

**DRAINAGE DESIGN CRITERIA  
Elgin O'Hare West Bypass**

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Task		Criteria			
		IDOT	Illinois Tollway	DuPage County	Cook County
<b>HYDROLOGY</b>					
1	Rainfall Intensity and Distribution	Bulletin 70 (Isohyetal Values) w/ Huff Distributions will be used for bridges, culverts and detention basin design. Bulletin 70 (Sectional Values) will be used for storm sewers and ditch design.	Same as IDOT	Bulletin 70 with Huff Distribution	Bulletin 70 with Huff Distribution for drainage areas greater than 1 square mile.
2	Peak Discharge for Major Waterway Crossings	FIS discharge will be used for major waterway structures when available. If storm gage data are available, they may be used for design purposes. Otherwise, a hydrograph method shall be used to calculate peak flows. Regression Equations may be used for watersheds greater than 450 acres in urban area.	FIS discharge will be used for major waterway structures when available. Regression Equations may be used for watersheds greater than 450 acres in urban areas. If a hydrograph method is used, the appropriate Huff rainfall distributions and a critical duration analysis must be utilized.	Event Hydrograph Methods (BUT NOT TR-55 graphical peak discharge method) or Continuous Simulation (HSPF) required	FIS discharge where available otherwise by hydrograph method. CCHD peak discharge same as IDOT.
3	Peak Discharge for Storm Sewers, roadway Ditches, and minor culverts.	Rational Method for watersheds <= 200 acres; however, Hydrograph Method is preferred for complex facilities and larger watersheds.	Rational Method or hydrograph method for watersheds <= 200 acres. A hydrograph method shall be used if drainage area exceeds 200 acres.	Hydrograph Methods or Continuous Simulation (HSPF) with critical duration analysis required	CCHD same as IDOT, but Rational Method for drainage areas less than 5 acres.
<b>HYDRAULICS</b>					
1	Bridge	Design frequency is 50 year storm. The calculated headwater for the design frequency storm (50-year) shall be 3' below the low edge of pavement in floodplain areas. 100-year shall not encroach onto the roadway edge of pavement on the low side of the roadway. The low chord shall be at least 2' above the 50-year natural high water elevation. If the structure is located in designated floodway or floodplain, see item 2 below for additional design criteria.	Design frequency is 50 year storm. The calculated headwater for the design frequency storm (50-year) shall be 3' below the low edge of pavement in floodplain areas and at least 2' below the low chord. The 500-year flood event shall not overtop roadway. If the structure is located in designated floodway or floodplain, see item 2 below for additional design criteria.	Regulatory model from FIS or/and FEQ is required if it is approved by the Director. Event Hydrograph Methods or Continuous Simulation (HSPF) with critical duration analysis is required, if neither Reg. nor FEQ is available	IDNR-OWR Part 3708 Floodway Construction Rules for Designated Floodways. IDNR-OWR Part 3700 rules for non-floodway areas greater than one mi <sup>2</sup> in drainage area. 1' freeboard for the roadway PGL and 1' clearance for the low beam above the 100-year floor elevation (CCHD).
2	Major Waterway Crossings Located in Designated Floodway or Floodplains	Required for all designated floodways and all floodplains with greater than 1 square mile (640 acres) watershed area. For structures in designated floodways, the structure shall meet the 17 ILL. ADM. CODE-Part 3708 rules for Bridge and Culvert Reconstruction or Modification which may involve determining the feasibility of reducing the created head to 0.1' over natural for floods up to and including the 100-year event if the structure is a source of flood damage. If the structure is not a source of flood damage, minimum design criteria is to not increase the flood profile by more than 0.1' over existing for flood profiles up to and including the 100-year design frequency. When no designated floodway exists, the proposed structure shall meet the Part 3700 rules for Bridge and Culvert Reconstruction. In general, replacement structures should reduce created head to 0.5' for floods up to and including the 100-year event.	Same as IDOT	All crossings must not increase the flood profile above the existing flood elevation unless public flood easements are obtained and a watershed benefit is provided. Existing crossings with an impoundment must be evaluated. If downstream or upstream flow rates, elevations, or floodway limits are increased from existing condition, easements must be acquired for any increases. A CLOMR may be required as well. If there is no mapped floodplain, a site-specific BFE needs to be determined for channels with tributary area >= 100 acres and depressional storage areas with tributary area >= 20 acres using FEMA-accepted models.	CCHD same as IDOT

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3	Storm Sewers Design Requirements	Storm sewers shall be designed for a 10 year frequency (gravity flow) unless there are large external offsite tributary area draining into ditches tributary to the storm sewer or when there is no overflow route in which case, the storm sewers shall be designed for a 50-year frequency (gravity flow). The maximum highwater elevation shall be kept below the top of the inlet grate and at least 2' below the manhole rim. Minimum size of storm sewer shall be 12".	Storm sewers shall be designed for a 50 year frequency (gravity flow) The maximum design highwater elevation shall be 2' below the manhole rim and 2' below the inlet rim elevation. The flowing full velocity shall be between 3-10 fps. Minimum size of storm sewer shall be 12". If under travel lane; minimum size of storm sewer shall be 15".	10-year frequency for design and 100-year storm check. A provision for 100-year overflow path.	CCHD same as IDOT, but minimum size of main storm sewer shall be 15".
