ITEM # __27___

Staff Report

500-YEAR FLOOD HYDRAULIC ANALYSIS OF RIVERSIDE MANOR AT 1204 S. 4TH STREET

March 3, 2015

BACKGROUND:

At the December 9, 2014 meeting, the City Council deferred action on a minor final plat for a proposed two-lot subdivision at 1204 S. 4th Street (Prairie Village Subdivision located at Riverside Manor). **The Council passed a motion referring this item back to staff asking for a third party evaluation of the hydraulic effects of the proposed project on the Oak-Riverside neighborhood north of the site and to explore what level of oversight is needed to ensure that the project would be built as approved.**

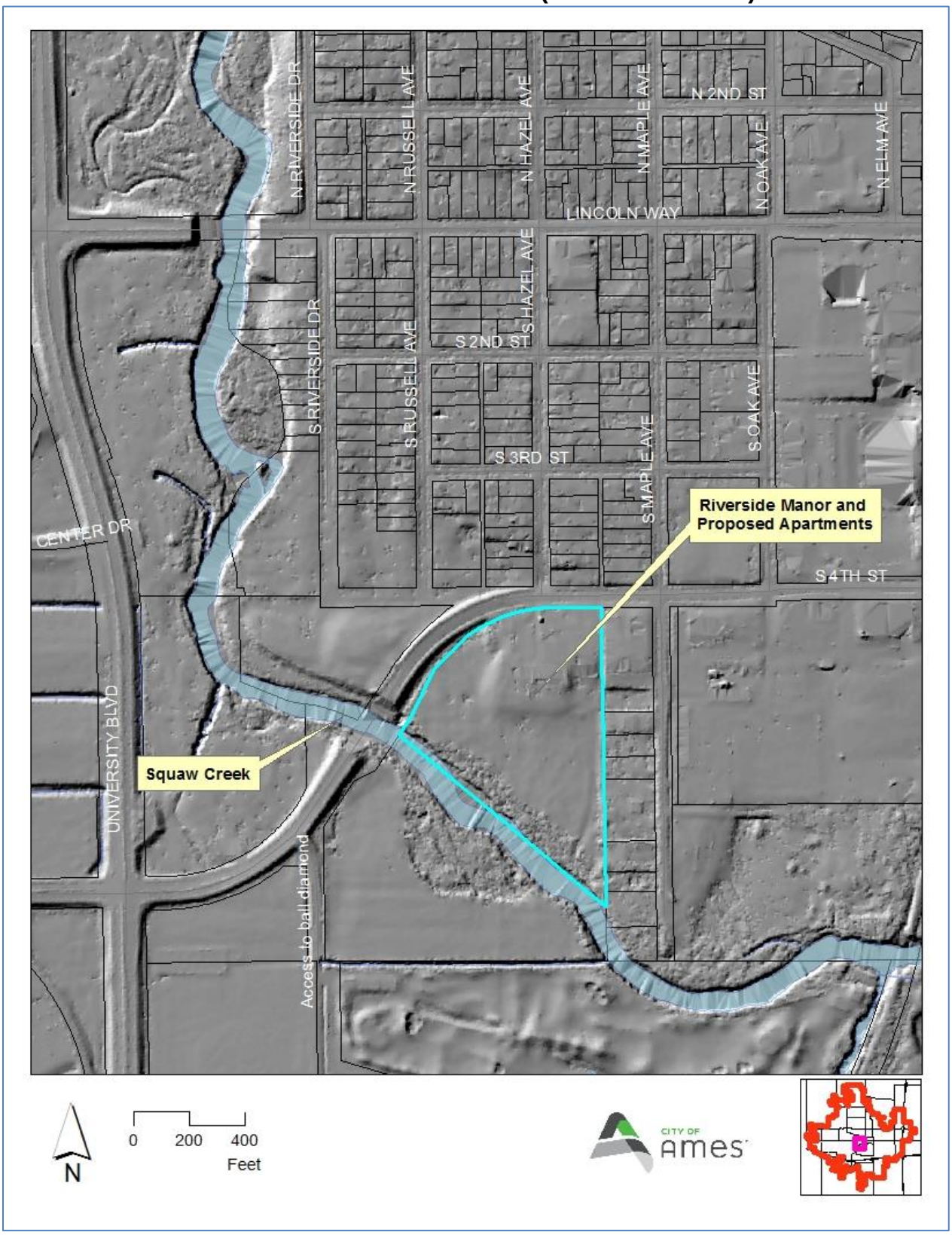
Staff returned to the City Council on January 13 with a report evaluating the impacts of a 100-year flood event to the Oak-Riverside neighborhood. Those impacts were calculated to increase the water surface level of a 100-year flood between 0.02 and 0.07 of a foot. **The City Council, cognizant that extreme levels of flooding exceeding the 100-year event have occurred more frequently, requested a flood study to model the impacts of a 500-year event.**

