shall be such that, in general, a minimum of two and one half (2.5) feet of cover is maintained over the top of the pipe. If the pipe is to be placed under pavement, then the minimum pipe cover shall be three (3.0) feet. Pipe cover less than the minimum may be used only upon approval of the Steuben County Drainage Board. Uniform slopes shall be maintained between inlets, manholes and inlets to manholes. Final grade shall be set with full consideration of the capacity required, sedimentation problems and other design parameters. Minimum and maximum allowable slopes shall be those capable of producing velocities of between 2.5 and 15 feet per second, respectively, when the sewer is flowing full. Maximum permissible velocities for storm sewer materials are listed in Table 3.

TABLE 3
Typical Values of Manning's "n"

Material	Manning's "n"	Desirable Maximum Velocities
Closed Conduits		
Concrete	0.013	15 f.p.s.
Vitrified Clay	0.013	15 f.p.s.
Brick	0.015	15 f.p.s.
Cast Iron	0.013	15 f.p.s.
Circular Corrugated Metal Pipe, Annular Corrugations, 2 2/3 x 1/2 in.		
Unpaved	0.024	7 f.p.s.
25% Paved	0.021	7 f.p.s.
50% Paved	0.018	7 f.p.s.
100% Paved	0.013	7 f.p.s.
Concrete Culverts	0.013	15 f.p.s.
High Density Polyethylene (HDPE)/PVC	0.012	10 f.p.s.
Open Channels		
Concrete, Trowel Finish	0.013	15 f.p.s.
Concrete, Broom or Float Finish	0.015	15 f.p.s.
Gunite	0.018	15 f.p.s.
Riprap Placed	0.030	10 f.p.s.
Riprap Dumped	0.035	10 f.p.s.
Gabion	0.028	10 f.p.s.
New Earth (Uniform, Sodded, Clay)	0.025	3-5 f.p.s.
Existing Earth (Fairly Uniform, With Some Weeds)	0.030	3-5 f.p.s.
Dense Growth of Weeds	0.040	3-5 f.p.s.
Dense Weeds and Brush	0.040	3-5 f.p.s.
Swale With Grass	0.035	3-5 f.p.s.

Source: HERPICC Stormwater Drainage Manual, July 1994.

d. Alignment

Storm sewers shall be straight between manholes.

e. Manholes

Manholes shall be installed to provide access to continuous underground storm sewers for the purpose of inspection and maintenance. Manholes shall be provided at the following locations:

1. Where two or more storm sewers converge.

2. Where pipe size changes.

3. Where a change in horizontal alignment occurs.

4. Where a change in grade occurs.

5. At intervals in straight sections of sewer, not to exceed the maximum allowed.

The maximum distance between storm sewer manholes shall be as follows:

Size of Pipe (Inches)	Maximum Distance (Feet)
12 through 42	400
48 and Larger	600

f. Inlets

Inlets or drainage structures shall be utilized to collect surface water through grated openings and convey it to storm sewers, channels or culverts. The inlet grate opening provided shall be adequate to pass the design 10-year flow with 50% of the sag inlet areas clogged. An overload channel from sag inlets to the overflow channel or basin shall be provided at sag inlets, so that the maximum depth of water that might be ponded in the street sag shall not exceed 7 inches. Inlet design and spacing may be done using the hydraulic equations by manufacturers or orifice/weir equations. Use of the U.S. Army Corps of Engineers HEC-12 computer program is also an acceptable method. Gutter spread on continuous grades may be determined using the Manning's equation, or by using Figure 2.

11. Workmanship and Materials

a. Workmanship

The specifications for the construction of storm sewers shall not be less stringent than those set forth in the latest edition of the Indiana Department of Transportation "Standard Specifications". Additionally, ductile iron pipe shall be laid in accordance with American Water Works Association (AWWA) C-600 and clay pipe shall be laid in accordance with either American Society of Testing Materials (ASTM) C-12 or the appropriate American Association of State Highway and Transportation Officials (AASHTO) specifications.

b. Materials

Storm sewer manholes and inlets shall be constructed of precast reinforced concrete. Material and construction shall conform to Indiana Department of Transportation "Standard Specifications", Section 720.

Pipe and fittings used in storm sewer construction shall be extra-strength clay pipe (ASTM C-700), ductile iron pipe (AWWA C-151), M304 plastic pipe, or concrete pipe (ASTM C-76). Other pipe and fittings not specified herein may be used only when specifically authorized by the Steuben County Surveyor. Pipe joints shall be flexible and watertight and shall conform to the requirements of Section 715.02 - Materials, of the latest edition of the Indiana Department of Transportation "Standard Specifications".

c. Special Hydraulic Structures

Special hydraulic structures required to control the flow of water in storm runoff drainage systems include junction chambers, drop manholes, inverted siphons, stilling basins and other special structures. The use of these structures shall be limited to those locations justified by prudent planning and by careful and thorough hydraulic engineering analysis.

