RPS klotz associates

TEXAS DEPARTMENT OF TRANSPORTATION
AUSTIN DISTRICT

Low Water Crossing Study

Project Number: 0121.072.004
February 2017

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February 27, 2017

Mr. John Nevares, P.E.
Assistant Director of Traffic Operations
Texas Department of Transportation, Austin District
P.O. Box 15426
Austin, Texas 78761

RE: Low Water Crossing Study
Contract No. 36-436P5027, Work Authorization No. 4
RPS Klotz Associates Project No. 0121.072.004

Dear Mr. Nevares:

Please find attached our final report for the Low Water Crossing Study at various locations within TxDOT Austin District. This report documents data collection, inventory, proposed high water detection system and summary of findings and recommendations of the study.

If you have any questions or comments concerning this study, please contact me at your convenience. Thank you for the opportunity to work with TxDOT on this important project.

Sincerely,

Kevin Tyer, P.E.
Deputy Operations Manager

Attachment

TEXAS DEPARTMENT OF TRANSPORTATION
AUSTIN DISTRICT

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Prepared by

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Texas P.E. Firm Registration No. F-929

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Executive Summary

On behalf of the Texas Department of Transportation (TxDOT) Austin District, RPS Klotz Associates conducted a Low Water Crossing Study. The purpose of this study was to conduct a detailed inventory and review of low water crossings within the district, perform a basic needs-assessment and prioritization of the locations identified, and prepare conceptual layouts of 20 highest priority suitable candidates for High Water Detection Systems (HWDS).

The Texas Hill Country is a region known for its rocky hills, springs and canyons. Due to this geography, roadway flooding is a natural hazard and a frequent occurrence in the region. In recent years, warning systems for roadway flooding have been increasingly deployed by public agencies in the region. The primary functions of HWDS are to warn drivers of hazardous road flooding conditions and notify the transportation and emergency management personnel who respond to flooding events. In order to maintain consistency and minimize driver confusion, the HWDS currently in use or deployed by public agencies in the region were studied and analyzed for applicability to TxDOT Austin District.

Through coordination with TxDOT Austin District, all of the maintenance offices within the district, and field investigations of all known low water crossings, a total 153 low water crossing locations were identified as part of this study. All locations were mapped in Aeronautical Reconnaissance Coverage Geographic Information System (ArcGIS) following TxDOT guidelines.

It is recommended that a Geographical User Interface (GUI) be developed based on the low water crossing information presented in the ArcGIS inventory database. This GUI would allow TxDOT Austin District Office and the various Area and Maintenance Offices to retrieve and document information pertaining to low water crossing locations and flood events, display exhibits or graphics for information purposes, edit the database to keep low water crossing information up to date, and provide information to the public of high water flood events.

Based on information gathered from the field inventory, literature review, discussion with agency officials and evaluation of various practical and/or feasible technologies that could be deployed within the study area, a total of 20 locations were identified and prioritized as suitable candidates for Phase I installation of a HWDS for the TxDOT Austin District.

The proposed conceptual layouts were developed for the 20 highest priority low water crossing locations within the district. However, flash flooding could occur after heavy rainfall events or times in which drivers would not expect roadways to be flooded and can occur at other low water crossing locations within the district. It is recommended that TxDOT develop a work program and allocate the necessary annual funds to install HWDS at low water crossing locations within the Austin District to improve safety during flood events, meet driver expectancy, and provide consistency throughout all maintenance sections.

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Introduction

Background

A Low Water Crossing (LWC) Study was conducted by RPS Klotz Associates for the Texas Department of Transportation (TxDOT) Austin District. The purpose of this study was to perform an inventory of LWC locations in the Austin District and prioritize various locations that are suitable candidates for High Water Detection Systems (HWDS). The study also included the assessment and recommendation of the automated system that will detect roadway flooding conditions, notify the assigned District personnel, and warn/inform approaching drivers. In addition, conceptual layouts and preliminary cost estimates were prepared for 20 highest priority LWC locations.

Scope

The scope of this study included the following tasks:

- Conduct a detailed inventory of the LWC locations provided by the District (i.e., locations were identified through coordination by District staff with the different Area and Maintenance Offices);
- Prepare Geographic Information System (GIS) maps of all inventoried locations;
- Conduct site visits at each LWC location;
- Coordinate with Maintenance Offices regarding LWC locations within the respective maintenance sections;
- Identify and rank each location and prioritize the order of design/implementation based on frequency of flooding/water ponding, and duration of flooding;
- Conduct an assessment of HWDS;
- Prepare conceptual layouts for 20 highest priority LWC locations including proposed warning signs, solar powered flashing beacons, and hardware/field equipment; and
- Prepare preliminary cost estimates for all 20 locations.

Methodology

The study methodology consisted of the major components listed below:

- Data Collection:
    a. Preliminary Inventory List: TxDOT Austin District coordinated with all Area and Maintenance Offices to provide an original list of LWC locations with preliminary rankings.
    b. Field Inventory Data: Several field visits were conducted in order to gather information pertaining to existing conditions at each LWC location including type of water crossing, roadway configuration, pavement condition, pavement marking and signing, existing warning devices, and speed limits. In addition, photographs were taken at each LWC.
    c. Meeting/Interview: Meetings with Maintenance Office staff were conducted to obtain input/feedback regarding LWC locations within the maintenance sections.
- Inventory GIS Map: A GIS map was developed based on field data collection and meeting/interview information and by utilizing standard State guidelines for the development of GIS Shape files.
- LWC Prioritization: The LWC locations within each respective maintenance section were ranked based on frequency of flood events, duration of road closures, impact to road users during flood events, and meetings with Maintenance Office staff.
- HWDS Evaluation: Existing and emerging HWDS were evaluated. The criteria and requirements for the implementation of proposed systems were recommended.
- Conceptual Layout: Key components of the HWDS were identified and proposed in the conceptual layouts for 20 highest priority locations and preliminary cost estimates were developed.

Inventory Study

The LWC data was initially obtained from each Area and Maintenance Office in 2015. The preliminary data was received from TxDOT Austin District, which identified the location and priority of LWC within each maintenance section. A total of 136 LWC locations were identified in the preliminary data collection. The detailed inventory data information is shown in Appendix A.

Field Observations

Based on the preliminary inventory data, field investigations were conducted from May 24, 2016 to June 10, 2016 to identify existing LWC characteristics such as roadway geometry, type of LWC, speed limits, pavement marking, advance warning signs, flood gauge signs, and object markers. Photographs of the roadway approaches to the LWC were taken. The site observations identified during the field investigations were used to evaluate the existing conditions of LWC locations.

Meeting/Interview

After the field inventory data were compiled and summarized, a series of meetings were conducted by RPS Klotz Associates with Maintenance offices in August 2016 and September 2016 to obtain input and feedback for each of the LWC locations. The preliminary inventory data were updated and the locations and priorities were reevaluated during these meetings. A couple of LWC locations were removed from the study because either these locations are maintained by other public agencies or there are ongoing projects to eliminate the LWC.

Some operation and maintenance issues were summarized as follows:

- TxDOT sends maintenance personnel to close flooded roadways and keep up with alerts during the flood events.
- Some LWC locations get flooded frequently on an annual basis.
- There is no available documentation of past road closures and flood events. The information is limited to the knowledge of the maintenance staff.
- There are concerns that automatic gates would block emergency vehicles.

A total of 153 LWC locations were summarized in the updated data collection. A summary of the updated inventory data is provided in Table 1 and detailed information can be found in Appendix A.

Table 1 – Summary of Updated Inventory Data

Maintenance Office	No. of LWC
Burnet	14
Fredericksburg	31
Lincoln	6
Johnson City	23
Llano	19
Lockhart	22
Mason	33
South Travis	2
San Marcos	3
Bastrop	0
North Travis	0
Travis Central	0
Travis East	0
Taylor	0
Georgetown	0
Total:	**153**

Inventory GIS Map

An inventory GIS map was developed based on field data collection and meeting/interview information by utilizing standard State guidelines for the development of GIS Shape files. Exhibit B1 in Appendix B provides the inventory GIS map of the 153 LWC locations identified within the TxDOT Austin District.

HWDS Review in Texas

Texas has the highest number of flood fatalities in United States. Most of these flood fatalities are vehicle-related. A traffic safety study shows that driving and walking into flood waters may be responsible for more than 93% of flood fatalities in Texas (1). In recent years, the HWDS have been increasingly deployed by the public agencies in Texas.

The focus of this study was on the HWDS currently in use or deployed by the public agencies near TxDOT Austin District in order to maintain consistency and minimize driver confusion. This section provides a brief review of these systems. The description identifies the key system components, technologies, and implementation issues associated with each of these systems in place.

TxDOT San Antonio District HWDS

The TxDOT San Antonio District installed 26 HWDS at LWC locations with a potential of or a history of flooding. Most of these systems have been installed in the rural areas within San Antonio District.

The system typically consists of one or a pair of water level sensors, a microprocessor master control, remote unit with Texas Manual on Uniform Traffic Control Devices (TMUTCD) warning signs and flashing beacon, solar power system, wireline or wireless communications from water level sensors to master control, wireline or wireless communications from master control to remote site, cellular communications from the system to a contracted operations center, and internet-based communications from the contracted operations center to the TxDOT San Antonio TransGuide network.

When a flooding event reaches a trigger threshold, the water level sensors transmit the information to a master control. The master control can activate flashing beacons at remote sites to inform drivers that a road is flooded ahead. It also can simultaneously notify TxDOT transportation and emergency management personnel of the flooded roadway condition so action can be taken.

Several implementation issues included compatibility between two different manufacturers and establishing cellular communications in remote areas. It was noticed that two poles were installed at each remote site to separate the warning sign with flashing lights from the remote control unit with solar power panel.

City of San Antonio Flood Emergency System (S.A.F.E)

The City of San Antonio installed its HWDS that warns motorists of flooded roadways and the Early Flood Warning System network of ALERT rain and stream gauges in the 1980's. However, both systems had fallen into disrepair during the 1990's following a period of drought.

In the 2000's, the City started to reactivate 19 LWC master gauging stations and 54 advance warning sites. The new sensors, communications, and equipment as necessary were installed during rehabilitation. Following the revitalization and integration of the two systems, the City completed the system expansion in 2010 including installation of 13 new detection systems with a total of 36 advance warning sites.

These systems inform drivers of a flooded roadway by activating flashing lights and in some cases an automated barrier gate. All of these systems are integrated into San Antonio Flood Emergency System (S.A.F.E.). In addition to high water warning system, drivers can find alternate routes from a network of S.A.F.E. routes at critical LWC locations throughout the City of San Antonio.

Bexar County HALT System

Bexar County installed its roadway flooding warning system in 2007. This system consists of four rain and stream gauging sites, which monitor conditions at LWC locations on two roadways. The system automatically activates flashing beacons to warn drivers during road flooding.

As part of the county's 10-year flood control program, Bexar County upgraded the system as High water Alert Lifesaving Technology (HALT) System in 2009. After the completion of the latest Phase III expansion in September 2016, there are more than 150 HALT systems within Bexar County. The water level sensors in HALT systems detect rising water and warn drivers to turn around with either flashing lights or a combination of flashing lights and gates. In addition to various levels of warning, including flashing lights and barricades, the system will also send real time information to the website which was developed through a partnership among Bexar County, the City of San Antonio and the San Antonio River Authority. Drivers can assess the website with information about the status of all of the County's LWCs. By subscribing to alerts through this website, drivers can receive text or email alerts when LWCs they choose to monitor have water over the road.

City of Austin Flood Early Warning System

The City of Austin began to establish its Flood Early Warning System (FEWS) in the middle of 1980's. Currently, the FEWS consists of 130 rain gauges or stream level sensors, flashing lights or automated gates at 15 LWC locations, gauge-adjusted radar rainfall system, and Closed Circuit Television (CCTV) cameras at LWC locations. The gauge-adjusted radar rainfall system collects rainfall data from the National Weather Service Doppler Radar and then adjusts the data based on the ground rainfall gauges in the Austin area. An important feature of predictive modeling and mapping was added through the Supervisory Control and Data Acquisition (SCADA) interface that the City developed in 2010. All flood related information from various sources was incorporated into SCADA interface. Based on hydrologic/hydraulic prediction model and all available information, the predicted floodplain maps in ArcGIS and Google Earth format are created and provided to the Emergency Operation Center (EOC) duty officers.

For small scale storms (less than 2-year storm events), FEWS personnel communicate directly with field operations barricade crews for road closures. For large scale storm (2-year storm events and above), FEWS personnel will communicate with EOC duty officers first and only make recommendations for road closures, creek warnings, and evacuations. EOC duty officers are responsible for making the decisions.

Hays County Low Water Crossing Warning System

Hays County installed 16 LWC warning systems at high-hazard road crossing locations in 2008. Hays County identified and prioritized LWCs based on the previous flooding events, flood related accidents, and the need based on area growth.

Each system consisted of one water level sensor and two warning signs with flashing lights. The devices were designed to flash warning when two inches of water overtopped the low point of the road surface and a second indication when the depth reached six inches. Each unit was equipped with a solar power system.

The sensor monitors the elevation of a nearby stream and reports any change, every three minutes, to the central computer. When flood water reaches the edge of the roadway, the system activates the warning text on the changeable signs and/or activates the flashing lights. The sensor control unit sends all this information back to the central computer. Emails are sent to staff and the appropriate

Street Services district alerting them of the need to place barricades at this location as soon as possible. The wireless communications are implemented between the sensor control units and changeable signs/flashing lights, and sensor control unit and the central computer. The sensor control unit normally activates the changeable message sign or flashing light without intervention from the central computer. However, the central computer can issue commands to turn on the signs and lights.

Proposed HWDS

As described in the previous section, HWDS currently implemented in the region have similar functionalities and characteristics. The primary functions of the HWDS are 1) to warn drivers of the hazardous road flooding conditions and 2) to notify the transportation and emergency management personnel who can response to flooding events.

The proposed HWDS should include the following key components:

- Water Level Sensor
- Master Control Unit
- Remote Unit with Advance Warning Devices
- Communications
- Power equipment

Water Level Sensors

The water level sensor that is ultimately deployed depends on the sensor's characteristics and the local geography and installation conditions. There are three main types of sensors used for detecting water levels that are applicable for the proposed HWDS.

- Pressure Transducer: A pressure transducer uses the hydrostatic pressure of the water to measure its height. It is commonly used to provide accurate and continuous water level readings and the rate at which the water is rising. It generally rests on streambeds protected by securely fastened conduit.

- Ultrasonic Sensor: An ultrasonic sensor produces an analog signal based on the height of the water. It is generally mounted above the level of a water surface (i.e., bridge, culvert, etc.) and measures the distance to the water surface.
- Bubbler Gauge: A bubbler gauge sensor measures the change in hydrostatic pressure of water above an air outlet. It is used when particularly hazardous conditions might jeopardize a sensor.

Other methods for determining water level include shaft encoder, fiber optic sensor, and radar sensor, etc. Regardless of the type of sensors used, several critical factors must be considered as follows:

- Sensors need to be protected from mud and debris associated with flash flooding.
- Sensors must be "immune" to vandalism and damage from humans and animals.
- Sensors in the waterbed need to survive freeze damage during the winter.

In addition to the water level sensor, a rain gauge can be installed at or near the LWC site to provide further insight as to what conditions are likely to occur. In some cases, redundant sensors are recommended to achieve the best reliability. Multiple sensors will allow more data to be taken during a flooding event.

Master Control Unit

The master control unit serves as the data processing and data disseminating center of the HWDS. The master control unit acquires the data from water level sensors, usually through a hardwire link. It interprets the data, and initiates actions based on the information received. It also monitors and controls the remote units with advance warning devices. The master control unit includes the capabilities to process information from more than one sensor site, data logging, and data disseminating and transmitting. The specific capabilities are typically chosen based upon site conditions, site needs, and integration with existing systems. The master control unit is normally housed in a National Electrical Manufacturers Association (NEMA) rated outdoor enclosure and mounted on a pole. The equipment must be kept out of the flood zone (above 100-year floodplain) and away from vehicle traffic.

Remote Unit with Advance Warning Devices

The remote unit is equipped with communication modules and automated control, allowing the master control unit to determine when activation of warning devices is required.

The advance warning devices should not only convey a clear message, but also command attention and the respect of drivers. Typical advance warning devices include warning signs, flashing lights, changeable message signs, and automatic barrier arms. Flashing lights, warning signs, and message signs provide warning messages, but they do not prevent drivers from making poor judgement and continuing into the flooded area. Automatic barriers/gates can automatically operate the barrier across the road when the system detects rising water levels, however, it may block the access for emergency vehicles. TxDOT has determined to not use Automatic barriers/gates to close roads within TxDOT Austin District.

In the proposed system, it is recommended to use TMUTCD standard weather condition warning signs "ROAD MAY FLOOD" (W8-18) with flashing beacons based on the LWC characteristics.

The location of the advance warning signs needs careful consideration. During flooding event, drivers may be lured into the flooded area when visibility is poor. The warning signs must be far enough ahead of the flooded roadway and in accordance with TMUTCD standard advance placement distances.

Communications

The communication flows in the proposed flooded roadway warning system includes master control unit to remote unit and master control unit to traffic management center.

Master Control Unit to Remote Unit

Communication between Master Control Unit and Remote Unit is normally via Very High Frequency/Ultra High Frequency (VHF/UHF) radio transmission. VHF/UHF radio-based communications platforms typically use the ALERT radio transmission protocol, which transmits in real time when each sensor event occurs. ALERT systems are fast, have good resolution, and low operating costs, but they can suffer from interferences from electrical noise and atmospheric conditions and require line-of-sight communication. If the devices do not have line of sight, one would have to use repeater(s) in order to transmit the signal from the master processing unit to the remote unit. The repeater is a specialized transmitter that receives an incoming signal, waits until the

entire signal has been received, and retransmits it. It is usually placed at a high elevation, midway between the master control unit and the remote unit. Because radio transmitters use public airwaves, they require licenses to legally operate.

Master Control Unit to Traffic Management Center

There are multiple options for the communications between master control units to the Traffic Management Center (TMC). Based on the available communication infrastructure in the study area, VHF/UHF radio and Cellular service are two most applicable methods in this study.

As discussed previously, VHF/UHF radio requires line-of-sight communications. It also requires a license to transmit signals on a certain frequency. In addition, since multiple transmitters share common radio frequencies, there are instances when simultaneous transmissions occur.

Cellular network through AT&T or Verizon Cellular service is normally available within the study area. Cellular networks take advantage of newer technology, making it less susceptible to interference, and easier to configure. It typically operates from locations served by the provider's voice network. The communication can be effectively established. Service providers often include licensing and network monitoring in their fee structure, but often charge proportionally according to the amount of data traffic. The cost of each cellular connection varies between $6 and $15 depending on the data usage. Potential risk factors for cellular networks may include denial of service during extreme traffic loading situations or outages related to severe weather. In this study, most of LWC locations are in remote areas. Cellular network will be the most applicable mode of communication between most master control units and TMC.

Power Equipment

Most HWDS are in remote areas away from existing commercial power grid. The systems generally rely on a combination of battery and solar power system. Solar power battery systems will continue to operate reliably when there is a power outage. The field devices typically are mounted on a pole that may also serve as the support pole for solar panels and backup batteries.

Highest Priority LWC Locations

Several criteria were applied to identify the 20 highest priority suitable candidates for conceptual design of HWDS. The criteria or requirements are summarized below:

- Frequency of flooding/water ponding
- Duration of flooding
- Flooded related crashes (especially fatality accidents)
- Type of LWC
- Roadway Characteristics
- Traffic Volumes
- Local operation and maintenance experiences

The 20 locations were identified from the 153 total inventory LWC locations. In general, the top two ranking locations were included from each Maintenance section.

Fredericksburg Maintenance Office

- The LWC on RM 1888 has been identified as top priority and the No. 1 ranking location by Fredericksburg Maintenance Office. There are high traffic volumes on RM 1888. During flood events, the maintenance personnel have to take a long detour to access the other side of the LWC location.
- The LWC on RM 1631 is the No. 2 ranking location by Fredericksburg Maintenance Office. There are new developments in the adjacent area. Unfamiliar drivers are anticipated to drive towards the LWC location.

Johnson City Maintenance Office

- The LWC on RM 1320 has been identified as top priority and the No. 1 ranking location by Johnson City Maintenance Office. If there is rain in the Pedernales River upstream area (Fredericksburg and Harper), flood water will cover the roadway at this LWC location.

- The LWC on RM 962 is the No. 2 ranking location by Johnson City Maintenance Office.

Llano Maintenance Office

- The LWC on RM 3404 has been identified as the highest priority location by Llano Maintenance Office. This LWC flooded four to five times in years 2015 and 2016. During a flood event, TxDOT Llano Maintenance Office will close the road on the RM 1431 side; Llano county sheriff office will close the other side of the road.
- The LWC on RM 152 is the No. 2 ranking location by Llano Maintenance Office.
- The LWC on RM 2323 is the No. 3 ranking location by Llano Maintenance Office. During a flood event, this LWC generally gets flooded first. Therefore, installing a HWDS at this location would provide TxDOT the information about the upcoming flood at other LWCs along RM 2323.

Mason Maintenance Office

- The LWC on RM 1871 has been identified as the No. 1 ranking location by Mason Maintenance Office. However, TxDOT is planning to replace the bridge at this LWC in fiscal year 2019. Therefore, this LWC location has been removed from the top priority list.
- The LWC on RM 2389 is the No. 2 ranking location by Mason Maintenance Office.
- The LWC on RM 2768 is the No. 3 ranking location by Mason Maintenance Office.

Lincoln Maintenance Office

- The LWC on RM 141 has been identified as the No. 1 ranking location by Lincoln Maintenance Office. According to the maintenance office staff, water could stay up to three days or longer at this LWC.
- The LWC on RM 1624 is the No. 2 ranking location by Lincoln Maintenance Office. A fatality occurred during a flood event at this LWC location on March 22, 2013.

Lockhart Maintenance Office

- The LWC on RM 1979 has been identified as the No. 1 ranking location by Lockhart Maintenance Office.

- The LWC on RM 1977 is the No. 2 ranking location by Lockhart Maintenance Office.
- The LWC on RM 20 is the No. 3 ranking location by Lockhart Maintenance Office.

Burnet Maintenance Office

- The LWC on RM 1174 and Oatmeal Creek has been identified as top priority and the No. 1 ranking location by Burnet Maintenance Office. According to the maintenance office staff, the water level rose up to four feet high during the flood in August 2016.
- The LWC on RM 1174 and an unnamed creek is the No. 2 ranking location by Burnet Maintenance Office.
- The LWCs on RM 243 at Williams Branch and Sycamore Springs Creeks are the No. 3 and 4 ranking locations. According to the maintenance office staff, there are high (mainly cut-through) volumes on RM 243. The distance between these two LWCs is less than 1.5 miles. Therefore, these two LWC locations on FM 243 were grouped into one HWDS.

South Travis Maintenance Office

- There are two LWC locations in the South Travis Maintenance section. Both of them (RM 2244 at Eanes Creeks and RM 1826 at Slaughter Creek) are identified within the top 20 highest priority locations in this study.

San Marcos Maintenance Office

- Three LWC locations are listed in San Marcos Maintenance section along RM 150. Two LWCs at Onion Creek and one LWC at Yorks Creek are identified within the top 20 highest priority locations in this study. Since these three LWC locations on RM 150 are separated by less than 2.0 miles, they are grouped into one HWDS.

Table 2 summarizes the 20 top priority locations and Exhibit B2 shows these 20 identified locations and can be found in Appendix B. The field inventory information for the identified 20 locations is summarized in Appendix C.

Table 2 – Highest Priority Locations for Conceptual Design

No.	Maintenance Office	Roadway	County	Latitude	Longitude	Body of Water	Type of Water Crossing
1	Fredericksburg	RM 1888	Gillespie	30.163769	-98.729469	Hunters Creek	Pipe Culvert
2	Fredericksburg	RM 1631	Gillespie	30.290195	-98.792646	Kiehne Creek	Pipe Culvert
3	Johnson City	RM 1320	Blanco	30.272171	-98.545541	Pedernales River	Bridge
4	Johnson City	RM 962	Blanco	30.383090	-98.249950	Cypress Creek	Pipe Culvert
5	Llano	RM 3404	Llano	30.681620	-98.485350	Llano River	Bridge
6	Llano	RM 152	Llano	30.705860	-98.892860	Vasterling Creek	Pipe Culvert
7	Llano	RM 2323	Llano	30.530310	-98.920560	Cottonwood Creek	Pipe Culvert
8	Mason	RM 2389	Mason	30.650172	-99.250713	Llano River	Bridge/Box Culvert
9	Mason	RM 2768	Llano	30.704000	-98.958833	Llano River	Pipe Culvert
10	Lincoln	FM 141	Lee	30.321623	-96.786472	Middle Yegua Creek	Bridge
11	Lincoln	FM 1624	Lee	30.388121	-97.064129	Middle Yegua Creek	Box Culvert
12	Lockhart	FM 1979	Caldwell	29.832114	-97.842355	San Marcos River	Bridge
13	Lockhart	FM 1977	Caldwell	29.783007	-97.831417	San Marcos River	Bridge
14	Lockhart	FM 20	Caldwell	29.752584	-97.781067	San Marcos River	Bridge
15	Burnet	RM 1174	Burnet	30.703320	-98.064290	Oatmeal Creek	Pipe Culvert
16	Burnet	RM 1174	Burnet	30.679850	-98.062550	Unnamed Creek	Pipe Culvert
17	Burnet	RM 243	Burnet	30.820920	-97.934770	Williams Branch	Pipe Culvert
				30.832800	-97.920380	Sycamore Springs Crk.	Pipe Culvert
18	South Travis	RM 2244	Travis	30.270687	-97.792718	Eanes Creek	Pipe Culvert
19	South Travis	RM 1826	Travis	30.209318	-97.903397	Slaughter Creek	Pipe Culvert
20	San Marcos	RM 150	Hays	30.085060	-98.013000	Onion Creek	Pipe Culvert
				30.083220	-98.008000	Onion Creek	Pipe Culvert
				30.059739	-97.989886	Yorks Creek	Pipe Culvert

Conceptual Design

The conceptual HWDS designs for 20 highest priority LWC locations were developed based on the local geometrics, adjacent roadway networks, LWC characteristics and installation conditions.

Scenario 1: HWDS at a Single LWC Location

In scenario 1, the proposed HWDS is at a single LWC location. This system consists of remote units with advance warning signs and flashing lights for both directions, yellow flood gauge sign, water level sensor, master control with data processing unit and cellular communication module. In some cases, additional remote units are proposed near the adjacent intersection to warn approaching drivers. Figures 1 provides the illustration of the proposed system installations at a single LWC location.

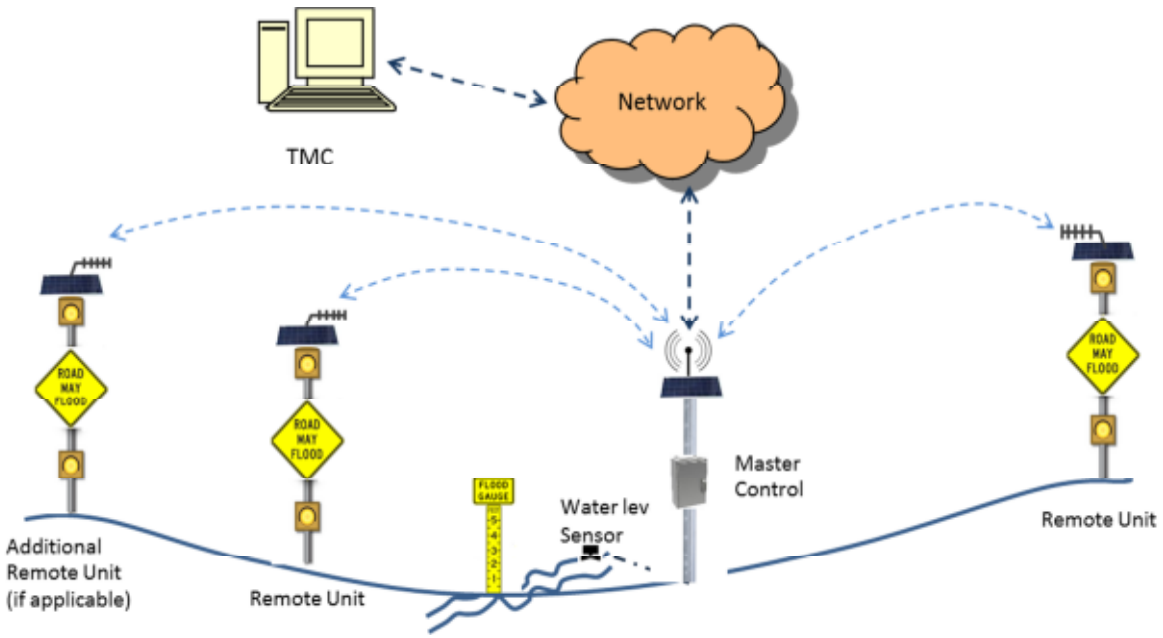

Figure 1 – Proposed HWDS at a Single LWC Location

Scenario 2: HWDS at the LWC on RM 2389

The LWC at RM 2389 and Llano River includes two bridges. The roadway segment between the two bridges is approximately 800 feet. This segment could be under water during a flood event. It is difficult to install one master control unit to detect both locations. Therefore, two control units are proposed. One control unit will serve as the master control unit; the other control unit will send the

water level information to the master control unit and the master control unit will then activate the flashing lights. Figure 2 provides the illustration of the proposed system installations at the LWC on RM 2389.

