

ZONING AND SHORELAND/FLOODPLAIN ZONING

490 Attachment 2

Village of Salem Lakes

Appendix B Hydraulic and Hydrologic Studies

HYDRAULIC AND HYDROLOGIC STUDIES TO ANALYZE DEVELOPMENT.

All hydraulic and hydrologic studies shall be completed under the direct supervision of a professional engineer registered in the State of Wisconsin. The study contractor shall be responsible for the technical adequacy of the study. All studies shall be reviewed and approved by the DNR.

(a) Zone A floodplains.

1 Hydrology.

- a. The appropriate method shall be based on the standards in § NR 116.07(3), Wis. Adm. Code, Hydrologic Analysis: Determination of Regional Flood Discharge.

2 Hydraulic modeling - The regional flood elevation shall be based on the standards in § NR 116.07(4), Wis. Adm. Code, Hydraulic Analysis: Determination of Regional Flood Elevation, and the following:

- a. Determination of the required limits of the hydraulic model shall be based on detailed study information for downstream structures (dam, bridge, culvert) to determine adequate starting water surface elevation for the study.
- b. Channel sections must be surveyed.
- c. Minimum four-foot contour data in the overbanks shall be used for the development of cross section overbank and floodplain mapping.
- d. A maximum distance of 500 feet between cross sections is allowed in developed areas with additional intermediate cross sections required at transitions in channel bottom slope, including a survey of the channel at each location.
- e. The most current version of HEC-RAS shall be used.
- f. A survey of bridge and culvert openings and the top of road is required at each structure.
- g. Additional cross sections are required at the downstream and upstream limits of the proposed development and any necessary intermediate locations based on the length of the reach if greater than 500 feet.

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- h. Standard accepted engineering practices shall be used when assigning parameters for the base model, such as flow, Manning's N values, expansion and contraction coefficients or effective flow limits. The base model shall be calibrated to past flooding data such as high-water marks to determine the reasonableness of the model results. If no historical data is available, adequate justification shall be provided for any parameters outside standard accepted engineering practices.
 - i. The model must extend past the upstream limit of the difference in the existing and proposed flood profiles in order to provide a tie-in to existing studies. The height difference between the proposed flood profile and the existing study profiles shall be no more than 0.00 foot.
 - 3 Mapping - A work map of the reach studied shall be provided, showing all cross-section locations, floodway/floodplain limits, based on best available topographic data, geographic limits of the proposed development and whether the proposed development is located in the floodway.
 - a. If the proposed development is located outside of the floodway, then it is determined to have no impact on the regional flood elevation.
 - b. If any part of the proposed development is in the floodway, it must be added to the base model to show the difference between existing and proposed conditions. The study must ensure that all coefficients remain the same as in the existing model, unless adequate justification based on standard accepted engineering practices is provided.
- (b) Zone AE Floodplains.
 - 1. Hydrology - If the proposed hydrology will change the existing study, the appropriate method to be used shall be based on § NR 116.07(3), Wis. Adm. Code, Hydrologic Analysis: Determination of Regional Flood Discharge.
 - 2. Hydraulic model - The regional flood elevation shall be based on the standards in § NR 116.07(4), Wis. Adm. Code, Hydraulic Analysis: Determination of Regional Flood Elevation, and the following:
 - a. Duplicate Effective Model - The effective model shall be reproduced to ensure correct transference of the model data and to allow integration of the revised data to provide a continuous FIS model upstream and downstream of the revised reach. If data from the effective model is available, models shall be generated that duplicate the FIS profiles and the elevations shown in the Floodway Data Table in the FIS report to within 0.1 foot.
 - b. Corrected Effective Model - The Corrected Effective Model shall not include any man-made physical changes since the effective model date, but shall import the model into the most current version of HEC-RAS for DNR review.

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- c. Existing (Pre-Project Conditions) Model - The Existing Model shall be required to support conclusions about the actual impacts of the project associated with the Revised (Post-Project) Model or to establish more up-to-date models on which to base the Revised (Post-Project) Model.
 - d. Revised (Post-Project Conditions) Model - The Revised (Post-Project Conditions) Model shall incorporate the Existing Model and any proposed changes to the topography caused by the proposed development. This model shall reflect proposed conditions.
 - e. All changes to the Duplicate Effective Model and subsequent models must be supported by certified topographic information, bridge plans, construction plans and survey notes.
 - f. Changes to the hydraulic models shall be limited to the stream reach for which the revision is being requested. Cross sections upstream and downstream of the revised reach shall be identical to those in the effective model and result in water surface elevations and top widths computed by the revised models matching those in the effective models upstream and downstream of the revised reach, as required. The Effective Model shall not be truncated.
- 3 Mapping - Maps and associated engineering data shall be submitted to the DNR for review, which meet the following conditions:
- a. Consistency between the revised hydraulic models, the revised floodplain and floodway delineations, the revised flood profiles, topographic work map, annotated FIRMs and/or Flood Boundary Floodway Maps (FBFMs), construction plans, bridge plans.
 - b. Certified topographic map of suitable scale, contour interval, and a planimetric map showing the applicable items. If a digital version of the map is available, it may be submitted in order that the FIRM may be more easily revised.
 - c. Annotated FIRM panel showing the revised 1% and 0.2% annual chance floodplains and floodway boundaries.
 - d. If an annotated FIRM and/or FBFM and digital mapping data (GIS or CADD) are used, then all supporting documentation or metadata must be included with the data submission along with the Universal Transverse Mercator (UTM) projection and State Plane Coordinate System in accordance with FEMA mapping specifications.
 - e. The revised floodplain boundaries shall tie into the effective floodplain boundaries.
 - f. All cross sections from the effective model shall be labeled in accordance with the effective map, and a cross section lookup table shall be included to relate to the model input numbering scheme.

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- g. Both the current and proposed floodways shall be shown on the map.
- h. The stream center line or profile baseline used to measure stream distances in the model shall be visible on the map.