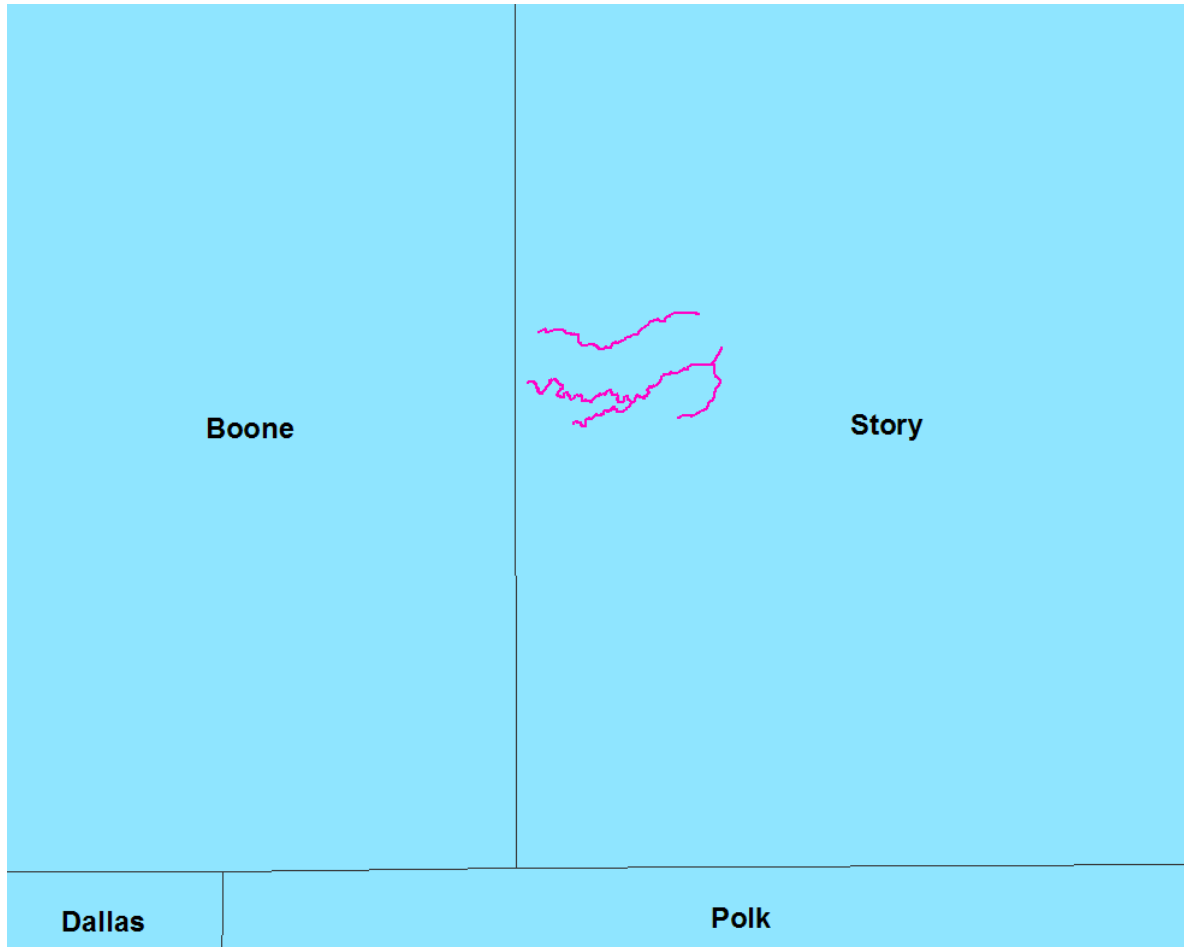


Hydraulics Summary Report

Story County, Iowa



Prepared for:
The State of Iowa
Department of Natural Resources

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STUDY AREA

Story County is located in central Iowa. The county seat is the city of Nevada which is located in the center of the county. The four rivers covered in this hydraulic report include Worle Creek, Worle Creek Tributary 1, Worle Creek Tributary 2 and College Creek. These four streams are located in the western portions of the city of Ames, which is located in the western portion of Story County.

Table 1 lists the reaches included in this study.