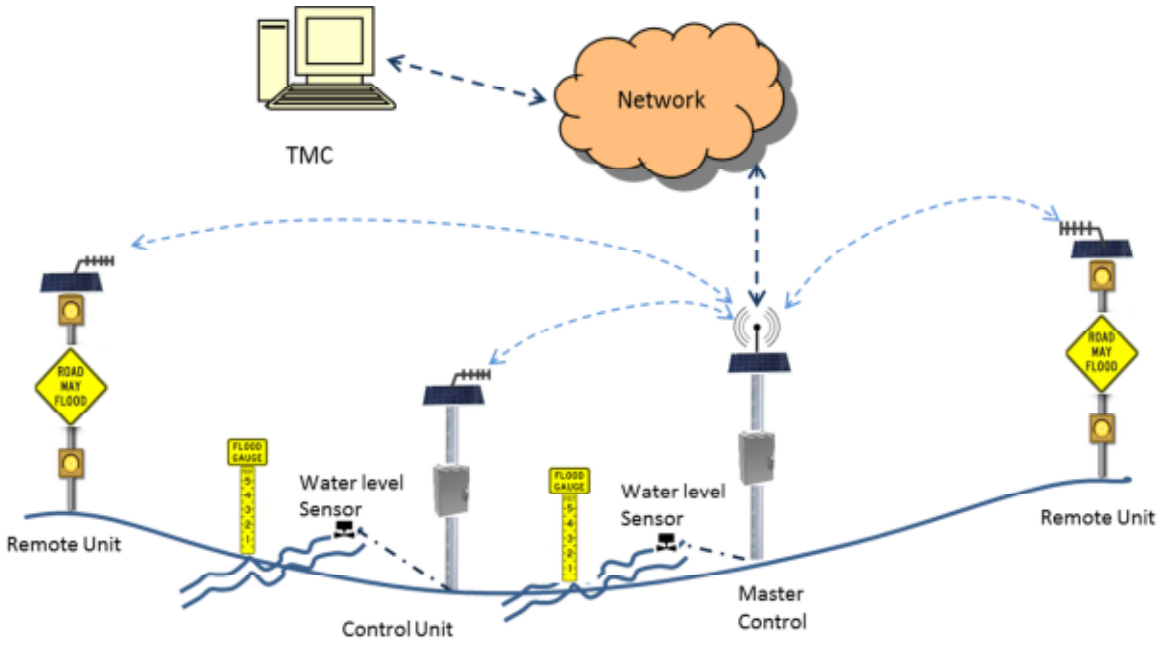

Figure 2 – Proposed HWDS at the LWC at RM 2389

Scenario 3: HWDS at the LWCs on RM 243

As discussed in the previous section, the LWCs on RM 243 at Williams Branch and Sycamore Springs Creeks are grouped into one HWDS. In addition to the advance warning signs with flashing lights at each LWC, it is recommended to install a remote unit with "ROAD CLOSED TO THRU TRAFFIC" (R11-4) sign and "WHEN FLASHING" (W16-13p) plaque at the beginning of the stretch of roadway near the intersection of US 183. This allows motorists to use an alternative route to turn around and avoid the risk of traveling the flooded roadways. Figure 3 provides the illustration of the proposed system installations at the LWCs on RM 243.

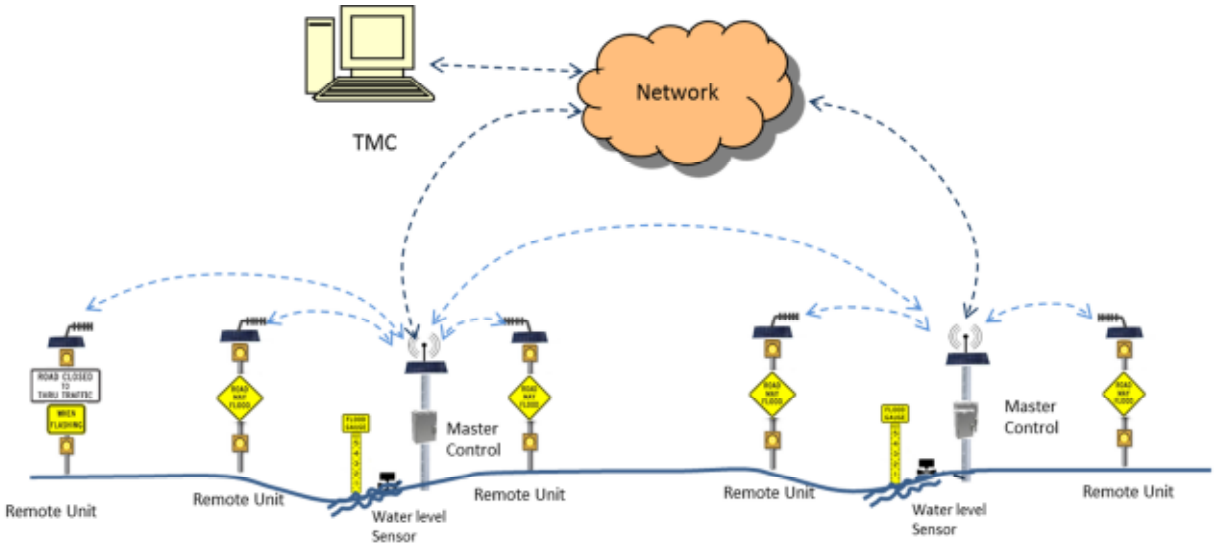

Figure 3 – Proposed HWDS at the LWCs at RM 243

Scenario 4: HWDS at the LWCs on RM 150

Three LWCs on RM 150 at Onion Creek and Yorks Creek are grouped into one HWDS. The advance warning signs with flashing lights are recommended at each LWC. One remote unit with "ROAD CLOSED TO THRU TRAFFIC" (R11-4) sign and "WHEN FLASHING" (W16-13p) plaque are proposed on northbound RM 150 near the intersection of RM 3237 and on southbound RM 150 near the intersection of Elder Hill Road. This allows motorists to use an alternative route to turn around and avoid the risk of traveling the flooded roadways. Figure 4 provides the illustration of the proposed system installations at the LWCs on RM 150.

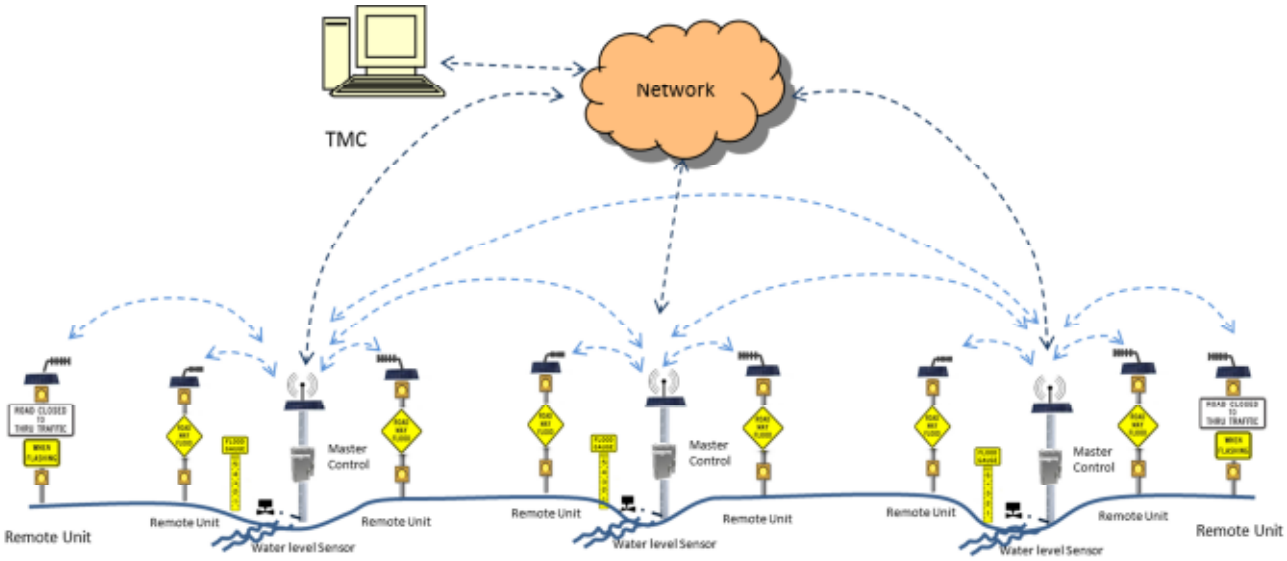

Figure 4 – Proposed HWDS at the LWCs at RM 150

The conceptual layout at each identified location and summary of the field visit and photographs are provided in Appendix C.

Preliminary Cost Estimates

Preliminary cost estimates were developed for the HWDS at 20 highest priority locations. These preliminary cost estimates are provided as a planning level assessment of projected cost for budgeting purposes. Actual construction cost may vary based on the detailed design of each proposed system and actual unit costs at time of construction. It was assumed that existing Right of Way (ROW) would be sufficient and ROW acquisition cost would not be required for this project. A summary of the planning level cost estimate is provided in Table 3 and detailed preliminary cost information can be found in Appendix C.

Table 3 – Summary of Preliminary Cost Estimates

	Area Office	Maintenance Office	Roadway	Preliminary Cost
1	Burnet	Fredericksburg	RM 1888	$48,470
2	Burnet	Fredericksburg	RM 1631	$48,470
3	Burnet	Johnson City	RM 1320	$49,010
4	Burnet	Johnson City	RM 962	$49,280
5	Burnet	Llano	RM 3404	$48,470
6	Burnet	Llano	RM 152	$48,470
7	Burnet	Llano	RM 2323	$48,470
8	Burnet	Mason	RM 2389	$68,310
9	Burnet	Mason	RM 2768	$63,990
10	Bastrop	Lincoln	FM 141	$51,170
11	Bastrop	Lincoln	FM 1624	$48,470
12	Bastrop	Lockhart	FM 1979	$65,610
13	Bastrop	Lockhart	FM 1977	$51,170
14	Bastrop	Lockhart	FM 20	$65,610
15	Burnet	Burnet	RM 1174	$48,470
16	Burnet	Burnet	RM 1174	$48,470
17	Burnet	Burnet	RM 243	$111,380
18	South Travis	South Travis	RM 2244	$48,470
19	South Travis	South Travis	RM 1826	$48,470
20	South Travis	San Marcos	RM 150	$159,840
TOTAL				**$1,220,070**

Recommendations and Conclusions

This study consisted of a detailed inventory at various LWC locations, reviews of HWDS currently deployed in Texas Hill Country region, key components of these systems, development of conceptual layout for the 20 highest priority locations, and cost estimates of the proposed system at each location.

A review of the HWDS currently in use provided critical information on the key components of the proposed system. The key components of the system would include water level sensors, master control, remote units with advance warning devices, communication among the field devices, communication between master control and TMC, and power equipment.

Through coordination with TxDOT Austin District, all of the maintenance offices within the district, and field investigations of all known LWCs, a total 153 LWC locations were identified as part of this study. All locations were mapped in Aeronautical Reconnaissance Coverage Geographic Information System (ArcGIS).

It is recommended that a Geographical User Interface (GUI) be developed based on the LWC information presented in the ArcGIS inventory database. This GUI would allow TxDOT Austin District office and the various Area and Maintenance Offices to retrieve and document information performing to LWC locations and flood events, display exhibits or graphics for information purposes, edit the database to keep LWC information up to date, and provide information to the public.

Based on information gathered from the field inventory, literature review, discussion with agency officials and evaluation of various practical and/or feasible technologies that could be deployed within the study area, a total of 20 locations were identified and prioritized as suitable candidates for Phase I installation of a HWDS for the TxDOT Austin District.

The proposed conceptual layouts were developed for the 20 highest priority LWC locations within the district. However, flash flooding could occur after heavy rainfall events or times in which drivers would not expect roadways to be flooded and can occur at other LWC locations within the district. It is recommended that TxDOT develop a work program and allocate the necessary funds to install HWDS at LWC locations within the Austin District to improve safety during flood events, meet driver expectancy, and provide consistency throughout all maintenance sections.

Reference

1) Analysis of Flood Fatalities in Texas, Hatim O. Sharif, Terrance L. Jackson, Md. Moazzem Hossain, and David Zane Natural Hazard Review, Volume 16 Issue 1, 2015.

RPS klotz associates

Appendix A- Inventory Form

RPS klotz associates

Summary of Preliminary TxDOT Low Water Crossing Inventory Data

RPS Klotz Associates Project No. 0121.072.004 | February 2017

RPS klotz associates

Low Water Crossings
Burnet Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Burnet	RM 1174	Burnet	1349-03	199+10	12.9	412+4063	30.703320	-98.064290	Oatmeal Creek
5	Burnet	Burnet	RM 1174	Burnet	1349-03	291+00	14.75	414+2694	30.679850	-98.062550	
4	Burnet	Burnet	RM 1174	Burnet	1349-03	595+10	20.51	420+1226	30.604330	-98.085330	Cow Creek
9	Burnet	Burnet	RM 243	Burnet	0440-03	279+15	1.9	514+326	30.666340	-98.075450	
3	Burnet	Burnet	RM 243	Burnet	0440-04	456+75	18.1	532+428	30.820920	-97.934770	Mahomet
11	Burnet	Burnet	RM 243	Burnet	0440-04	618+00	19.5	532+8161	30.832800	-97.920380	
12	Burnet	Burnet	RM 963	Burnet	1198-01	192+18	3.46	508+7725	30.806070	-98.203730	
6	Burnet	Burnet	RM 963	Burnet	1198-01	224+39	4.072	510+385	30.814360	-98.199800	Wardens
7	Burnet	Burnet	RM 963	Burnet	1198-01	236+00	6.486	512+2567	30.841530	-98.178360	
8	Burnet	Burnet	RM 963	Burnet	1198-01	372+54	6.906	512+4787	30.845760	-98.173220	
13	Burnet	Burnet	RM 2340	Burnet	2205.01	218+00	4.14	400+775	30.893830	-98.893830	
14	Burnet	Burnet	RM 2340	Burnet	2205.01	264+20	5	400+5324	30.881530	-98.179860	
10	Burnet	Burnet	RM 1855	Burnet	1752-01	35+40	0.97	502+3225	30.645970	-98.269740	
2	Burnet	Burnet	RM 2147	Burnet	3338-01	33+66	7.3	506+1720	30.539740	-98.272130	Double Horn Creek

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Fredericksburg Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Fredericksburg	RM 1888	Gillespie	2929-01			476+.75	30.163769	-98.729469	Hunters Creek
2	Burnet	Fredericksburg	RM 1376	Gillespie	1899-03			450+1.10	30.151260	-98.736985	West Fork Hunters Creek
3	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01			482+1.16	30.374190	-98.664780	Willow Creek
4	Burnet	Fredericksburg	RM 0965	Llano	1199-02			424+.43	30.507148	-98.759140	Crabapple Creek
5	Burnet	Fredericksburg	RM 1376	Gillespie	1899-03			446+1.30	30.175813	-98.745941	Hopfs Creek
6	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01			472+.43	30.290195	-98.792646	Kiehne Creek
7	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01			452+.55	30.258090	-99.153977	Flag Creek
7	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01			452+1.45	30.257487	-99.139053	North Creek
7	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01			454+.62	30.254315	-99.119651	draw
7	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01			454+1.4	30.251006	-99.107327	Devils Creek
7	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01			456+.19	30.247437	-99.094763	draw
8	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04			432+.07	30.430571	-99.155313	Edwards Creek
8	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04			432+1.49	30.419451	-99.172533	Threadgill Creek
8	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04			432+1.80	30.416444	-99.176368	Threadgill Creek
8	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04			434+.80	30.409153	-99.190139	Threadgill Creek
8	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04			434+1.74	30.398577	-99.196576	draw
8	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04			436+.68	30.387610	-99.199623	Threadgill Creek
8	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04			436+.77	30.384547	-99.200631	Maverick Springs
9	Burnet	Fredericksburg	RM 0783	Gillespie	1135-01			446-.33	30.277177	-99.242813	draw (Lange Rd)
10	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01			462+1.16	30.241504	-98.980103	Mud Creek
11	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04			476+.10	30.412905	-98.734069	Knott Branch
12	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01			478+1.30	30.343010	-98.713153	Spring Creek
13	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01			480+.18	30.345088	-98.700426	Sagebiel Branch
14	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01			478+.70	30.335468	-98.716562	draw (Koennecke-Eckhardt Rd)

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Fredericksburg Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
15	Burnet	Fredericksburg	RM 0965	Llano	1199-02			424+.88	30.510723	-98.764917	Keener Branch
16	Burnet	Fredericksburg	RM 0965	Gillespie	1199-01			428+.15	30.497518	-98.817462	draw (Enchanted Rock)
17	Burnet	Fredericksburg	RM 0965	Gillespie	1199-01			440+.31	30.341527	-98.857818	draw (Achtzehn Rd)
18	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04			480+.60	30.392676	-98.674273	draw (Andy Moore Mt. Rd)
19	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04			480+00	30.392922	-98.684369	draw (Herber-Schaefer Rd)
20	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04			484+.18	30.390711	-98.626569	Youngblood Creek

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Lincoln Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	Bastrop	Lincoln	FM 1624	Lee					30.388121	-97.064129	Middle Yegua Creek
1	Bastrop	Lincoln	FM 141	Lee					30.321623	-96.786472	Middle Yegua Creek
2	Bastrop	Lincoln	FM 1624	Lee					30.303636	-97.050766	West Yegua Creek

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Johnson City Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Johnson City	RM 1320	Blanco	954-4			442+0.464	30.272171	-98.545541	Pedernales River
2	Burnet	Johnson City	RM 962	Blanco	1056-6			510+0.943	30.383090	-98.249950	Cypress Creek near Cypress Mill
3	Burnet	Johnson City	RM 1323	Blanco	1056-5				30.362642	-98.468402	Hickory Creek at Sandy
4	Burnet	Johnson City	RM 1623	Blanco	1534-1			500+0.805	30.124800	-98.504445	Big Creek
5	Burnet	Johnson City	RM962	Blanco	1056-6			504+0.319	30.429338	-98.339570	North Cypress
6	Burnet	Johnson City	RM 2325	Blanco	285-1			504++0.133	30.113379	-98.302448	Near RM 165
7	Burnet	Johnson City	RM 962 West	Blanco	2204-2			502+1.632	30.433755	-98.348118	North Cypress RM 962 West
8	Burnet	Johnson City	RM 2325	Hays	285-2			508+0.065	30.106034	-98.270117	Near Blanco County Line
9	Burnet	Johnson City	RM 2325	Hays	285-2			508+1.419	30.098670	-98.249527	
10	Burnet	Johnson City	RM 1320	Blanco	954-4			434+1.551	30.342715	-98.483748	Spring Creek
11	Burnet	Johnson City	RM 1323	Blanco	1056-5			494+1.518	30.362697	-98.494361	Spring Creek
12	Burnet	Johnson City	RM 1323	Blanco	1056-5			500-0.119	30.349093	-98.435432	Buffalo Creek
13	Burnet	Johnson City	RM 962	Blanco	1056-6			508+1.270	30.397807	-98.265806	Cleveland Branch

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Llano Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Llano	RM 3014	Llano	2209-2 08			492+.73 mi.	30.862770	-98.455000	When this crossing is closed due to high water there are 1000+ people who are stranded until the water recedes
2	Burnet	Llano	RM 3404	Llano	3388-1 08			490	30.681620	-98.485350	Crossing over the Llano River
3	Burnet	Llano	RM 2342	Burnet	2207-1 08			422+.69 mi.	30.690800	-98.385420	Only low water crossing on RM 2342. 32 mile round trip from the Llano Warehouse
4	Burnet	Llano	RM 2323	Llano	2411-1 08			420+164'	30.719830	-98.703790	There are 3 sub divisions within a mile of this crossing that are not accessible from RM 2323 when the crossing is
5	Burnet	Llano	RM 2241	Llano	547-1 08			482+1.53 mi.	30.774220	-98.696900	This low water crossing stays closed longer than the rest of the low water crossings on RM 2241 during high water
6	Burnet	Llano	RM 2241	Llano	547-1 08			482+.73 mi.	30.770040	-98.641540	
7	Burnet	Llano	RM 2241	Llano	547-1 08			490+1.10 mi.	30.820750	-98.522640	No culvert pipe at this low water crossing
8	Burnet	Llano	RM 2323	Llano	2411-1 08			424+1.88 mi.	30.667960	-98.777520	
9	Burnet	Llano	RM 2323	Llano	2411-1 08			430+1.32 mi	30.623210	-98.843850	
10	Burnet	Llano	RM 2323	Llano	2411-1 08			440	30.530310	-98.920560	
11	Burnet	Llano	RM 152	Llano	396-9 08			468+200'	30.697260	-98.936560	
12	Burnet	Llano	RM 152	Llano	396-9 08			470+.79 mi.	30.705860	-98.892860	
13	Burnet	Llano	RM 2323	Llano	2411-1 08			426+1.89 mi.	30.660310	-98.808770	
14	Burnet	Llano	RM 690	Burnet	3005-1 08			406+1 mi.	30.762690	-98.399640	
15	Burnet	Llano	RM 690	Burnet	3005-1 08			406+.84 mi.	30.764550	-98.401102	
16	Burnet	Llano	RM 152	Llano	396-9 08			476+1.41 mi	30.722480	-98.787060	
17	Burnet	Llano	RM 152	Llano	396-9 08			480+.72 mi.	30.736930	-98.736940	
18	Burnet	Llano	RM 2323	Llano	2411-1 08			422+1.85 mi.	30.682720	-98.749010	No culvert pipe at this low water crossing
19	Burnet	Llano	RM 152	Llano	396-9 08			480+1.58 mi	30.742040	-98.725050	

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Lockhart Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	Bastrop	Lockhart	FM 1979	Caldwell	1898-1				29.832114	-97.842355	San Marcos River
2	Bastrop	Lockhart	FM 1977	Caldwell	1434-3				29.783007	-97.831417	San Marcos River
3	Bastrop	Lockhart	FM 20	Caldwell	115-2				29.752584	-97.781067	San Marcos River
4	Bastrop	Lockhart	FM 672	Caldwell	384-4				29.893555	-97.658898	Plum Creek
	Bastrop	Lockhart	FM 672	Caldwell					29.900159	-97.652375	
5	Bastrop	Lockhart	FM 86	Caldwell	571-2				29.785633	-97.583254	Plum Creek
	Bastrop	Lockhart	FM 86	Caldwell					29.802518	-97.568851	
6	Bastrop	Lockhart	FM 1322	Caldwell	1375-2				29.758715	-97.593173	Plum Creek
	Bastrop	Lockhart	FM 1322	Caldwell					29.746671	-97.592754	
	Bastrop	Lockhart	FM 1322	Caldwell					29.681976	-97.599406	
	Bastrop	Lockhart	FM 1322	Caldwell					29.676150	-97.617506	
7	Bastrop	Lockhart	FM 1322	Caldwell	1375-2				29.676313	-97.621711	Cottonwood Creek
	Bastrop	Lockhart	FM 1322	Caldwell					29.676555	-97.627918	
8	Bastrop	Lockhart	FM 1386	Caldwell	2478-1				29.700094	-97.586583	Draw
	Bastrop	Lockhart	FM 1386	Caldwell					29.699763	-97.580494	
9	Bastrop	Lockhart	FM 3158	Caldwell	3211-1				29.803435	-97.556955	Daniels Creek
	Bastrop	Lockhart	FM 3158	Caldwell					29.798275	-97.555641	
10	Bastrop	Lockhart	FM 713	Caldwell	805-3				29.852453	-97.519101	Tennis Creek
11	Bastrop	Lockhart	FM 20	Caldwell	115-3				29.940812	-97.504873	Draw
12	Bastrop	Lockhart	FM 20	Caldwell	115-2				29.784383	-97.738602	Draw

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Mason Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Mason	RM 1871	Mason	1753-01		-0.875	444	30 39.489N	99 19.439W	Llano River; FY2019 project to replace, CSJ 1753-01-017
2	Burnet	Mason	RM 2389	Mason	2688-01		0.57	418	30 39.00N	99 14.04W	Llano River
3	Burnet	Mason	RM 2768	Llano	2099-01		0.467	410	30 42.24N	98 57.53W	Llano River
4	Burnet	Mason	RM 1222	Mason	1102-3		-0.846	458	30 55.57N	99 08.18W	
5	Burnet	Mason	RM 1222	Mason	1102-3		-1.522	456	30 55.56N	99 10.11W	
6	Burnet	Mason	RM 1222	Mason	1102-3		-1.085	448	30 54.08N	99 16.54W	
7	Burnet	Mason	RM 1222	Mason	1102-3		-1.094	454	30 55.62N	99 11.72W	
8	Burnet	Mason	RM 1222	Mason	1102-3		-1.727	454	30 55.62N	99 12.35W	
9	Burnet	Mason	RM 1222	Mason	1102-3		-0.979	452	30 55.63N	99 13.62W	
10	Burnet	Mason	RM 1222	Mason	1102-3		1.339	448	30 54.10N	99 16.80W	
11	Burnet	Mason	RM 386	Mason	577-1		-1.051	406	30 49.94N	99 10.68W	
12	Burnet	Mason	RM 386	Mason	577-1		-1.22	406	30 50.05N	99 10.56W	
13	Burnet	Mason	RM 386	Mason	577-1		-1.066	400	30 53.71N	99 07.30W	
14	Burnet	Mason	RM 386	Mason	577-1		0.348	396	30 55.80N	99 07.09W	
15	Burnet	Mason	RM 2768	Llano	2099-01		1.387	408	30 43.05N	98 57.29W	
16	Burnet	Mason	RM 1723	Mason	1538-01		-0.381	410	30 42.84N	99 13.12W	
17	Burnet	Mason	RM 1871	Mason	1753-01		-0.97	452	30 44.264N	99 14.586W	
18	Burnet	Mason	RM 1871	Mason	1753-01		0.249	450	30 43.650N	99 14.595W	
19	Burnet	Mason	RM 1871	Mason	1753-01		0.146	448	30 42.499N	99 16.187W	
20	Burnet	Mason	RM 1871	Mason	1753-01		-0.874	448	30 42.041N	99 16.187W	
21	Burnet	Mason	RM 1871	Mason	1753-01		0.868	432	30 36.234N	99 28.261W	
22	Burnet	Mason	RM 152	Mason	396-8		-0.365	458	30 38.469N	99 03.559W	
23	Burnet	Mason	RM 152	Mason	396-8		0.157	460	30 39.361N	99 01.211W	
24	Burnet	Mason	RM 152	Mason	396-8		-0.36	466	30 41.864N	98 58.196W	
25	Burnet	Mason	RM 648	Gillespie	1056-2		0.788	456	30 26.739N	99 03.088W	

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
Mason Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
26	Burnet	Mason	RM 648	Gillespie	1056-2		-0.113	454	30 26.675N	99 05.910W	
27	Burnet	Mason	RM 648	Gillespie	1056-2		0.509	452	30.444673N	99.121623W	
28	Burnet	Mason	RM 783	Mason	1056-1		-0.893	416	30 37.728N	99 05.875W	
29	Burnet	Mason	RM 783	Mason	1056-1		-0.147	420	30 33.721N	99 07.223W	
30	Burnet	Mason	RM 783	Mason	1056-1		0.57	418	30 34.909N	99 07.002W	
31	Burnet	Mason	RM 783	Mason	1056-1		-0.227	422	30 32.504N	99 08.036W	
32	Burnet	Mason	RM 783	Mason	1056-1		0.298	422	30 32.032N	99 08.023W	
33	Burnet	Mason	RM 783	Gillespie	1056-2		0.536	426	30 29.466N	99 07.850W	

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
South Travis Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
1	STAEO	STMO	RM1826	Travis	1754-02				30.209318	97.903397	Slaughter Creek
2	STAEO	STMO	RM2244	Travis	2102-01				30.270687	97.792718	Dry Creek/Eanes Creek
1	STAEO	SMMO	RM0150	Hays	1197-01			456+6085'	30.08322* N	98.00800* W	Onion Creek
2	STAEO	SMMO	IH0035	Hays	0016-02			215-1610'	30.00292* N	97.86594* W	Plum Creek

Note: Preliminary Inventory Provided By TxDOT

Low Water Crossings
San Marcos Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						http://itouchmap.com/latlong.html		NOTES
* RANK	* AREA	* MAINTENANCE	* ROADWAY	* COUNTY	* CONTROL-SECTION	STATION	MILEPOINT	REF MARKER	LATITUDE	LONGITUDE	
Bastrop County (Maintenance)			PR 1C at Alum Creek Road								
Travis North Maintenance			Loop 360 at Spicewood Springs (City of Austin Maintained)								

Note: Preliminary Inventory Provided By TxDOT

RPS klotz associates

Summary of Final TxDOT Low Water Crossing Inventory Data

RPS Klotz Associates Project No. 0121.072.004 | February 2017

Low Water Crossings
Burnet Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Burnet	RM 1174	Burnet	1349-03	412+0.77	30.703320	-98.064290	Oatmeal Creek. Needs a big box culvert or bridge. It rose upto 4' during last event. Top Priority
2	Burnet	Burnet	RM 1174	Burnet	1349-03	414+0.51	30.679850	-98.062550	Top Priority. Check to see if multiple locations along RM 1174 can be accommodated on one LWC system
3	Burnet	Burnet	RM 243	Burnet	0440-04	532+0.08	30.820920	-97.934770	Mahomet. Heavy traffic
4	Burnet	Burnet	RM 243	Burnet	0440-04	532+1.55	30.832800	-97.920380	Road serves as cut-thru for traffic from Marble Falls. Unfamiliar drivers on this roadway. Heavy traffic
5	Burnet	Burnet	RM 2147	Burnet	3338-01	506+0.33	30.539740	-98.272130	Double Horn Creek. Heavy traffic
6	Burnet	Burnet	RM 1174	Burnet	1349-03	420+0.23	30.604330	-98.085330	Cow Creek. Heavy Traffic
7	Burnet	Burnet	RM 963	Burnet	1198-01	510+0.07	30.814360	-98.199800	Wardens
8	Burnet	Burnet	RM 963	Burnet	1198-01	512+0.49	30.841530	-98.178360	
9	Burnet	Burnet	RM 963	Burnet	1198-01	512+0.91	30.845760	-98.173220	
10	Burnet	Burnet	RM 963	Burnet	1198-01	508+1.37	30.806070	-98.203730	
11	Burnet	Burnet	RM 243	Burnet	0440-03	514+0.06	30.666340	-98.075450	Coming out of Bircham, barricade RM 1174
12	Burnet	Burnet	RM 1855	Burnet	1752-01	502+0.61	30.645970	-98.269740	
13	Burnet	Burnet	RM 2340	Burnet	2205-01	400+0.15	30.893739	-98.181087	
14	Burnet	Burnet	RM 2340	Burnet	2205-01	400+1.01	30.881530	-98.179860	