12. Open Channel Design Standards

All open channels, whether private or public, and whether constructed on private or public land, shall conform to the design standards and other design requirements contained herein.

a. Manning's Equation

The waterway for channels shall be determined using Manning's Equation, where:

$$Q = 1.486/n \; A \; R^{2/3} \; S^{1/2}$$

Q = Discharge in cubic feet per second (cfs)

A = Waterway area of channel in square feet

Parameters R, S, and n are explained in Section 10a

b. Channel Cross-Section and Grade

The required channel cross-section and grade are determined by the design capacity, the material in which the channel is to be constructed, and the requirements for maintenance. A minimum depth may be required to provide adequate outlets for subsurface drains, tributary ditches, or streams. The channel grade shall be such that the velocity in the channel is high enough to prevent siltation but low enough to prevent erosion. Velocities less than 1.5 feet per second should be avoided since siltation will take place and ultimately reduce the channel cross-section. The maximum permissible velocities in vegetal-lined channels are shown in Table 4. Developments through which the channel is to be constructed shall be considered in the design of the channel section.

c. Side Slopes

Earthen channel side slopes shall be no steeper than 2 horizontal to 1 vertical (2:1). Flatter slopes may be required to prevent erosion and for ease of maintenance. Where channels will be lined, side slopes shall be no steeper than 1 1/2 horizontal to 1 vertical (1.5:1) with adequate provisions made for weep holes. Side slopes steeper than 1 1/2 horizontal to 1 vertical (1.5:1) may be used for lined channels provided that the side lining is designed and constructed as a structural retaining wall with provisions for live and dead load surcharge.

TABLE 4

Maximum Permissible Velocities in Vegetal-Lined Channels [1/]

Cover	Side Slope Range [3/] (Percent)	Permissible Velocity [2/]	
		Erosion Resistant Soils (ft. per sec.) [4/]	Easily Eroded Soils (ft. per sec.) [4/]
Bermuda Grass	0-5 5-10 Over 10	8 7 6	6 5 4
Bahia Buffalo Grass Kentucky Bluegrass Smooth Brome Blue Grama	0-5 5-10 Over 10	7 6 5	5 4 3
Grass Mixture Reed Canary Grass	[3/]0-5 5-10	5 4	4 3
Lespedeza Sericea Weeping Lovegrass Yellow Bluestem Redtop Alfalfa Red Fescue	[4/]0-5 5-10	3.4	2.5
Common Lespedeza [5/] Sundangrass [5/]	[6/] 0-5	3.5	2.5

1/ From Soil Conservation Service, SCS-TP-61, "Handbook of Channel Design for Soil and Water Conservation".

2/ Use velocities exceeding 5 feet per second only where good channel ground covers and proper maintenance can be obtained.

3/ Do not use on slopes steeper than 10 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

4/ Do not use on slopes steeper than 5 percent except for vegetated side slopes in combination with a stone, concrete, or highly resistant vegetative center section.

5/ Annuals - use on mild slopes or as temporary protection until permanent covers are established.

6/ Use on slopes steeper than 5 percent is not recommended.

d. Channel Stability

1. Characteristics of a stable channel are:

   i. It neither promotes sedimentation or degrades the channel bottom and sides beyond tolerable limits.

   ii. The channel banks do not erode to the extent that the channel cross-section is changed appreciably.

   iii. Excessive sediment bars do not develop.

   iv. Excessive erosion does not occur around culverts, bridges, outfalls or elsewhere.

   v. Gullies do not form or enlarge due to the entry of uncontrolled flow to the channel.

2. Channel stability shall be determined for an aged condition and the velocity shall be based on the design flow or the bank full flow, whichever is greater, using an "n" value for various channel linings as shown in Table 3 of this ordinance. In no case is it necessary to check channel stability for discharges greater than that from a 100-year frequency storm.

3. Channel stability shall be checked for conditions immediately after construction. For this stability analysis, the velocity shall be calculated for the expected flow from a 10-year frequency storm on the watershed, or the bank full flow, whichever is smaller, and the "n" value for the newly constructed channels in fine-grained soils and sands may be determined in accordance with the "National Engineering Handbook 5, Supplement B, Soil Conservation Service" and shall not exceed 0.025. The allowable velocity in the newly constructed channel may be increased by a maximum of 20 percent to reflect the effects of vegetation to be established under the following conditions:

   i. The soil and site in which the channel is to be constructed are suitable for rapid establishment and support of erosion controlling vegetation.

   ii. Species of erosion controlling vegetation adapted to the area, and proven methods of establishment are shown.

   iii. The channel design includes detailed plans for establishment of vegetation on the channel side slopes.