Table 1 – Detailed Study Reaches			
Stream	Reach Limits	Reach Length (mile)	Study Type
College Creek	From approximately 1440 feet upstream of Wilder Avenue to confluence with Squaw Creek	4.34	Detail
Worle Creek	From approximately 300 feet upstream of 500 th Avenue to the confluence with Squaw Creek	8.1	Detail
Worle Creek Tributary 1	From just downstream of 530 th Avenue to the confluence with Worle Creek	1.9	Detail
Worle Creek Tributary 2	From approximately 900 feet upstream of South Dakota Avenue to the confluence with Worle Creek	2.1	Detail

PURPOSE AND TYPE OF STUDY

This study is performed to expand the extents of the streams studied by detailed methods, incorporate recently obtained LiDAR topography data (Reference 1) and updated hydrology data.

HYDROLOGIC MODELING APPROACH

AMEC performed the hydrology for this study. A detailed discussion of the hydrology for this study can be found in the Story County Hydrology Report document (Reference 2). In summary the hydrologic flows were developed using HEC-HMS Version 3.5 (Reference 3).

HYDRAULIC ANALYSIS SUMMARY

The defined Zone AE streams were studied using the USACE HEC-RAS Version 4.1 (Reference 4). AMEC's program, AFG (Automated Floodplain Generator) was used to assist in the development of the geometries and resulting floodplains. The 10, 25, 50, 100 and 500-year discharges developed during the hydrologic phase of this project were used in the modeling.

HEC-RAS GEOMETRY DEVELOPMENT AND SURVEY DATA

Cross section geometry was derived from LIDAR topographic data (Reference 1). A digital elevation model (DEM) with a 1m cell size was used to define the cross section geometry using HEC-GeoRas and GIS processes. Field investigation and detailed survey information collected by AMEC was utilized for the hydraulic models (Reference 5) for the channel and structure data. For each stream, cross sections were placed based on appropriate spacing and location. Since the floodplain development was based on HEC-GeoRAS technology, the bounding polygon principle must be observed, so the cross sections were extended to contain the plotted floodplain.

HYDRAULIC PARAMETERS

Detailed studies (Zone AE) utilize field notes consisting of structure dimensions and channel geometry, as well as structure material and survey points. Near structures, contraction and expansion coefficients were set at 0.3 and 0.5, respectively.

Normal depth was used as the downstream boundary condition. Ineffective flow areas were appropriately incorporated and based on engineering judgment. Bank stations were derived from the 2011 NAIP aerial photography (Reference 6) and field investigations. Manning's "n" values were assigned by field investigation and aerial photography. Table 2 summarizes the range of values utilized.

Table 2 - Range of Manning's "n" Values for Detail and Limited Detail Studies			
	Left Overbank	Channel	Right Overbank
College Creek	0.05 – 0.1	0.04	0.05 – 0.1
Worle Creek	0.065 – 0.11	0.04 – 0.05	0.065 – 0.11
Worle Creek Tributary 1	0.03 – 0.12	0.038 – 0.045	0.03 – 0.15
Worle Creek Tributary 2	0.065 – 0.11	0.045	0.04 – 0.11

RESULTS AND FLOODPLAIN DEVELOPMENT

For Worle Creek, its 2 tributaries and College Creek the 1% and 0.2% annual chance floodplains were plotted using the available 1m LiDAR data. The floodplains were merged at confluences using best fit judgment.

The floodway was developed in accordance to FEMA Guidelines and Specifications for Zone AE studies. The floodplain was encroached on using HEC-RAS resulting in less than one foot of water surface elevation rise. Within HEC-RAS the encroachments were first obtained by using equal conveyance calculations and method 1 with several target water surface elevations to generate a representative floodway. Then the encroachments were transferred to method 4 to finalize the floodway. The floodway was plotted in accordance with FEMA Guidelines and

Specification using the encroachment stations developed from the HEC-RAS models. Base flood elevations (BFEs) and profiles were also prepared.

It should be noted that in some instances draw-downs less than 0.5 feet are present. An attempt was made to resolve all draw-downs by using reasonable engineering methods to alter the hydraulics. If this attempt was not successful, draw-downs will be resolved by projecting the downstream water surface elevation upstream until it crosses the original profile.