Low Water Crossings
Fredericksburg Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Fredericksburg	RM 1888	Gillespie	2929-01	476+0.75	30.163769	-98.729469	Hunters Creek. Heavy traffic. Blind Curve. TxDOT cannot access the other side when flooded (long detour). Explore possibility of adding culvert
2	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01	472+0.43	30.290195	-98.792646	Kiehne Creek. Development occurring in the area. LWC catches drivers by surprise
3	Burnet	Fredericksburg	RM 1376	Gillespie	1899-03	450+1.10	30.151260	-98.736985	West Fork Hunters Creek
4	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01	482+1.16	30.374190	-98.664780	Willow Creek
5	Burnet	Fredericksburg	RM 0965	Llano	1199-02	424+0.43	30.507148	-98.759140	Crabapple Creek. Water stays up for upto 12 hrs
6	Burnet	Fredericksburg	RM 1376	Gillespie	1899-03	446+1.30	30.175813	-98.745941	Hopfs Creek
7	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01	452+.55	30.258090	-99.153977	Flag Creek
8	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01	452+1.45	30.257487	-99.139053	North Creek
9	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01	454+0.62	30.254315	-99.119651	draw
10	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01	454+1.40	30.251006	-99.107327	Devils Creek
11	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01	456+0.19	30.247437	-99.094763	draw
12	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04	432+0.07	30.430571	-99.155313	Edwards Creek
13	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04	432+1.49	30.419451	-99.172533	Threadgill Creek
14	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04	432+1.80	30.416444	-99.176368	Threadgill Creek
15	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04	434+0.80	30.409153	-99.190139	Threadgill Creek
16	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04	434+1.74	30.398577	-99.196576	draw
17	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04	436+0.68	30.387610	-99.199623	Threadgill Creek
18	Burnet	Fredericksburg	RM 0783	Gillespie	1135-04	436+0.77	30.384547	-99.200631	Maverick Springs
19	Burnet	Fredericksburg	RM 0783	Gillespie	1135-01	446-0.33	30.277177	-99.242813	draw (Lange Rd)
20	Burnet	Fredericksburg	FM 2093	Gillespie	1903-01	462+1.16	30.241504	-98.980103	Mud Creek

Low Water Crossings
Fredericksburg Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
21	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04	476+0.10	30.412905	-98.734069	Knott Branch. Stays up for upto 12 hrs. "Dip" in roadway. Add pipes?
22	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01	478+1.30	30.343010	-98.713153	Spring Creek
23	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01	480+0.18	30.345088	-98.700426	Sagebiel Branch
24	Burnet	Fredericksburg	RM 1631	Gillespie	1536-01	478+0.70	30.335468	-98.716562	draw (Koennecke-Eckhardt Rd)
25	Burnet	Fredericksburg	RM 0965	Llano	1199-02	424+0.88	30.510723	-98.764917	Keener Branch
26	Burnet	Fredericksburg	RM 0965	Gillespie	1199-01	428+0.15	30.497518	-98.817462	draw (Enchanted Rock)
27	Burnet	Fredericksburg	RM 0965	Gillespie	1199-01	440+0.31	30.341527	-98.857818	draw (Achtzehn Rd)
28	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04	480+0.60	30.392676	-98.674273	draw (Andy Moore Mt. Rd)
29	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04	480+0.00	30.392922	-98.684369	draw (Herber-Schaefer Rd)
30	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04	484+0.18	30.390711	-98.626569	Youngblood Creek
31	Burnet	Fredericksburg	RM 1323	Gillespie	1056-04	480+1.62	30.383000	-98.666590	draw

Low Water Crossings
Lincoln Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	Bastrop	Lincoln	FM 141	Lee	0334-05	436	30.321623	-96.786472	Middle Yegua Creek. Water stays up - 3 days or longer
2	Bastrop	Lincoln	FM 1624	Lee	1537-01	432	30.388121	-97.064129	Middle Yegua Creek. Fatality (drowning) occurred on March 22, 2013
3	Bastrop	Lincoln	FM 1624	Lee	1537-01	438	30.303636	-97.050766	West Yegua Creek
4	Bastrop	Lincoln	RM 696	Lee	1073-02	576	30.385056	-97.167847	
5	Bastrop	Lincoln	RM 696	Lee	1073-02	574	30.383908	-97.190388	
6	Bastrop	Lincoln	RM 112	Milam	0334-02	576	30.470777	-97.158658	At Williamson County Line

Low Water Crossings
Johnson City Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Johnson City	RM 1320	Blanco	0954-04	442+0.46	30.272171	-98.545541	Pedernales River. Top priority. Fills up even with no rain. If Fredericksburg & Harper get rain, this LWC gets flooded. Old Low Bridge
2	Burnet	Johnson City	RM 962	Blanco	1056-06	510+0.94	30.383090	-98.249950	Cypress Creek near Cypress Mill
3	Burnet	Johnson City	RM 1323	Blanco	1056-05	496+1.41	30.362642	-98.468402	Hickory Creek at Sandy
4	Burnet	Johnson City	RM 962	Blanco	1056-06	504+0.32	30.429338	-98.339570	North Cypress
5	Burnet	Johnson City	RM 2325	Blanco	0285-01	504+0.13	30.113379	-98.302448	Near RM 165
6	Burnet	Johnson City	RM 962 West	Blanco	2204-02	502+1.63	30.433755	-98.348118	North Cypress RM 962 West
7	Burnet	Johnson City	RM 1323	Blanco	1056-05	494+1.52	30.362697	-98.494361	Spring Creek
8	Burnet	Johnson City	RM 1323	Blanco	1056-05	500-0.12	30.349093	-98.435432	Buffalo Creek
9	Burnet	Johnson City	RM 1623	Blanco	1534-01	500+0.81	30.124800	-98.504445	Big Creek
10	Burnet	Johnson City	RM 1320	Blanco	0954-04	434+1.55	30.342715	-98.483748	Spring Creek
11	Burnet	Johnson City	RM 962	Blanco	1056-06	508+1.27	30.397807	-98.265806	Cleveland Branch
12	Burnet	Johnson City	RM 2325	Hays	0285-02	508+0.07	30.106034	-98.270117	Near Blanco County Line
13	Burnet	Johnson City	RM 2325	Hays	0285-02	508+1.42	30.098670	-98.249527	
14	Burnet	Johnson City	RM 962	Blanco	2204-02	502+0.11	30.420134	-98.317352	
15	Burnet	Johnson City	RM 165	Blanco	0954-02	500+1.80	30.111769	-98.334208	Rebe's Creek
16	Burnet	Johnson City	RM 2766	Blanco	2677-01	496+0.35	30.274622	-98.395553	Deer Creek
17	Burnet	Johnson City	RM 2766	Blanco	2677-01	498+1.18	30.274767	-98.352769	Rough Hollow
18	Burnet	Johnson City	RM 3232	Blanco	3351-02	498+1.28	30.235428	-98.249569	Flat Creek
19	Burnet	Johnson City	RM 1320	Blanco	0954-04	436+0.15	30.339111	-98.491306	North Grape Creek
20	Burnet	Johnson City	RM 1320	Blanco	0954-04	440+0.86	30.294306	-98.540783	Post Oak Creek
21	Burnet	Johnson City	RM 1320	Blanco	0954-04	440+0.53	30.298555	-98.541306	
22	Burnet	Johnson City	RM 1323	Blanco	1056-05	496+1.51	30.364797	-98.464214	
23	Burnet	Johnson City	RM 1323	Blanco	1056-05	502+1.23	30.313889	-98.406833	

Low Water Crossings
Llano Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Llano	RM 3404	Llano	3388-01	490+0.00	30.681620	-98.485350	Crossing over the Llano River. High Priority. Llano County closes their side. TxDOT closes their side (on 3404 off RM 1431). Sheriff's office closes the other side. Has flooded
2	Burnet	Llano	RM 152	Llano	0396-09	470+0.79	30.705860	-98.892860	
3	Burnet	Llano	RM 2323	Llano	2411-01	440+0.00	30.530310	-98.920560	Hickory Creek. This LWC floods first
4	Burnet	Llano	RM 2323	Llano	2411-01	420+0.03	30.719830	-98.703790	
5	Burnet	Llano	RM 2342	Burnet	2207-01	422+0.69	30.690800	-98.385420	Boys Road. Need to replace. Only low water crossing on RM 2342. 32 mile round trip from the Llano Warehouse
6	Burnet	Llano	RM 2241	Llano	0547-01	482+1.53	30.774220	-98.696900	This low water crossing stays closed longer than the rest of the low water crossings on RM 2241 during high water
7	Burnet	Llano	RM 2241	Llano	0547-01	482+0.73	30.770040	-98.641540	
8	Burnet	Llano	RM 2241	Llano	0547-01	490+1.10	30.820750	-98.522640	No culvert pipe at this low water crossing
9	Burnet	Llano	RM 3014	Llano	2209-02	492+0.73	30.862770	-98.455000	When this crossing is closed due to high water there are 1000+ people who are stranded until the water recedes . Need culverts to fix the problem
10	Burnet	Llano	RM 2323	Llano	2411-01	424+1.88	30.667960	-98.777520	
11	Burnet	Llano	RM 2323	Llano	2411-01	430+1.32	30.623210	-98.843850	
12	Burnet	Llano	RM 152	Llano	0396-09	468+0.04	30.697260	-98.936560	Comes up quickly
13	Burnet	Llano	RM 2323	Llano	2411-01	426+1.89	30.660310	-98.808770	
14	Burnet	Llano	RM 690	Burnet	3005-01	406+1.00	30.762690	-98.399640	
15	Burnet	Llano	RM 690	Burnet	3005-01	406+0.84	30.764550	-98.401102	
16	Burnet	Llano	RM 152	Llano	0396-09	476+1.41	30.722480	-98.787060	
17	Burnet	Llano	RM 152	Llano	0396-09	480+0.72	30.736930	-98.736940	
18	Burnet	Llano	RM 2323	Llano	2411-01	422+1.85	30.682720	-98.749010	No culvert pipe at this low water crossing
19	Burnet	Llano	RM 152	Llano	0396-09	480+1.58	30.742040	-98.725050	

Low Water Crossings
Lockhart Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	Bastrop	Lockhart	FM 1979	Caldwell	1898-01	532	29.832114	-97.842355	San Marcos River
2	Bastrop	Lockhart	FM 1977	Caldwell	1434-03	534	29.783007	-97.831417	San Marcos River
3	Bastrop	Lockhart	FM 20	Caldwell	0115-02	542	29.752584	-97.781067	San Marcos River
4	Bastrop	Lockhart	FM 672	Caldwell	0384-04	546	29.893555	-97.658898	Plum Creek. Ist crossing coming into the County. Bridge does not flood
5	Bastrop	Lockhart	FM 672	Caldwell	0384-04	548	29.900159	-97.652375	TxDOT usually closes FM 672 u/s of both crossings (4 & 5)
6	Bastrop	Lockhart	FM 86	Caldwell	0571-02	476	29.785633	-97.583254	Plum Creek
7	Bastrop	Lockhart	FM 86	Caldwell	0571-02	474	29.802518	-97.568851	
8	Bastrop	Lockhart	FM 1322	Caldwell	1375-02	476	29.753350	-97.592972	Plum Creek
9	Bastrop	Lockhart	FM 1322	Caldwell	1375-02	476	29.746671	-97.592754	
10	Bastrop	Lockhart	FM 1322	Caldwell	1375-02	482	29.681976	-97.599406	
11	Bastrop	Lockhart	FM 1322	Caldwell	1375-02	482	29.676150	-97.617506	
12	Bastrop	Lockhart	FM 1322	Caldwell	1375-02	482	29.676313	-97.621711	Cottonwood Creek. Flood Gauge not visible in photos
13	Bastrop	Lockhart	FM 1322	Caldwell	1375-02	482	29.676555	-97.627918	
14	Bastrop	Lockhart	FM 1386	Caldwell	2478-01	544	29.700094	-97.586583	Draw
15	Bastrop	Lockhart	FM 1386	Caldwell	2478-01	544	29.699763	-97.580494	
16	Bastrop	Lockhart	FM 3158	Caldwell	3211-01	474	29.803435	-97.556955	Daniels Creek
17	Bastrop	Lockhart	FM 3158	Caldwell	3211-01	474	29.798275	-97.555641	Not much traffic. Rises and goes back down fast.
18	Bastrop	Lockhart	FM 713	Caldwell	0805-03	550	29.852453	-97.519101	Tennis Creek
19	Bastrop	Lockhart	FM 20	Caldwell	0115-03	566	29.940812	-97.504873	Draw. Need lot of rain to flood, so low priority
20	Bastrop	Lockhart	FM 20	Caldwell	0115-02	544	29.784383	-97.738602	Draw. Need lot of rain to flood, so low priority
21	Bastrop	Lockhart	FM 86	Caldwell	0571-02	474	29.796381	-97.574131	
22	Bastrop	Lockhart	FM 1322	Caldwell	1375-02	482	29.675950	-97.607989	Plum Creek

Low Water Crossings
Mason Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	Burnet	Mason	RM 1871	Mason	1753-01	444-0.90	30.658150	-99.323983	Llano River; FY2019 project to replace, CSJ 1753-01-017
2	Burnet	Mason	RM 2389	Mason	2688-01	418+0.60	30.650000	-99.234000	Llano River. 2 bridges (crossings). Solution is to sign once for both No. 2 & 3. If 1 floods, then 2 & 3 flood as well. (12 hour lag). Runs down pretty fast. Stays up 1-2 days
3	Burnet	Mason	RM 2768	Llano	2099-01	410+0.50	30.704000	-98.958833	Llano River. Bridge upgrade was planned but cancelled due to public opposition
4	Burnet	Mason	RM 1222	Mason	1102-03	458-0.80	30.926167	-99.136333	Not much traffic but causes the most inconvenience to drivers. If RM 1222 floods even at one location, TxDOT puts barricades at US 87 and at RM 386 at other end
5	Burnet	Mason	RM 1222	Mason	1102-03	456-1.50	30.926000	-99.168500	
6	Burnet	Mason	RM 386	Mason	0577-01	400-1.10	30.895167	-99.121667	No alternate way if RM 386 is flooded. Closed it several times last few years.
7	Burnet	Mason	RM 386	Mason	0577-01	396+0.30	30.930000	-99.118167	
8	Burnet	Mason	RM 1222	Mason	1102-03	454-1.70	30.927000	-99.205833	Local Traffic only
9	Burnet	Mason	RM 1222	Mason	1102-03	452-1.00	30.927167	-99.227000	
10	Burnet	Mason	RM 1222	Mason	1102-03	448+1.30	30.901667	-99.280000	
11	Burnet	Mason	RM 386	Mason	0577-01	406-1.10	30.832333	-99.178000	Rises up and goes down fast
12	Burnet	Mason	RM 386	Mason	0577-01	406-1.20	30.834167	-99.176000	Rises up and goes down fast
13	Burnet	Mason	RM 1222	Mason	1102-03	448-1.10	30.901333	-99.275667	
14	Burnet	Mason	RM 1222	Mason	1102-03	454-1.10	30.927000	-99.195333	Local Traffic only
15	Burnet	Mason	RM 2768	Llano	2099-01	408+1.40	30.717500	-98.954833	
16	Burnet	Mason	RM 1723	Mason	1538-01	410-0.40	30.714000	-99.218667	
17	Burnet	Mason	RM 1871	Mason	1753-01	452-1.00	30.737733	-99.243100	
18	Burnet	Mason	RM 1871	Mason	1753-01	450+0.20	30.727500	-99.243250	
19	Burnet	Mason	RM 1871	Mason	1753-01	448+0.10	30.708317	-99.269783	
20	Burnet	Mason	RM 1871	Mason	1753-01	448-0.90	30.700683	-99.269783	
21	Burnet	Mason	RM 1871	Mason	1753-01	432+0.90	30.603900	-99.471017	
22	Burnet	Mason	RM 152	Mason	0396-08	458-0.40	30.641150	-99.059317	

Low Water Crossings
Mason Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
23	Burnet	Mason	RM 152	Mason	0396-08	460+0.20	30.656017	-99.020183	RM 152 impacts more people than RM 783
24	Burnet	Mason	RM 152	Mason	0396-08	466-0.40	30.697733	-98.969933	
25	Burnet	Mason	RM 648	Gillespie	1056-02	456+0.80	30.445650	-99.051467	
26	Burnet	Mason	RM 648	Gillespie	1056-02	454-0.10	30.444583	-99.098500	
27	Burnet	Mason	RM 648	Gillespie	1056-02	452+0.50	30.444673	-99.121623	
28	Burnet	Mason	RM 783	Mason	1056-01	416-0.90	30.628800	-99.097917	
29	Burnet	Mason	RM 783	Mason	1056-01	420-0.10	30.562017	-99.120383	
30	Burnet	Mason	RM 783	Mason	1056-01	418+0.60	30.581817	-99.116700	
31	Burnet	Mason	RM 783	Mason	1056-01	422-0.20	30.541733	-99.133933	
32	Burnet	Mason	RM 783	Mason	1056-01	422+0.30	30.533867	-99.133717	
33	Burnet	Mason	RM 783	Gillespie	1056-02	426+0.50	30.491100	-99.130833	

Low Water Crossings
South Travis Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	South Travis	South Travis	RM 2244	Travis	2102-01	544	30.270687	-97.792718	Eanes Creek
2	South Travis	South Travis	RM 1826	Travis	1754-02	446	30.209318	-97.903397	Slaughter Creek

Low Water Crossings
San Marcos Maintenance Office

PRIORITY	RESPONSIBLE OFFICE		LOCATION						NOTES
RANK	AREA	MAINTENANCE	ROADWAY	COUNTY	CONTROL-SECTION	REF MARKER	LATITUDE	LONGITUDE	
1	South Travis	San Marcos	RM 150	Hays	1197-01	456+1.15	30.083220	-98.00800	Onion Creek. Circuitous route to get to Wimberley if closed. TxDOT closes crossing at Creek if you come from Dripping Springs. Elder Hill Road has signage (7 mile). Heavy traffic
2	South Travis	San Marcos	RM 150	Hays	1197-01	456+0.85	30.085060	-98.013000	Onion Creek.
3	South Travis	San Marcos	RM 150	Hays	1197-01	458+1.33	30.059769	-97.989886	Yorks Creek. Yorks creek typically fills up when Onion creek fills up.

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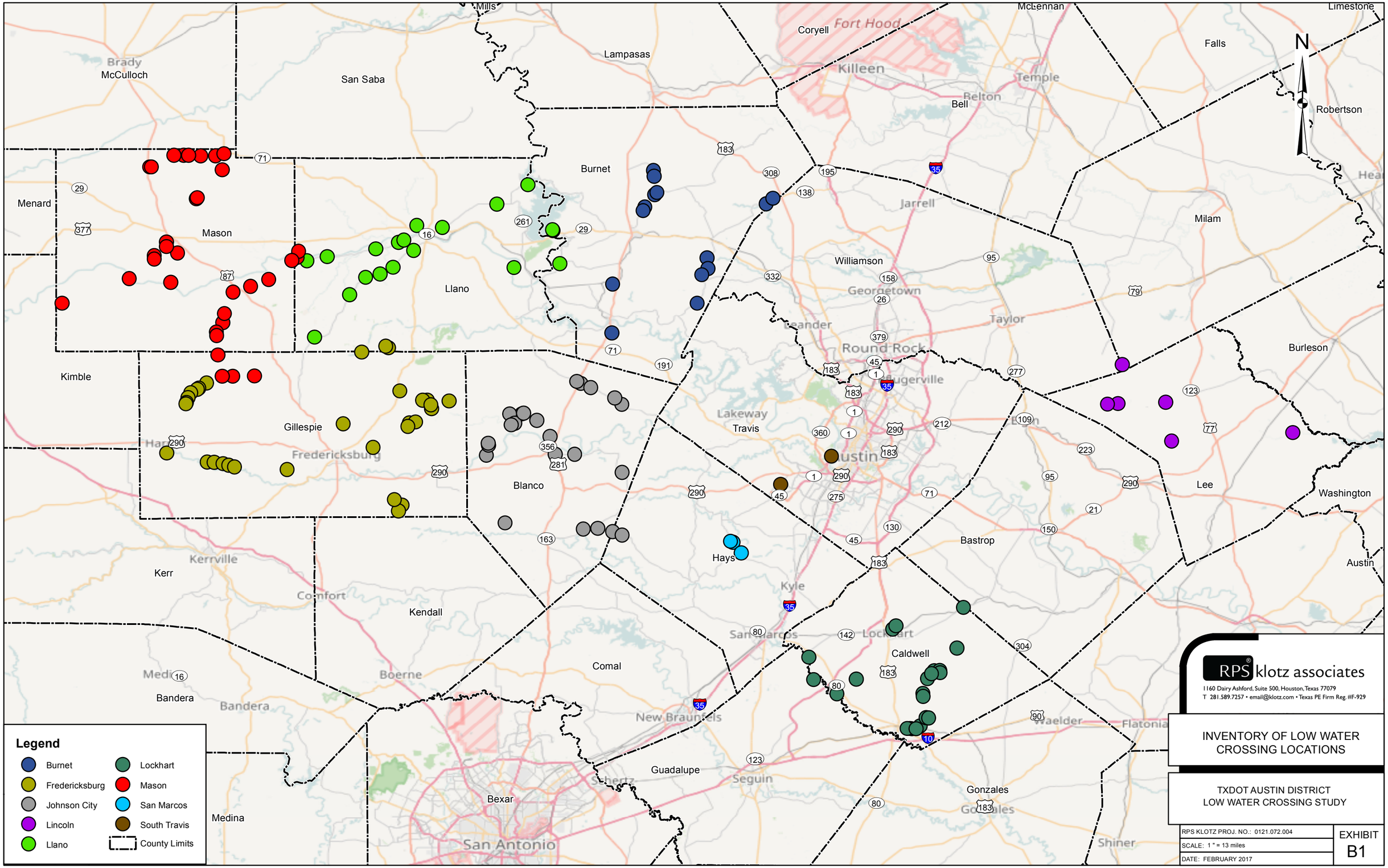
Appendix B-
GIS Inventory Map



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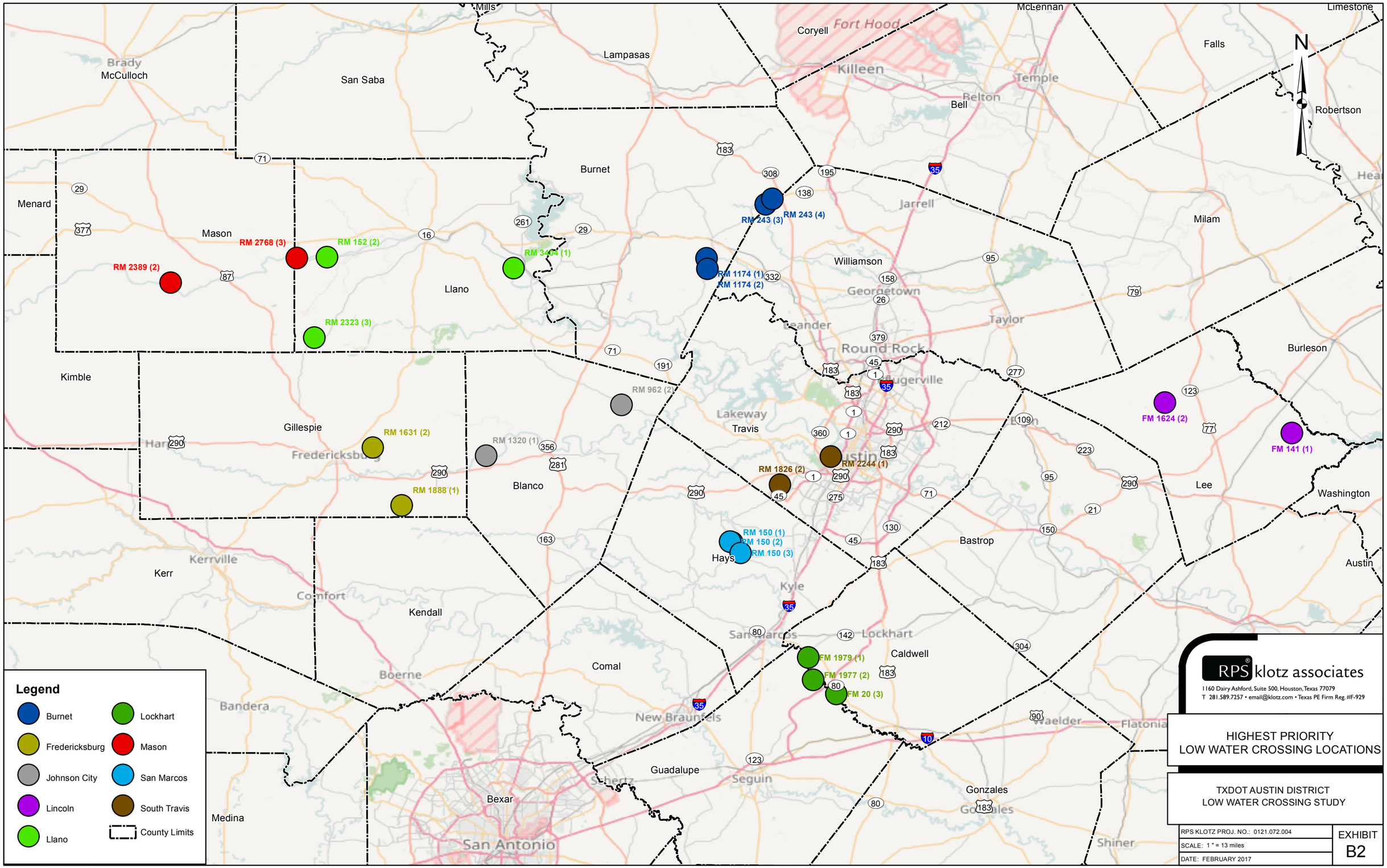
INVENTORY OF LOW WATER CROSSING LOCATIONS

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS KLOTZ PROJ. NO.: 0121.072.004	EXHIBIT B1
SCALE: 1 " = 13 miles	
DATE: FEBRUARY 2017	



Legend

- Burnet
- Fredericksburg
- Johnson City
- Lincoln
- Llano
- Lockhart
- Mason
- San Marcos
- South Travis
- County Limits

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HIGHEST PRIORITY LOW WATER CROSSING LOCATIONS

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS KLOTZ PROJ. NO.: 0121.072.004	EXHIBIT B2
SCALE: 1 " = 13 miles	
DATE: FEBRUARY 2017	

Appendix C-
Conceptual Layouts

RPS klotz associates

Location 1 – RM 1888 at Hunters Creek

Low Water Crossing Inventory	
Location:	RM 1888 at Hunters Creek
Coordinate:	Latitude: 30.163769 Longitude: -98.729469
County:	Gillespie
TxDOT Maintenance Office:	Fredericksburg
Body of Water Crossing:	Hunters Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM1-3V
Advanced Warning Signs:	W1-2, W3-1P, W8-2, W8-18, "WARNING STREAM CROSSING SUBJECT TO FLOODING NEXT 18 MILES"
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 1888 is an east-west two-lane roadway with one 12-foot lane in each direction and 2 foot shoulders. Both RM 1888 approaches are relatively straight with slight curvature at the low water crossing location. The posted speed limit on RM 1888 is 60 mph.