4	Cross Road Culvert	HY-8 for non floodplain areas and HECRAS for floodplain areas. Minimum size shall be 24" under travel lanes and ramps. Design frequency is 50 year storm. The calculated design headwater shall be 3' below the low edge of pavement. The 100-year headwater shall not encroach onto the pavement.	HY-8 for non floodplain areas and HECRAS for floodplain areas. Minimum size shall be 24" under travel lanes and ramps. When culvert length exceeds 200', minimum culvert size shall be 30". Design frequency is 50 year storm. The calculated design headwater shall be 3' below the low edge of pavement, 500-year flood event shall not overtop roadway. The culverts will be checked for a HW/D factor of 1:1 or less.	Reg. Models from FIS for crossings in the floodway and/or the FEQ unsteady flow hydraulic model, if approved by the Director, must evaluate the 2-year to 100-year frequency. Same design criteria as IDOT for non-floodplain and floodplain areas.	CCHD same as IDOT, but no minimum size is required.
5	Ditch Design Requirements	Ditches shall be designed for a 50-year design frequency. The ditch depth shall be a minimum of 3' or the 50-year design high water level (HWL) in the ditch shall be 1' below the edge of pavement, whichever is controlling. The 100-year HWL shall not encroach onto the roadway. The minimal longitudinal slope shall be minimum 0.3% (0.5% preferred by District One). The velocities shall be generally between 4 fps to 6 fps. Ditches with velocities between 6 fps and 8 fps will need to be lined. Ditch lining recommendations will consider velocity and soil types.	Ditches shall be designed for a 50-year design frequency. The 50-year design high water level (HWL) in the ditch shall be 1' below the roadway subbase. The minimal longitudinal slope shall be minimum 0.3% (0.5% recommended). Ditch lining is required when the design velocity exceeds the scour velocity of a grassed ditch.	Same design criteria as IDOT's for areas located outside of floodplain. 100-year storm with critical duration analysis for areas located within floodplain.	CCHD same as IDOT with exceptions of 2' bottom and 1' freeboard to PGL for the 100-year flood event.
6	Ditch Cross Section Requirements	For new ditches 6:1 foreslopes and a 4' bottom with 4:1 backslopes are desirable; but 4:1 foreslopes with a 2' bottom and 3:1 backslopes are acceptable. When existing ditches to remain or to be re-established, use 4:1 foreslopes, 2' bottom, and 3:1 backslopes.	For new ditches use 6:1 foreslopes, 4' bottom, 4:1 backslopes. When existing ditches to remain or to be re-established, use 4:1 foreslopes, 2' bottom, and 3:1 backslopes	No specific requirements	CCHD accepts 3:1 foreslopes and 3:1 backslopes.