EFFECTIVE ELEVATION COMPARISON

The resulting water surface elevations reflect the updated flows from HEC-HMS, the available LiDAR data and new survey data. Figure 1 shows a comparison along the previously effective reach of Worle Creek which was mapped using detailed methods. Figure 2 shows a comparison along the previously effective reach of Worle Creek Tributary 1 which was mapped using detailed methods. Figure 3 shows a comparison along the previously effective reach of College Creek which was mapped using detailed methods.

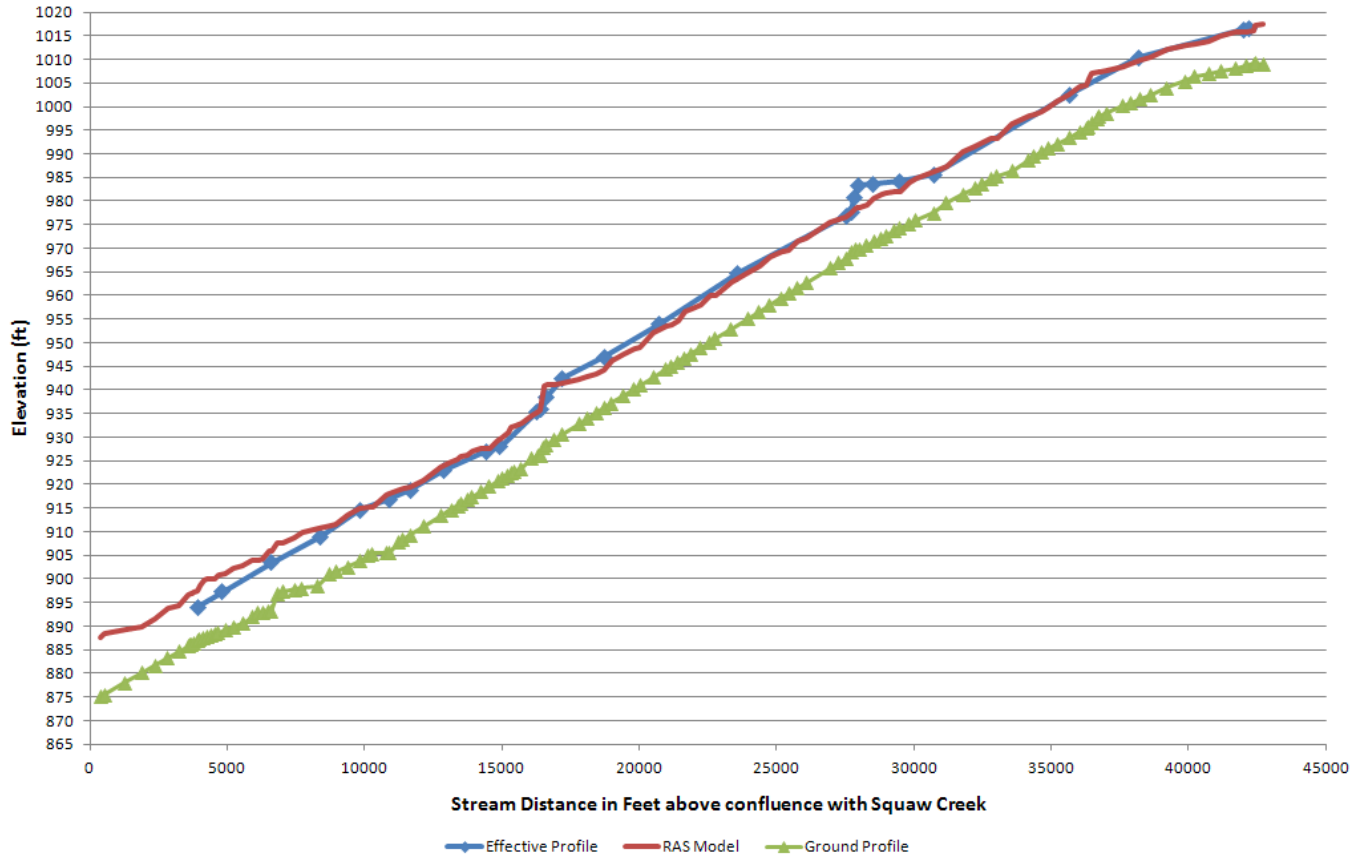


Figure 1. Comparison of Effective Elevations to Updated RAS Model for Worle Creek