e. Drainage of Waterways

Vegetated waterways that are subject to low flows of long duration or where wet conditions prevail shall be drained with a tile system or by other means such as paved gutters. Tile lines may be outletted through a drop structure at the ends of the waterway or through a standard tile outlet.

f. Establishment of New Regulated Drain

When the Steuben County Drainage Board determines it is necessary to establish a new regulated drain, each developer shall provide the necessary information and meet the requirements of the 1965 Indiana Drainage Code, as amended, for the establishment of a new Regulated Drain. The Steuben County Drainage Board shall determine necessary easements for adequate maintenance of any new Regulated Drain.

g. Appurtenant Structures

The design of channels will include provisions for operation and maintenance and the proper functioning of all channels, laterals, travelways and structures associated with the project. Recessed inlets and structures needed for entry of surface and subsurface flow into channels without significant erosion or degradation shall be included in the design of channel improvements. The design will also provide for necessary flood gates, water level control devices, and any other appurtenance structure affecting the functioning of the channels and the attainment of the purpose for which they are built.

The effects of channel improvements on existing culverts, bridges, buried cables, pipelines and inlet structures for surface and subsurface drainage on the channel being improved and laterals thereto shall be evaluated to determine the need for modification or replacement. Culverts and bridges which are modified or added as part of channel improvement projects shall meet reasonable standards for the type of structure, and shall have a minimum capacity equal to the design discharge or governmental agency design requirements, whichever is greater.

h. Disposition of Spoil

Spoil material resulting from clearing, grubbing and channel excavation shall be disposed of in such a manner which will:

1. Minimize overbank wash.

2. Provide for the free flow of water between the channel and floodplain boundary unless the valley routing and water surface profiles are based on continuous dikes being installed.

3. Not hinder the development of travelways for maintenance.

4. Leave the right-of-way in the best condition feasible, consistent with the project purposes, for productive use by the owner.

5. Improve the aesthetic appearance of the site to the extent feasible.

6. Be approved by the IDNR or US Army Corps of Engineers (whichever is applicable), if deposited in the floodway.

13. Construction and Materials

a. Construction

Specifications shall be in keeping with the proceeding standards and shall describe the requirements for proper installation of the project to achieve its intended purpose.

b. Materials

Materials acceptable for use as channel lining are:

1. Grass
2. Revetment Riprap
3. Concrete
4. Hand Laid Riprap
5. Precast Cement Concrete Riprap
6. Grouted Riprap
7. Gabions
8. Mattings (Biodegradable)

Other lining materials shall receive specific approval of the Steuben County Surveyor. Materials shall comply with the latest edition of the Indiana Department of Transportation "Standard Specifications".

14. Stormwater Detention

The following shall govern the design of any improvement with respect to the detention of stormwater runoff:

a. Acceptable Detention Methods

The increased stormwater runoff resulting from a proposed development should be detained on-site by the provisions of appropriate wet bottom retention or dry bottom detention facilities, storage on flat roofs, parking lots, streets, lawns, or other acceptable techniques. Measures which retard the rate of overland flow and the velocity in runoff channels shall also be used to partially control runoff rates. Detention/retention facilities shall be sized to store excess flows from storms with a 100-year return period. Control devices shall limit the discharge to a rate no greater than that prescribed by this ordinance (see Section 14, subsection e).

b. Design Storm

Design of stormwater detention/retention facilities shall be based on a storm with a 1% chance of occurrence every year, also known as a 100-year storm. The storage volume and outflow rate shall be sufficient to handle stormwater runoff from a 24-hour duration storm. Rainfall depth-duration-frequency relationships and intensity-duration-frequency relationships shall be used based on the parameters provided in Tables 5A and 5B.

c. Allowable Release Rate

The SCS TR-20 computer model, the SCS TR-55 time of concentration and curve number calculation methodologies and the Huff Third Quartile (50%) Rainfall Distribution (Table 6) shall be used to determine the 5-year return period pre-development release rate for development sites larger than 5 acres in size, or when the contributing drainage area is in excess of 50 Acres or contains significant existing depressional storage. Alternatively, the SCS TR-55 computer model may be used with its built-in SCS Type II Rainfall Distribution, provided that the same computer model is also used for the determination of Storage Volume (Section 14.e.).