The City, at its own cost, contracted with HDR to complete this requested analysis. **In summary, the proposed grading and fill at Riverside Manor would result in an expected increase in the water surface level of a 500-year flood of between 0.08 and 0.22 of a foot at the same four locations noted in the January report. The modeling indicated the greatest increase in water surface level would be approximately 0.61 foot in the area near the existing eastern entrance to Riverside Manor.**

NEXT STEPS

With Council's acceptance of the HDR report, Staff will place the previously continued Prairie Village Subdivision final plat on the March 24th City Council meeting agenda.

ATTACHMENT
ELEVATION MODEL LOCATION MAP (PRE-DEVELOPMENT)



February 27, 2015

City of Ames
Attn: Charlie Kuester
515 Clark Avenue
Ames, Iowa 50010

Dear Charlie,

Task Order No. 1 of the Master Services agreement between the City of Ames and HDR Engineering, Inc. (HDR) (executed February 6, 2015) included evaluating the hydraulic effects the proposed Riverside Manor development project on water surfaces near the Oak-Riverside neighborhood (upstream from the proposed project) for the effective Federal Emergency Management Agency (FEMA) 0.2 percent annual probability flood event (500-year). Information from the effective FEMA 1 percent annual probability flood event (100-year) evaluation, developed as part of the City's Grand Avenue extension project (HR Green 2014), is also presented. A key assumption in this evaluation is that the analysis will be used as a decision support tool to evaluate potential hydraulic impacts only and will not be used for permitting or as part of a greater flood risk evaluation.

Following the 2010 flooding event in Ames, the Iowa Department of Transportation (Iowa DOT) staff developed and calibrated a series of two-dimensional (2D) hydraulic models to investigate the Interstate 35 (I-35) South Skunk River crossing, and evaluated flood risk mitigation alternatives (Iowa DOT 2013). This series of models included a detailed model of Squaw Creek and the Skunk River as they are conveyed through Ames. The model was developed using TUFLOW (BMT-WBM 2014), a proprietary software package, and multiple light detection and ranging (LiDAR) (Iowa Department of Natural Resources and Iowa DOT) data sets as well as survey data.

The intent of this evaluation was to execute the 2D hydraulic model for the 0.2 percent annual probability flood event, to modify the 2D hydraulic model with proposed grading from Riverside Manor, to execute the modified 2D hydraulic model for the 0.2 percent annual probability flood event, to develop water surface information near the Oak Riverside neighborhood for both simulations, and to compare the differences. Elevations from the effective FEMA 0.1 percent annual probability flood event (100-year) evaluation that were performed as part of the Grand Avenue Extension study (HR Green 2014) are also presented.

The model was executed for the effective 0.2 percent annual chance flood event (500-year). The 0.2 percent annual chance flood discharge is 26,300 cubic feet per second (cfs) on Squaw Creek (FEMA 2008). Flood extent and velocity contours are shown in Figure 1. Comparison locations are depicted in Figure 1. Modeled water surface elevations were compared to the effective 0.2 and 1 percent flood profiles (see Table 1) just upstream from South 4th Street. The modeled water surface elevations compare within plus or minus 0.5 foot to the FEMA model. While not expected to compare exactly, since the information was developed using different methods for different

purposes, the water surface elevations should show reasonable agreement, or warrant a discussion if they do not compare well. The model is considered appropriate for the purposes of comparing water surfaces from an existing condition to a proposed condition for this task order.