Photograph Date: 6/8/2016

Photograph 1 – RM 1888 looking east, Eastbound (1)

Photograph Date: 6/8/2016

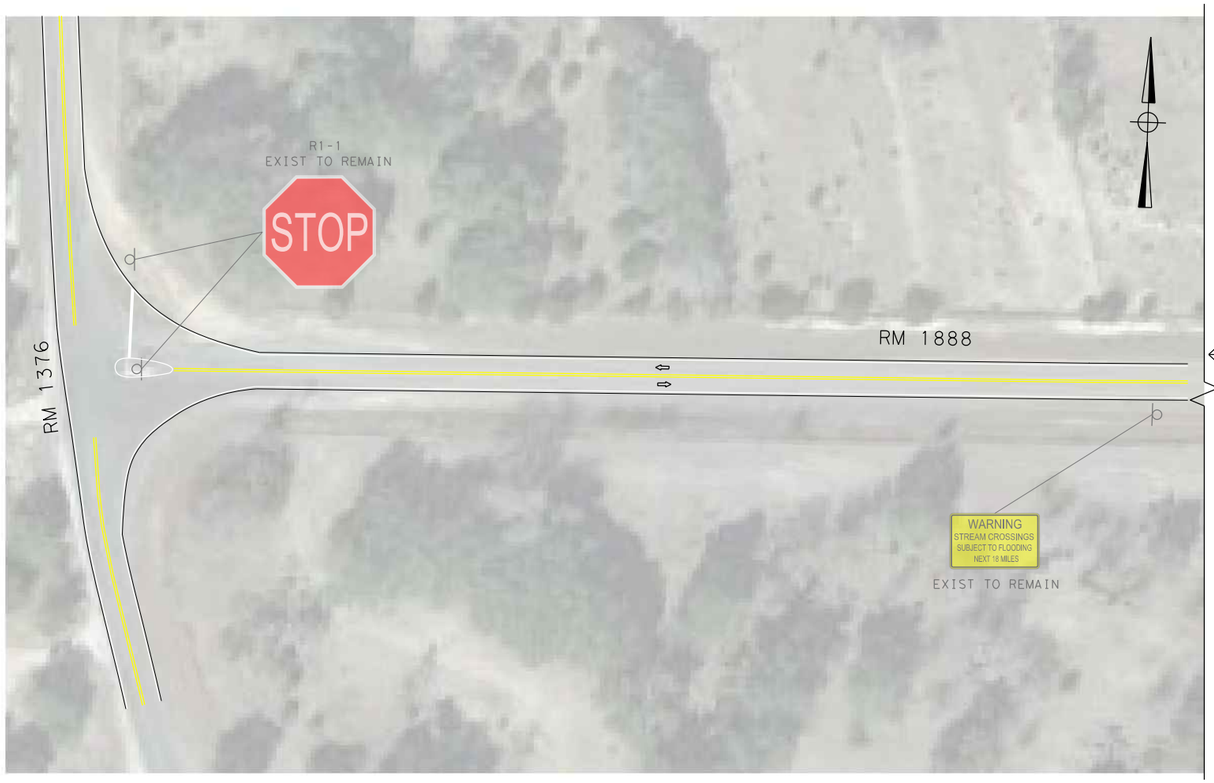
Photograph 2 – RM 1888 looking east, Eastbound (2)

Photograph Date: 6/8/2016

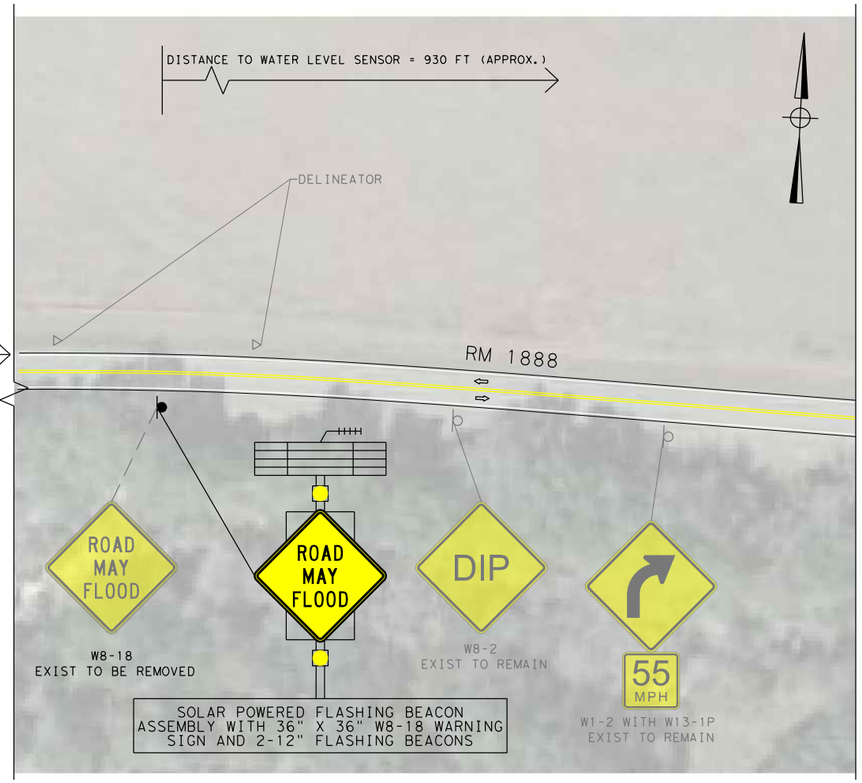
Photograph 3 – RM 1888 looking west, Westbound (1)

Photograph Date: 6/8/2016

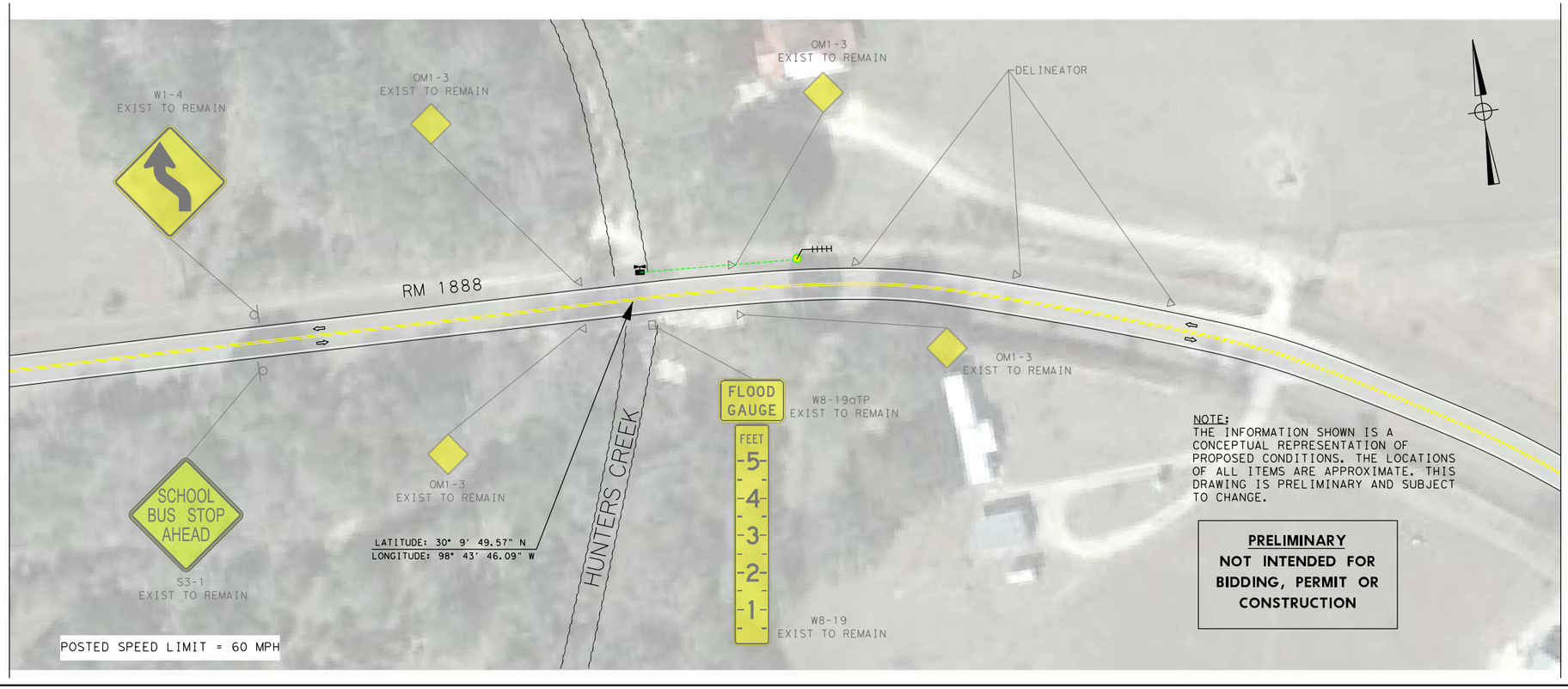
Photograph 4 – RM 1888 looking west, Westbound (2)



2340 FT (APPROX.)



MATCH LINE A-A



MATCH LINE B-B

NOTE:
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PRELIMINARY
NOT INTENDED FOR BIDDING, PERMIT OR CONSTRUCTION

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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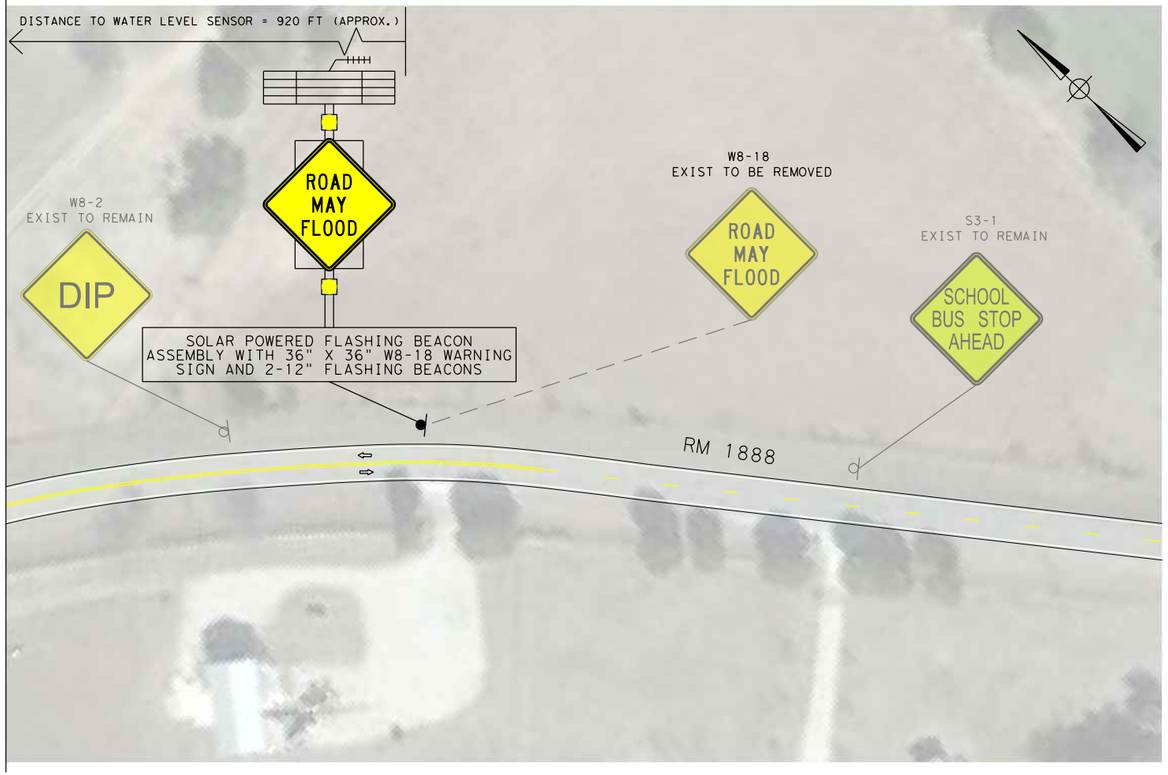
PROPOSED CONCEPTUAL LAYOUT
RM 1888 AT HUNTERS CREEK

SHEET 1 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C1-1
Date: FEBRUARY 2017	



LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- PROPOSED SIGN ON POST
- PROPOSED OMNI-DIRECTIONAL ANTENNA
- PROPOSED SOLAR PANEL

POSTED SPEED LIMIT = 60 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 1888 AT HUNTERS CREEK

SHEET 2 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C1-2
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
RM 1888 at Hunters Creek - Preliminary Estimate of Construction Cost
Gillespie, Texas

Table C1: Preliminary Cost Estimation for RM 1888 at Hunters Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 2 – RM 1631 at Kiehne Creek

Low Water Crossing Inventory	
Location:	RM 1631 at Kiehne Creek
Coordinate:	Latitude: 30.290195 Longitude: -98.792646
County:	Gillespie
TxDOT Maintenance Office:	Fredericksburg
Body of Water Crossing:	Kiehne Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM1-3V
Advanced Warning Signs:	W1-2; W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Fair
Pavement Marking Condition:	Fair
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 1631 is an east-west two-lane roadway with one 12-foot lane in each direction. There are no shoulders present in the study area. Both RM 1631 approaches are relatively straight with slight curvature at the low water crossing location. The posted speed limit on RM 1631 is 60 mph.

Photograph Date: 5/26/2016

Photograph 1 – RM 1631 looking east, Eastbound (1)

Photograph Date: 5/26/2016

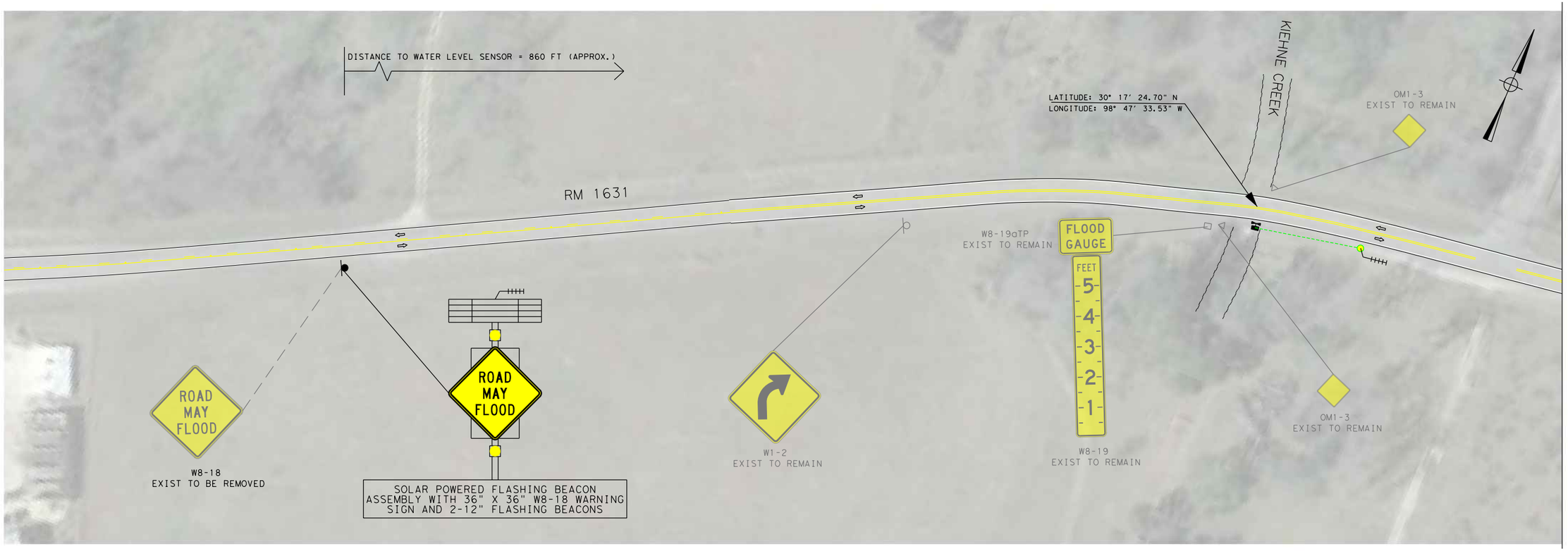
Photograph 2 – RM 1631 looking east, Eastbound (2)

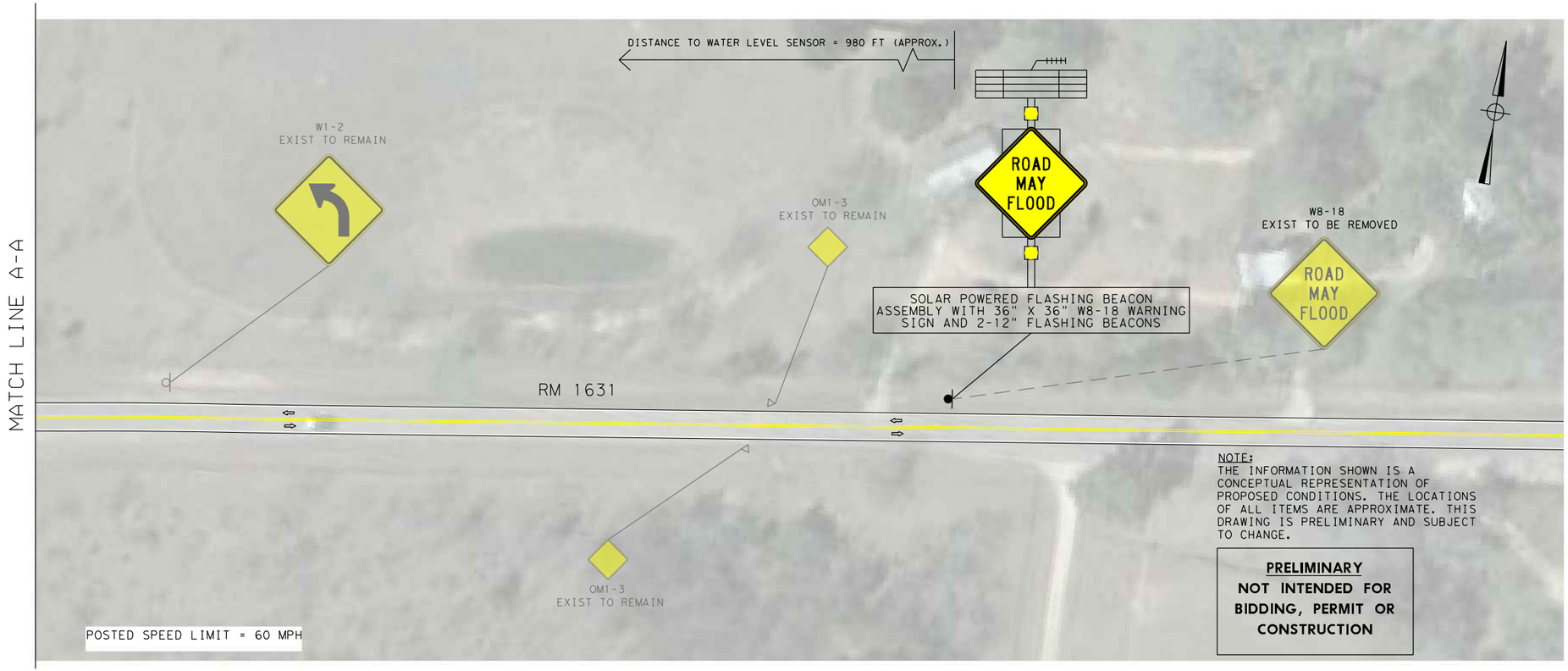
Photograph Date: 5/26/2016

Photograph 3 – RM 1631 looking west, Westbound (1)

Photograph Date: 5/26/2016

Photograph 4 – RM 1631 looking west, Westbound (2)





NOTE:
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PRELIMINARY
NOT INTENDED FOR BIDDING, PERMIT OR CONSTRUCTION

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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PROPOSED CONCEPTUAL LAYOUT
RM 1631 AT KIEHNE CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C2
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

FOR REVIEW ONLY
DO NOT USE FOR PERMITTING, BIDDING, OR CONSTRUCTION.

TxDOT Austin District
Low Water Crossing Study
RM 1631 at Kiehne Creek - Preliminary Estimate of Construction Cost
Gillespie, Texas

Table C2: Preliminary Cost Estimation for RM 1631 at Kiehne Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 3 – RM 1320 at Pedernales River

Low Water Crossing Inventory	
Location:	RM 1320 at Pedernales River
Coordinate:	Latitude: 30.272171 Longitude: -98.54551
County:	Blanco
TxDOT Maintenance Office:	Johnson City
Body of Water Crossing:	Pedernales River
Low Water Crossing Type:	Bridge
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19)
Object Markers:	OM1-3
Advanced Warning Signs:	W1-9T, W8-13aT, W8-15*
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 1320 is a north-south two-lane roadway with one 12-foot lane in each direction. There are no shoulders present. Both RM 1320 approaches are slightly curved at the low water crossing location. The posted speed limit on RM 1320 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/8/2016

Photograph 1 – RM 1320 looking north, Northbound (1)

Photograph Date: 6/8/2016

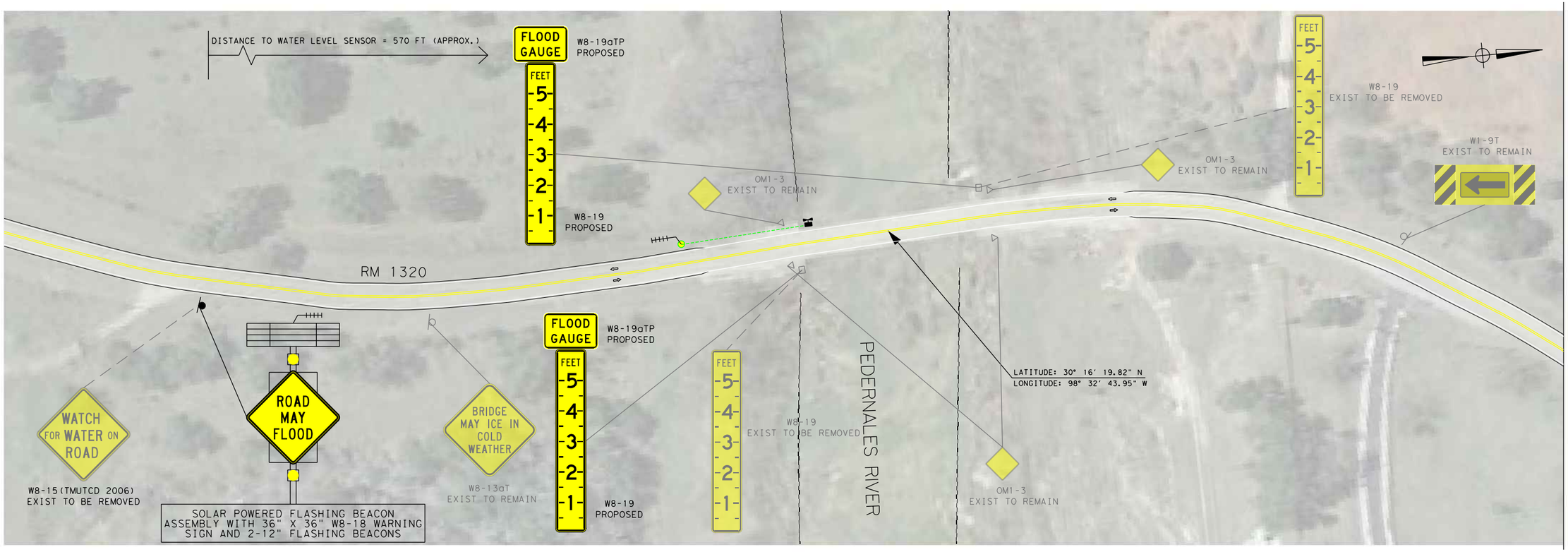
Photograph 2 – RM 1320 looking north, Northbound (2)

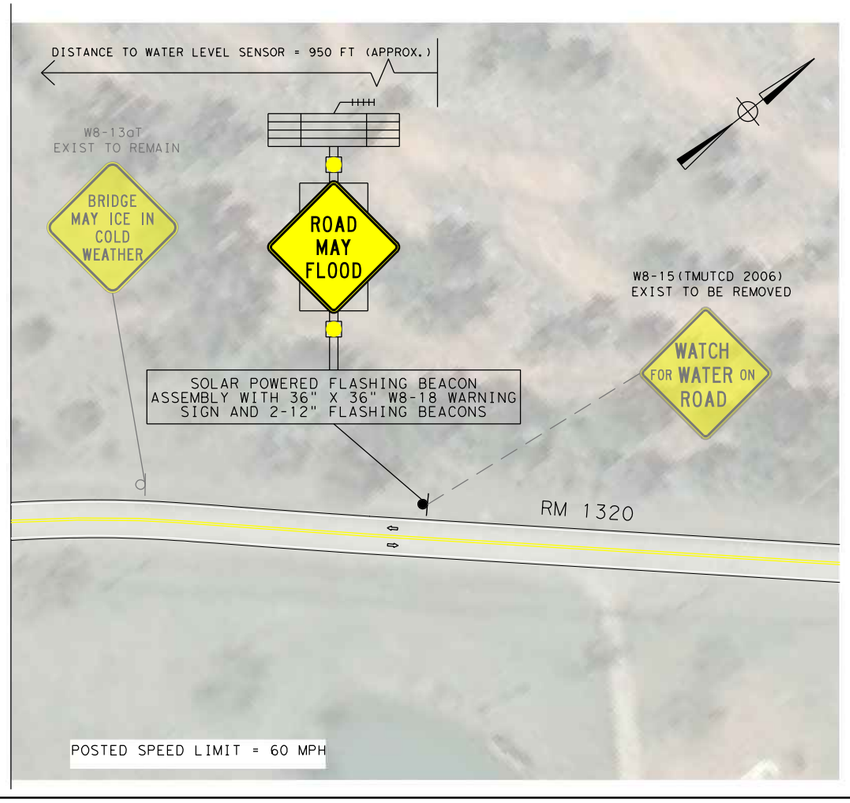
Photograph Date: 6/8/2016

Photograph 3 – RM 1320 looking south, Southbound (1)

Photograph Date: 6/8/2016

Photograph 4 – RM 1320 looking south, Southbound (2)





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 1320 AT PEDERNALES RIVER

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C3
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

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TxDOT Austin District
Low Water Crossing Study
RM 1320 at Pedernales River - Preliminary Estimate of Construction Cost
Blanco, Texas

Table C3: Preliminary Cost Estimation for RM 1320 at Pedernales River

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	4	$200	$800
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$36,300**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,630.00	$3,630.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$9,075.00	$9,075.00
				TOTAL (Rounded)	**$49,010**

RPS klotz associates

Location 4 – RM 962 at Cypress Creek

Low Water Crossing Inventory	
Location:	RM 962 at Cypress Creek
Coordinate:	Latitude: 30.383090 Longitude: -98.249950
County:	Blanco
TxDOT Maintenance Office:	Johnson City
Body of Water Crossing:	Cypress Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19)
Object Markers:	OM2-1V
Advanced Warning Signs:	W1-9T, W8-15*, "WARNING STREAM CROSSING SUBJECT TO FLOODING NEXT 7 MILES"
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Excellent
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 962 is a north-south two-lane roadway with one 12-foot lane in each direction. There are no shoulders present. Both RM 962 approaches are relatively straight at the low water crossing location. The posted speed limit on RM 962 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/7/2016

Photograph 1 – RM 962 looking north, Northbound (1)

Photograph Date: 6/7/2016

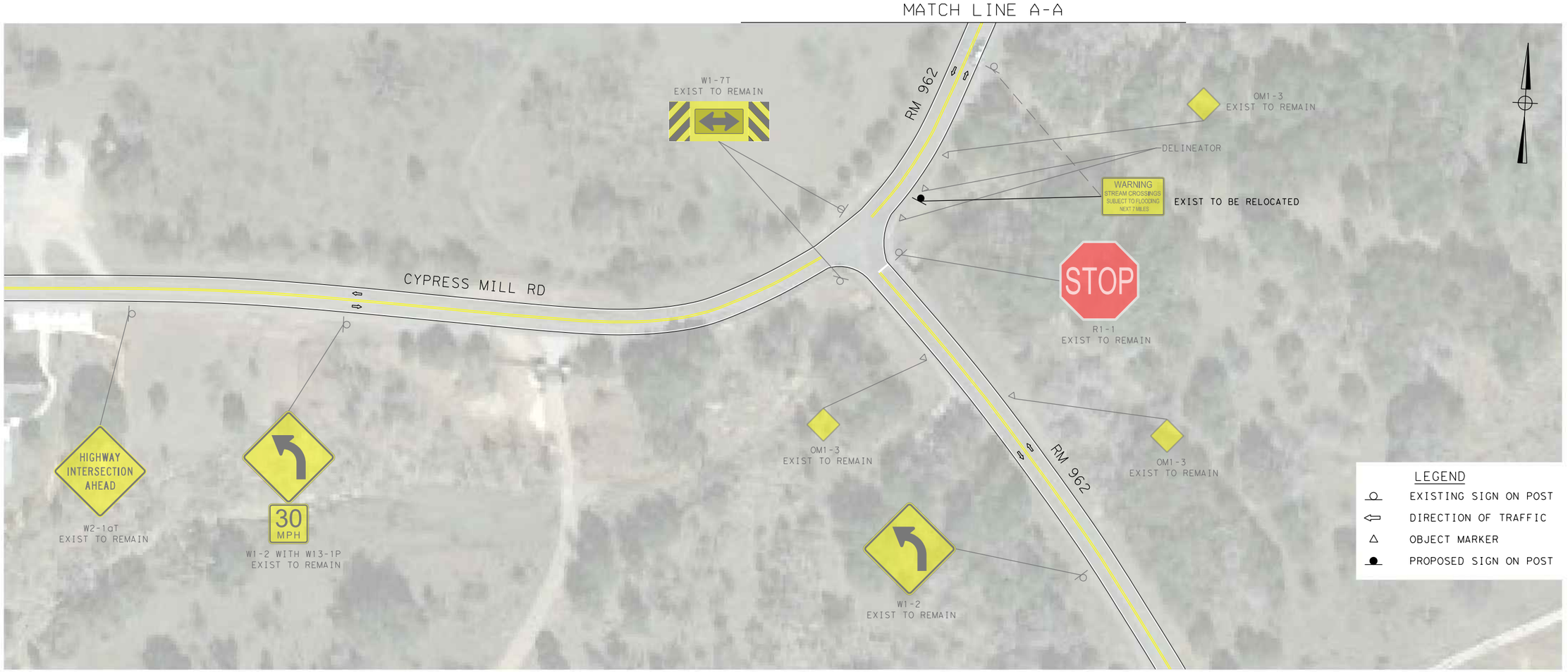
Photograph 2 – RM 962 looking north, Northbound (2)

Photograph Date: 6/8/2016

Photograph 3 – RM 962 looking south, Southbound (1)

Photograph Date: 6/8/2016

Photograph 4 – RM 962 looking south, Southbound (2)



