From: Olds, Christopher J - DNR [mailto:Christopher.Olds@wisconsin.gov]
Sent: Thursday, December 14, 2017 9:57 AM
To: Brad Woznak
Cc: Lenz, Bernard; Hase, Michelle M - DNR
Subject: RE: Ebner Coulee - La Crosse Request for Wisconsin DNR input

Brad,

Because of vacancies in the regions and shuffling of our regional engineer's coverage areas, I can be your point of contact for this floodplain study on Ebner Coulee. After doing some research on the effective study, I am going to have a tough time approving a study on Ebner Coulee that uses regression equations as the way to calculate hydrology for this specific watershed.

I have attached a couple documents to support this position. The first document is a rough summary created in 2010 when edits were made to the existing model, on the City's request, based on new survey of the overbank and channel of Ebner Coulee upstream of Farnum St. Also included in that word document is some narrative from a 1994 report done by USGS, reviewing the original Corps hydrology from 1976. There are 6 independent methods reviewed comparing the results of the Corps hydrology. They, (USGS) concluded that the Corps results were reasonable, with some caveats on whether some of the methods they used to compare to the Corps study were really valid. The statement in that report (underlined in red) is interesting concerning regression. It states that regression equations should not be used because the slope of the upper watershed for Ebner Coulee is outside of the range for the gaged watersheds used to derive the regional regression. (300 ft./mi). I don't know if that has changed with newer regression equations.

The Corps used the Clark method which assumes a rainfall distribution centered around the middle time period of the storm duration assumed, (3 hours). It is similar to the HYDRO35 distribution contained in HMS. The Corps concluded that 3 hours was the critical duration for Ebner Coulee. The 100 year rainfall they used was 3.8 inches, (from TP40). A 3 hour duration seems appropriate for a 0.7 mi2 basin. The runoff generated is over 3 inches. That could seem conservative if we compared it to the SCS CN method that we use now. The Clark variable used an assumption of 0.15 inches/hour constant loss rate over the entire storm time. The Corps derived this number from a comparison to Gilmore Creek, in Minnesota, where they had calibrated information from 4 past flood events. They believed that Gilmore Creek was a good comparison to Ebner Coulee because of the similar stream slope. By comparison, the Atlas14 rainfall for 3hr duration is 4.9 inches.

The 2nd document is a 1998 memo from Dave Dieter. He summarizes the approach that we had approved in the Mead and Hunt study, which mainly utilized the storage available in the overbank along Ebner Coulee to more accurately predict the flood elevations along the stream. Storage in the flood hydrograph seems key to accurately predicting flood elevations along Ebner Coulee. Perhaps comparing the flood storage in the Corps 100 year hydrograph to Gilmore Creek would be appropriate at this point, or some other waterway that has similar characteristics to Ebner Coulee.

Let me know if you would like to discuss this further. I will be out of the office the week between Christmas and New Year's but have no other travel plans for the holidays at this point.

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

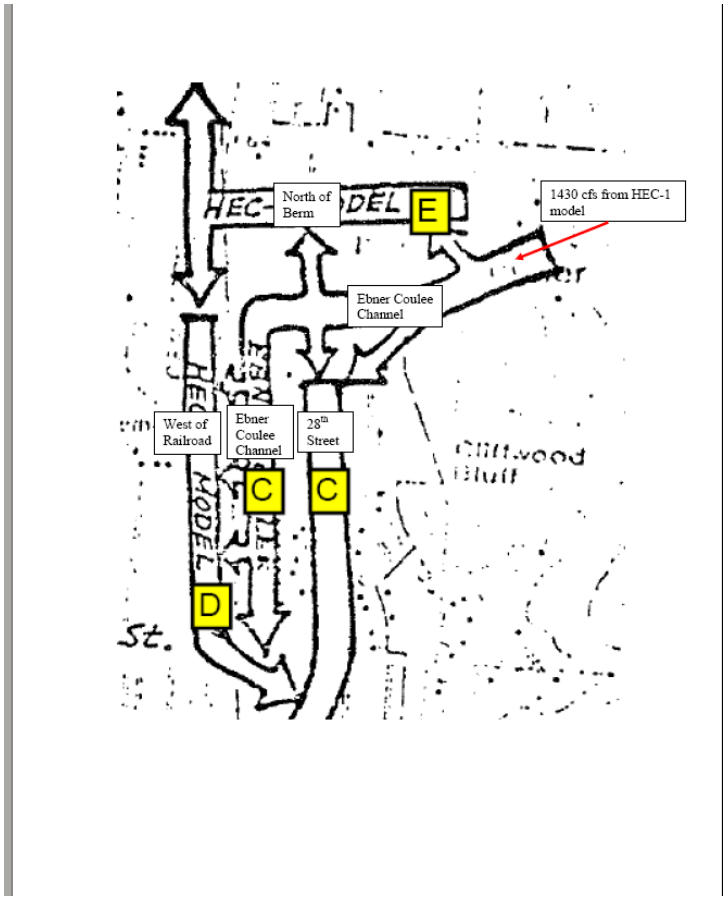
CHRIS OLDS, PE
Floodplain Engineer
Wisconsin Department of Natural Resources
Phone: (608) 266-5606
Christopher.Olds@wi.gov

1. Hydrology
    a. COE
        i. SCS Unit Hydrograph Method
        ii. $Q_{Headwater}$ = 1426 cfs
    b. Mead & Hunt - HEC-1
        i. HEC-1
        ii. $Q_{Headwater}$ = 1452 cfs.
    c. It appears that this flow is split into two at this spot (at letter "E"). Part of it was routed to Pond 1 and the rest to the spill.