The proposed model included only updating the proposed Riverside Manor development (fill to be 3 feet above the base flood elevation). The proposed grading contours for Riverside Manor are shown in Figure 2 and were obtained from the developer.

The proposed model was executed for the effective 0.2 percent annual chance flood event (500-year) with the flood extent and velocity contours shown in Figure 3. The differences between water surface elevations in the two conditions are shown in Figure 4. Table 2 shows the differences in water surface elevation between the existing condition and proposed condition for the 0.2 and 1 percent annual chance flood.

The difference plot (see Figure 4) combined with photographs from the site (see Figures 5, 6, and 7) provide the following evaluation of model results at the 0.2 percent annual chance event.

Inspecting Figure 4, the model results show that due to changes in grading at Riverside Manor, water surface elevations upstream during the 0.2 percent annual chance event will range from 0.6 foot higher (right upstream from Riverside Manor, in the 4th Street right-of-way), to less than 0.3 foot higher in the park to the north of Riverside Manor, and less than 0.1 foot higher at Lincoln Way.

The site inspection shows that as of February 20, 2015, some proposed grading has been performed (final grading can be confirmed by the City of Ames after As-Built submittal) and results (as expected) in ground elevations that are higher or nearly equal to the South 4th Street embankment (see the area circled in red in Figure 6). Before this area was filled, floodplain flows overtopped South 4th and continued across the developed area back to the Squaw Creek. This area serves as a new obstruction to floodplain flows during the 0.2 percent annual chance flood event. The model shows that with this fill, more water continues along South 4th Street than in the existing condition. Figure 7 confirms that this is a viable flow path. The fill also leads to slightly higher water surface elevations upstream from the development for the 0.2 percent annual chance flood.

References

BMT-WBM. 2014. TUFLOW [computer software] Build 2013-12-AC. www.tuflow.com.

Federal Emergency Management Agency (FEMA). 2008. Flood Insurance Study. Story County, Iowa and Incorporated Areas. Federal Emergency Management Agency. 19169CV000A.

HR Green (2014). Grand Avenue Extension. Progress Meeting Minutes dated November 25, 2014

Iowa Department of Transportation (Iowa DOT) 2013. I-35 Over South Skunk River, Hydraulic Analysis- General. Technical Memorandum. May 14, 2013.