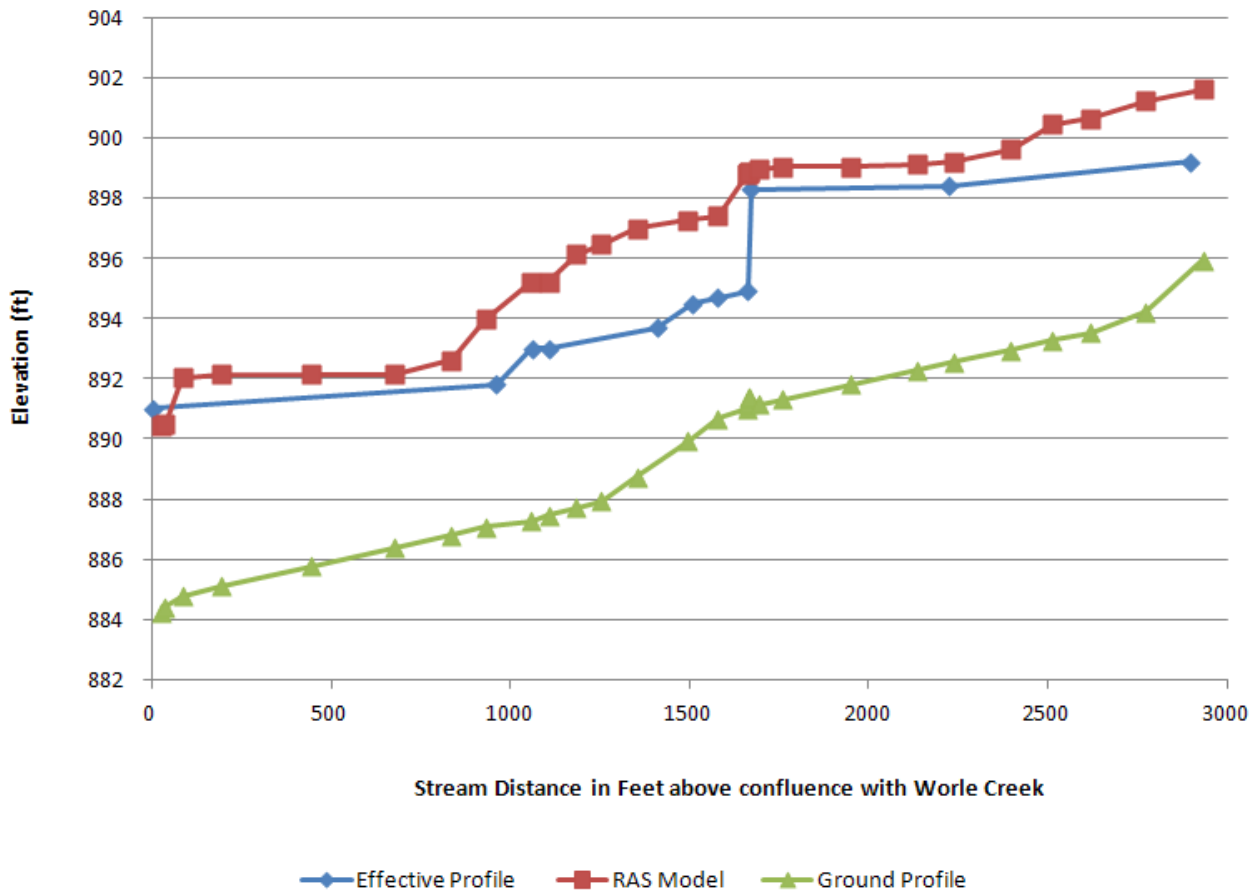


Figure 2. Comparison of Effective Elevations to Updated RAS Model for Worle Creek Tributary 1