POSTED SPEED LIMIT = 60 MPH

NOTE:
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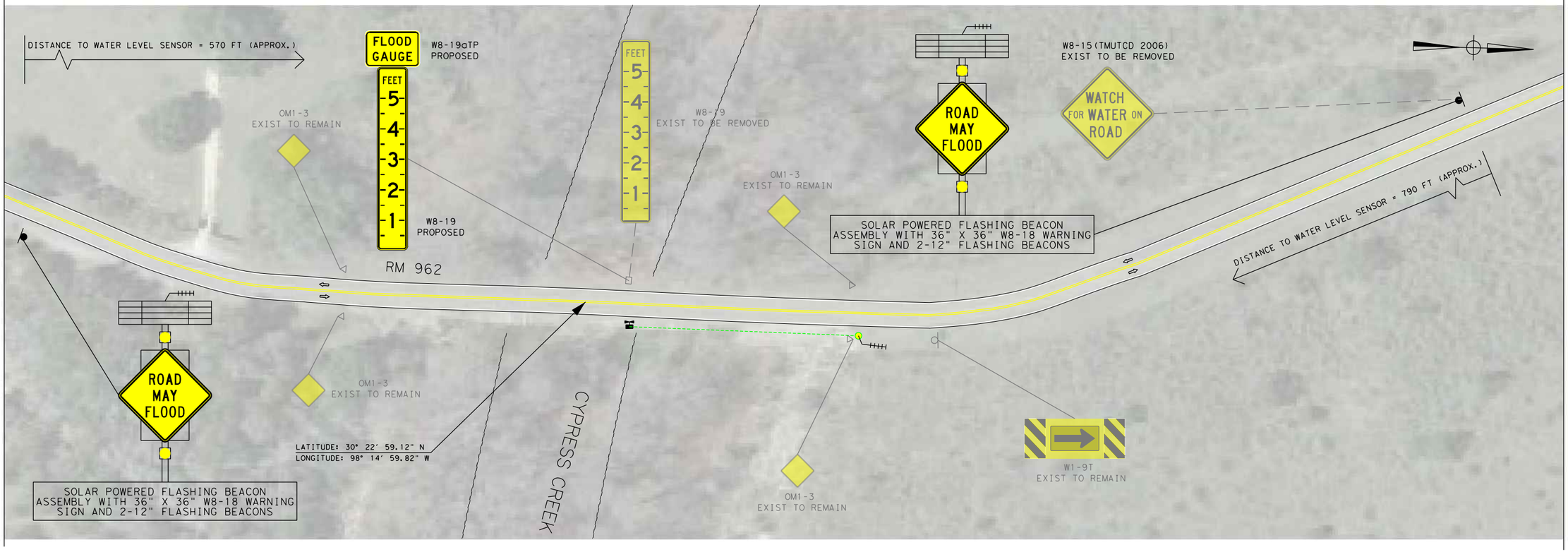
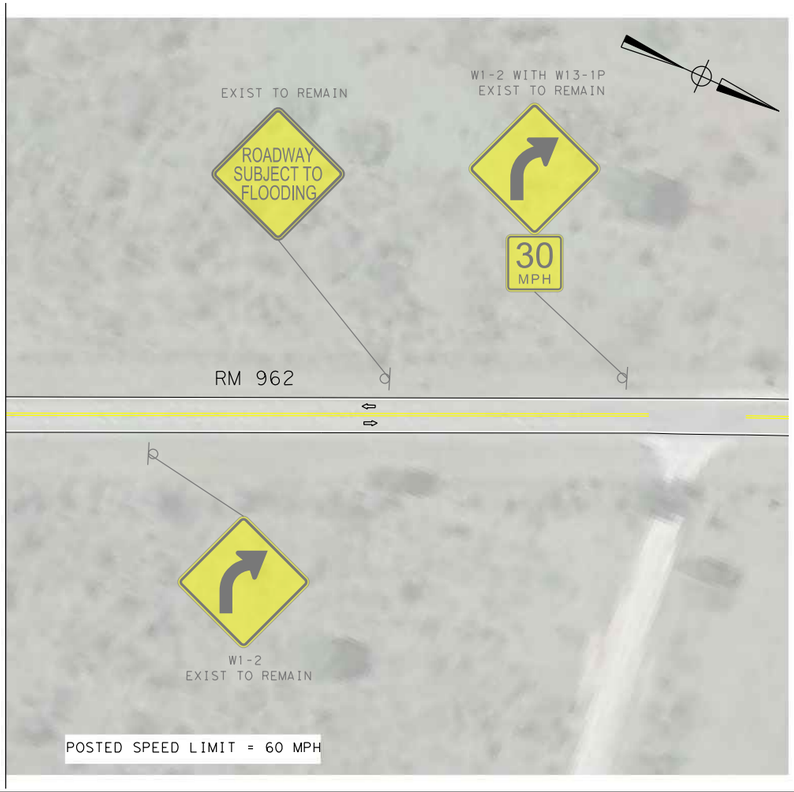
PROPOSED CONCEPTUAL LAYOUT
RM 962 AT CYPRESS CREEK

SHEET 1 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C4-1
Scale: 1"=100'	
Date: FEBRUARY 2017	





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 962 AT CYPRESS CREEK

SHEET 2 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C4-2
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

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TxDOT Austin District
Low Water Crossing Study
RM 962 at Cypress Creek - Preliminary Estimate of Construction Cost
Blanco, Texas

Table C4: Preliminary Cost Estimation for RM 962 at Cypress Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	3	$200	$600
2	RELOCATE EXISTING SIGNS	EA	1	$400	$400
3	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
4	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
5	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
6	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$36,500**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,650.00	$3,650.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$9,125.00	$9,125.00
				TOTAL (Rounded)	**$49,280**

RPS klotz associates

Location 5 – RM 3404 at Llano River

Low Water Crossing Inventory	
Location:	RM 3404 at Llano River
Coordinate:	Latitude: 30.681620 Longitude: -98.485350
County:	Llano
TxDOT Maintenance Office:	Llano
Body of Water Crossing:	Llano River
Low Water Crossing Type:	Bridge
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM1-3V
Advanced Warning Signs:	W1-2, W8-13aT, W8-15*
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 3404 is a northeast-southwest two-lane roadway with one lane in each direction. There are no shoulders present. Both RM 3404 approaches are relatively straight with slight curvature at the low water crossing location. The posted speed limit on RM 3404 is 55 mph in the north of the Llano River and 35 mph in the south of the Llano River. The RM 3404 was closed due to flooded roadway at the lower crossing bridge in the field visit on June 7, 2016.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/7/2016

Photograph 1 – RM 3404 looking southwest, Southwestbound (1)

Photograph Date: 6/7/2016

Photograph 2 – RM 3404 looking southwest, Southwestbound (2)

Photograph Date: 6/7/2016

Photograph 3 – RM 3404 looking southwest, Southwestbound (3)

Photograph Date: 11/28/2016 Snapshot from Google Earth

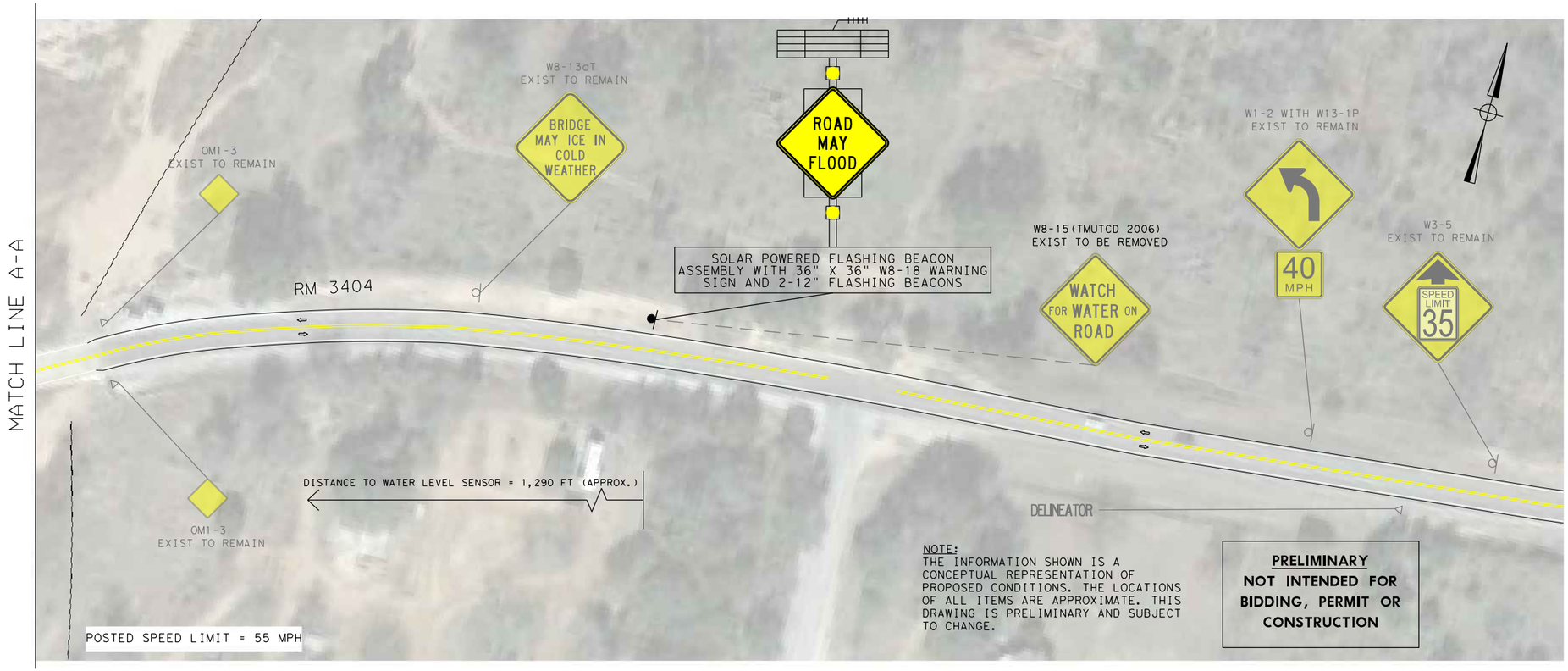
Photograph 4 – RM 3404 looking southwest, Southwestbound (4)

Photograph Date: 11/28/2016 Snapshot from Google Earth

Photograph 5 – RM 3404 looking northeast, Northeastbound (1)

Photograph Date: 11/28/2016 Snapshot from Google Earth

Photograph 6 – RM 3404 looking northeast, Northeastbound (2)



LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PRELIMINARY
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PROPOSED CONCEPTUAL LAYOUT
RM 3404 AT LLANO RIVER

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C5
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

FOR REVIEW ONLY
DO NOT USE FOR PERMITTING, BIDDING, OR CONSTRUCTION.

TxDOT Austin District
Low Water Crossing Study
RM 3404 at Llano River - Preliminary Estimate of Construction Cost
Llano, Texas

Table C5: Preliminary Cost Estimation for RM 3404 at Llano River

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 6 – RM 152 at Vasterling Creek

Low Water Crossing Inventory	
Location:	RM 152 at Vasterling Creek
Coordinate:	Latitude: 30.705860 Longitude: -98.892860
County:	Llano
TxDOT Maintenance Office:	Llano
Body of Water Crossing:	Vasterling Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-1V
Advanced Warning Signs:	W1-9T, W8-2, W8-15*
Sign Condition:	Excellent
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Excellent
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 152 is an east-west two-lane roadway with one 12-foot lane in each direction. There are no shoulders present in the study area. Both RM 152 approaches are relatively straight with slight curvature at the lower crossing location. The posted speed limit on RM 152 is 55 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 5/25/2016

Photograph 1 – RM 152 looking east, Eastbound (1)

Photograph Date: 5/25/2016

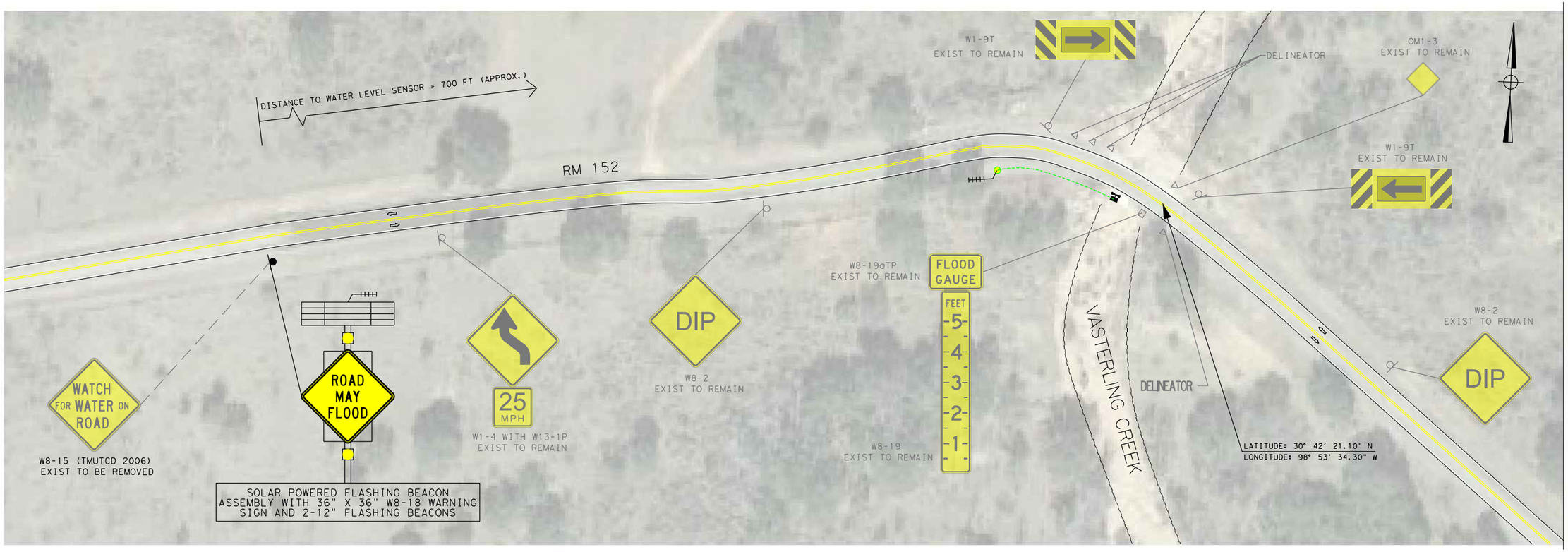
Photograph 2 – RM 152 looking east, Eastbound (2)

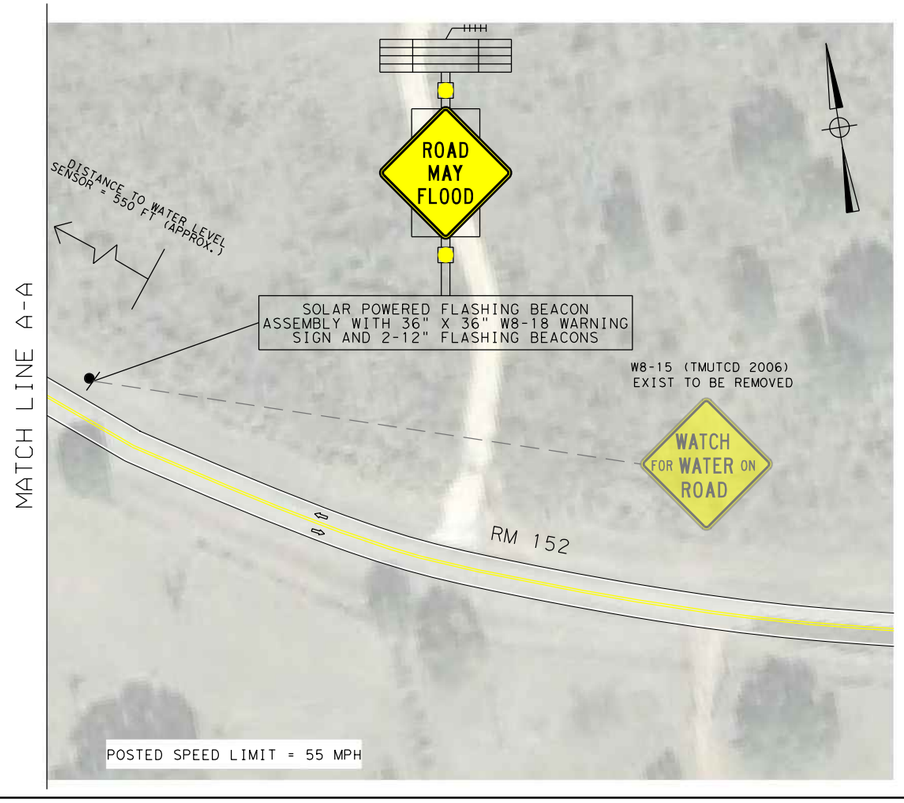
Photograph Date: 5/25/2016

Photograph 3 – RM 152 looking west, Westbound (1)

Photograph Date: 5/25/2016

Photograph 4 – RM 152 looking west, Westbound (2)





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PRELIMINARY
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PROPOSED CONCEPTUAL LAYOUT
RM 152 AT VASTERLING CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C6
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

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DO NOT USE FOR PERMITTING, BIDDING, OR CONSTRUCTION.

TxDOT Austin District
Low Water Crossing Study
RM 152 at Vasterling Creek - Preliminary Estimate of Construction Cost
Llano, Texas

Table C6: Preliminary Cost Estimation for RM 152 at Vasterling Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 7 – RM 2323 at Cottonwood Creek

Low Water Crossing Inventory	
Location:	RM 2323 at Cottonwood Creek
Coordinate:	Latitude: 30.530310 Longitude: -98.920560
County:	Llano
TxDOT Maintenance Office:	Llano
Body of Water Crossing:	Cottonwood Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-1V
Advanced Warning Signs:	W8-2, W8-15*
Sign Condition:	Excellent
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Fair
Pavement Marking Condition:	Excellent
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 2323 is a northeast-southwest two-lane roadway with one 12-foot lane in each direction. There are no shoulders present in the study area. Both RM 2323 approaches are relatively straight with slight curvature at the lower crossing location. The posted speed limit on RM 2323 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 5/25/2016

Photograph 1 – RM 2323 looking northeast, Northeastbound (1)

Photograph Date: 5/25/2016

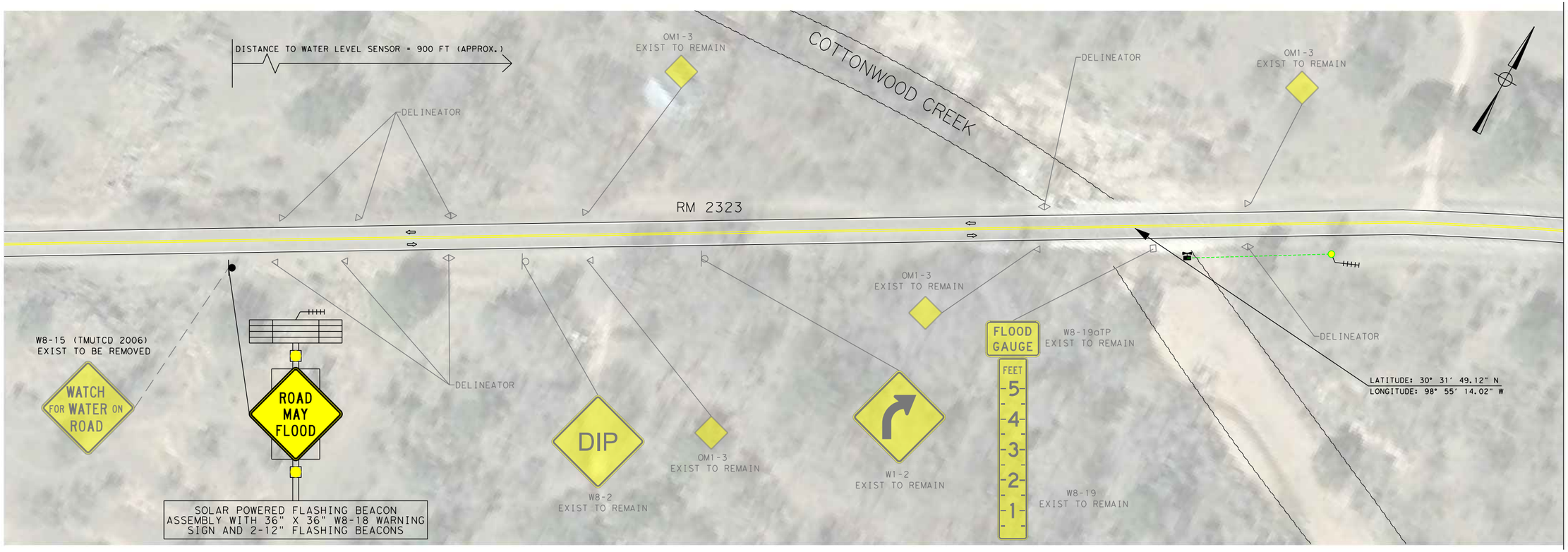
Photograph 2 – RM 2323 looking northeast, Northeastbound (2)

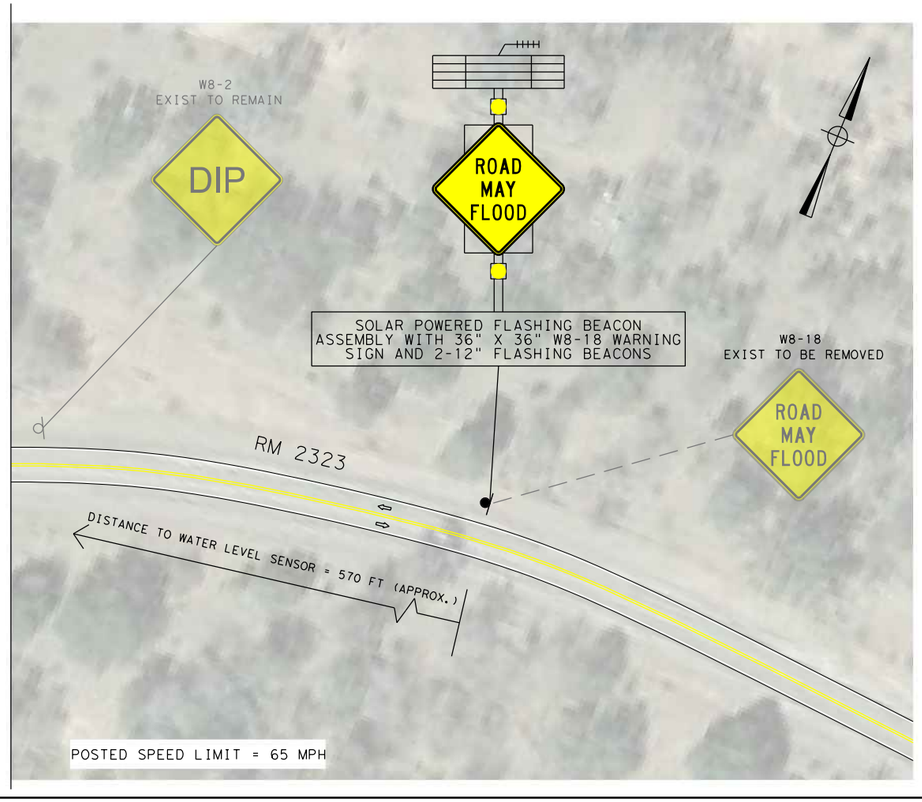
Photograph Date: 5/25/2016

Photograph 3 – RM 2323 looking southwest, Southwestbound (1)

Photograph Date: 5/25/2016

Photograph 4 – RM 2323 looking southwest, Southwestbound (2)





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PROPOSED CONCEPTUAL LAYOUT RM 2323 AT COTTONWOOD CREEK

TXDOT AUSTIN DISTRICT LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C7
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

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TxDOT Austin District
Low Water Crossing Study
RM 2323 at Cottonwood Creek- Preliminary Estimate of Construction Cost
Llano, Texas

Table C7: Preliminary Cost Estimation for RM 2323 at Cottonwood Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 8 – RM 2389 at Llano River

Low Water Crossing Inventory	
Location:	RM 2389 at Llano River
Coordinate:	Latitude: 30.650172 Longitude: -99.250713
County:	Mason
TxDOT Maintenance Office:	Mason
Body of Water Crossing:	Llano River
Low Water Crossing Type:	Bridge/Box Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V
Advanced Warning Signs:	W5-2, W8-2, W8-13aT, W8-15*
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 2389 is a northwest-southeast two-lane roadway with one lane in each direction. There are no shoulders present in the study area. The total length of the lower water crossing is around 1,350 feet. RM 2389 ends approximately 750 feet south of Llano River and it turns into Schep Creek Road. The posted speed limit on RM 2389 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 5/26/2016

Photograph 1 – RM 2389 looking northwest, Northwestbound (1)

Photograph Date: 5/26/2016

Photograph 2 – RM 2389 looking northwest, Northwestbound (2)

Photograph Date: 5/26/2016

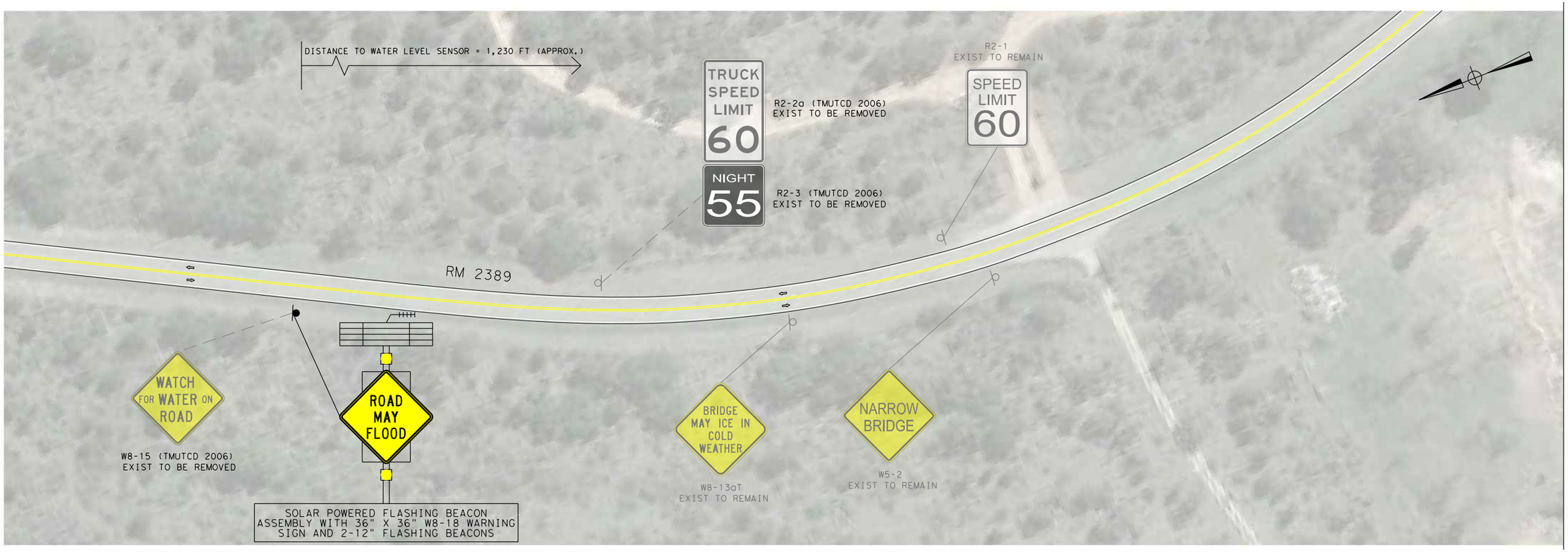
Photograph 3 – RM 2389 looking northwest, Northwestbound (3)

Photograph Date: 5/26/2016

Photograph 4 – RM 2389 looking southeast, Southeastbound (1)

Photograph Date: 5/26/2016

Photograph 5 – RM 2389 looking southeast, Southeastbound (2)



MATCH LINE A-A

MATCH LINE B-B

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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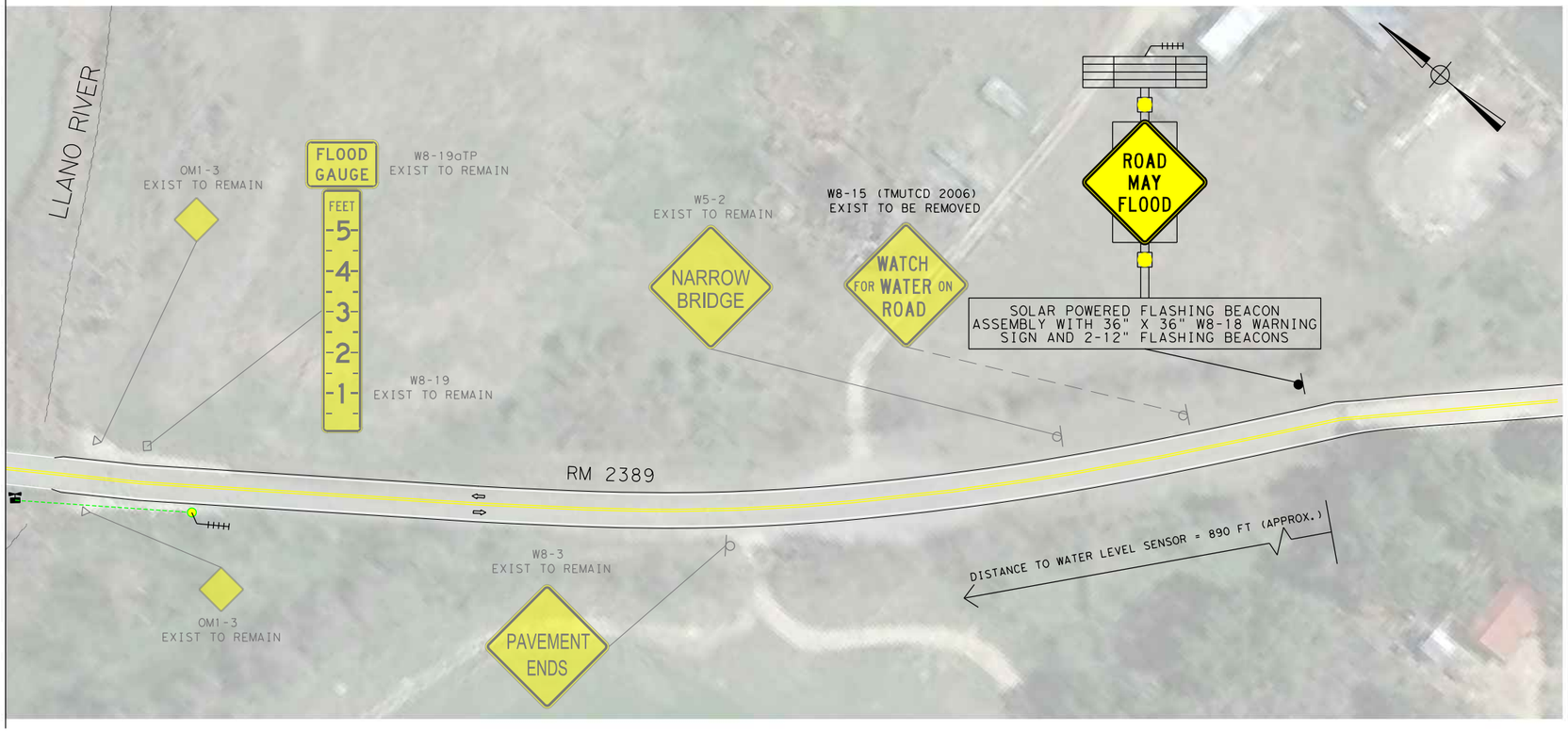
PROPOSED CONCEPTUAL LAYOUT
RM 2389 AT LLANO RIVER

SHEET 1 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C8-1
Scale: 1"=100'	
Date: FEBRUARY 2017	



LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

POSTED SPEED LIMIT = 60 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 2389 AT LLANO RIVER

SHEET 2 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C8-2
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

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TxDOT Austin District
Low Water Crossing Study
RM 2389 at Llano River - Preliminary Estimate of Construction Cost
Mason, Texas

Table C8: Preliminary Cost Estimation for RM 2389 at Llano River

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	3	$200	$600
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	2	$12,000	$24,000
4	PRESSURE TRANSDUCER SENSOR	EA	2	$2,000	$4,000
5	ANTENNA	EA	4	$500	$2,000
				Sub-Total	**$50,600**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$5,060.00	$5,060.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$12,650.00	$12,650.00
				TOTAL (Rounded)	**$68,310**

RPS klotz associates

Location 9 – RM 2768 at Llano River

Low Water Crossing Inventory	
Location:	RM 2768 at Llano River
Coordinate:	Latitude: 30.704000 Longitude: -98.958833
County:	Llano
TxDOT Maintenance Office:	Mason
Body of Water Crossing:	Llano River
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V
Advanced Warning Signs:	W8-15*, W8-18
Sign Condition:	Excellent
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Fair
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 2768 is a north-south two-lane roadway with one lane in each direction. There are no shoulders present in the study area. North of Llano River, RM 2768 intersects with County Road 104; south of Llano River, RM 2768 intersects with RM 152. The posted speed limit on RM 2768 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 5/25/2016

Photograph 1 – RM 2768 looking north, Northbound (1)

Photograph Date: 5/25/2016

Photograph 2 – RM 2768 looking north, Northbound (2)

Photograph Date: 5/25/2016

Photograph 3 – RM 2768 looking south, Southbound (1)

Photograph Date: 5/25/2016

Photograph 4 – RM 2768 looking south, Southbound (2)

MATCH LINE A-A

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL
- TYPE 3 BARRICADE

POSTED SPEED LIMIT = 60 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 2768 AT LLANO RIVER

SHEET 1 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C9-1
Scale: 1"=100'	
Date: FEBRUARY 2017	

MATCH LINE A-A

POSTED SPEED LIMIT = 60 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 2768 AT LLANO RIVER

SHEET 2 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C9-2
Scale: 1"=100'	
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
RM 2768 at Llano River - Preliminary Estimate of Construction Cost
Llano, Texas

Table C9: Preliminary Cost Estimation for RM 2768 at Llano River

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	4	$200	$800
2	PROPOSED SIGNS	EA	1	$600	$600
3	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	3	$10,000	$30,000
4	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
5	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
6	ANTENNA	EA	4	$500	$2,000
				Sub-Total	**$47,400**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$4,740.00	$4,740.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$11,850.00	$11,850.00
				TOTAL (Rounded)	**$63,990**

RPS klotz associates

Location 10 – FM 141 at Middle Yegua Creek

Low Water Crossing Inventory	
Location:	FM 141 at Middle Yegua Creek
Coordinate:	Latitude: 30.321623 Longitude: -96.786472
County:	Lee
TxDOT Maintenance Office:	Lincoln
Body of Water Crossing:	Middle Yegua Creek
Low Water Crossing Type:	Bridge/Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	None
Object Markers:	OM2-2V, OM3-L, OM3-R
Advanced Warning Signs:	W5-2, W8-13aT, W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Fair
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, FM 141 is a northwest-southeast two-lane roadway with one lane in each direction. There are no shoulders present in the study area. Both FM 141 approaches are relatively straight with slight curvature at the lower crossing location. The posted speed limit on FM 141 is 60 mph. There are metal beam guardrails along both sides at the low water crossing location.

