Final Report

Guadalupe Blanco River Authority

Early Warning System – Hays County Rainfall Gauges

TWDB Contract No. 1600012043
RAINFALL SCADA – HAYS COUNTY
December 21, 2018

Ms. Sarah Hustead  
Texas Water Development Board  
PO Box 13231  
Austin, TX 78711-3231

Re:   TWDB Contract No. 1600012043  
Early warning system Report – Hays County Rainfall Gauges

Dear Ms. Hustead:

The project for the installation of eight rainfall gauges in Hays County is complete. In accordance with the construction grant, transmitted is our final report entitled: Early Warning System Report – Hays County Rainfall Gauges.

This revised report includes a Table of Contents, Scope of Work, photos of Equipment Installed and List of Figures as set out in Contract No. 1600012043.

Please contact me should you have any questions or require any additional information to finalize the reporting requirements

Sincerely,

[Signature]

Thomas D. Hill, P.E.  
Chief Engineer

TDH:mcn

Enclosures as stated
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LIST OF ACRONYMS

**EAA** – Edwards Aquifer Authority

**EMC** – Emergency Management Coordinator

**GBRA** – Guadalupe Blanco River Authority

**HADS** – Hydrometeorological Automated Data System

**HAYS** – Hays County

**NEMA** – National Electrical Manufacturers Association

**NWS** – National Weather Service

**NWS-RFC** – National Weather Service River Forecast Center

**RAWS** – Servicio Meteorologico Nacional (Mexico)

**SCADA** - Supervisory Control and Data Acquisition
RAINFALL SCADA HAYS COUNTY

INTRODUCTION

A. General Purpose

The areas all along the Blanco River and San Marcos River watershed have seen considerable growth. With rapidly developing communities bringing concerns about the increasing threat of flooding and associated damages due to increased urbanization. These areas have been hit hard affecting many populated areas, scenic and environmental resources since major flood events in 1998, 2002, the Memorial Day Flooding in May 2015 and again on October 30, 2015.

The Texas Hill County is known as “Flash Flood Alley”. This area is the most flash flood-prone in the state, and among the most flood-prone areas in the country. Much like other flash flood-prone communities across the country, the geography in this region can rapidly transform the rivers and creeks in the Hill Country into raging tidal surges of water, mud and debris that is capable of taking out entire homes, businesses, roads and bridges.

The purpose of this project provided additional rainfall gauges to an existing early warning system in the watersheds of the Blanco and San Marcos rivers. Using an existing supervisory control and data acquisition (SCADA) system, the Guadalupe-Blanco River Authority (GBRA) network incorporated these gauges into their monitoring network. The real-time monitoring of the rainfall gauges allows for a rapid response to changing conditions, reducing losses and improving the overall efficiency by City Officials and Emergency Management Coordinators (EMC) and officers of potential flooding.

The Blanco - Memorial Day Flood of 2015 brought to light the need to improve metrological data collection within the watershed. Due to the steep terrain of the upper watershed, floodwaters peak higher and travel faster than most rivers. The high growth rate of the region, and the accompanying additions of impervious cover leading to runoff of floodwaters in major rain events, increase the potential for additional loss of life in the future for residents and those coming to the area for recreational activities.
B. **SCOPE OF WORK**

The primary purpose of the project is to expand the existing GBRA rainfall network into the eastern Hays County. The existing GBRA rainfall program was created to provide a data collection platform within the Guadalupe River Watershed to support flooding monitoring and flood forecasting efforts by the National Weather Service (NWS) and local emergency responders. The network in Hays county assists in improved forecasting and warning dissemination along the San Marcos River watershed and the Plum Creek watershed.

Additional rain gauges maintained by other entities are also located in Hays County and are shown in Figures “A-2” and “A-3”. These gauges are sponsored by Edwards Aquifer Authority (EAA); Hydrometeorological Automated Data System (HADS); Hays County (HAYS); Lower Colorado River Authority (LCRA); National Weather Service (NWS); and Servicio Meteorologico Nacional – Mexico (RAWS).

**Type of Equipment:**

The eight rainfall gauging sites utilized equipment which was consistent with the existing GBRA rainfall network. Each rain gauge site consisted of a 6 inch diameter tipping bucket rain gauge Model TR-525 by Texas Electronics, Inc., a SCADA-Pack Model 201 programmable logic controller with a built-in Freewave Radio and a Yagi antenna. Power was provided by a 50 watt solar panel and 75 amp-hour battery. The battery has the electrical storage capacity to last 6 or 7 days with minimal sunlight.

