

MEMORANDUM

To: Chief Doug Spears, City of Saginaw

From: Misty D. Christian, P.E.
Kimley-Horn and Associates, Inc.

Date: August 11, 2017

Subject: Fire Station Drainage Assessment

The City of Saginaw tasked Kimley-Horn with performing an assessment on the City of Saginaw's fire station located at the corner of Bus. Hwy 287 and Franklin Avenue. The purpose of the assessment was to perform an evaluation of the subsurface and surface conditions between the fire station's north building wall (building wall) located along Franklin Avenue, to investigate potential causes of the infiltrating water into the fire station's living quarters, and to recommend options to alleviate the infiltrating water. A visual observation and geotechnical analysis was performed to gather additional information to be able to recommend a strategy for the City to implement to address the flooding issues. The goals of this memorandum are the following:

- Provide a history of the drainage basin issues;
- Provide a summary of the fire station issues and previous mitigation efforts;
- Provide a summary of the assessment and results;
- Provide recommendations for moving forward.

The sections below provide more detailed information about each of these goals.

History of the Drainage Basin Issues

The fire department is located along Bus. Hwy 287 in an area that is known for poor drainage. Bus. Hwy 287, which is owned and maintained by the Texas Department of Transportation (TxDOT), has little internal storm drainage systems within the roadway section. The fire station is in one (1) of the three (3) major drainage basins along Bus. Hwy 287. These three (3) drainage basins are known as System No. 1, System No. 2, and System No. 3. The fire department is in System No. 3, the most southern drainage basin which generally extends from McLeroy to Longhorn Road. The topography within System No. 3 is such that the water is conveyed from west to east through the side streets within the existing residential subdivision, and from north to south. The upstream subdivision, which includes portions of Green Street, Anderson Street, Franklin Avenue, Southern Avenue, Palomino Drive, Hampshire Street, and Hialeah Park Street, does not have an internal storm drain system. The

drainage reaches Bus. Hwy 287 via surface flow and often stops at Bus. Hwy 287. The water typically 'ponds' in the right of way until the water has an opportunity to enter the small pipes under Bus. Hwy 287. The topography along Bus. Hwy 287 in System No. 3 is relatively flat. When the water ponds, the associated spread limits of the water are very large. Historically, businesses along the Bus. Hwy 287, including the fire station, have flooded during 4-6-inch storm events.

The City of Saginaw did perform a drainage study for System No. 3 to determine what improvements were needed to alleviate the flooding along Bus. Hwy 287. The study determined that a storm drainage system needs to be installed along the western right of way of Bus. Hwy 287. A main storm drainage crossing needs to be installed under Bus. Hwy 287 in order to collect and convey the drainage under the highway and to the eastern right of way.

Preliminary plans were prepared for these improvements and coordination occurred with TxDOT. The project came to a stop when additional costs were requested by TxDOT to review and approve the plans. There are no plans to move forward with the System No. 3 improvements at this time.

Summary of the Fire Station Issues and Previous Mitigation Efforts

As mentioned in the section above, Bus. Hwy 287 floods during heavy storm events. In the past, the water from Bus. Hwy 287 has entered the fire station through the fire truck bays. However, more commonly, water enters the building through the north wall of the building which is located adjacent to Franklin Avenue. Water has overtopped the top of curb along Franklin Avenue during heavy storm events and has inundated the area between the building face and the curb which causes the water to enter the building. It was also noted that water also enters the building when the water is contained within the curb of Franklin Avenue especially after days of rain events.



North Building Wall of the Fire Station: Franklin Avenue

Over the past twenty (20) years, the flooding and inundation of water in the fire station has occurred in some manner. The fire department, with help from the Public Works Department, has implemented several improvements in an attempt to mitigate the flooding and infiltration of water. The following is a summary of those efforts:

1. Installation of a sidewalk along the north and northwest portions of the building to provide an impervious surface: The area between the north building and the curb along Franklin Avenue was a pervious, vegetated area. In order to prevent the water from entering the building, concrete was placed between the north wall and curb.
2. Installation of a floodwall or extended curb along Franklin Avenue: The installation of the extended curb was to prevent the water in Franklin Avenue from overtopping the curb and inundating the building. The extended curb was removed.