TABLE 5A
Rainfall Depths for Various Return Periods and Storm Durations(For TR-20, TR-55, HEC-1,...)
(Fort Wayne, Indiana)

Depth (Inches)						
Duration	Return Period (Years)					
	2	5	10	25	50	100
5 Min.	0.42	0.49	0.54	0.60	0.64	0.69
10 Min.	0.66	0.78	0.87	0.98	1.07	1.15
15 Min.	0.80	0.97	1.09	1.25	1.37	1.49
20 Min.	0.93	1.14	1.27	1.48	1.62	1.77
30 Min.	1.09	1.36	1.55	1.75	2.01	2.21
40 Min.	1.13	1.46	1.66	1.93	2.18	2.39
50 Min.	1.21	1.54	1.79	2.04	2.30	2.54
1 Hr.	1.25	1.59	1.83	2.16	2.43	2.63
1.5 Hrs.	1.34	1.73	1.98	2.30	2.54	2.78
2 Hrs.	1.40	1.80	2.06	2.38	2.64	2.96
3 Hrs.	1.56	2.04	2.37	2.67	3.09	3.40
4 Hrs.	1.64	2.16	2.52	2.88	3.28	3.61
5 Hrs.	1.75	2.35	2.72	3.00	3.57	3.93
6 Hrs.	1.80	2.40	2.84	3.12	3.73	4.11
7 Hrs.	1.89	2.52	2.90	3.22	3.81	4.19
8 Hrs.	1.92	2.56	2.95	3.36	3.85	4.24
9 Hrs.	1.98	2.58	2.99	3.42	3.90	4.28
10 Hrs.	2.00	2.60	3.01	3.50	3.91	4.29
12 Hrs.	2.04	2.64	3.08	3.60	3.99	4.38
14 Hrs.	2.10	2.77	3.20	3.64	4.16	4.56
16 Hrs.	2.16	2.82	3.27	3.68	4.26	4.67
18 Hrs.	2.20	2.89	3.36	3.78	4.38	4.82
20 Hrs.	2.23	2.94	3.41	4.00	4.45	4.89
24 Hrs.	2.40	3.02	3.60	4.08	4.58	5.03

Source: Purdue, A.M., et. al., “Statistical Characteristics of Short Time Incremental Rainfall”, Aug., 1992.

TABLE 5B
Rainfall Intensities for Various Return Periods and Storm Durations (for Rational Method)
(Fort Wayne, Indiana)

Intensity (Inches/Hour)						
Duration	Return Period (Years)					
	2	5	10	25	50	100
5 Min.	5.04	5.88	6.43	7.16	7.70	8.22
10 Min.	3.94	4.70	5.20	5.88	6.39	6.88
15 Min.	3.87	3.87	4.34	4.99	5.48	5.96
20 Min.	2.78	3.41	3.82	4.43	4.85	5.32
30 Min.	2.17	2.71	3.09	3.50	4.01	4.41
40 Min.	1.70	2.19	2.49	2.90	3.27	3.58
50 Min.	1.45	1.85	2.15	2.45	2.76	3.05
1 Hr.	1.25	1.59	1.83	2.16	2.43	2.63
1.5 Hrs.	0.89	1.15	1.30	1.53	1.69	1.85
2 Hrs.	0.70	0.90	1.03	1.19	1.32	1.48
3 Hrs.	0.52	0.68	0.79	0.89	1.03	1.13
4 Hrs.	0.41	0.54	0.63	0.72	0.82	0.90
5 Hrs.	0.35	0.47	0.54	0.60	0.71	0.79
6 Hrs.	0.30	0.40	0.47	0.52	0.62	0.69
7 Hrs.	0.27	0.36	0.41	0.46	0.54	0.60
8 Hrs.	0.24	0.32	0.37	0.42	0.48	0.53
9 Hrs.	0.22	0.29	0.33	0.38	0.43	0.48
10 Hrs.	0.20	0.26	0.30	0.35	0.39	0.43
12 Hrs.	0.17	0.22	0.26	0.30	0.33	0.37
14 Hrs.	0.15	0.20	0.23	0.26	0.30	0.33
16 Hrs.	0.135	0.18	0.20	0.23	0.27	0.29
18 Hrs.	0.12	0.16	0.19	0.21	0.24	0.27
20 Hrs.	0.11	0.15	0.17	0.20	0.22	0.24
24 Hrs.	0.10	0.13	0.15	0.17	0.19	0.21

Source: Purdue, A.M., et. al., “Statistical Characteristics of Short Time Incremental Rainfall”, Aug., 1992

TABLE 6

Huff Third Quartile (50%) Rainfall Distribution (For TR-20 or HEC-1)

Cumulative Percent of Storm Rainfall for Give Storm Type	
Cumulative Percent of Storm Time	Third Quartile
5	3
10	6
15	9
20	12
25	15
30	19
35	23
40	27
45	32
50	38
55	45
60	57
65	70
70	79
75	85
80	89
85	92
90	95
95	97

Source: Purdue, A.M., et. al., "Statistical Characteristics of Short Time Incremental Rainfall", Aug., 1992.

The Rational Method may be used to determine the 5-year return period pre-development release rate for development sites of less than or equal to 5 acres in size of commonly owned contiguous property, with a drainage area less than or equal to 50 Acres and no depressional storage.