The equipment was placed in a NEMA 4 Electrical metal box and mounted on a vertical 4 inch diameter galvanized pole which transitioned to a 3 inch pole at the top. The electrical enclosure equipment was placed 6 to 7 feet above the ground to minimize vandalism. The solar panel, tipping bucket and Yagi antenna was located toward the top of the pole.

**Siting of Rainfall Gauges**

A number of factors were used to select the gauge locations including:

a) Maintain spacing between gauges to 5 or 6 miles.
b) Insure an unobstructed radio frequency path to the site,
c) The ease of obtaining right of way for the equipment.
d) A site location which provides ease of access for maintenance.

A review of past studies suggested rain gauges should be spaced approximately 7 to 8 miles apart. Due to the compact nature of storm events in Central Texas, a spacing of 5-6 miles was selected and used where possible. The map showing the location and coordinates for the rain gauges can be found in Figure “A-1”. It should be noted gauging site H-09, H-10 and H-11 shown on figure “A-1” were installed using a different funding source, but included in the Hays County map.
Use of Data

Rainfall data is available for use by a number of entities and include:

a) County Road Administrator to identify and install safety barriers around low water crossings.
b) County Emergency Management Coordinator (EMC) to assist with localized flooding issues.
c) The NWS Forecast Office to help forecasters decide whether to issue flood and weather warning.
d) The NWS River Forecast Center in Fort Worth utilizes this data to assist with the calibration of NEXRAD weather radar rainfall estimates. This process is sometimes referred to as "ground-truthing."
e) General Public

Access to Data

The rainfall-telemetry gauge reports every 6 minutes to the Master GBRA computer located in Seguin, Texas. A web report is published every 10 minutes in a tabular format. The data can be accessed from two sources:

a) Data can be found at https://www.gbra.org/rain. The web report displays rainfall totals for every 1-hour, 3-hour, 6-hour and 24-hour. See Figure "C-a"
b) The Hays county eight gauging sites along with the other GBRA gauging sites are also displayed on the TWDB TexMesonet web-site and can be found at https://www.texmesonet.org/. TexMesonet provides access to rainfall data from not only GBRA but from LCRA, USGS, FAA, and EAA. See Figure "C-b".

Maintenance

Rainfall sites will be visited at least every two to three months to check for visual signs of damages from high wind or vandals. The rain gauges will be inspected to insure the tipping bucket mechanism is not jammed. The battery will need to be checked at least once a year. The battery is expected to last for four to six years. The remaining equipment will have a life expectancy of twenty-five to thirty years.
FIGURE “A-1”