3. Installation of a French drain system: A 6-inch PVC pipe was installed in the area between the north building wall and the curb along Franklin Avenue. The French drain system discharges to the curb inlet located at the intersection of Bus. Hwy 287 and Franklin Avenue. It is unknown how well this drain is functioning today.
4. Installation of the sidewalk/curb along the northwest portions of the building: Water would be conveyed east along Franklin Avenue and would enter the fire station through the driveway area. Sidewalk and curb was placed in this area to prevent the water from entering the fire station and keeping the water within Franklin Avenue.
5. Installation of a wall along the north building wall: Public works installed a wall against the north wall. During the installation of the wall, the City placed an asphaltic/mastic material along the new wall to help seal the wall. This wall remains in place today.

There is a history of repairs to the fire department to prevent the water from entering the building. Even with these improvements, the fire department has flooded over fifteen (15) times in the past 5-years with two (2) of those events requiring outside flood remediation experts to perform the clean up efforts.

Overview of the Assessment and Results

Kimley-Horn performed a two-step assessment which included the following:

1. Performed a geotechnical analysis
2. Performed a visually observation

A more detailed description of each of the steps performed are described below:

1. *Performing a Geotechnical Analysis*

Kimley-Horn, through subconsultant, CMJ Engineering, performed a geotechnical analysis of the subsurface conditions along the area along the building wall and Franklin Avenue. Four (4) bores were performed at a depth of fifteen (15) feet. The locations of the bores are described in the geotechnical report included in **Appendix A**. The geotechnical study indicated the following key information:

- Ground water was present in Bore 1 and Bore 2 logs at various depths;
- Ground water was initially present in the two (2) bore logs closest to the building wall;
- The geotechnical study stated the following recommendations:
 - Extend the gutters away from the building;
 - Place concrete along the grassed area along the northeastern portion of the building;

- Install a 6-inch French drain along the north building wall approximately 12 inches deeper than the wall.

2. Perform a visually observation

Kimley-Horn performed a site visit to visually review the subsurface conditions. It rained at the site a few hours prior to the site visit. Public Works staff removed portions of the sidewalk adjacent to the north building wall. Once the sidewalk was removed, the following observations were made:

- The fire station wall did have an asphaltic/mastic material along the wall.
- There was a small void located in the area where water had been reported to infiltrate the wall.
- The soils were saturated with moisture.
- The wall was about 6-inches deeper than the at grade elevations.
- The living quarters of the fire station has a finished floor elevation lower than the top of curb elevation of Franklin Avenue



Void located under the building

In addition to the observations at the north wall, Kimley-Horn observed other areas on the property that had poor drainage conditions. The roof system of the fire department did not have adequate drainage. The roof above the administrative offices was significantly holding water. Ponding of water occurred in the parking area to the west of the fire station. There were several indicators that the area around the fire station did not drain properly and the ponding water attributes to the saturated soil conditions.



Poor Drainage on the Building



Poor Drainage along the Western Portion of the Building (Parking Area)

Recommendations for Next Steps

The objective of this assessment was to evaluate options to alleviate the flooding at the fire station. Based upon the geotechnical study, field observations, and knowledge of the drainage issues along Bus. Hwy 287, there are a few options to consider moving forward. A summary of the recommendations is provided in the table below followed by a description of each recommendation.