In the event the natural downstream channel or storm sewer system is inadequate to accommodate the release rate provided above, then the allowable release rate shall be reduced to that rate permitted by the capacity of the receiving downstream channel or storm sewer system and additional detention as determined by the Steuben County Drainage Board shall be required to store that portion of the runoff exceeding the capacity of the receiving sewers or waterways.

If more than one detention/retention facility is involved in the development of the area upstream of the limiting restriction, the allowable release rate from any one detention basin shall be in direct proportion to the ratio of its drainage area to the drainage area of the entire watershed upstream of the restriction.

d. Drainage System Overflow Design

Drainage systems, including all ditches, channels, conduits, swales, etc., shall have adequate capacity to convey the stormwater runoff from all upstream tributary areas (off-site land areas) through the development under consideration for a 100-year return period design storm calculated on the basis of the upstream land in its present state of development. Swales between privately owned residential lots shall not be used to convey the above referenced stormwater runoff unless the discharge paths are confined within the drainage easements and/or common areas. An allowance, equivalent to the reduction in flow rate provided, may be made for upstream detention when such upstream detention and release rate have previously been approved by the Steuben County Drainage Board and evidence of its construction and maintenance can be shown.

e. Acceptable Outlet

Design and construction of the stormwater facility shall provide for the discharge of the stormwater runoff from off-site land areas as well as the stormwater from the area being developed (on-site land areas) to an acceptable outlet(s) having capacity to receive upstream (off-site) and on-site drainage.

The acceptable outlet for stormwater discharge shall be a regulated open (ditch) drain or a "Blue Line" open drain as shown on the U.S.G.S. Quadrangle Maps. “Blue Line” open drains shall have adequate available capacity to handle design runoff. Roadside ditches may be acceptable provided permission is granted from Right-of-Way owner, roadside ditch is in a maintained condition, and the outlet for the roadside ditch is a

Regulated open drain or "Blue Line" open drain.

In the event of extreme hardship, the Steuben County Surveyor has final authority over the acceptable outlet.

Where the outfall from the stormwater drainage system of any developer flows through real estate owned by others prior to reaching a regulated drain or natural waterway, no approval shall be granted for such stormwater drainage system until all impacted owners either consent in writing to such use of their real estate or are notified of such proposal. The notification shall include the time and place of a hearing and be delivered either personally or by certified mail, at least five (5) days prior to the hearing thereon and proof of such notice to each landowner shall be filed with the Steuben County Drainage Board prior to such hearing, which proof shall be by affidavit.

f. Determination of Storage Volume

The required volume of stormwater storage for development sites less than or equal to 5 Acres in size, with a drainage area less than or equal to 50 Acres and no depressional storage, shall be calculated using, as a minimum, the Rational Method and based on the runoff from a 100-year return period storm. However, the use of the SCS TR-20 computer model, SCS TR-55 computer model, or the POND-2 computer model is recommended to provide a more detailed analysis. Other design methods may also be used, subject to approval of the Steuben County Drainage Board.

The following 11 step procedure, based on the Rational Method, may be used to determine the required volume of storage.

Step Procedure

1. Determine total drainage area in acres "A".
2. Determine composite runoff coefficient "C_u" based on existing land use.
3. Determine time of concentration "t_c" in minutes based on existing conditions.
4. Determine rainfall intensity "I_u" in inches per hour, based on time of concentration and using Figure 1 or from data given in Table 5B for the 5-year return period.
5. Compute runoff based on existing land use and 5-year return period. $Q_u=C_uI_uA_u$.
6. Determine composite runoff coefficient "C_d" based on developed conditions and a 100-year return period.
7. Determine 100-year return rainfall intensity "I_d" for various storm durations "t_d" up through the time of concentration for the developed area using Table 5B.

8. Determine developed inflow rates "Q_d" for various storm durations times "td", measured in hours.

$$Q_d = C_d I_d A_d$$

9. Compute a storage rate "$S(t_d)$" for various storm durations "t_d" up through the time of concentration of the developed area.

$$S(t_d) = Q_d - Q_u$$

10. Compute required storage volume "S_R" in acre-feet for each storm duration "t_d". This assumes a triangular hydrograph of duration ($2*t_d$) hours with a peak flow of $S(t_d)$ at t_d hours.

$$S_R = S(t_d)\ t_d/12$$

11. Select largest storage volume computed in Step 10 for any storm duration "t_d" for detention basin design.

All detention storage calculations for development sites greater than 5 acres in size, or when the contributing drainage area is in excess of 50 Acres or contains significant depressional storage, shall be prepared using the SCS TR-20 computer program. The SCS TR-55 time of concentration and curve number calculation methodologies shall be used, along with the Huff Third Quartile (50%) and a 24-hour duration storm. Alternatively, the SCS TR-55 computer model may be used with its built-in SCS Type II Rainfall Distribution, provided that the same computer model is also used for the calculation of the Allowable Release Rate (Section 14.c.).

g. <u>General Detention Basin Design Requirements</u>

Basins shall be constructed to temporarily detain the stormwater runoff which exceeds the maximum peak release rate authorized by this ordinance. The volume of storage provided in these basins, together with such storage as may be authorized in other on-site facilities shall be sufficient to control excess runoff from the 100-year storm.

