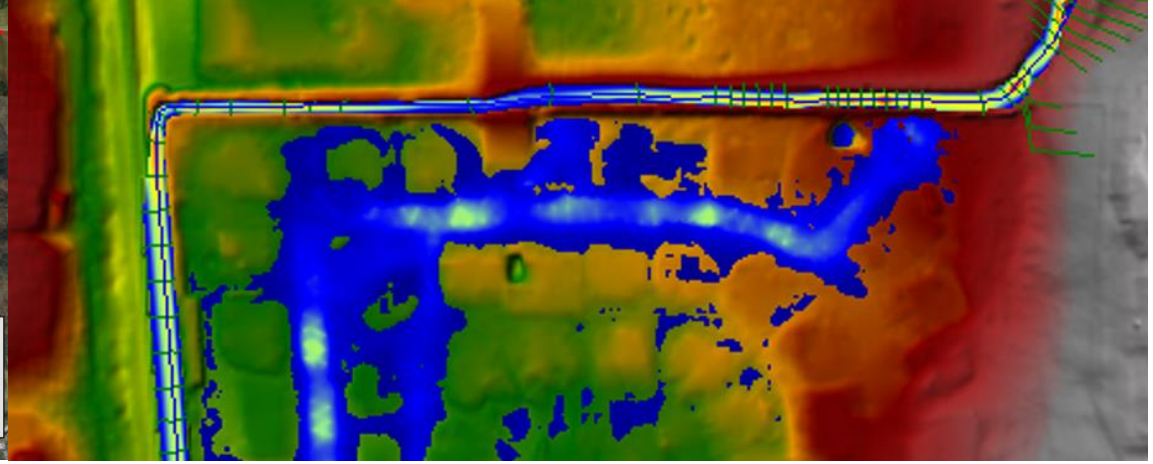

Ebner Coulee Floodway FIRM Remapping Study

October 4, 2017

SEH

Study Overview

- Summarized on Fact Sheet

Ebner Coulee Floodway Remapping Study

October 2017 Fact Sheet

The Ebner Coulee watershed (as delineated for this study) is shown above along with the study limits.

Project Background

The flooding associated with Ebner Coulee has been analyzed multiple times since the late 1970s. Various methods have been employed in an effort to develop a better estimate and understanding of the flooding resulting from rainfall events within the Ebner Coulee watershed.

This study incorporates a methodology developed by the US Geologic Survey (USGS) to estimate the magnitude of runoff from the watershed combined with the most up to date version of software developed by the US Army Corps of Engineers (USACE) for estimating the resulting flooding.

This new methodology could be used to support a change to the FEMA Flood Insurance Rate Map (FIRM).

Hydrologic Analysis

Estimating how much water is flowing down the Coulee.

The first study task of the study was to develop an estimate of the peak discharge rates for Ebner Coulee utilizing the regional regression equations. This method is based on equations developed by the USGS to estimate the flood discharge rates based on watershed characteristics and comparing those characteristics to those of gaged streams in which data exists for peak flow rate estimation. In contrast, the peak flow rates utilized for the FEMA flood mapping of Ebner Coulee were developed with computer based rainfall-runoff modeling. This method requires the modeler to input the watershed characteristics and a rainfall event with the model output being the estimated flood discharge rate.

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Hydrologic Analysis

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MEMORANDUM

TO: Mr. Bernard Lenz

FROM: Brad Woznak, PE, PH, CFM

DATE: August 18, 2017

RE: Ebner Coulee Floodway FIRM Remapping: Hydrologic Analysis

Background
The City of La Crosse has engaged SEH to determine the feasibility of submitting a Letter of Map Revision (LOMR) to FEMA for the Ebner Coulee Floodway and Floodplain. The City has requested that this work be completed in phases, with the first task focusing on the hydrology of the Ebner Coulee system. The peak discharge rates for Ebner Coulee reported in the effective FEMA Flood Insurance Study (FIS) were supported using the Bureau of Public Roads Method, also called the Cook Method, with scaling of flood frequency from Gilmore Creek at Winona, MN. According to a letter from the USGS to the WiDNR dated September 29, 1994, "the Bureau of Public Roads and Cook methods are highly empirical and inappropriate for a watershed as steep as Ebner Coulee, and the [flood frequency] scaling procedures applied are inconsistent with current recommended procedures."