Table 1: Summary of Recommendations

Improvement Name	Cost	Comments
Installation of French Drain	\$180,000	A new French Drain may be installed along the north building wall approximately 12-inches deeper than the wall. Select fill will be imported in to serve as a clay cap along the building. The French Drain will not solve the flooding issue, but could alleviate the flooding.
Rebuilding the living quarters on-site	TBD based upon Scope	The City could relocate or build an expansion/separate building to accommodate staff and to keep the 911 facility onsite. The underground utilities would need to be evaluated with
Relocate the fire station facilities, new site	TBD based upon Scope	Due to the location of the fire station on Bus. Hwy 287 with regards to traffic and flooding

Installation of a French Drain System:

Installation a French Drain System along the north wall would collect the ground water and convey it downstream. It is recommended the water is collected and sent to the sanitary sewer system which is located about 50 feet from the north building wall. Connecting the French Drain system to the storm drain system on Bus. Hwy 287 would not be feasible since the topography is higher at the highway than along the French Drain system. There would be costs associated with ‘treating’ the storm water as it connects to the sanitary sewer system. These costs would need to be added to the Opinion of Probable Construction Cost (OPCC) provided in **Appendix B**.

The benefit of installation the French Drain system is that it would alleviate some of the infiltration water. The water would be captured by the perforated pipe instead of entering through the wall. However, due to the nature of ground water, the French Drain system will not completely alleviate the flooding or infiltration. There is a chance that during heavy storm events, water will continue to enter the building since the finished floor is located below grade. This would be considered a solution to help the situation, but it will not solve the issue.

As mentioned previously, a French Drain system was previously installed along Franklin Avenue. It is unknown whether this system works, the design for the system, or how well it was constructed.

The costs for the French Drain system is provided in the OPCC included in **Appendix B**.

Rebuilding the Living Quarters On-Site:

Due to the ground water continuing to be a problem on site and the living quarters of the fire station being below grade, ground water will always be an issue. The City should consider relocating or rebuilding the living quarters of the building on-site. The facilities could be reconstructed on-site in the western parking area (detached from the existing fire station), or it can be reconstructed in the same footprint as the existing living quarters. Constructing a new living quarters detached from the fire station would need to consider the existing sanitary sewer line located in the parking area, franchise utilities, and the location of a generator. Constructing a new detached building would allow the firemen to remain in their current location while the construction occurred. The 911 Call Center could also remain on-site without being affected.

Demolishing and reconstructing the living quarters within the same footprint of the existing facility would require the firemen to temporary relocate to other areas onsite while the construction occurred, but the need to relocate the sanitary sewer line, franchise utilities, and the generator would be avoided. The poor roof drainage could also be addressed with this option.

With both options, the new building could be expanded to accommodate the need for additional space. For both options, the 911 Call Center could also remain on-site without being affected. Site improvements could also be performed to improve the surface drainage on-site (parking area), however, since the fire station remains in a flood-prone area, the fire station will always be dealing with flooding issues along Bus. Hwy 287 or Franklin Avenue.

Relocation of the Fire Station Facilities (New Site):

Another consideration would be to construct a new fire station at a new location in the City. It is understood that this option would be the most costly option and would require years of planning efforts to select a site and perform the design and construction phases. The benefit to constructing a fire station at a new location is that the drainage issues associated with System No. 3 will be avoided. As long as the fire station remains at its current location, the City will always need to deal with drainage issues. No costs were provided with this option since it would require a separate planning and feasibility study. The 911 Call Center may also need to be relocated with is a significant endeavor.

Closing

Kimley-Horn performed an assessment by evaluating the subsurface and on-site conditions at the fire station. Based upon the information collected, Kimley-Horn recommends three (3) potentially approaches to managing the issue of infiltrating water in the fire station. One of the recommendations include installing a French Drain system along Franklin Avenue which would not prevent the water from infiltrating the building during heavy storm events. The other two (2) recommendations involve rebuilding all or portions of the fire station above ground which would address the issue of infiltrating water.

For other questions or comments, please contact Misty Christian, P.E. at misty.christian@kimley-horn.com, or at 817-900-8525.