7	Pump Station	Pump stations and storm sewers with inlets draining the subway shall be designed for a 50-year flood frequency. The design hydraulic gradeline shall have a 2 feet freeboard below the top of the inlet and the 100-year hydraulic gradeline shall not be above the top of the inlet.	Same as IDOT	Backup power must be available and active without human intervention.	CCHD same as IDOT
8	Interchange and Expressway	The proposed interchange and expressway in the floodplain shall have a minimum of three feet freeboard against the 50-year flood frequency elevation or two feet freeboard against the 100-year flood frequency elevation, whichever is higher shall govern.	All storm sewers and inlet spacing shall be designed for a 50-year flood frequency.	No specific requirements	No specific requirements
<b>FLOODPLAIN</b>					
1	Compensatory Storage	For fill in floodway, 17 ILL. ADM. CODE-Part 3708 rules will need to be followed. Compensatory storage for fill due to roadway widening and structures in all floodway areas shall be provided between the normal -10 yr and 10-100 yr water surface elevations at a 1:1 ratio.	For fill in floodway, 17 ILL. ADM. CODE-Part 3708 rules will need to be followed. Compensatory storage for fill due to roadway widening and structures in all floodway areas shall be provided between the normal -10 yr and 10-100 yr water surface elevations at a 1:1 ratio, unless local requirements are more restrictive. Incremental compensatory storage for fill in the floodplain will also be provided in accordance with local ordinances.	Compensatory storage for fill in the floodplain area shall be provided incrementally at a 1:1 ratio for roadway projects.	Same as IDOT but the ratio is 1.5:1 for floodplain fill in unincorporated areas, City of Des Plaines, and City of Northlake. IDNR rules are not applicable to City of Chicago. Local ordinances may govern if stricter.

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<b>DETENTION REQUIREMENTS</b>					
1	Design Storm	Detention requirements must be evaluated based upon outlet evaluation. If detention is required based upon outlet evaluation, detention shall be provided for the increased impervious area only due to the highway project. The detention shall be sized for the 10-Year storm event for inline detention in oversized storm sewer pipe. The detention shall be sized for the 50-Year storm event with a 50-year release rate for detention to be provided in ditches and stormwater basin.	Detention shall be provided for added impervious areas only in stormwater basins (dry basins preferred) sized for 100-year storm event using bulletin 70 rainfall data. Offsite drainage shall be bypassed rather than detained. Detention in ditches can be provided if it does not cause hazard to traffic. Detention in pipes is acceptable only if no other alternate is feasible. A 2 fps cleansing velocity must be provided for upsized pipes used for conveyance and storage purpose.	2-year and 100-year storm, Bulletin 70 rainfall depth, 24-hour duration. All disturbed areas including detention basins shall be included as development areas.	MWRDGC requires accommodation for upstream bypass using maximum "C" value of 0.35 except where there is an upstream detention. The upstream bypass is preferred to flow around, not through a detention basin that shall be designed for a 100-year storm event. CCHD same as IDOT
2	Release Rate	Match pre-developed condition release rate. The release rates may need to be reduced based upon outlet evaluation and further coordination with IDOT.	0.04 cfs/acre for the 2 year storm and 0.15 cfs/acre for the 100-year storm. Local requirements must be met if more restrictive. The offsite post-development release rate shall match the pre-developed condition release rate for the 100-year storm.	Match pre-development conditions release rate of 2-year, 24-hour duration and 100-year, 24-hour duration	0.15 x area x I <sub>3</sub> (TP 40) for the 100-year storm (MWRDGC) CCHD same as IDOT
3	Methodology	Modified Rational Method to determine detention volume required in Phase I. In Phase II, a hydrograph method will be required to route the flows through the detention basin to determine the basin high water level and design of spillway.	Detention basin shall be designed using Hydrograph Method such as HEC 1, TR-20 or HEC-HMS or Graphic Method.	Hydrograph Method or Continuous Stimulation Method	Modified Rational Method (MWRDGC) Hydrograph Method (CCHD)
4	Basin Design	The invert of the spillway at the outfall should be at an elevation 1 to 2 feet above the maximum design storage elevation. It is preferable to have a minimum freeboard of 2 ft. For very small impoundments (less than 2 acres surface area) either a minimum of 1 ft of freeboard or a minimum overflow elevation based on the 500-year storm water elevation may be acceptable.	Dry detention basins are preferred. Wet basins allowed for water quality if they are not a hazard or are shielded by guardrail - with Tollway approval. A minimum of 2 feet freeboard shall be provided above the 100-year high water level to the top of berm. A minimum of 3" above the maximum water surface elevation over emergency spillway to the top of berm shall be provided. Detention basin and floodplain compensatory storage site shall be provided separately.	One foot freeboard. Storage facilities shall provide an overflow structure and overflow path that can safely pass excess flows through the development site. The minimum design rate shall be 1.0 cfs/acre of area tributary to the storage facility.	CCHD accepts a minimum of one foot freeboard.
<b>NON RIVERINE DEPRESSION</b>					
1	Requirements	No specific requirements.	No specific requirements.	A site-specific BFE needs to be determined for channels with tributary area >= 100 acres and depression storage areas with tributary area >= 20 acres using FEMA-accepted models.	No specific requirements.