Photograph Date: 6/10/2016

Photograph 1 – FM 141 looking northwest, Northwestbound (1)

Photograph Date: 6/10/2016

Photograph 2 – FM 141 looking northwest, Northwestbound (2)

Photograph Date: 6/10/2016

Photograph 3 – FM 141 looking southeast, Southeastbound (1)

Photograph Date: 6/10/2016

Photograph 4 – FM 141 looking southeast, Southeastbound (2)

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 141 AT MIDDLE YEGUA CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C10-1
Date: FEBRUARY 2017	

MATCH LINE B-B

MATCH LINE C-C

OM3-R
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

FLOOD
GAUGE

FEET
5
4
3
2
1

W8-19aTP
EXIST TO REMAIN

W8-19
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

RM 141

OM3-L
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

OM3-R
EXIST TO REMAIN

MATCH LINE C-C

MATCH LINE D-D

DELINEATOR

OM3-L
EXIST TO REMAIN

GUARDRAIL
EXIST TO REMAIN

OM3-R
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

OM3-R
EXIST TO REMAIN

DELINEATOR

NARROW
BRIDGE

W5-2
EXIST TO REMAIN

RM 141

LATITUDE: 30° 19' 17.84" N
LONGITUDE: 96° 47' 11.30" W

DELINEATOR

OM1-3
EXIST TO REMAIN

OM3-L
EXIST TO REMAIN

OM3-R
EXIST TO REMAIN

MIDDLE YEGUA CREEK

DELINEATOR

POSTED SPEED LIMIT = 60 MPH

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER
- FLOOD GAUGE ASSEMBLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR (ULTRASONIC)
- PROPOSED CONDUIT
- PROPOSED ANTENNA

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 141 AT MIDDLE YEGUA CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C10-2
Scale: 1"=100'	
Date: FEBRUARY 2017	

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

POSTED SPEED LIMIT = 60 MPH

NOTE:
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PRELIMINARY
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PROPOSED CONCEPTUAL LAYOUT
RM 141 AT MIDDLE YEGUA CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C10-3
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
FM 141 at Middle Yegua Creek - Preliminary Estimate of Construction Cost
Lee, Texas

Table C10: Preliminary Cost Estimation for FM 141 at Middle Yegua Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	ULTRASONIC SENSOR	EA	1	$4,000	$4,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$37,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,790.00	$3,790.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$9,475.00	$9,475.00
				TOTAL (Rounded)	**$51,170**

RPS klotz associates

Location 11 – FM 1624 at Middle Yegua Creek

Low Water Crossing Inventory	
Location:	FM 1624 at Middle Yegua Creek
Coordinate:	Latitude: 30.388121 Longitude: -97.064129
County:	Lee
TxDOT Maintenance Office:	Lincoln
Body of Water Crossing:	Middle Yegua Creek
Low Water Crossing Type:	Concrete Box Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-1V
Advanced Warning Signs:	W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, FM 1624 is a northeast-southwest two-lane roadway with one lane in each direction. There are no shoulders present in the study area. Both FM 1624 approaches are relatively straight with slight curvature at the lower crossing location. No speed limit signs were found on FM 1624 during the field visit. It is assumed the speed limit is 60 mph at the study area.

Photograph Date: 6/10/2016

Photograph 1 – FM 1624 looking northeast, Northeastbound (1)

Photograph Date: 6/10/2016

Photograph 2 – FM 1624 looking northeast, Northeastbound (2)

Photograph Date: 6/10/2016

Photograph 3 – FM 1624 looking southwest, Southwestbound (1)

Photograph Date: 6/10/2016

Photograph 4 – FM 1624 looking southwest, Southwestbound (2)

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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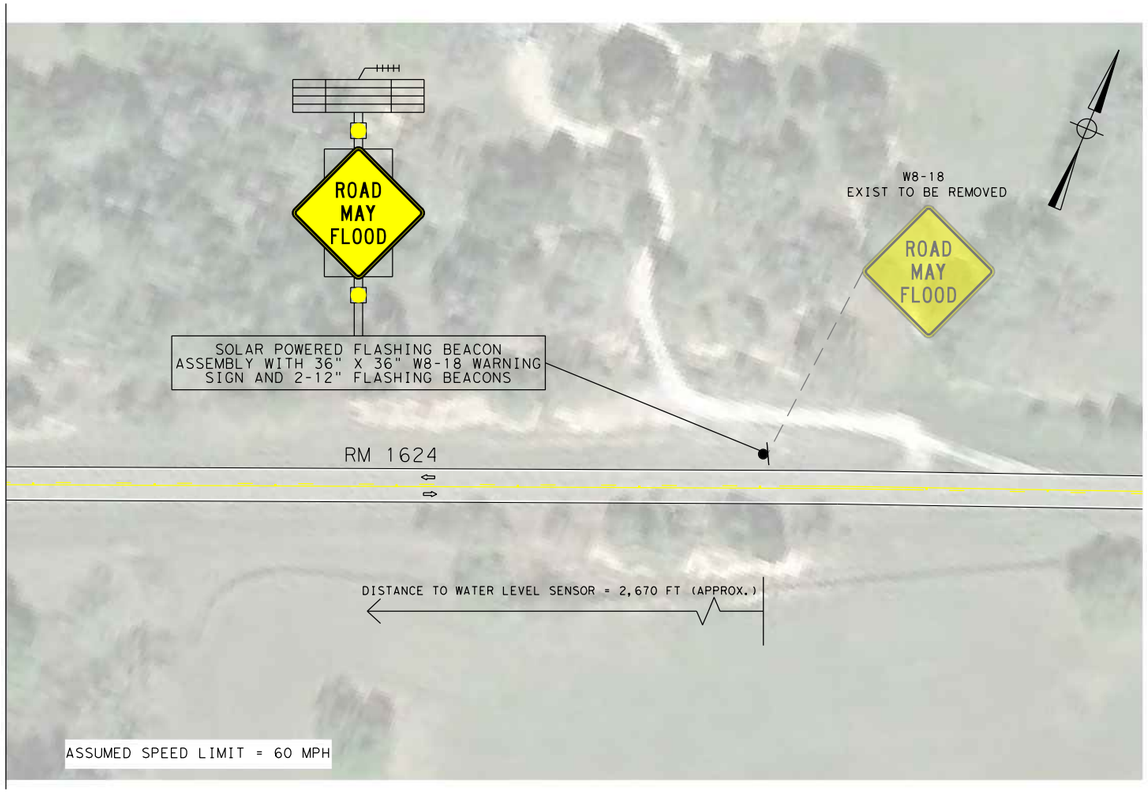
PROPOSED CONCEPTUAL LAYOUT RM 1624 AT MIDDLE YEGUA CREEK

SHEET 1 of 2

TXDOT AUSTIN DISTRICT LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C11-1
Scale: 1"=100'	
Date: FEBRUARY 2017	



LEGEND

- DIRECTION OF TRAFFIC
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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PROPOSED CONCEPTUAL LAYOUT RM 1624 AT MIDDLE YEGUA CREEK

SHEET 2 of 2

TXDOT AUSTIN DISTRICT LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C11-2
Scale: 1"=100'	
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
FM 1624 at Middle Yegua Creek - Preliminary Estimate of Construction Cost
Lee, Texas

Table C11: Preliminary Cost Estimation for FM 1624 at Middle Yegua Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 12 – FM 1979 at San Marcos River

Low Water Crossing Inventory	
Location:	FM 1979 at San Marcos River
Coordinate:	Latitude: 29.832114 Longitude: -97.842355
County:	Caldwell
TxDOT Maintenance Office:	Lockhart
Body of Water Crossing:	San Marcos River
Low Water Crossing Type:	Bridge
Flood (Depth) Gauge Sign:	None
Object Markers:	OM2-2V, OM3-R
Advanced Warning Signs:	W8-13aT, W8-18bT
Sign Condition:	Good
Pavement Type:	Asphalt , Concrete Bridge
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, FM 1979 is a north-south two-lane roadway with one lane in each direction and 3 foot shoulders. Both FM 1979 approaches are relatively straight with slight curvature at the lower crossing location. The posted speed limit on FM 1979 is 45 mph.

Photograph Date: 6/9/2016

Photograph 1 – FM 1979 looking north, Northbound (1)

Photograph Date: 6/9/2016

Photograph 2 – FM 1979 looking north, Northbound (2)

Photograph Date: 6/9/2016

Photograph 3 – FM 1979 looking south, Southbound (1)

Photograph Date: 6/9/2016

Photograph 4 – FM 1979 looking south, Southbound (2)

MATCH LINE A-A

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR (ULTRASONIC)
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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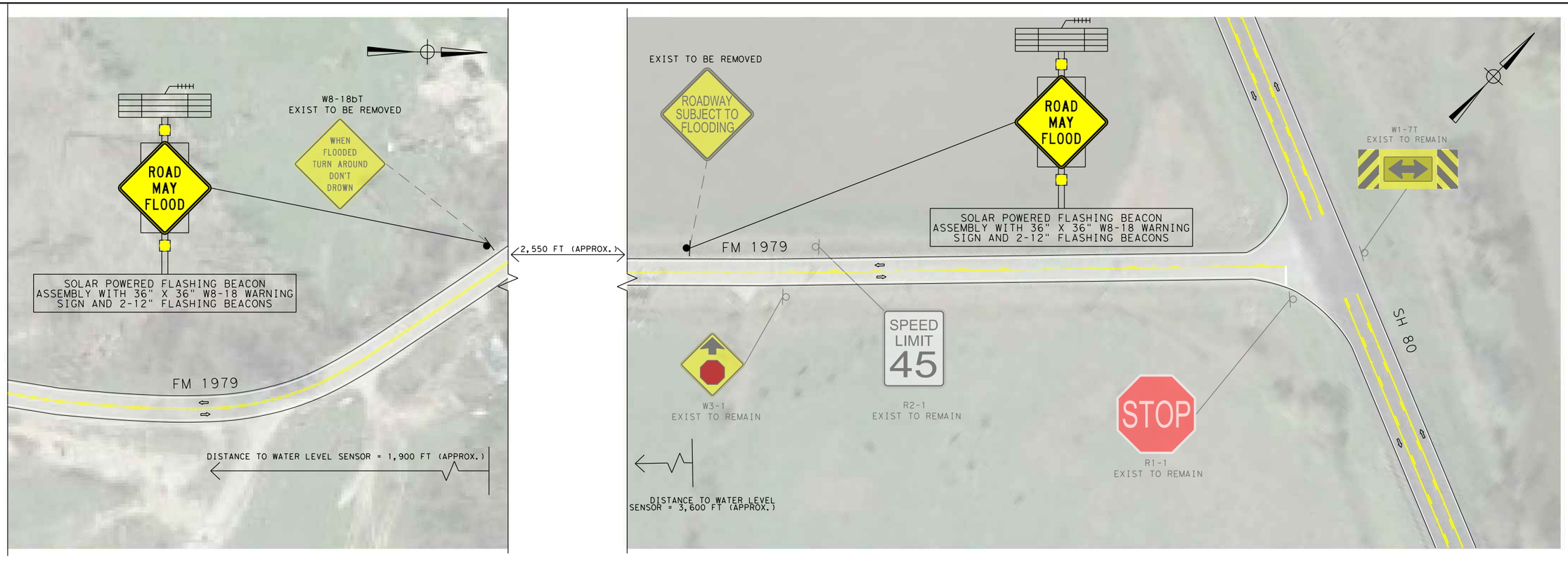
PROPOSED CONCEPTUAL LAYOUT FM 1979 AT SAN MARCOS RIVER

SHEET 1 of 2

TXDOT AUSTIN DISTRICT LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C12-1
Scale: 1"=100'	
Date: FEBRUARY 2017	



LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

POSTED SPEED LIMIT = 45 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT FM 1979 AT SAN MARCOS RIVER

SHEET 2 of 2

TXDOT AUSTIN DISTRICT LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C12-2
Scale: 1"=100'	
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
FM 1979 at San Marcos River - Preliminary Estimate of Construction Cost
Caldwell, Texas

Table C12: Preliminary Cost Estimation for FM 1979 at San Marcos River

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	3	$200	$600
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	3	$10,000	$30,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	ULTRASONIC SENSOR	EA	1	$4,000	$4,000
5	ANTENNA	EA	4	$500	$2,000
				Sub-Total	**$48,600**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$4,860.00	$4,860.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$12,150.00	$12,150.00
				TOTAL (Rounded)	**$65,610**

RPS klotz associates

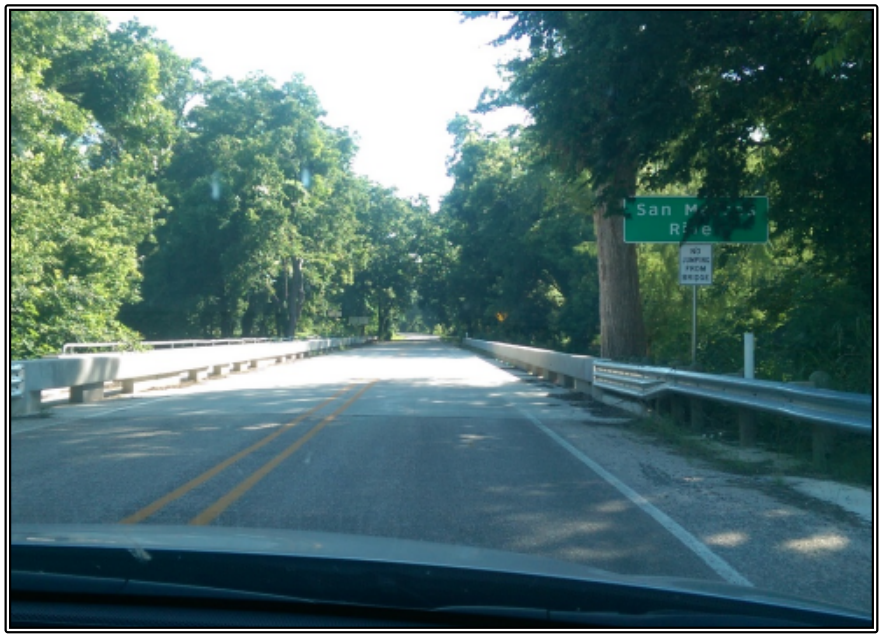
Location 13 – FM 1977 at San Marcos River

Low Water Crossing Inventory	
Location:	FM 1977 at San Marcos River
Coordinate:	Latitude: 29.783007 Longitude: -97.831417
County:	Caldwell
TxDOT Maintenance Office:	Lockhart
Body of Water Crossing:	San Marcos River
Low Water Crossing Type:	Bridge
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM3-R
Advanced Warning Signs:	W8-13aT, W8-15*
Sign Condition:	Good
Pavement Type:	Asphalt, Concrete Bridge
Rumble Strips:	None
Pavement Condition:	Fair
Pavement Marking Condition:	Fair
Raised Pavement Markers:	Yes
Description:	Within the study area, FM 1977 is a northeast-southwest two-lane roadway with one 12-foot lane in each direction and 3 foot shoulders. Both FM 1977 approaches are relatively straight with slight curvature at the lower crossing location. The posted speed limit on FM 1977 is 55 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/9/2016

Photograph 1 – FM 1977 looking northeast, Northeastbound (1)

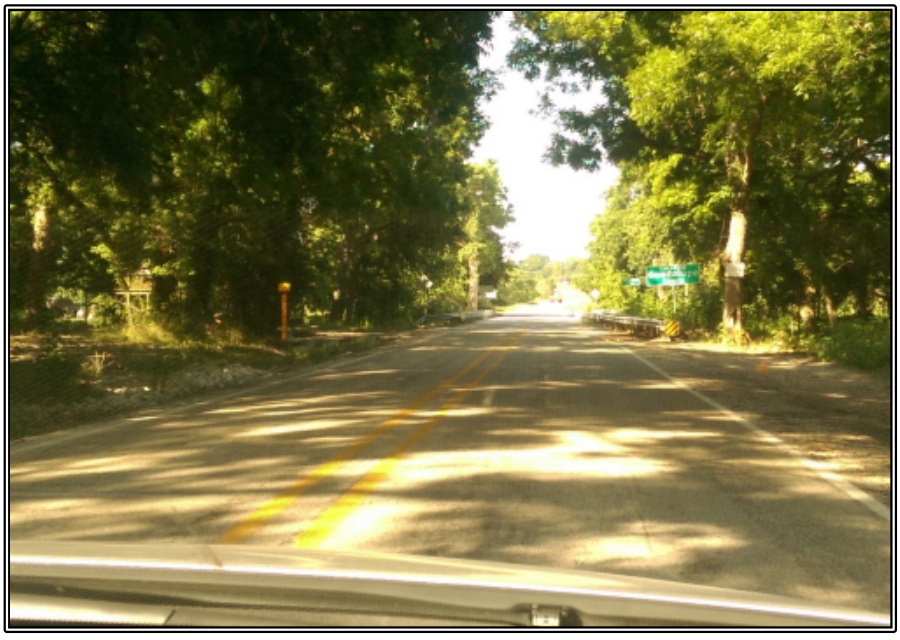


Photograph Date: 6/9/2016

Photograph 2 – FM 1977 looking northeast, Northeastbound (2)

Photograph Date: 6/9/2016

Photograph 3 – FM 1977 looking southwest, Southwestbound (1)



Photograph Date: 6/9/2016

Photograph 4 – FM 1977 looking southwest, Southwestbound (2)

NOTE:
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PRELIMINARY
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LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR (ULTRASONIC)
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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PROPOSED CONCEPTUAL LAYOUT
FM 1977 AT SAN MARCOS RIVER

SHEET 1 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C13-1
Scale: 1"=100'	
Date: FEBRUARY 2017	

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- PROPOSED FLASHING BEACON ASSEMNLY
- OBJECT MARKER
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

POSTED SPEED LIMIT = 55 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
FM 1977 AT SAN MARCOS RIVER

SHEET 2 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C13-2
Scale: 1"=100'	
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
FM 1977 at San Marcos River - Preliminary Estimate of Construction Cost
Caldwell, Texas

Table C13: Preliminary Cost Estimation for FM 1977 at San Marcos River

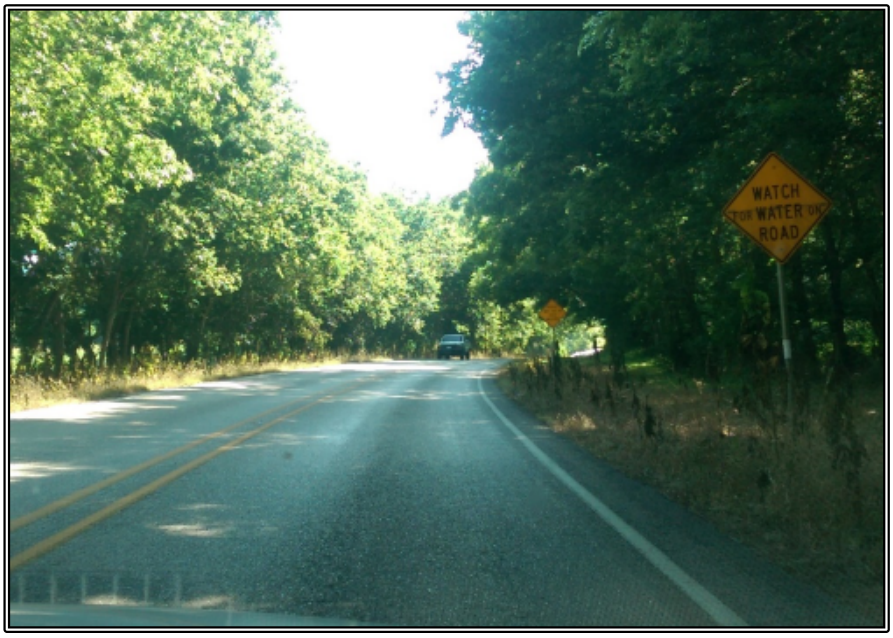
ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	ULTRASONIC SENSOR	EA	1	$4,000	$4,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$37,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,790.00	$3,790.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$9,475.00	$9,475.00
				TOTAL (Rounded)	**$51,170**

RPS klotz associates

Location 14 – FM 20 at San Marcos River

Low Water Crossing Inventory	
Location:	FM 20 at San Marcos River
Coordinate:	Latitude: 29.75284 Longitude: -97.781067
County:	Caldwell
TxDOT Maintenance Office:	Lockhart
Body of Water Crossing:	San Marcos River
Low Water Crossing Type:	Bridge
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V, OM3-R
Advanced Warning Signs:	W8-13aT, W8-15*
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	N/A
Pavement Condition:	Fair
Pavement Marking Condition:	Fair
Raised Pavement Markers:	Yes
Description:	Within the study area, FM 20 is a northeast-southwest two-lane roadway with one lane in each direction. There are no shoulders present north of San Marcos River. There are 3-foot shoulders present south of San Marcos River. Both FM 20 approaches are relatively straight with slight curvature at the low water crossing location. The posted speed limit on FM 20 is 50 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*



Photograph Date: 6/9/2016

Photograph 1 – FM 20 looking northeast, Northeastbound (1)

Photograph Date: 6/9/2016

Photograph 2 – FM 20 looking northeast, Northeastbound (2)

Photograph Date: 6/9/2016

Photograph 3 – FM 20 looking southwest, Southwestbound (1)

Photograph Date: 6/9/2016

Photograph 4 – FM 20 looking southwest, Southwestbound (2)

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMBLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR (ULTRASONIC)
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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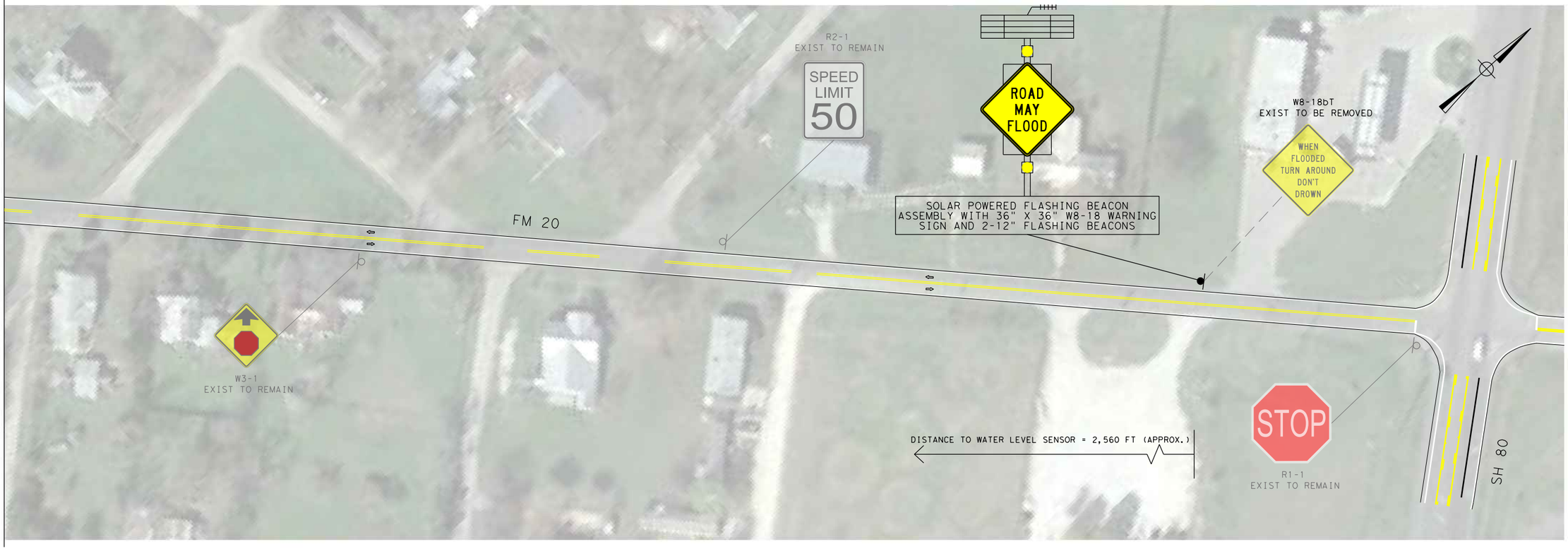
PROPOSED CONCEPTUAL LAYOUT
FM 20 AT SAN MARCOS RIVER

SHEET 1 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C14-1
Scale: 1"=100'	
Date: FEBRUARY 2017	



LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

POSTED SPEED LIMIT = 50 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
FM 20 AT SAN MARCOS RIVER

SHEET 2 of 2

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C14-2
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
FM 20 at San Marcos River - Preliminary Estimate of Construction Cost
Caldwell, Texas

Table C14: Preliminary Cost Estimation for FM 20 at San Marcos River

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	3	$200	$600
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	3	$10,000	$30,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	ULTRASONIC SENSOR	EA	1	$4,000	$4,000
5	ANTENNA	EA	4	$500	$2,000
				Sub-Total	**$48,600**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$4,860.00	$4,860.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$12,150.00	$12,150.00
				TOTAL (Rounded)	**$65,610**

RPS klotz associates

Location 15 – RM 1174 at Oatmeal Creek

Low Water Crossing Inventory	
Location:	RM 1174 at Oatmeal Creek
Coordinate:	Latitude: 30.703320 Longitude: -98.064290
County:	Burnet
TxDOT Maintenance Office:	Burnet
Body of Water Crossing:	Oatmeal Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-1V
Advanced Warning Signs:	W8-2, W8-18
Sign Condition:	Fair
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Fair
Pavement Marking Condition:	Fair
Raised Pavement Markers:	None
Description:	Within the study area, RM 1174 is a north-south two-lane roadway with one lane in each direction. Near the low water crossing location, both RM 1174 approaches are relatively straight. The posted speed limit on RM 1174 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/7/2016

Photograph 1 – RM 1174 looking north, Northbound (1)