In order to determine the feasibility of submitting a LOMR to FEMA based primarily on revised hydrology, SEH has reviewed the existing FEMA Flood Insurance Study (FIS) and model information, and estimated new peak flow values entering the modeled area using the methods described in Water Resources Investigation Report 03-4250 "Flood-Frequency Characteristics of Wisconsin Streams". A new flood hydrograph was then developed using HEC-HMS, and FEMA's guidelines were used to determine if the results are statistically significant enough to warrant modification of the FIS/FIRM. This memorandum provides a summary of the hydrologic analysis completed by SEH.

Hydrology Analysis
Data Collection
The effective FIS was obtained from the FEMA web portal and the effective HEC-RAS model was obtained from the Wisconsin DNR through the Surface Water Data Viewer tool. FEMA GIS data including the Special Flood Hazard Area map, cross-sections, and streamline were also obtained and will be used as a starting point for any future modifications to the hydraulic model. The City of La Crosse GIS staff provided a one meter resolution LiDAR-derived DEM for the county and the city. The city's storm sewer GIS database was also provided.

Review of Existing FIS and Available Models
The FEMA effective HEC-RAS model extends from Farnam Street (downstream limit) to 950 feet east of 29th Street S (upstream limit); this is where Ebner Coulee leaves the bluff area and enters the flatter residential area. Figure 1. (attached) shows the FEMA lettered cross-sections and streamlines. There are two streamlines; the north and west streamline is for the main channel, and the south and east streamline is for flow that diverts out of the main channel and flows through the residential area. Some flow also diverts to the north and is included in the FEMA mapping, but the cross-sections do not extend to the north.

The drainage area listed in Table 8 (included below) of the La Crosse County FIS is 0.9 square miles for all flows in the Ebner Coulee main channel and Ebner Coulee Southeast bank models. Based on modern LiDAR data, the

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Table 1: Regression Analysis & Flood-Frequency Equation Results

Source	Location	Drainage Area (SqMi)	Peak Flow (cfs)	ESE (%)	Minus 1 Standard Error (cfs)	Plus 1 Standard Error(cfs)
FEMA Effective	All Locations	0.9	1430.0			
Regression Eq.	Upstream Limit of Fema Model	0.61	360.8	44	202.0	519.5
Regression Eq.	Jackson Street	0.88	428.5	44	240.0	617.0
Regression Eq.	Farnman Street	1.13	494.7	44	277.0	712.3

Check for Statistical Significance per FEMA Guidelines
According to language provided in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix C, the hydrologic analysis should base the test for significance on the confidence limits, plus or minus one standard error, of the more recent analysis:

> *"The Mapping Partner performing the hydrologic analysis should base the test for significance on the confidence limits of the more recent analysis. Plus or minus one standard error, which is equivalent to a 68-percent confidence interval, should be used to determine if the effective and new base flood discharges are significantly different. If the effective base flood discharges are within the 68-percent confidence interval (one standard error) of the new base flood discharges, the new estimates are not considered statistically different and there is no need for a new study based only on changes in the flood discharges. If the effective discharges fall outside the 68-percent confidence interval (one standard error) of the new discharges, the estimates are considered significantly different and a new study may be warranted based on changes in the flood discharges."*

Figure 2 (below) shows that the effective 100 year peak flow of 1430 cfs is well above the flow calculated in the regression analysis, and also well outside of the 68-percent confidence interval (one standard error); indicating a new study is warranted based on the changes in the flood discharges alone.