The following design principles shall be observed:

1. The maximum volume of water stored and subsequently released at the design release rate shall not result in a storage duration in excess of 48 hours from the start of the storm unless additional storms occur within the period.

2. For residential developments, the maximum planned depth of stormwater stored (without a permanent pool) shall not exceed four (4) feet.

3. All stormwater detention facilities shall be separated by not less than 25 feet from any occupied building or structure.

4. All excavated excess spoil shall be spread so as to provide for aesthetic and recreational features such as sledding hills, sports fields, etc. Slopes no steeper than 6 horizontal to 1 vertical (6:1) for safety, erosion control, stability and ease of maintenance shall be permitted.

5. Safety screens having a maximum opening of four (4) inches shall be provided for any pipe or opening to prevent children or large animals from crawling into the structures.

6. Danger signs shall be mounted at appropriate locations to warn of deep water, possible flood conditions during storm periods and other dangers that exist. Fencing shall be provided if deemed necessary by the Steuben County Drainage Board.

7. Outlet control structures shall be designed to operate as simply as possible and shall require little or no maintenance and/or attention for proper operation. They shall limit discharges into existing or planned downstream channels or conduits so as not to exceed the predetermined maximum authorized peak flow rate.

8. Emergency overflow facilities such as a weir or spillway shall be provided for the release of at least 100-year storm runoff (or, if applicable, the minimum required under the IDNR dam safety criteria) or in emergency conditions should the normal discharge devices become totally or partially inoperative. The overflow facility shall be of such design that its operation is automatic and does not require manual attention.

9. Grass or other suitable vegetative cover shall be provided throughout the entire detention storage basin area. Grass shall be cut regularly at approximately monthly intervals during the growing season or as required to maintain facility.

10. Debris and trash removal and other necessary maintenance shall be performed on a regular basis to assure continued operation in conformance to design.

11. Hydraulic calculations shall be submitted to substantiate all design features.

12. No detention facility or other water storage area, permanent or temporary, shall be constructed under or within ten (10) feet of any pole or high voltage electric line. Likewise, poles or high voltage electric lines shall not be placed within ten (10) feet of any detention facility or other water storage area.

13. No residential lots or any part thereof shall be used for any part of a detention basin or for the storage of water, either temporary or permanent.

h. Dry Bottom Facility Design Requirements

Detention facilities which will not contain a permanent pool of water shall comply with the following requirements:

1. Provisions shall be incorporated into facilities for complete interior drainage of dry bottom facilities, including the provisions of natural grades to outlet structures, longitudinal and transverse grades to perimeter drainage facility, paved gutters, or the installation of subsurface drains.

2. The detention facility shall, whenever possible, be designed to serve as a secondary or multipurpose function. Recreational facilities, aesthetic qualities (open spaces) or other types of use shall be considered in planning the detention facility.

3. In excavated detention facilities, a minimum side slope of 3:1 shall be provided for stability. In the event of valley storage, natural slopes may be considered to be stable.

i. Wet Bottom Facility Design Requirements

Where part of a detention facility will contain a permanent pool of water, all the items required for detention storage shall apply except that the system of drains with a positive gravity outlet required to maintain a dry bottom facility will not be required. A controlled positive outlet will be required to maintain the design water level in the wet bottom facility and provide required detention storage above the design water level. However, the following additional conditions shall apply:

1. Facilities designed with permanent pools or containing permanent lakes shall have a water area of at least one-half (0.5) acre. If fish are to be used to keep the pond clean, a minimum depth of approximately ten (10) feet shall be maintained over at least 25 percent of the pond area. The remaining lake area shall have no extensive shallow areas, except as required by subsection 3 below.

2. In excavated lakes, the underwater side slopes in the lake shall be stable. In the event of valley storage, natural slopes may be considered to be stable.

3. A safety ledge four (4) to six (6) feet in width is required and shall be installed in all lakes approximately 30 to 36 inches below the permanent water level. In addition, a similar maintenance ledge 12 to 18 inches above the permanent water line shall be provided. The slope between the two ledges shall be stable and of a material such as stone or riprap which will prevent erosion due to wave action.

4. A safety ramp exit from the lake will be required in all cases and shall have a minimum width of twenty (20) feet and exit slope to 6 horizontal to 1 (6:1) vertical. The ramp shall be of a material that will prevent its deterioration due to vehicle use or wave action.

