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Memo

To: Mayor-President Josh Guillory, Chad Nepveaux, Fred Trahan, PE

From: Pamela Gonzales Granger, MS, PE

Date: June 14, 2021

Re: **Bayou Vermilion Flood Control/Homewood Regional Detention Pond**

This memo provides a summary of the due diligence modeling and evaluation performed by McBade Engineers & Consultants, LLC (McBade) regarding the Homewood Regional Detention Pond as well as the conclusions and recommendations. A more detailed report with additional results and backup data may be provided in the future once additional project efforts are complete.

Background and Project Purpose

As a result of a Town Hall meeting conducted on March 16, 2021, McBade was contracted to perform modeling as part of a 90-day due diligence period to evaluate the creation of a large regional detention pond on a 350-acre parcel along the east side of the Vermilion River near confluence of Coulee Ile des Cannes and the Vermilion River. Prior to the Town Hall meeting, preliminary planning modeling was completed by others that demonstrated the project would have a flood risk reduction benefit along the Vermilion River for a storm event similar to the August 2016 flood event. However, the model used in the evaluation did not evaluate the 10-year, 50-year and 100-year 24-hour design storm events using the Louisiana Rainfall Depth for National Resource Conservation Service (NRCS) method of 7.8 inches, 11.1 inches and 12.6 inches, respectively, commonly used to evaluate projects at the design level of project implementation. In addition, the preliminary planning model did not evaluate localized benefits of the project or benefits along the Coulee Ile Des Cannes. Therefore, the purpose of the due diligence activities was to determine if a large regional detention pond constructed on the approximate 350-acre parcel of land located near Homewood Drive and Picard Park along the Vermilion River would provide flood risk reduction benefit along the Vermilion River, along Coulee Ile Des Cannes and in the local residential developments adjacent to the proposed projects.

Data Collection

Initial data collection consisted of requesting the preliminary planning model in an effort to revise the hydrology within the model to that of the 10-year, 50-year and 100-year 24-hour design storm events. Unfortunately, we were unable to obtain the model previously used in the preliminary planning. Therefore, additional data collection efforts consisted of obtaining:

- Federal Emergency Management Agency (FEMA) HEC-RAS Model for Vermilion River as part of the Lafayette Parish Flood Insurance Study (FIS)
- FEMA Lafayette Parish FIS HEC-RAS models for the limited tributary channels available:
    - Coulee Lantier
    - Beau Bassin Coulee
    - Bayou Tortue
    - Coulee Des Poches
    - Coulee Mine
    - Grand Avenue Coulee
    - Broadmoor Coulee
    - Acadiana Coulee
    - Isaac Verot Coulee
    - Coulee Ile Des Cannes
    - Anslem Coulee
    - Darby Coulee
- LIDAR
- Watershed boundaries
- Models for additional tributary channels from Dubroc Engineering, Inc. archived files:
    - Oak Coulee
    - Dan Debaillon Coulee
    - Edith Coulee
    - West Farrell Road
    - Grand Avenue Coulee
- Geometric survey data collected in 2017 by the United States Army Corps of Engineers (USACE) for the Vermilion River from Vermilion Bay to Surrey Street
- The updated Coulee Ile Des Cannes developed by C.H. Fenstermaker & Associates which was approved by FEMA
- A limited preliminary topographic survey was conducted and consisted of cross-sections of the Riverwood Subdivision Outfall, Picard Park Coulee and all drainage structure crossings from the upstream ends to their confluences with the Vermilion River.
- Survey data points and CAD files from the side scan sonar of the Vermilion River LA 1256 near Bayou Carencro to West Milton Avenue collected by C.H. Fenstermaker & Associates as part of a separate contract.

Modeling and Analysis

Once all data was collected, the FEMA Lafayette Parish FIS HEC-RAS models were reviewed and the following was determined:

- The Vermilion River HEC-RAS model
    - Was not georeferenced,
    - Was not based upon a 100-year 24-hour storm event hydrology,
    - Included flows from receiving tributaries that were not reflective of the flows as determined in the individual contributing tributary FIS HEC-RAS models.