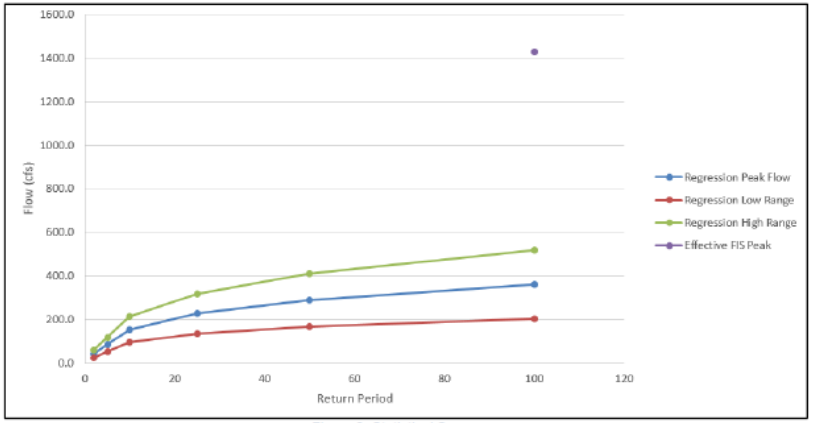

Figure 2: Statistical Summary

SEH

Technical Feasibility Report

DRAFT

Technical Feasibility Report

Ebner Coulee Floodway FIRM Remapping

La Crosse, WI

LACRS 142540 | August 22, 2017

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2.3.1.2 One-dimensional / Two-dimensional Integrated HEC-RAS model

Figure 3 shows the results of the one-dimensional/two-dimensional integrated HEC-RAS model with the yellow depicting the effective FEMA 1-percent floodplain, and the blue showing the revised 1-percent floodplain based on modeling results from this study. Based on these modeling results, approximately 14 acres could be removed from floodplain and 24 residential structures removed as depicted on Figure 3.

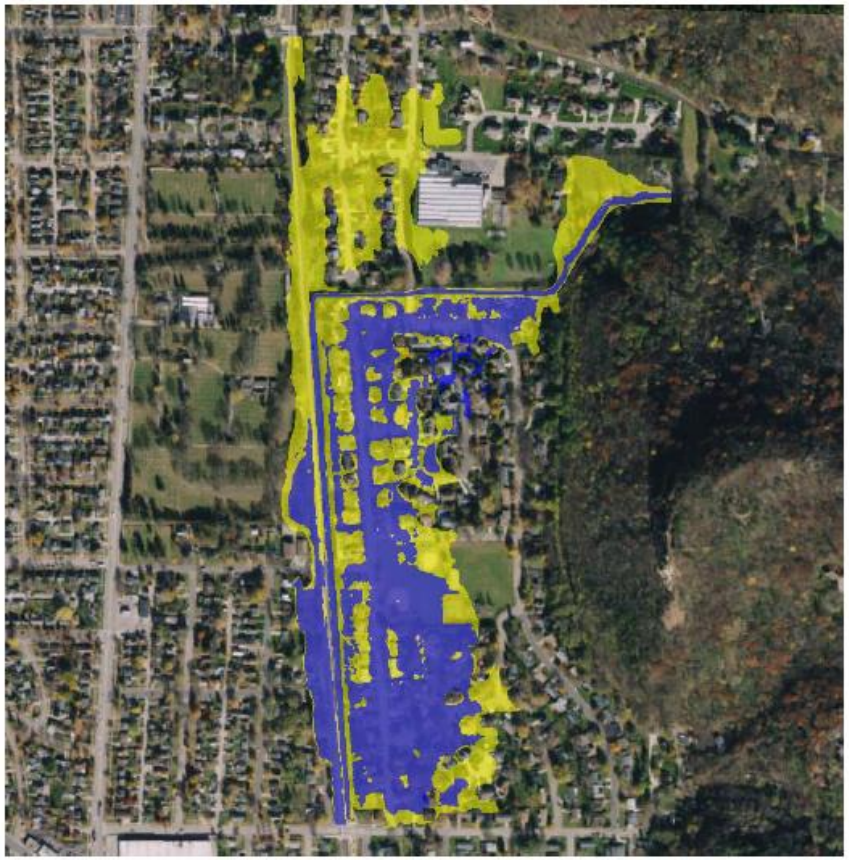

Figure 3 – Results of 1D/2D Integrated HEC-RAS Model

SEH

Questions?