Ebner Coulee Hydrologic and Hydraulic Models

The following is a brief narrative of how the modeling of Ebner Coulee was conducted in the existing FIS to Farnam Street. Exhibit 1 is a schematic of the HEC-1 and HEC-2 models.

Existing Hydrology. The existing FIS hydrology was based on a 100-year rainstorm, or more precisely, 100-year "excess" rainstorm, and a unit hydrograph. This produced a hydrograph that peaked at 1423 cfs. This hydrograph was split into three portions using a U.S. Army Corps of Engineers model called Spill. The three portions were 1) channel flow; 2) left overbank flow; and 3) right overbank flow. The overbank flow portions of the main hydrograph were routed individually to Farnam Street (using HEC-1), and then combined together with the flow that exceeded the storm sewer capacity at Farnam Street, and then the aggregate flow hydrograph was routed down to where it would combine with Pammel Creek. The routing parameters for the HEC-1 routings were computed using HEC-2 backwater models of the various reaches.



Previous Hydrologic Analysis

In the early 1960s the Corps began to study the feasibility of building flood control measures on Ebner Coulee and Pammel Creek in La Crosse, Wisconsin. The Corps estimated the 1-percent exceedance probability flood-peak discharge for Ebner Coulee at 29th Street (a drainage area of 470 acres a main channel length of 8,100 ft) by six synthetic methods because no data are available for this catchment (U.S. Army Corps of Engineers, 1976). The results in cubic feet per second (ft^3/s) are as follows.

Bureau of Public Roads Method	1,800 ft^3/s
Cook Method	1,610 ft^3/s
Rational Method	1,010 ft^3/s
Soil Conservation Service (SCS)	
Unit Hydrograph Method	860 ft^3/s
Scaling of frequency for Gilmore Creek	
at Winona, Minnesota	1,500 ft^3/s
Clark Unit Hydrograph Method	1,430 ft^3/s

Synthetic hydrographs estimated by the Clark unit hydrograph method and Rational method, SCS Technical Release Number 55 (TR55), and comparisons with similar drainage basins are used in this study to estimate the 100-year flood peak discharge for Ebner Coulee. The USGS regional regression relations are not used because the high slope of Ebner Coulee is outside the range of the slopes for the gaged watersheds used to derive the regional regression relations. Scaling of flood-frequency curves for a small number of hydrologically similar watersheds using the watershed characteristics and powers determined by Krug and others (1992) is a more reasonable approach.

March 24, 1998 IN REPLY REFER TO: Ebner Coulee

To: Bob Watson

From: David Dieter

CC: to file

SUBJECT: Ebner Coulee restudy for a LOMR for the City of La Crosse

Dear Bob,

First, a general summary of the history of reasons for the restudy of Ebner Coulee. When the original Flood Insurance Study was conducted, the COE modeled for the hydraulics using HEC-2 for a regular floodplain analysis. The channel inside the city limits consisted of a levied open channel, capacity of about 200 cfs, down to Farnam Street and a 72 inch R.C.P. from Farnam Street down, capacity of 130cfs, to Pammel Creek. The 130 cfs capacity of the pipe was subtracted from the 1430cfs inflow hydrograph generated by the upper end of the Coulee and the floodplain and the flood fringe was delineated. As a result, the channel could not convey the flow and the upper portion of the Coulee (above state road) became a one large storage area putting many residents within the floodway. The hydrology of the COE study did not take into account the flows from the lateral systems. The city was forced to mitigate by installing a large box culvert (8' x 10' box to Glendale Avenue then becomes a 10' x 12' box until it drains into Pammel Creek) to compliment the current drainage system (72" R.C.P.).

This COE analysis no longer represented the conditions when the city installed the parallel box culvert, because the capacity of the channel was significancy increased. The current system now is reasonable for carrying flood flows from Farnam Street to Pammel Creek and the lateral sewer storm systems in between. We, the DNR, approved a new approach, for Mead & Hunt, to try and model the new box culvert and the service sewer cells that would be connected laterally with an open channel above. U-NET was used to model the many level pools that would exist in each subbasin over the low service points. In the upper portion the 1,3,4, & 5 subbasins are connected and they are modeled with rating curves for interbasin flow. The other subbasins are independent to each other and store water until their respective lateral can drain the stored volume into the box culvert.

Results found:

The upper portion of the box culvert reaches slight pressure flow (about the first 40') under the Q100. The rest of the box culvert never reaches pressure flow.

The increase in conveyance with the addition of the box culvert allows the Ebner Coulee, especially above State Road, to drain the flood flow quicker and without surcharges to the laterals(according to M&H's study). Ultimately this significancy decreases the RFE's about an average of 1-2' above State Road. I believe that M&H's study will remove the majority of the landowners currently within the floodplain, especially with the new detailed mapping (2' contour) and the city's effort to survey each house in upper east Ebner Coulee.

Comments:

HYDROLOGY

I believe the hydrology, especially the upper basin, seems quite reasonable. The inflow hydrograph M&H generated closely represents the COE original FIS inflow, in fact, it is a little more conservative (1452 cfs vs. 1430). The parameters used to calculate the lateral subbasin flows are reasonable, but there are no prior information or calculations for a comparison. The volumes generated, in my opinion, are acceptable. Overall, the hydrology is acceptable.

HYDRAULICS

In my opinion, the hydraulics should be reviewed after the hydrology is approved and the floodplain is delineated on a map for closer scrutiny. Once the floodplain is mapped, the volumes of the service cells can be planimetered for verification with the elevations. The weir lengths between the connected cells in the upper portion of the Coulee can also be examined for accuracy. I personally did not review in depth the U-NET model, but the general methodology to accurately represent this dynamic situation seems logical.