AREA MAP

RAINFALL GAUGE PLACEMENT MAP FOR NEW INSTALLS IN HAYS COUNTY WITH TWDB FUNDING
**FIGURE “A-2”**

**ALL RAINFALL GAUGE COORDINATES IN HAYS COUNTY**

<table>
<thead>
<tr>
<th>Map Label</th>
<th>Station</th>
<th>Location Name</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAA-1</td>
<td>EA003</td>
<td>DiLeo Ranch - EAA</td>
<td>30°1'28.26&quot;N</td>
<td>98°12'39.27&quot;W</td>
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<tr>
<td>HAYS1</td>
<td>NRCS Dam 4 - HAYS</td>
<td>29°52'59.66&quot;N</td>
<td>98°1'53.39&quot;W</td>
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<tr>
<td>HAYS2</td>
<td>50021011</td>
<td>Uhland Rd (CR 161) - HAYS</td>
<td>29°53'40.59&quot;N</td>
<td>97°54'2.30&quot;W</td>
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<tr>
<td>HAYS3</td>
<td>50024011</td>
<td>Post Rd (CR 140) - HAYS</td>
<td>29°56'14.58&quot;N</td>
<td>97°53'42.06&quot;W</td>
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<td>HAYS4</td>
<td>50022011</td>
<td>Hilliard Rd (CR222) - HAYS</td>
<td>29°56'53.97&quot;N</td>
<td>97°57'37.75&quot;W</td>
</tr>
<tr>
<td>HAYS5</td>
<td>50025011</td>
<td>Wayside Dr. (CR 179) - HAYS</td>
<td>29°58'2.25&quot;N</td>
<td>98°11'22.59&quot;W</td>
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<tr>
<td>HAYS6</td>
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<td>Little Arkansas Rd (CR 174) - HAYS</td>
<td>29°59'2.27&quot;N</td>
<td>98°3'39.84&quot;W</td>
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<td>HAYS7</td>
<td>CR1492 at Blanco River - HAYS</td>
<td>29°59'6.07&quot;N</td>
<td>98°6'33.59&quot;W</td>
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<tr>
<td>HAYS8</td>
<td>50031011</td>
<td>Chaparral Rd at Little Bear Creek - HAYS</td>
<td>30°8'16.96&quot;N</td>
<td>97°52'36.68&quot;W</td>
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<td>Rohde Rd (CR126) - HAYS</td>
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<td>97°46'11.08&quot;W</td>
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<td>HADS-1</td>
<td>KYET2</td>
<td>Blanco River Near Kyle 25W - HADS</td>
<td>29°58'51.99&quot;N</td>
<td>97°54'24.2&quot;W</td>
</tr>
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<td>HADS-2</td>
<td>BFST2</td>
<td>Blanco River at Fischer Store near Wimberley 6W - HADS</td>
<td>29°59'51.94&quot;N</td>
<td>98°11'59.71&quot;W</td>
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<tr>
<td>HADS-3</td>
<td>HFXT2</td>
<td>Blanco River at Halifax Ranch Near Kyle 5W - HADS</td>
<td>30°0'28.33&quot;N</td>
<td>97°57'9.82&quot;W</td>
</tr>
<tr>
<td>HADS-4</td>
<td>DRWT2</td>
<td>Onion Creek Near Driftwood 3SSE - HADS</td>
<td>30°4'55.8&quot;N</td>
<td>98°0'42.41&quot;W</td>
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<td>LCRA-1</td>
<td>DRGT2</td>
<td>Dripping Springs 5 SSW - LCRA</td>
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<td>98°6'55.67&quot;W</td>
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<td>Dripping Springs 4 NNE - LCRA</td>
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<td>LCRA-5</td>
<td>BDUT2</td>
<td>Onion Creek at Buda - LCRA</td>
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<td>MCTC2</td>
<td>Manchaca 4W - LCRA</td>
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<td>NWS-1</td>
<td>KHY1</td>
<td>San Marcos, San Marcos Municipal Airport - NWS/FAA</td>
<td>29°53'54.24&quot;N</td>
<td>97°52'0.83&quot;W</td>
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<td>RAWS-1</td>
<td>SRWT2</td>
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<td>KRET2</td>
<td>Kyle-East - RAWS</td>
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<td>97°50'59.03&quot;W</td>
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<td>AURT2</td>
<td>South Austin RAWS - RAWS</td>
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<td>RAWS-4</td>
<td>DSRT2</td>
<td>Dripping Springs North - RAWS</td>
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<td>98°5'11.85&quot;W</td>
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<tr>
<td>RAWS-5</td>
<td>HWWT2</td>
<td>Wimberley-West - RAWS</td>
<td>30°2'49.58&quot;N</td>
<td>98°12'12.07&quot;W</td>
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<td>RAWS-6</td>
<td>AUWT2</td>
<td>Austin Water QD - RAWS</td>
<td>30°4'40.83&quot;N</td>
<td>97°58'43.75&quot;W</td>
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<td>GBRA - H-1</td>
<td>H-1</td>
<td>Harris Hill Top</td>
<td>25°55'15.30&quot;N</td>
<td>97°52'29.22&quot;W</td>
</tr>
<tr>
<td>GBRA - H-2</td>
<td>H-2</td>
<td>Bunton Lane</td>
<td>29°59'33.31&quot;N</td>
<td>97°50'32.67&quot;W</td>
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<tr>
<td>GBRA - H-3</td>
<td>H-3</td>
<td>Engelke at FM 300</td>
<td>30°1'46.87&quot;N</td>
<td>97°43'43.11&quot;W</td>
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<tr>
<td>GBRA - H-4</td>
<td>H-4</td>
<td>Hays Youth Complex in Buda</td>
<td>30°2'57.43&quot;N</td>
<td>97°52'8.28&quot;W</td>
</tr>
<tr>
<td>GBRA - H-5</td>
<td>H-5</td>
<td>Sierra West</td>
<td>30°0'30.81&quot;N</td>
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<tr>
<td>GBRA - H-6</td>
<td>H-6</td>
<td>Rocking M</td>
<td>30°0'53.54&quot;N</td>
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<td>Rogers Ranch Road</td>
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<tr>
<td>GBRA - H-9</td>
<td>H-9</td>
<td>Longhorn Trail</td>
<td>30°5′34.79″N</td>
<td>98°12′35.80″W</td>
</tr>
<tr>
<td>GBRA</td>
<td>H-10</td>
<td>Mt. Olive</td>
<td>30°5′10.92″N</td>
<td>98°8′20.83″W</td>
</tr>
<tr>
<td>GBRA</td>
<td>H-11</td>
<td>Rim Rock</td>
<td>29°56′44.33″N</td>
<td>98°6′46.91″W</td>
</tr>
</tbody>
</table>
FIGURE “A-3”