- Various HEC-RAS models from the FIS were based upon an unsteady state scenario:
    - Coulee Mine
    - Acadiana Coulee
    - Isaac Verot Coulee
    - Coulee Ile Des Cannes
    - Anslem Coulee
- Various models were based upon a steady state scenario:
    - Coulee Lantier
    - Beau Bassin Coulee
    - Bayou Tortue
    - Coulee Des Poches
    - Grand Avenue Coulee
    - Broadmoor Coulee
    - Darby Coulee

Due the many inconsistencies in modeling events, scenarios and outdated geometry, it was determined that a new HEC-RAS model for the current existing condition needed to be created. The model would be created using the most recent, best available data in order to provide a better base line Vermilion River model to evaluate the Homewood Regional Detention Pond as well as other proposed project alternatives. It was determined this would allow the model to be expanded and further refined as additional data was collected.

The new existing conditions HEC-RAS model of the Vermilion River was developed using the following:

- Geometric data from the 2017 USACE survey from W Milton Avenue to Vermilion Bay
- Geometric data from the C.H. Fenstermaker side scan sonar survey from W. Milton Avenue to LA 1256, near Bayou Carencro
- LIDAR data for the watershed area beyond the surveyed banks of the Vermilion River
- LIDAR data as well as geometric data from both the 2017 USACE survey and the C.H. Fenstermaker survey were combined and a surface was created. Cross-section from the created surface were then input into HEC-RAS at similar cross-section locations to the FEMA FIS HEC-RAS model
- Bridge data from the USACE and C.H. Fenstermaker surveys supplemented with bridge data from the existing FEMA FIS HEC-RAS Model
- All HEC-RAS models for the contributing tributaries were analyzed for the unsteady state scenario for the 10-year, 50-year, and 100-year 24-hour storm events and resulting flows were input as inflows from the tributaries into the Vermilion River
- Flows were calculated for the contributing tributaries that did not have existing FEMA FIS HEC-RAS models based upon watershed parameters and the 10-year, 50-year and 100-year storm events and input as inflows from the tributaries into the Vermilion River

Once the development of the existing conditions model was completed and the model was executed for the 10-year, 25-year and 100-year storm events the results were reviewed and water surface elevation levels were compared to observed data from previous rain events. It

was determined that the results of the models were indicative of those observed during recent events.

The existing conditions model was then expanded by adding the Coulee Ile Des Cannes model developed by C.H. Fenstermaker & Associates. To maximize the stability of the model, tributaries to the Coulee Ile Des Cannes model were replaced with their inflows with the exception of the Coulee Granges. Then the Riverwood Subdivision Outfall was added to the model using the topographic survey data collected by C.H. Fenstermaker & Associates as part of this project effort. This became the existing conditions model used to evaluate the Homewood Detention Pond and other project alternatives as part of this modeling effort.

A separate HEC-RAS model was developed for the Picard Park Coulee using the topographic survey data collected by C.H. Fenstermaker & Associates as part of this project effort. When combined with the Vermilion River model there was some instability issues that would have required additional time to stabilize the model. Therefore, the resulting flows from the Picard Park Coulee models were input into the existing conditions Vermilion River model in lieu of the adding the entire coulee data to the Vermilion River model.

Once the existing conditions models were completed for both the Vermilion River and Picard Park Coulee, project alternatives were evaluated. The following project alternatives were evaluated as part of this effort:

- A 40-acre pond and a 93-acre pond with separate 30' weirs on the Vermilion River
- A 23-acre pond along the Riverwood Subdivision Outfall with box culvert intake structures
- A 28-acre pond with a 30' weir along Picard Park Coulee with box culvert intake structures
- A 90-acre pond along Coulee Ile Des Cannes with 30' weir
- A 30-acre pond along Coulee Granges with box culvert intake structures

See attached exhibit for the conceptual layout of the 40-acre, 93-acre, 28-acre and 23-acre ponds within the project location for the Homewood Regional Detention Pond.
Due to the preliminary nature of the ponds along Coulee Granges and Coulee Ile Des Cannes their location is undisclosed at this time.

Results

Existing Conditions

Based upon the analysis of the existing conditions model of the Vermilion River, the resulting water surface elevations along the Vermilion River and Coulee Ile Des Cannes for the 10-year 24-hour event are reflective of the observed water surface elevations after recent similar events, especially after short duration high intensity 10-year and 25-year rainfall events. Also, the 50-year and 100-year water surface elevations are similar for both events due to the resulting water levels being higher than the river banks during those rainfall events. In addition, the model

duplicates the observed behavior of the “backflow” condition of the Vermilion River, north of the confluence of the Coulee Ile Des Cannes. The existing model results show that Coulee Mine and Coulee Ile Des Cannes experience peak flows almost simultaneously and the peak flows occur before the remainder of the coulees outfall to the Vermilion River with the exception of Isaac Verot Coulee.