Photograph Date: 6/7/2016

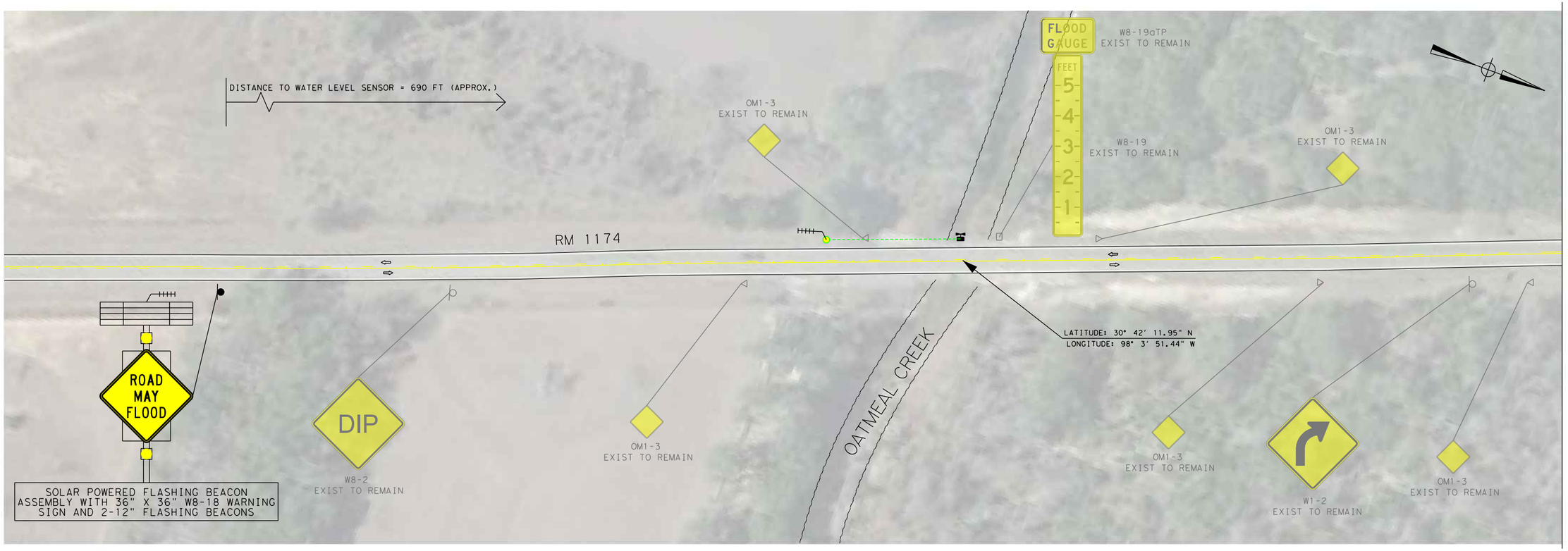
Photograph 2 – RM 1174 looking north, Northbound (2)

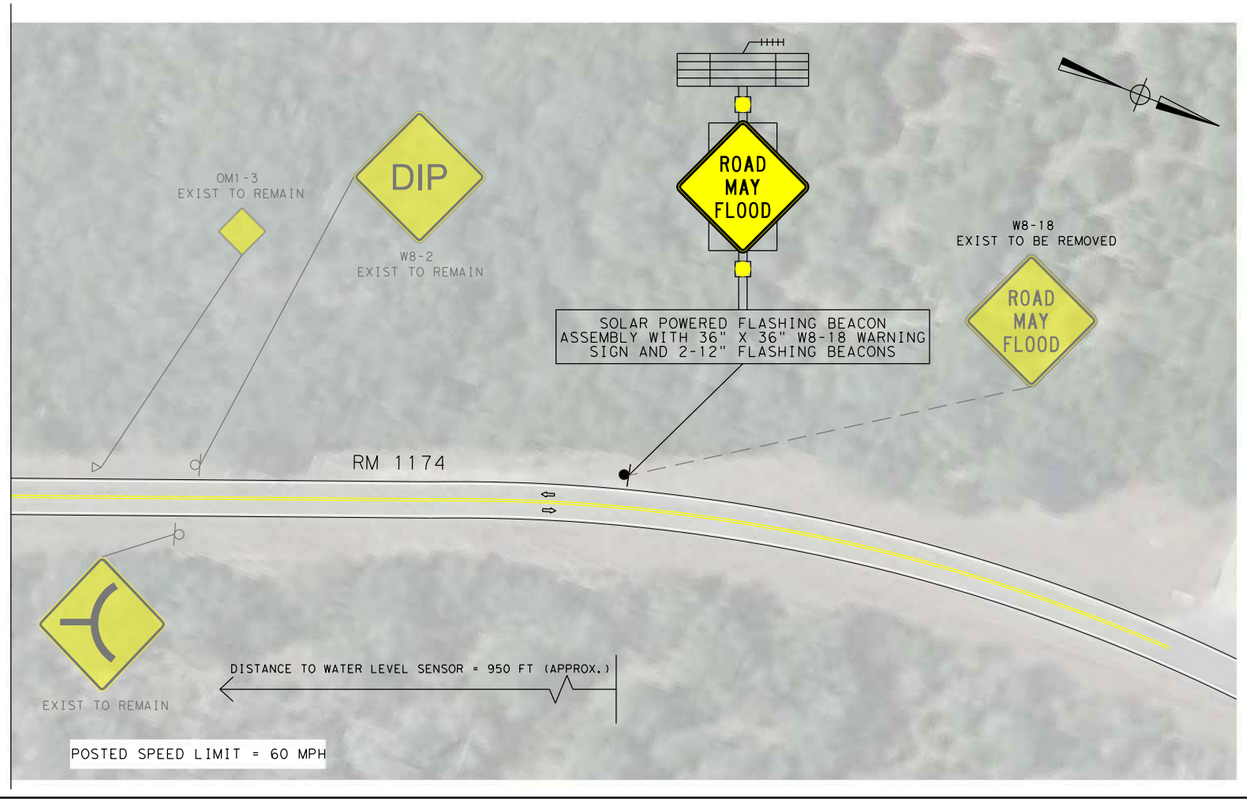
Photograph Date: 6/7/2016

Photograph 3 – RM 1174 looking south, Southbound (1)

Photograph Date: 6/7/2016

Photograph 4 – RM 1174 looking south, Southbound (2)





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 1174 AT OATMEAL CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C15
Date: FEBRUARY 2017	

RPS klotz associates

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TxDOT Austin District
Low Water Crossing Study
RM 1174 at Oatmeal Creek - Preliminary Estimate of Construction Cost
Burnet, Texas

Table C15: Preliminary Cost Estimation for RM 1174 at Oatmeal Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 16 – RM 1174 at Unnamed Creek

Low Water Crossing Inventory	
Location:	RM 1174 at Unnamed Creek
Coordinate:	Latitude: 30.679850 Longitude: -98.062550
County:	Burnet
TxDOT Maintenance Office:	Burnet
Body of Water Crossing:	Unnamed Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-1V
Advanced Warning Signs:	W8-2, W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 1174 is a north-south two-lane roadway with one lane in each direction. Near the low water crossing location, both RM 1174 approaches are relatively straight. RM 1174 intersects RM 243 from the north approximately 1.2 miles south from the lower water crossing location. The posted speed limit on RM 1174 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/7/2016

Photograph 1 – RM 1174 looking north, Northbound (1)

Photograph Date: 6/7/2016

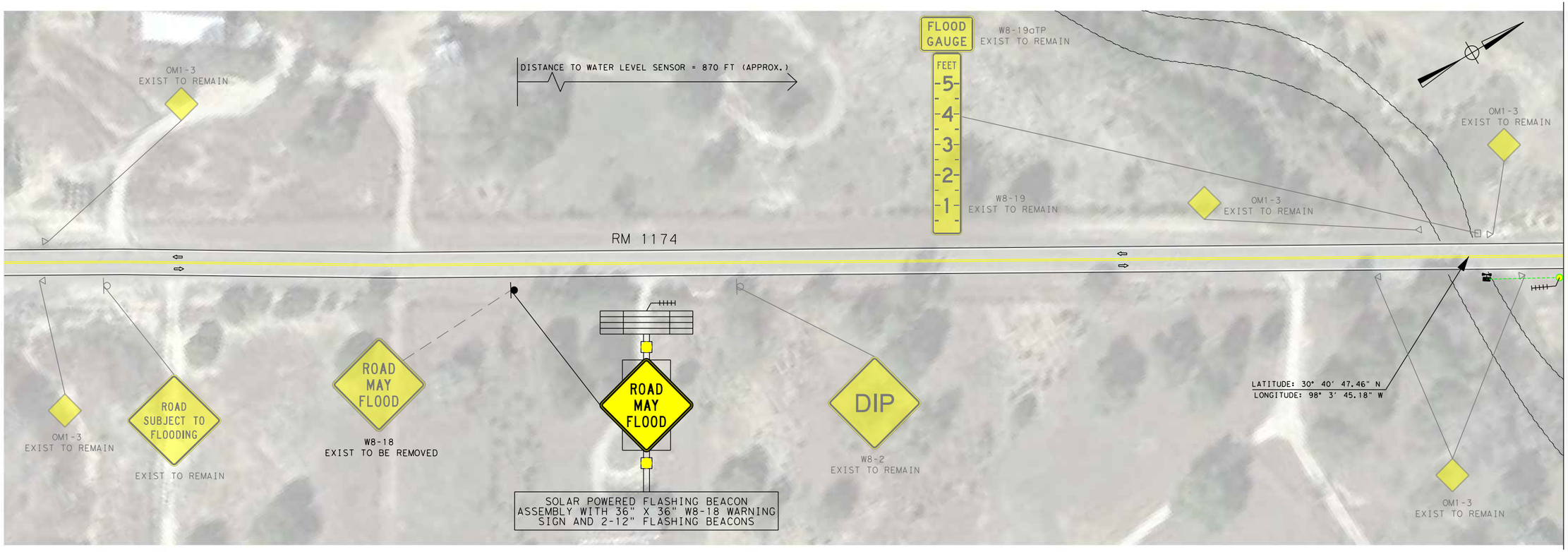
Photograph 2 – RM 1174 looking north, Northbound (2)

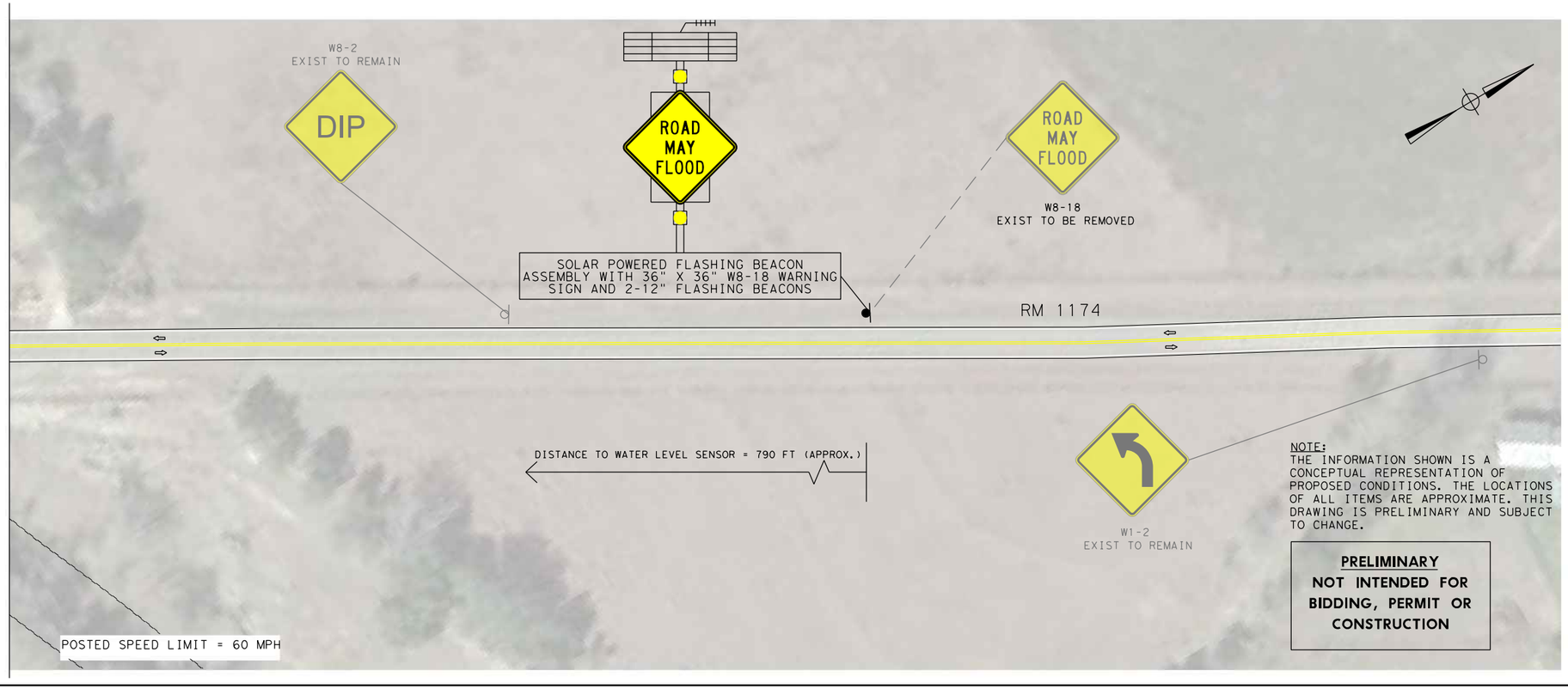
Photograph Date: 6/7/2016

Photograph 3 – RM 1174 looking south, Southbound (1)

Photograph Date: 6/7/2016

Photograph 4 – RM 1174 looking south, Southbound (2)





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
THE INFORMATION SHOWN IS A CONCEPTUAL REPRESENTATION OF PROPOSED CONDITIONS. THE LOCATIONS OF ALL ITEMS ARE APPROXIMATE. THIS DRAWING IS PRELIMINARY AND SUBJECT TO CHANGE.

PRELIMINARY
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PROPOSED CONCEPTUAL LAYOUT
RM 1174 AT UNNAMED CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C16
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
RM 1174 at Unamed Creek - Preliminary Estimate of Construction Cost
Burnet, Texas

Table C16: Preliminary Cost Estimation for RM 1174 at Unamed Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 17– RM 243 at Williams Branch
– RM 243 at Sycamore Springs Creek

Low Water Crossing Inventory	
Location:	RM 243 at Williams Branch
Coordinate:	Latitude: 30.820920 Longitude: -97.934770
County:	Burnet
TxDOT Maintenance Office:	Burnet
Body of Water Crossing:	Williams Branch
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V
Advanced Warning Signs:	W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Excellent
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 243 is an east-west two-lane roadway with one lane in each direction. There are no shoulders present within the study area. Both RM 243 approaches are relatively straight with slight curvature at the low water crossing location. The posted speed limit on RM 243 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/7/2016

Photograph 1 – RM 243 looking east, Eastbound (1)

Photograph Date: 6/7/2016

Photograph 2 – RM 243 looking east, Eastbound (2)

Photograph Date: 6/7/2016

Photograph 3 – RM 243 looking west, Westbound (1)

Photograph Date: 6/7/2016

Photograph 4 – RM 243 looking west, Westbound (2)

RPS klotz associates

Location 17(2) – RM 243 at Sycamore Springs Creek

Low Water Crossing Inventory	
Location:	RM 243 at Sycamore Springs Creek
Coordinate:	Latitude: 30.832800 Longitude: -97.920380
County:	Burnet
TxDOT Maintenance Office:	Burnet
Body of Water Crossing:	Sycamore Springs Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V
Advanced Warning Signs:	W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Excellent
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 243 is an east-west two-lane roadway with one lane in each direction. There are no shoulders present within the study area. Both RM 243 approaches are relatively straight at the low water crossing location. RM 243 intersects US 183 from the west approximately 1.1 miles east from the low water crossing location. The posted speed limit on RM 243 is 60 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/7/2016

Photograph 1 – RM 243 looking east, Eastbound (1)

Photograph Date: 6/7/2016

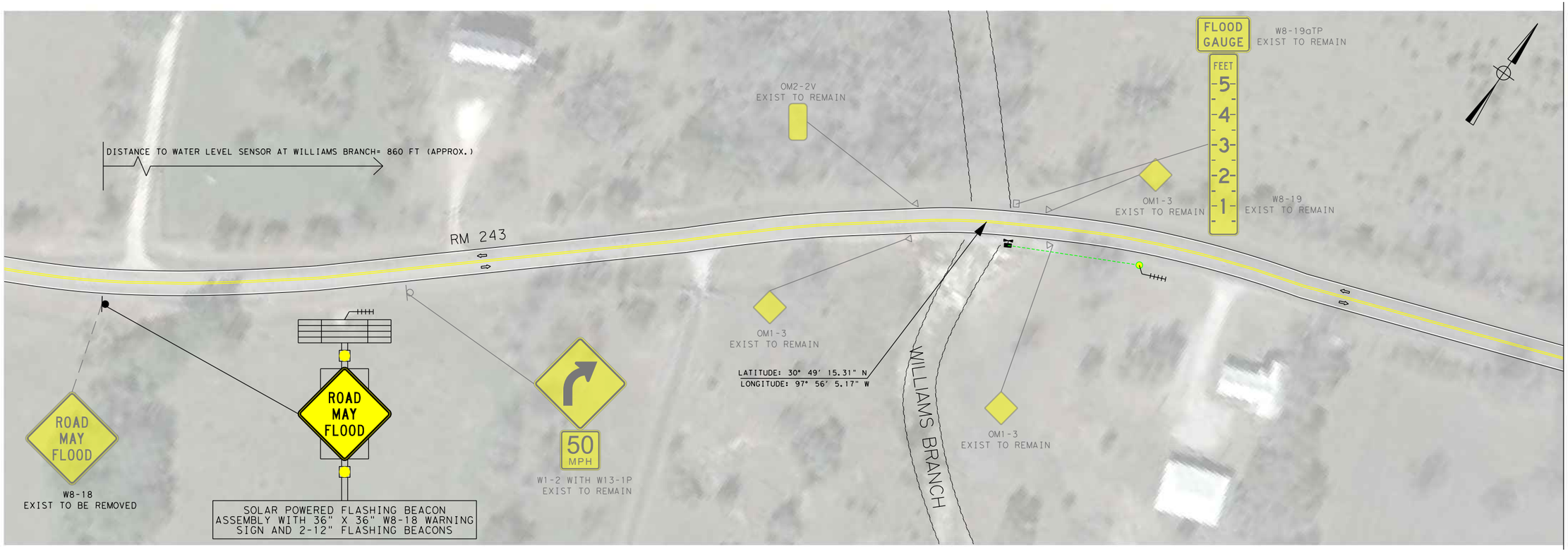
Photograph 2 – RM 243 looking east, Eastbound (2)

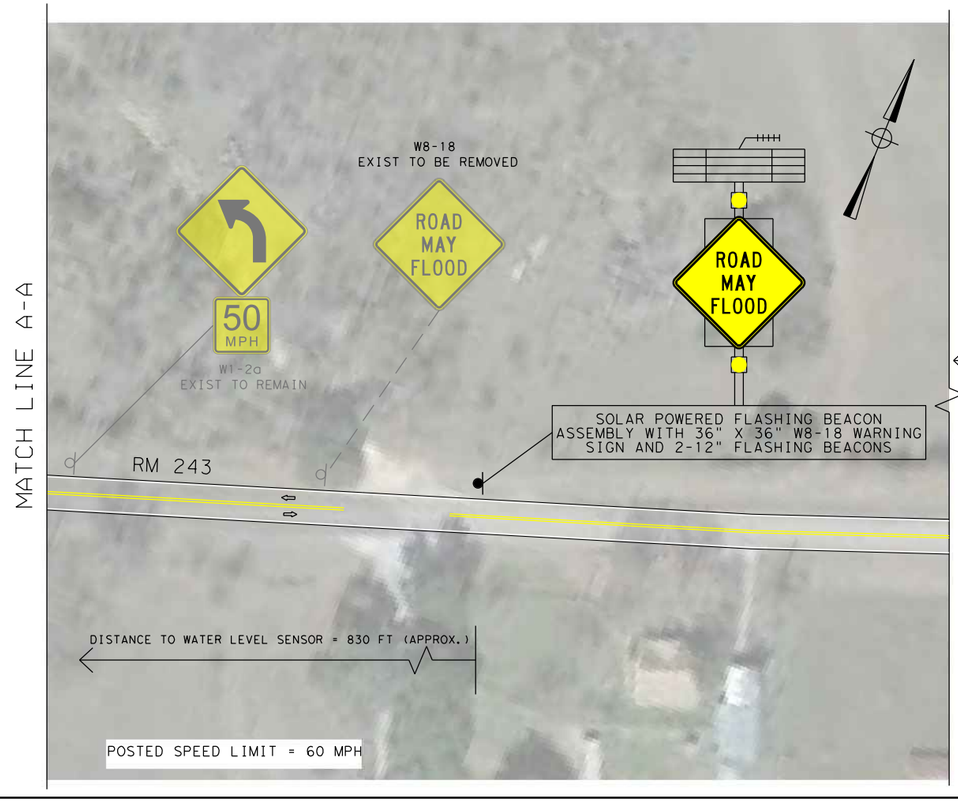
Photograph Date: 6/7/2016

Photograph 3 – RM 243 looking west, Westbound (1)

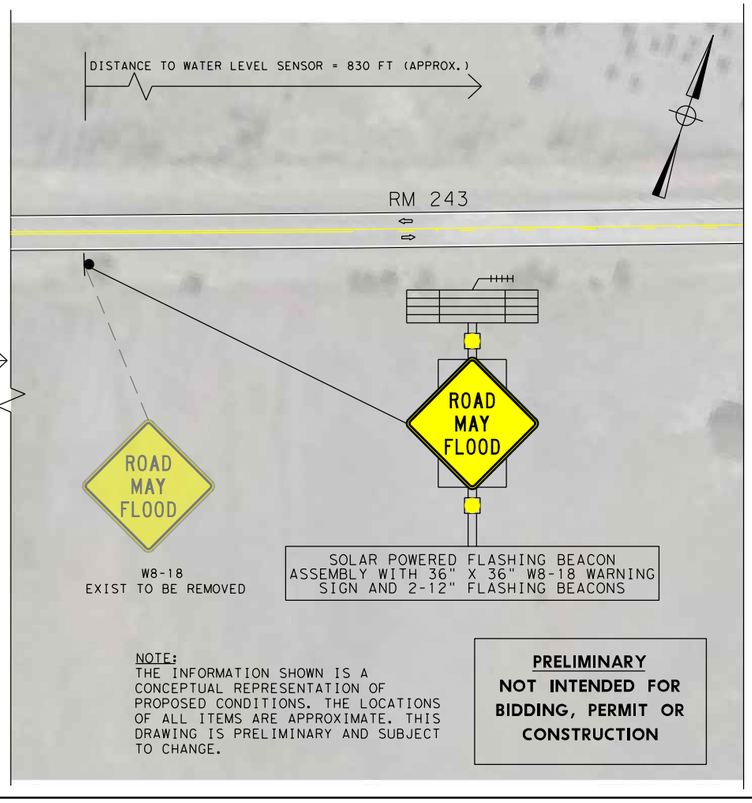
Photograph Date: 6/7/2016

Photograph 4 – RM 243 looking west, Westbound (2)





5850 FT (APPROX.)



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PRELIMINARY
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LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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PROPOSED CONCEPTUAL LAYOUT
RM 243 AT WILLIAMS BRANCH

SHEET 1 of 3

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C17-1
Scale: 1"=100'	
Date: FEBRUARY 2017	

MATCH LINE B-B

MATCH LINE C-C

SYCAMORE SPRINGS CREEK

RM 243

OM1-3
EXIST TO REMAIN

OM1-3
EXIST TO REMAIN

W8-18
EXIST TO REMAIN

ROAD MAY FLOOD

SOLAR POWERED FLASHING BEACON ASSEMBLY WITH 36" X 36" W8-18 WARNING SIGN AND 2-12" FLASHING BEACONS

W8-18
EXIST TO BE REMOVED

ROAD MAY FLOOD

LATITUDE: 30° 49' 58.08" N
LONGITUDE: 97° 55' 13.37" W

DISTANCE TO WATER LEVEL SENSOR = 810 FT (APPROX.)

MATCH LINE C-C

MATCH LINE D-D

FM 243

RM 243

POSTED SPEED LIMIT = 60 MPH

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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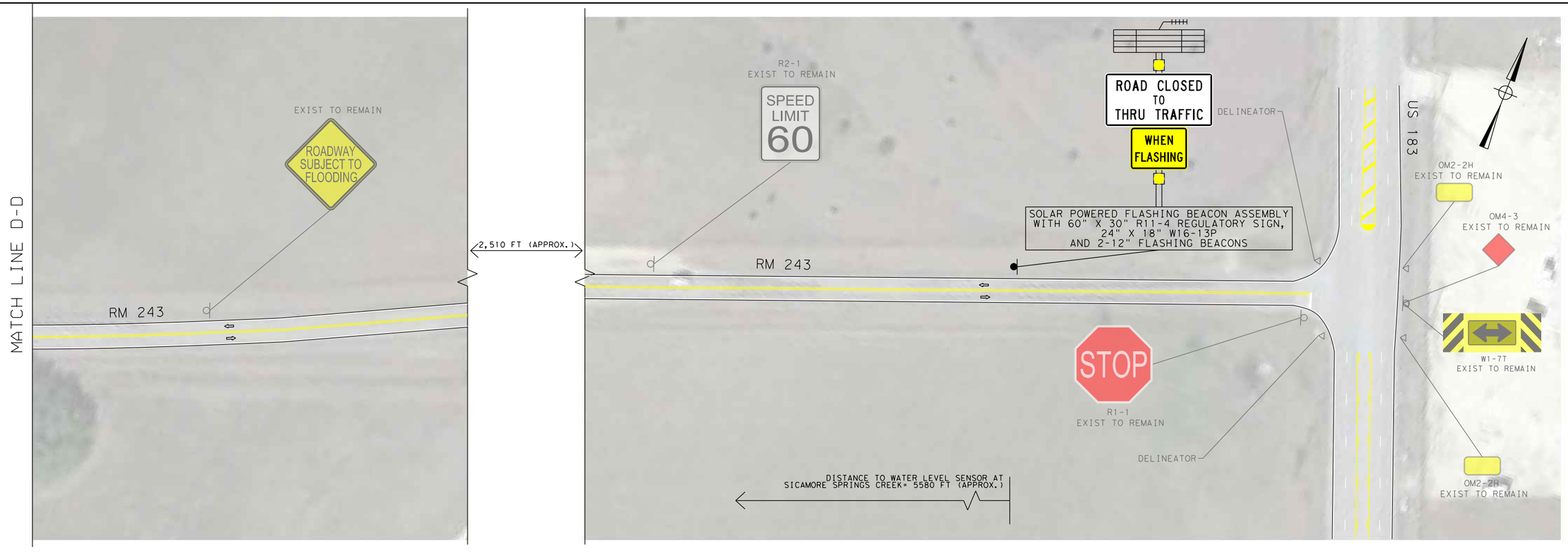
PROPOSED CONCEPTUAL LAYOUT
RM 243 AT SYCAMORE SPRINGS CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C17-2
Scale: 1"=100'	
Date: FEBRUARY 2017	



LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

POSTED SPEED LIMIT = 60 MPH

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 243 AT SYCAMORE SPRINGS CREEK

SHEET 3 OF 3

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C17-3
Scale: 1"=100'	
Date: FEBRUARY 2017	

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TxDOT Austin District
Low Water Crossing Study
Preliminary Estimate of Construction Cost
- RM 243 at Willams Branch
- RM 243 at Sycamore Springs Creek
Burnet, Texas

Table C17: Preliminary Cost Estimation for RM 243 at Willams Branch and RM 243 at Sycamore Springs Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	5	$200	$1,000
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	5	$10,000	$50,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	2	$12,000	$24,000
4	PRESSURE TRANSDUCER SENSOR	EA	2	$2,000	$4,000
5	ANTENNA	EA	7	$500	$3,500
				Sub-Total	**$82,500**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$8,250.00	$8,250.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$20,625.00	$20,625.00
				TOTAL (Rounded)	**$111,380**

RPS klotz associates

Location 18 – RM 2244 at Eanes Creek

Low Water Crossing Inventory	
Location:	RM 2244 at Eanes Creek
Coordinate:	Latitude: 30.270687 Longitude: -97.792718
County:	Travis
TxDOT Maintenance Office:	South Travis
Body of Water Crossing:	Eanes Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	None
Object Markers:	OM2-2V
Advanced Warning Signs:	W8-15*, W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 2244 is an east-west four-lane roadway with two 12-foot lanes in each direction. There are no shoulders present within the study area. Both RM 2244 approaches are relatively straight with slight curvature at the low water crossing location. The posted speed limit on RM 2244 is 40 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/10/2016

Photograph 1 – RM 2244 looking east, Eastbound (1)

Photograph Date: 6/10/2016

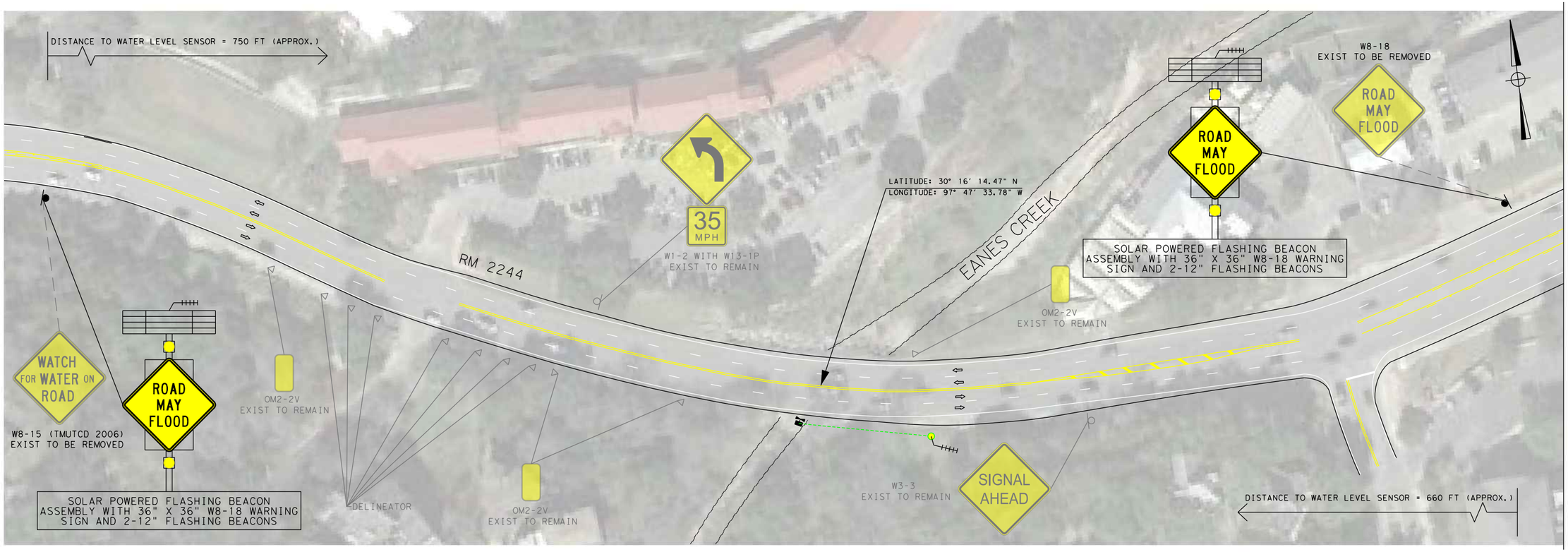
Photograph 2 – RM 2244 looking east, Eastbound (2)

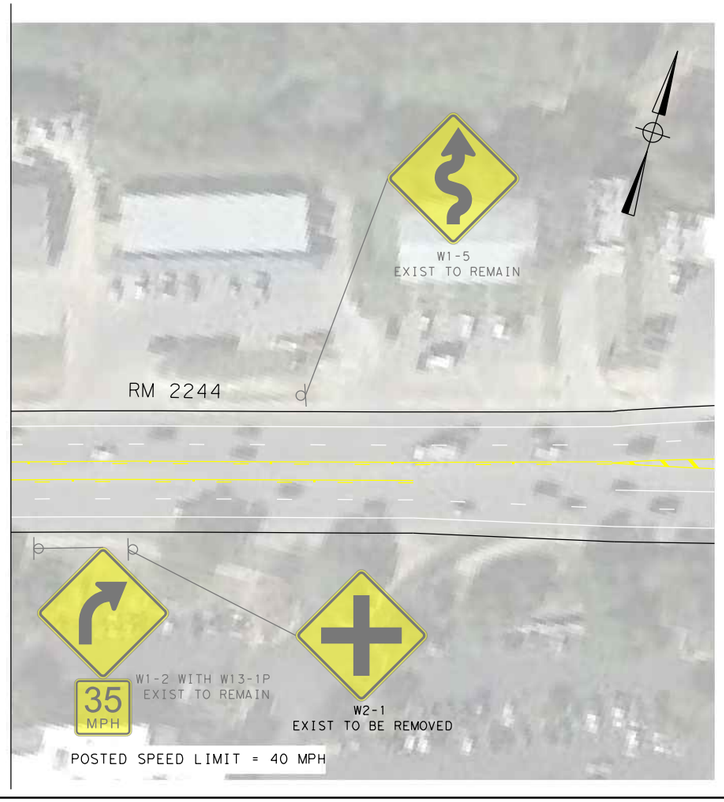
Photograph Date: 6/10/2016

Photograph 3 – RM 2244 looking west, Westbound (1)

Photograph Date: 6/10/2016

Photograph 4 – RM 2244 looking west, Westbound (2)





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 2244 AT EANES CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C18
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

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DO NOT USE FOR PERMITTING, BIDDING, OR CONSTRUCTION.