5. Periodic maintenance is required in lakes to control weed and larval growth. The facility shall also be designed to provide for the easy removal of sediment which will accumulate during periods of reservoir operation. A means of maintaining the designed water level of the lake during prolonged periods of dry weather is also required.

6. For emergency use, facility cleaning or shoreline maintenance, additional facilities may have to be provided or plans prepared for auxiliary equipment to permit emptying and drainage.

7. Aeration facilities to prevent pond stagnation shall be provided, if required. Design calculations to substantiate the effectiveness of these aeration facilities shall be submitted with final engineering plans. Agreements for the perpetual operation and maintenance of aeration facilities shall be prepared to the satisfaction of the Steuben County Drainage Board.

j. Roof Top Storage

Detention storage requirements may be met in total or in part by detention on flat roofs. Details of such design to be included in the building permit application shall include the depth and volume of storage, details of outlet devices and downdrains, elevations of emergency overflow provisions and certification of the structural portion of the building design plans by a structural engineer.

k. Parking Lot Storage

Paved parking lots may be designed to provide temporary detention storage of storm waters on all or a portion of their surfaces. Outlets will be designed so as to empty the stored waters slowly. Depths of storage shall be limited to a maximum depth of seven (7) inches so as to prevent damage to parked vehicles and so that access to parked vehicles is not impaired. Ponding should in general, be confined to those positions of the parking lots farthest from the area served.

l. Facility Financial Responsibilities

The construction cost of stormwater control systems and required facilities which are identified in the Zoning Ordinance of Steuben County shall be accepted as part of the cost of land development.

m. Facility Maintenance Responsibilities

Maintenance of detention/retention facilities during construction and thereafter, shall be the responsibility of the land developer/owner. Assignment of responsibility for maintaining facilities serving more than one lot or holding shall be documented by appropriate covenants to property deeds, unless responsibility is formally accepted by a public body, and shall be determined before the final drainage plans are approved.

n. Inspections

All public and privately owned detention storage facilities may be inspected by representatives of the Steuben County.

o. Corrective Measures

If deficiencies are found by the inspector, the owner of the detention/retention facility will be required to take the necessary measurements to correct such deficiencies. If the owner fails to do so, Steuben County will undertake the work and collect the cost of maintenance or repair from the owner using lien rights if necessary.

p. Joint Development of Control Systems

Stormwater control systems may be planned and constructed jointly by two or more developers as long as compliance with this ordinance is maintained.

q. Installation of Erosion Control Systems

Runoff and erosion control systems shall be installed as soon as possible during the course of site development. The Steuben County Drainage Board will require an erosion control plan to be submitted as part of the construction plans and specifications. Detention/retention basins shall be designed with an additional six (6) percent of available capacity to allow for sediment accumulation resulting from development and to permit the pond to function for reasonable periods between cleanings. Basins should be designed to collect sediment and debris in specific locations so that removal costs are kept to a minimum.

r. Detention Facilities in Floodplains

If detention storage is provided within a 100-year floodplain, only the net increase in storage volume above that which naturally existed on the floodplain shall be credited to the development. No credit will be granted for volumes below the elevation of the regulatory flood at the location unless compensatory storage is also provided.

s. Off-Site Drainage Provisions

When the allowable runoff is released in an area that is susceptible to flooding, the developer may be required to construct appropriate storm drains through such area to avert increased flood hazard caused by the concentration of allowable runoff at one point instead of the natural overland distribution. The requirement of off-site drains shall be at the discretion of the Steuben County Drainage Board.

15. Erosion and Sediment Control

Erosion and sediment control shall follow the guidelines and specifications outlined in the "Indiana Handbook for Erosion Control in Developing Areas, Guidelines for Protecting Water Quality Through the Control of Soil Erosion and Sedimentation on Construction Sites", published by the Division of Soil Conservation, Indiana Department of Natural Resources (October 1992). Plans for erosion and sediment control for all developments subject to this ordinance shall be submitted as part of the construction plans and specifications and shall include the following:

a. Temporary erosion control measures, necessary during the initial construction and establishment phases up to final site grading and seeding.

b. A permanent erosion control plan of all the graded and non-hard surface areas within the proposed development, as planned for completion, up to and including seeding of the final lot on which business or residential dwellings are to be placed.

c. Details concerning removal of temporary erosion control devices after the initial establishment of adequate vegetative cover.

d. Maintenance procedures and responsible parties, as part of the continuing plan, to keep all of the land under adequate cover and erosion at an acceptable minimum.

Upon receipt of the erosion and sediment control plan, the Steuben County Surveyor may, at his/her discretion, submit a copy to the local Soil and Water Conservation District (SWCD) for review and concurrence.