AREA MAP

PLACEMENT MAP OF ALL INSTALLED RAINFALL GAUGES FOR HAYS COUNTY

“Map Label” legend in Figure A-2 above
FIGURE “B-1”

Rain Gauges Installed

GBRA - H-1
Harris Hill Road

$29°55'15.30"N$  $97°52'29.22"W$
FIGURE “B-2”

Rain Gauge Installed

GBRA - H-2
Bunton Lane

29°59'33.31"N  97°50'32.67"W
GBRA - H-3
Engelke Rd at FM 300
30°1'46.87"N 97°43'43.11"W
GBRA - H-4
Hays Youth Complex in Buda
30°2'57.43"N 97°52'8.28"W
FIGURE “B-5”

Rain Gauge Installed

GBRA - H-5

Sierra West

30°03'08.51"N   97°59'40.20"W
FIGURE “B-6”

Rain Gauge Installed

GBRA - H-6

Rocking M

30°0'53.54"N 97°53'40.29"W
FIGURE “B-7”

Rain Gauge Installed

GBRA - H-7

FM 21

29°56'35.57"N    97°47'56.88"W
FIGURE "B-8"

Rain Gauge Installed

GBRA - H-8

Rogers Ranch Road

29°58'28.85"N    97°47'56.88"W
FIGURE “B-9”

Rain Gauge Installed

GBRA - H-9

Longhorn Trail

30°5'34.79"N 98°12'35.80"W
FIGURE “B-10”

Rain Gauge Installed

GBRA - H-10

Mt. Olive

30°5'10.92"N 98°8'20.83"W
FIGURE "B-11"

Rain Gauge Installed

GBRA - H-11

Rim Rock

29°56′44.33″N  98°6′46.91″W
### Rain Gauge Report

**Monday, October 8, 2018**

3:42 PM CST *(RTU Times Do Not Reflect Daylight Saving Time)*

Note: Data is gathered by remote automated sensors and is posted without a quality check. GBRA assumes no responsibility for inaccuracy due to equipment failure. [Interactive map](https://www.gbtra.org/rain), [Comal and Guadalupe County rain gauge map](https://www.gbtra.org/rain)

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<th>3-Hr</th>
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<td>Chuck Wagon Rd</td>
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<td></td>
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<tr>
<td></td>
<td>Liberty Lane</td>
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<tr>
<td></td>
<td>Rolling Ridge</td>
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<td>Tower Rd</td>
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<tr>
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<td>Rogers Ranch Rd</td>
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<td>Comal</td>
<td>GBRA Tower</td>
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<td>Startzville</td>
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<td></td>
<td>Waggener Ranch</td>
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<td>0.00</td>
<td>0.00</td>
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<td>0.00</td>
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<tr>
<td></td>
<td>Stenen Road</td>
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<tr>
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<td>Shadow Hills</td>
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<td>0.01</td>
<td>0.01</td>
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<td></td>
<td>NBU Tower on Geronimo Creek</td>
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<td>0.03</td>
<td>0.19</td>
<td>0.19</td>
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<tr>
<td></td>
<td>FM 3009 on Dry Comal Creek</td>
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<td>Kruger Canyon Rd on Dry Comal</td>
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<td>Bresky Road on Isaac Creek</td>
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<td>Guadalupe</td>
<td>Seguin WTP</td>
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<td>Hwy 123 @ Geronimo Creek</td>
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<td>Branch Road on Geronimo Creek</td>
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<tr>
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<td>FM 1044 on Young Creek</td>
<td>2:30 PM</td>
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<td>FM 1044 on Long Creek</td>
<td>2:30 PM</td>
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<tr>
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<td>FM 775 on Deadmans Creek</td>
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