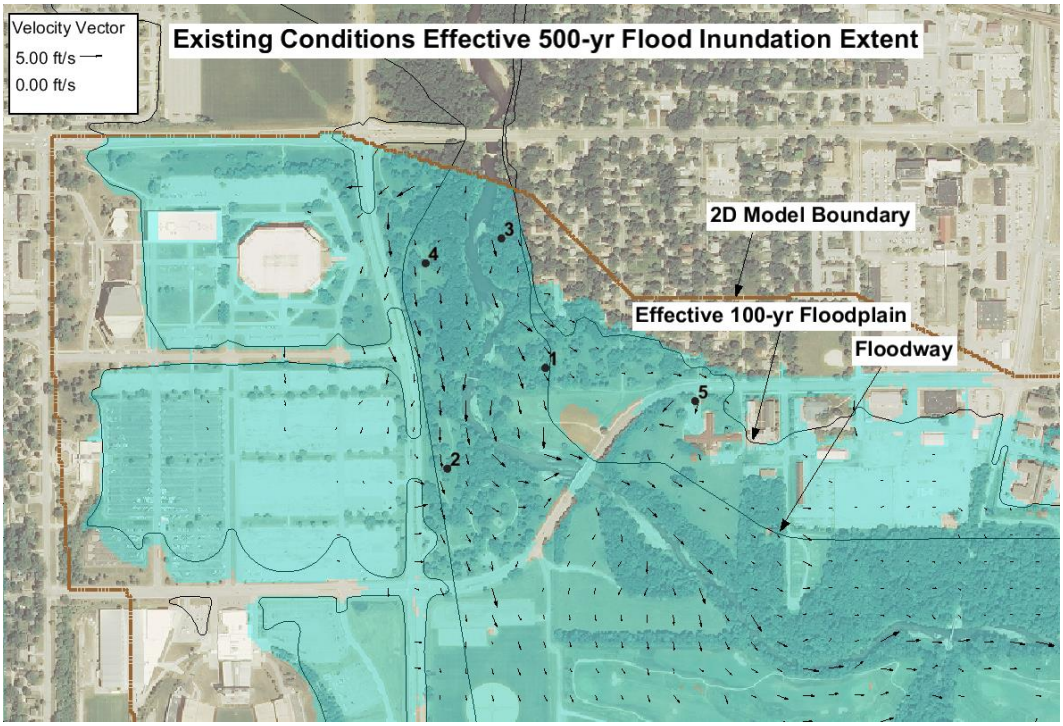


Figure 1: Modeled existing conditions 500-year inundation extent and comparison points

Table 1: Water surface elevations during 0.2 (500-year) and 1 percent (100-year) annual chance events compared to effective FIS water surface elevations (NAVD 1988).

Point	Effective 500-year WSEL[1]	Modeled Existing Condition 500-year WSEL[1]	Effective 100-year WSEL[1]	Modeled Existing Condition 100-year WSEL[1]
1	897.8	897.69	896.1	896.04
2	897.8	897.38	896.1	895.67
3	898.9	898.63	897.0	897.01
4	898.9	898.68	897.0	897.04

1. Water Surface Elevation (WSEL) measured in feet.

Figure 2: Riverside Manor Grading plan compared to effective floodway and base flood floodplain boundary

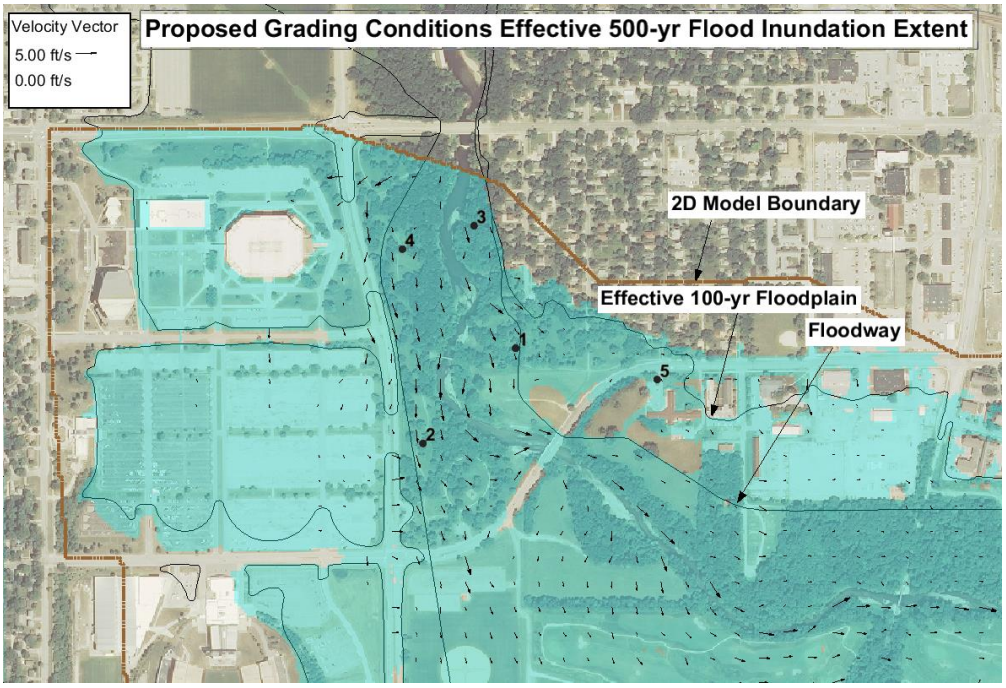


Figure 3: Riverside Manor grading- post grading 500-year inundation extent and comparison points