16. Certifications Required

After completion of the project and before final approval and acceptance can be made, a professionally prepared and certified "As-Built" set of plans shall be submitted to the Steuben County Drainage Board for review. These plans shall include all pertinent data relevant to the completed storm drainage system and shall include as a minimum:

a. Pipe size and pipe material.

b. Invert elevations.

c. Top rim elevations.

d. Lengths of all pipe structures.

e. Submittal of the data and calculations showing detention basin storage volume.

f. Certified statement on plans saying the completed storm drainage system substantially complies with construction plans as approved by the Steuben County Drainage Board.

All such submitted plans shall be reviewed for compliance within 30 days after submission to the Steuben County Drainage Board or the Steuben County Surveyor.

17. Changes in Plan

Any significant change or deviation in the detailed plans and specifications after granting formal approval shall be filed in duplicate with and approved by the Steuben County Drainage Board prior to the land development involving the change. Copies of the changes, if approved, shall be attached to the original plans and specifications.

18. Determination of Impact Drainage Areas

The Steuben County Drainage Board is authorized, but not required, to classify certain geographical areas as Impact Drainage Areas and to enact and promulgate regulations which are generally applied. In determining Impact Drainage Areas, the Steuben County Drainage Board shall consider such factors as topography, soil type, capacity of existing legal drains and distance from adequate drainage facilities. The following areas shall be designated as Impact Drainage Areas, unless good reason for not including them is presented to the Steuben County Drainage Board.

a. A floodway or floodplain as designated by the Zoning Ordinance of Steuben County.

b. Land within 75 feet of each bank of any regulated ditch.

c. Land within 75 feet of the center line of any regulated drain tile.

Land where there is not an adequate outlet, taking into consideration the capacity and depth of the outlet, may be designated as an Impact Drainage Area by resolution of the Steuben County Drainage Board. Special requirements for development within any Impact Drainage Area shall be included in the resolution.

19. Other Requirements

a. Sump Pumps

Sump pumps installed to receive and discharge ground waters or other storm waters shall be connected to the storm sewer where possible or discharged into a designated storm drainage channel. Sump pumps installed to receive and discharge floor drain flow or other sanitary sewage shall be connected to the sanitary sewers. A sump pump shall be used for one function only, either the discharge of storm waters or the discharge of sanitary sewage.

b. Down Spouts

All down spouts or roof drains shall discharge onto the ground or be connected to the storm sewer. No down spouts or roof drains shall be connected to the sanitary sewers.

c. Footing Drains

Footing drains shall be connected to storm sewers where possible or designated storm drainage channels. No footing drains or drainage tile shall be connected to the sanitary sewer.

d. Basement Floor Drains

Basement floor drains shall be connected to the sanitary sewers.

20. Disclaimer of Liability

The degree of protection required by this ordinance is considered reasonable for regulatory purposes and is based on historical records, engineering and scientific methods of study. Larger storms may occur or stormwater runoff depths may be increased by man-made or natural causes. This ordinance does not imply that land uses permitted will be free from stormwater damage. This ordinance shall not create liability on the part of Steuben County or any officer or employee thereof for any damage which may result from reliance on this ordinance or on any administrative decision lawfully made thereunder.

21. Corrective Action

Nothing herein contained shall prevent Steuben County from taking such other lawful action as may be necessary to prevent or remedy any violation. All costs connected therewith shall accrue to the person or persons responsible.

22. Repealer

All ordinances or parts thereof in conflict with the provisions of this ordinance are repealed.

23. When Effective

This ordinance shall become effective after its final passage, approval and publication as required by law.

24. Exempt Projects

All residential, commercial or industrial subdivision (major or minor) or construction project thereon, which has had its drainage plan approved by the Steuben County Drainage Board prior to the effective date of this ordinance, shall be exempt from all of the requirements of this ordinance.

25. No Private Rights Conferred

Notwithstanding any provision as contained herein, this ordinance shall not be construed to confer any private enforceable rights upon any private person, firm or corporation for enforcement of this ordinance, for damages, for injunctive relief or for any cause of action whatsoever resulting of non-compliance herewith. All rights to enforcement of this ordinance shall be exclusively delegated to the County of Steuben in its public capacity.

Ordained by the Steuben County Commissioners on this 3rd day of September, 1996.

STEUBEN COUNTY BOARD OF COMMISSIONERS

_____F. Mayo Sanders

_____ Dale Hughes, Jr.

_____ Rodney Wells

Attest: _____
Linda Hansen, Auditor

NOTHING IN THIS ORDINANCE SHALL GRANT ANY STANDING TO ANY PRIVATE PERSON TO ENFORCE THIS ORDINANCE AND ONLY THE ADMINISTRATOR OF THIS ORDINANCE MAY ENFORCE THIS ORDINANCE IN ANY COURT OF LAW