Based upon the frequent occurrence of the short duration high intensity events that result in 5-8 inches of rainfall in less than 24 hours, we recommend evaluating alternatives that focus on the results of the 10-year 24-hour storm alternative but also evaluate the higher but less frequent 50-year and 100-year 24-hour storms.

Proposed Homewood Regional Detention Ponds

For the 10-year 24-hour storm event, the construction of the 40-acre and 93-acre ponds with 30’ weirs on the Vermilion River decreases the water surface elevation approximately 5.76 inches at the confluence of Coulee Ile Des Cannes. The water surface elevation reduction for the 10-year 24-hour storm event extends as far upstream as Surrey Street with approximately 2 inches and downstream within Lafayette Parish to Anslem Coulee with 5.28 inches. Water surface elevation reduction benefits are also observed for the 50-year and 100-year 24-hour events.

Maximum flow reductions within the Vermilion River for the 10-year 24-hour rainfall event extend from Surrey Street to Anslem Coulee and range from 7.80% at Surrey Street to 5.84% at Anslem Coulee with a reduction of 12.48% at Coulee Ile Des Cannes with an average reduction of reverse flow from Coulee Ile Des Cannes to Camelia Boulevard of 14%. Flow reduction benefits are also observed for the 50-year and 100-year 24-hour events.

Proposed Coulee Granges and Coulee Ile Des Cannes Regional Detention Ponds

For the 10-year 24-hour storm event, the construction of the 30-acre regional detention pond on Coulee Granges and 90-acre detention pond on Coulee Ile Des decreases the water surface elevation decreases approximately 6 inches at the confluence of Coulee Ile Des Cannes. Approximately 1.44 inches of the reduction is due to the Coulee Granges Pond and 4.5 inches of the reduction is due to the Coulee Ile Des Cannes Pond. The water surface elevation reduction for the 10-year 24-hour storm event extends as far upstream as Surrey Street with approximately 2 inches and downstream within Lafayette Parish to Anslem Coulee with 5.64 inches. Water surface elevation reduction benefits are also observed for the 50-year and 100-year 24-hour events.

Maximum flow reductions within the Vermilion River for the 10-year 24-hour rainfall event extend from Surrey Street to Anslem Coulee and range from 9.16% at Surrey Street to 5.3% at Anslem Coulee with a reduction of 44.82% at Coulee Ile Des Cannes with an average reduction of reverse flow from Coulee Ile Des Cannes to Camelia Boulevard of 18%. Flow reduction benefits are also observed for the 50-year and 100-year 24-hour events.

Proposed Riverwood Subdivision Outfall Detention Pond and Picard Park Coulee Detention Pond

The 23-acre pond along the Riverwood Subdivision Outfall and the 28-acre pond along Picard Park Coulee result in water surface elevation reductions along the respective channels, providing benefit to the local residential and commercial developments that outfall to the respective channels. For a 10-year 24-hour storm event, the Riverwood Subdivision Outfall detention pond reduces the water surface elevation by approximately 1 foot at Oak Brook Boulevard and 11 inches at Bendel Road. Water surface elevation reduction benefits are also observed for the 50-year and 100-year 24-hour events.

For a 10-year 24-hour storm event the Picard Park Coulee detention pond reduces the water surface elevation by approximately 3.5 inches at Riverwood Drive, 5 inches at Woodward Drive and 4 inches at Rue Fosse. For the higher 50-year 24-hour storm event, the water surface elevations at Riverwood Drive, Woodward Drive, and Rue Fosse are reduced by 6 inches, 11 inches, and 8 inches respectively. Water surface elevation reduction benefits are also observed for the 100-year 24-hour event.

Conclusion

Based upon the model results of the conceptual pond layouts, locations, outfall and intake structures, we recommend proceeding with the final modeling, design and construction of the Homewood Regional Detention Ponds, the Riverwood Subdivision Outfall Pond, the Picard Park Coulee Pond, the Coulee Granges Pond and the Coulee Ile Des Cannes Regional Detention Pond.

Due to the limited time for the completion of the due diligence data collection and modeling, we recommend additional design modeling to maximize efficiency of the ponds by evaluating additional intake and outfall alternatives. It is also recommended that parameter data be continuously updated in the model where assumptions were used or where existing conditions data may not have been available. Please note that additional modeling enhancements are needed for the Vermilion River model to be approved as an updated FEMA model. The model may not be used for exact flood zone A or AE limit extents but can be enhanced to provide that level of results should LCG desire in the future.