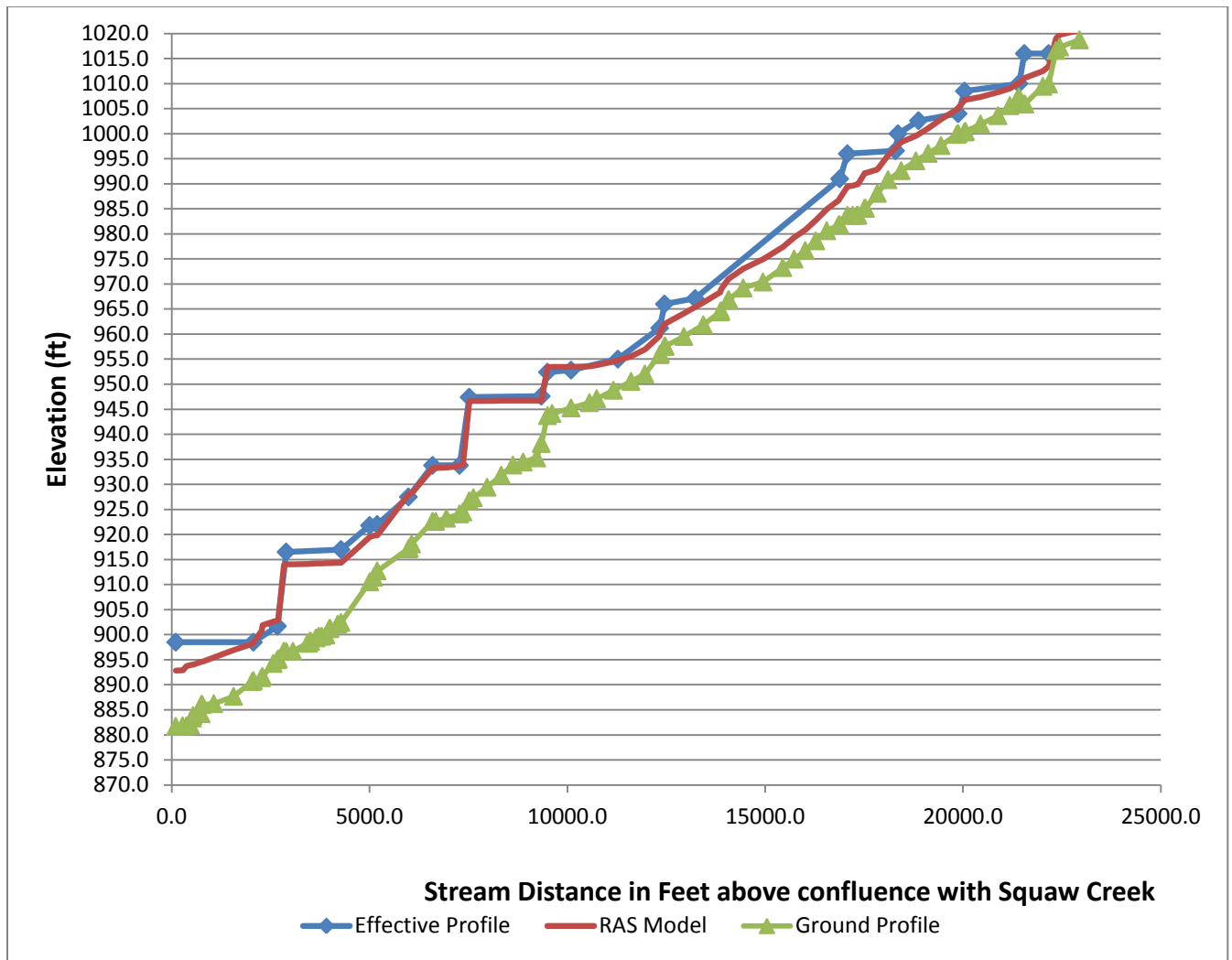


Figure 3. Comparison of Effective Elevations to Updated RAS Model for College Creek

Disclaimer: As mapping tasks are completed, the potential for minor changes to the information submitted in the hydrology submission and within this report may become necessary. The data provided in this submission and report may not be completely representative of the hydraulics used to produce the final map product. Therefore, this report and the hydraulics submission should be considered as draft. This submission should be considered a complete step in progress but not necessarily the final product since the post preliminary process is not yet completed and the floodplain maps are not yet effective.

References

- (1) Iowa Department of Natural Resources 1-meter LIDAR Collection. 2011.
- (2) Story County, IA, Detailed AE Hydrology Report, AMEC. February 2012.
- (3) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Hydrologic Modeling System (HEC-HMS), Version 3.5, August 2010.
- (4) U.S. Army Corps of Engineers, Hydrologic Engineering Center, River Analysis System (HEC-RAS), Version 4.1, January 2010.
- (5) AMEC Survey Data, collected January 2012.
- (6) 2011 NAIP Aerial Photography, flown Spring 2009