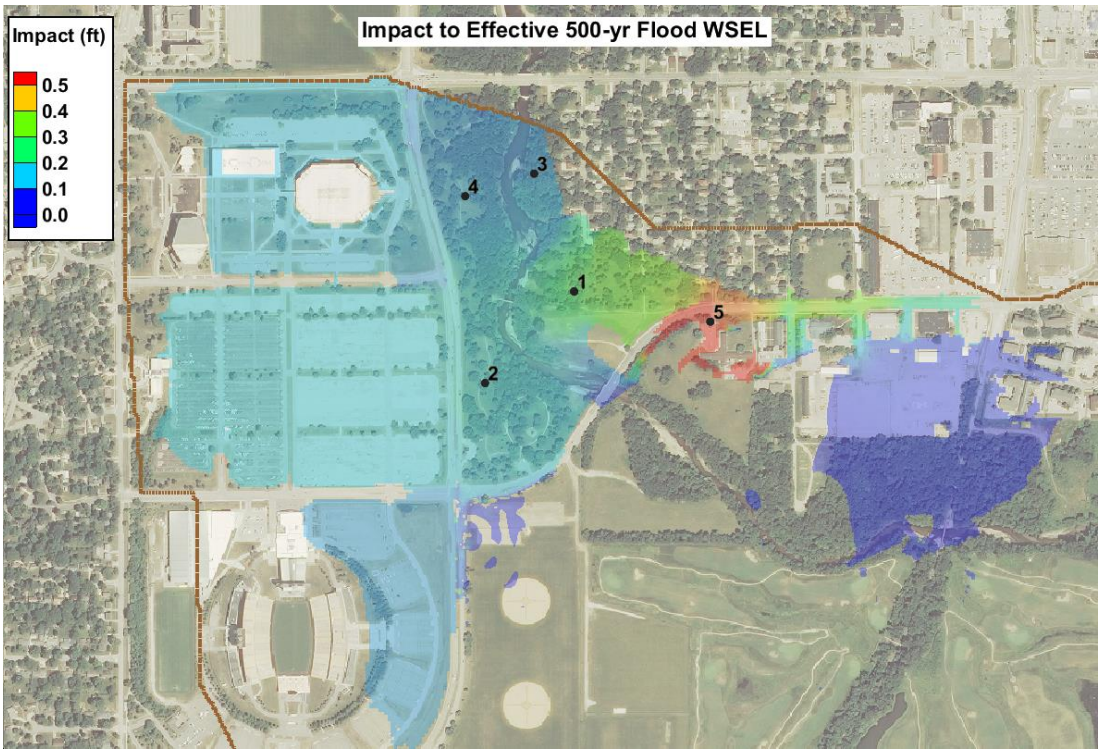


Figure 4: Riverside Manor grading – impact on 500-year water surface elevation

Table 2: Existing condition water surface elevations during 0.2 (500-year) and 1 percent (100-year) annual chance event compared to proposed conditions (NAVD 1988).

Point	Modeled Existing Condition 500-year WSEL[1]	Proposed Condition (With Riverside Manor Grading) 500-year WSEL[1]	Impact on 500-year WSEL[1]	Modeled Existing Condition 100-year WSEL[1]	Proposed Condition (With Riverside Manor Grading) 100-year WSEL[1]	Impact on 100-year WSEL[1]
1	897.69	897.91	0.22	896.04	896.11	0.07
2	897.38	897.50	0.12	895.67	895.72	0.05
3	898.63	898.71	0.08	897.01	897.03	0.02
4	898.68	898.76	0.08	897.04	897.07	0.03
5	897.26	897.87	0.61	896.00	896.10	0.10

1. Water Surface Elevation (WSEL) measured in feet.

Figure 5: Riverside Manor looking north to south across South 4th Street

Figure 6: Riverside Manor looking north to south (the fill is higher than South 4th pavement)

Figure 7: Riverside Manor – South 4th to the east

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Signature 2/27/2015
Date

ANDREW W. McCOY
Printed or Typed Name

My license renewal date is December 31, 2015

Pages or sheets covered by this seal: All

If you have any questions, do not hesitate to contact me at 515.280.4950 or andrew.mccoy@hdrinc.com.

Sincerely,

HDR Engineering, Inc.

Andrew McCoy, PhD, PE

Senior Water Resources Engineer