TxDOT Austin District
Low Water Crossing Study
RM 2244 at Eanes Creek - Preliminary Estimate of Construction Cost
Travis, Texas

Table C18: Preliminary Cost Estimation for RM 2244 at Eanes Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 19 – RM 1826 at Slaughter Creek

Low Water Crossing Inventory	
Location:	RM 1826 at Slaughter Creek
Coordinate:	Latitude: 30.209318 Longitude: -97.903397
County:	Travis
TxDOT Maintenance Office:	South Travis
Body of Water Crossing:	Slaughter Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	None
Object Markers:	OM3-R, OM3-L
Advanced Warning Signs:	W8-15*
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 1826 is an east-west two-lane roadway with one 12-foot lane in each direction. There are no shoulders present within the study area. Both RM 1826 approaches are relatively straight at the low water crossing location. The posted speed limit on RM 1826 is 55 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 11/28/2016 Snapshot from Google Earth

Photograph 1 – RM 1826 looking east, Eastbound (1)

Photograph Date: 11/28/2016 Snapshot from Google Earth

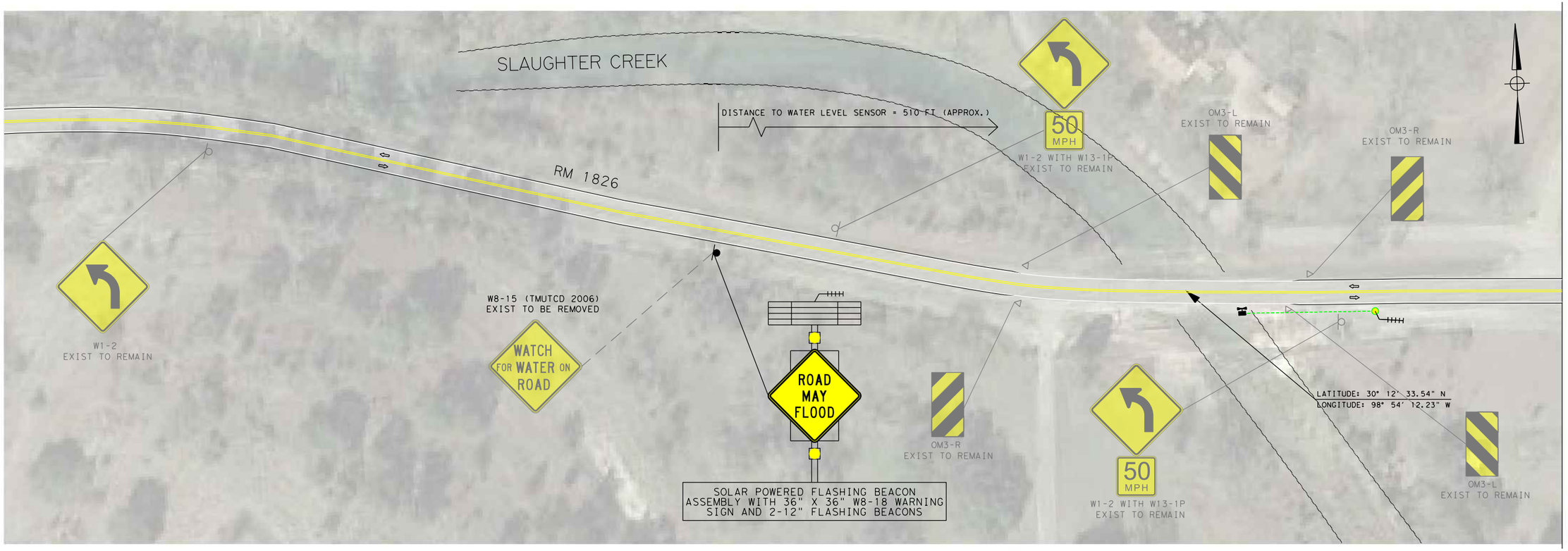
Photograph 2 – RM 1826 looking east, Eastbound (2)

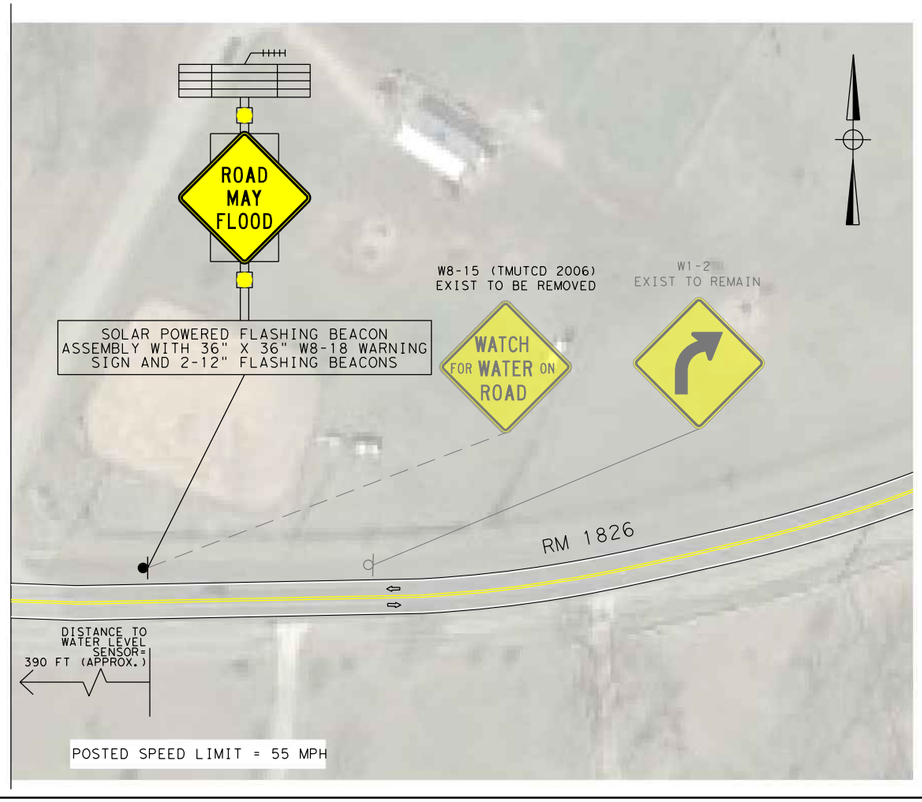
Photograph Date: 11/28/2016 Snapshot from Google Earth

Photograph 3 – RM 1826 looking west, Westbound (1)

Photograph Date: 11/28/2016 Snapshot from Google Earth

Photograph 4 – RM 1826 looking west, Westbound (2)





LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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PROPOSED CONCEPTUAL LAYOUT RM 1826 AT SLAUGHTER CREEK

TXDOT AUSTIN DISTRICT LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C19
Scale: 1"=100'	
Date: FEBRUARY 2017	

RPS klotz associates

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TxDOT Austin District
Low Water Crossing Study
RM 1826 at Slaughter Creek - Preliminary Estimate of Construction Cost
Travis, Texas

Table C19: Preliminary Cost Estimation for RM 1826 at Slaughter Creek

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	2	$200	$400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	2	$10,000	$20,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	1	$12,000	$12,000
4	PRESSURE TRANSDUCER SENSOR	EA	1	$2,000	$2,000
5	ANTENNA	EA	3	$500	$1,500
				Sub-Total	**$35,900**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$3,590.00	$3,590.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$8,975.00	$8,975.00
				TOTAL (Rounded)	**$48,470**

RPS klotz associates

Location 20 – RM 150 at Onion Creek
– RM 150 at Onion Creek
– RM 150 at Yorks Creek

Low Water Crossing Inventory	
Location:	RM 150 at Onion Creek
Coordinate:	Latitude: 30.085060 Longitude: -98.013000
County:	Hays
TxDOT Maintenance Office:	San Marcos
Body of Water Crossing:	Onion Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V
Advanced Warning Signs:	W1-9T, W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 150 is a northeast-southwest two-lane roadway with one lane in each direction. There are no shoulders present within the study area. Both RM 150 approaches are relatively straight at the low water crossing location. East of Onion Creek, RM 150 has winding turns. The posted speed limit on RM 150 is 55 mph.

Photograph Date: 6/8/2016

Photograph 1 – RM 150 looking northwest, Northwest bound (1)

Photograph Date: 6/8/2016

Photograph 2 – RM 150 looking northwest, Northwest bound (2)

Photograph Date: 6/8/2016

Photograph 1 – RM 150 looking southeast, Southeast bound (1)

Photograph Date: 6/8/2016

Photograph 2 – RM 150 looking southeast, Southeast bound (2)

Location 20(2) – RM 150 at Onion Creek

Low Water Crossing Inventory	
Location:	RM 150 at Onion Creek
Coordinate:	Latitude: 30.083220 Longitude: -98.008000
County:	Hays
TxDOT Maintenance Office:	San Marcos
Body of Water Crossing:	Onion Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V
Advanced Warning Signs:	W1-9T, W8-15*, W8-18
Sign Condition:	Poor
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 150 is a northeast-southwest two-lane roadway with one lane in each direction. There are no shoulders present within the study area. Both RM 150 approaches are relatively straight at the low water crossing location. South of Onion Creek, RM 150 turns into a north-south roadway. The posted speed limit on RM 150 is 55 mph.

**"WATCH FOR WATER ON ROAD" removed in TxMUTCD 2011*

Photograph Date: 6/8/2016

Photograph 1 – RM 150 looking northeast, Northeast bound (1)

Photograph Date: 6/8/2016

Photograph 2 – RM 150 looking northeast, Northeast bound (2)

Photograph Date: 6/8/2016

Photograph 3 – RM 150 looking southwest, Southwest bound (1)

Photograph Date: 6/10/2016

Photograph 4 – RM 150 looking southwest, Southwest bound (2)

RPS klotz associates

Location 20(3) – RM 150 at Yorks Creek

Low Water Crossing Inventory	
Location:	RM 150 at Yorks Creek
Coordinate:	Latitude: 30.059739 Longitude: -97.989886
County:	Hays
TxDOT Maintenance Office:	San Marcos
Body of Water Crossing:	Yorks Creek
Low Water Crossing Type:	Concrete Pipe Culvert
Flood (Depth) Gauge Sign:	Yellow Flood Gauge Sign (W8-19, W8-19aTP)
Object Markers:	OM2-2V
Advanced Warning Signs:	W1-2, W8-18
Sign Condition:	Good
Pavement Type:	Asphalt
Rumble Strips:	None
Pavement Condition:	Good
Pavement Marking Condition:	Good
Raised Pavement Markers:	Yes
Description:	Within the study area, RM 150 is a north-south two-lane roadway with one lane in each direction. There are no shoulders present within the study area. Both RM 150 approaches are relatively straight at the low water crossing location. North of Yorks Creek, RM 150 turns into a northwest-southeast roadway. The posted speed limit on RM 150 is 55 mph.

Photograph Date: 6/8/2016

Photograph 1 – RM 150 looking north, Northbound (1)

Photograph Date: 6/8/2016

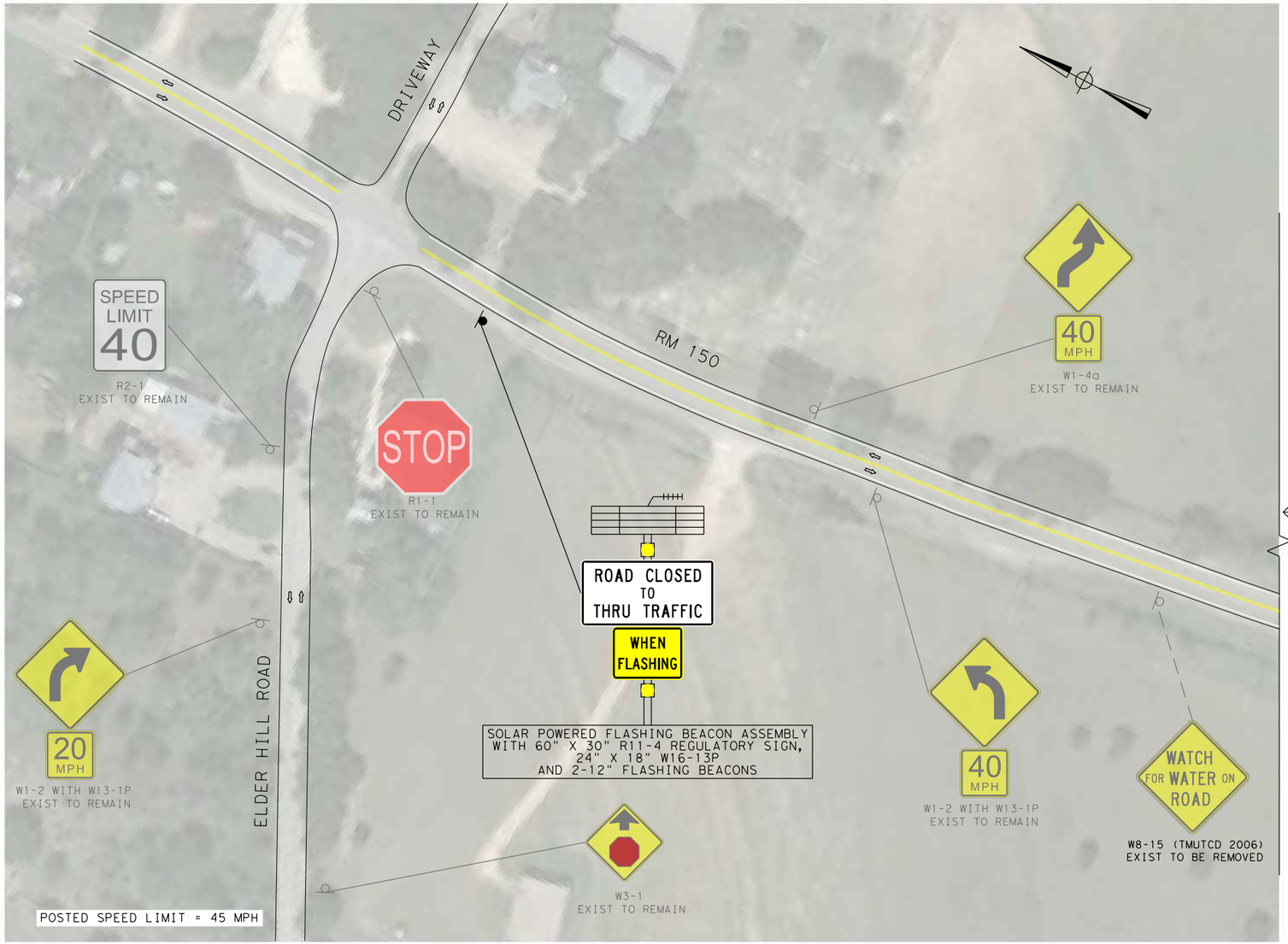
Photograph 2 – RM 150 looking north, Northbound (2)

Photograph Date: 6/8/2016

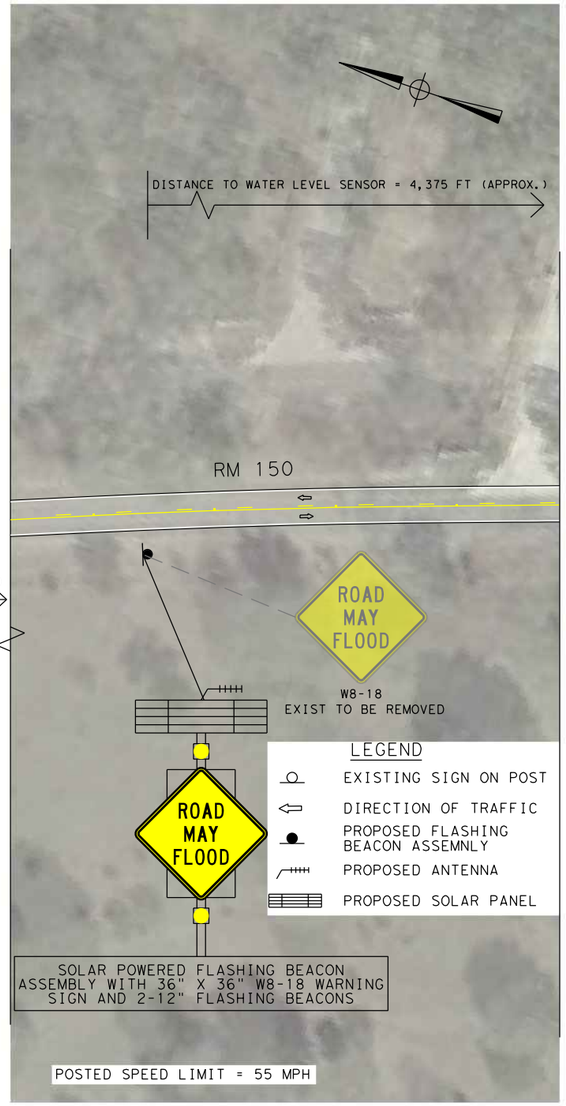
Photograph 3 – RM 150 looking south, Southbound (1)

Photograph Date: 6/10/2016

Photograph 4 – RM 150 looking south, Southbound (2)



2.0 MILES (APPROX.)



MATCH LINE A-A

NOTE:
THE INFORMATION SHOWN IS A CONCEPTUAL REPRESENTATION OF PROPOSED CONDITIONS. THE LOCATIONS OF ALL ITEMS ARE APPROXIMATE. THIS DRAWING IS PRELIMINARY AND SUBJECT TO CHANGE.

PRELIMINARY
NOT INTENDED FOR BIDDING, PERMIT OR CONSTRUCTION

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PROPOSED CONCEPTUAL LAYOUT
RM 150 AT ONION CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C20-1
Scale: 1"=100'	
Date: FEBRUARY 2017	

MATCH LINE A-A

RM 150

2,780 FT (APPROX.)

W1-9T
EXIST TO REMAIN

DISTANCE TO WATER LEVEL SENSOR = 840 FT (APPROX.)

W1-8L AND W1-8R
EXIST TO REMAIN

OM2-2V
EXIST TO REMAIN

ONION CREEK

RM 150

FLOOD GAUGE

FEET
5
4
3
2
1

W8-19aTP
EXIST TO REMAIN

W8-19
EXIST TO REMAIN

LATITUDE: 30° 5' 6.20" N
LONGITUDE: 98° 0' 46.80" W

MATCH LINE B-B

ROAD MAY FLOOD

ROAD MAY FLOOD

W8-18
EXIST TO BE REMOVED

SOLAR POWERED FLASHING BEACON ASSEMBLY WITH 36" X 36" W8-18 WARNING SIGN AND 2-12" FLASHING BEACONS

SCHOOL BUS STOP AHEAD

S3-1
EXIST TO REMAIN

MATCH LINE B-B

W8-18
EXIST TO BE REMOVED

W1-9T
EXIST TO REMAIN

ROAD MAY FLOOD

ROAD MAY FLOOD

SOLAR POWERED FLASHING BEACON ASSEMBLY WITH 36" X 36" W8-18 WARNING SIGN AND 2-12" FLASHING BEACONS

RM 150

W1-8L AND W1-8R
EXIST TO REMAIN

DISTANCE TO WATER LEVEL SENSOR = 710 FT (APPROX.)

OM2-2V
EXIST TO REMAIN

W1-8L AND W1-8R
EXIST TO REMAIN

POSTED SPEED LIMIT = 55 MPH

MATCH LINE C-C

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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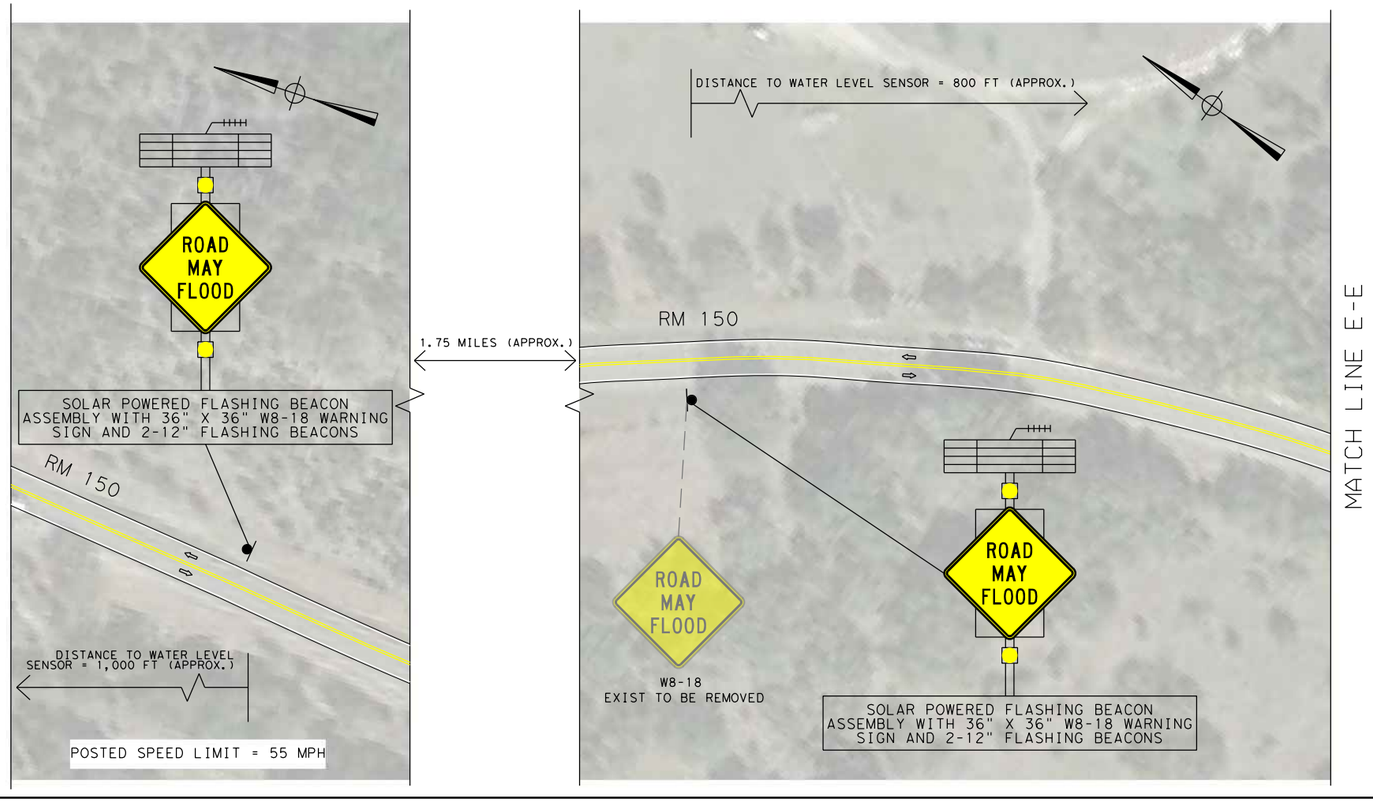
PROPOSED CONCEPTUAL LAYOUT
RM 150 AT ONION CREEK

SHEET 2 of 5

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C20-2
Scale: 1"=100'	
Date: FEBRUARY 2017	



LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

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PROPOSED CONCEPTUAL LAYOUT
RM 150 AT ONION CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C20-3
Scale: 1"=100'	
Date: FEBRUARY 2017	

MATCH LINE E-E

MATCH LINE F-F

MATCH LINE F-F

MATCH LINE G-G

YORKS CREEK

OM2-2V
EXIST TO REMAIN

RM 150

W8-18
EXIST TO BE REMOVED

ROAD MAY FLOOD

ROAD MAY FLOOD

SOLAR POWERED FLASHING BEACON ASSEMBLY WITH 36" X 36" W8-18 WARNING SIGN AND 2-12" FLASHING BEACONS

W1-2
EXIST TO REMAIN

W8-19aTP
EXIST TO REMAIN

FLOOD GAUGE

FEET
5
4
3
2
1

W8-19
EXIST TO REMAIN

LATITUDE: 30° 3' 35.10" N
LONGITUDE: 97° 59' 23.60" W

DISTANCE TO WATER LEVEL SENSOR = 770 FT (APPROX.)

2,130 FT (APPROX.)

RM 150

POSTED SPEED LIMIT = 55 MPH

R2-1
EXIST TO REMAIN

SPEED LIMIT 55

RM 150

W2-4
EXIST TO REMAIN

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- OBJECT MARKER/DELINEATOR
- FLOOD GAUGE ASSEMBLY
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED MASTER CONTROL UNIT
- WATER LEVEL SENSOR
- PROPOSED CONDUIT
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PROPOSED CONCEPTUAL LAYOUT
RM 150 AT YORKS CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit C20-4
Scale: 1"=100'	
Date: FEBRUARY 2017	

LEGEND

- EXISTING SIGN ON POST
- DIRECTION OF TRAFFIC
- PROPOSED FLASHING BEACON ASSEMNLY
- PROPOSED ANTENNA
- PROPOSED SOLAR PANEL

NOTE:
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PRELIMINARY
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POSTED SPEED LIMIT = 55 MPH

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PROPOSED CONCEPTUAL LAYOUT
RM 150 AT YORKS CREEK

TXDOT AUSTIN DISTRICT
LOW WATER CROSSING STUDY

RPS Klotz Proj. No: 0121.072.004	Exhibit
Scale: 1"=100'	C20-5
Date: FEBRUARY 2017	

RPS klotz associates

FOR REVIEW ONLY
DO NOT USE FOR PERMITTING, BIDDING, OR CONSTRUCTION.

TxDOT Austin District
Low Water Crossing Study
Preliminary Estimate of Construction Cost
RM 150 at Onion Creek (1)
RM 150 at Onion Creek (2)
RM 150 at Yorks Creek
Hays, Texas

Table C20: Preliminary Cost Estimation for RM 150

ITEM NO.	DESCRIPTION	UNIT	ESTIMATED QUANTITY	PRICE PER UNIT	AMOUNT
1	REMOVE EXISTING SIGNS	EA	7	$200	$1,400
2	FLASHING BEACON WITH SOLAR PANEL AND REMOTE UNIT	EA	7	$10,000	$70,000
3	PED POLE ASSEMBLY WITH SOLAR PANEL AND MASTER CONTROL UNIT	EA	3	$12,000	$36,000
4	PRESSURE TRANSDUCER SENSOR	EA	3	$2,000	$6,000
5	ANTENNA	EA	10	$500	$5,000
				Sub-Total	**$118,400**
	MOBILIZATION (10% OF ALL ITEMS)	LS	1	$11,840.00	$11,840.00
	CONTINGENCY (25% OF ALL ITEMS EXCLUDING MOBILIZATION)	LS	1	$29,600.00	$29,600.00
				TOTAL (Rounded)	**$159,840**