Appendix 4G
Bid Documents Associated with Flood Management Evaluations and Flood Management Strategies

Quotation

High Sierra Electronics, Inc.

High Sierra Electronics, Inc.
155 Spring Hill Dr., Suite 106
Grass Valley, CA 95945
Phone: 530-273-2080
Email: sales@hsierra.com

Order #	Date
S186674	01/26/2022

Bill To:
Marfa, City of 113 S Highland Ave Marfa, TX 79843 Phone: Email: mroane@cityofmarfa.com

Customer: Marfa, City of

Ship To:
Marfa, City of c/o HSE Warehouse 12786 O'Connor Road San Antonio, TX 78223

Contact: Mandy Roane

Notes: Budgetary Estimate for High Water Detection System consisting of 2 Master Gauging Stations with 8 corresponding Remote Stations with Automatic Barrier Gates, and 1 Rain-Stream Gauging Station in the northern watershed, plus Base Station with Software, Assorted Services, Turn-Key Installation.

8-12 Weeks ARO

Sales Rep	Payment Terms	Shipping Terms	Carrier	Ship Service
sswenor	NET 30	Prepaid & Billed	UPS	Ground

Item #	Number	Description	Unit Price	Qty Ordered	Total Price
1	HWDS A2 Master	ALERT2 Master Gauging Station kit for concrete foundation, complete.	$0.00	2 ea	$ 0.00
2	7410-20	Traffic Pole Assembly: Includes; 16 ft Pole, Breakaway Base with Extended Neck, Locking Collar, 4 in. Cap and Anchor Bolts, Nuts and Washer Kit for concrete foundation.	$1,216.00	2 ea	$ 2,432.00
3	3582-30	ALERT2 HydroMet Controller (Master or Remote); Includes: Model 3512-00 HydroMet Data Logger, ALERT2 Transceiver, Ritron Radio (148 to 174 MHz) Radio, Lightning Protection (VHF GPS), 5315-01 Solar Charger Load Control. Mounted on a L-Panel Assy Note: Radio frequency pending FCC license assistance.	$5,063.00	2 ea	$ 10,126.00
4	2400-15	Rain Gauge Top Section for Slotted Standpipe (12 Diameter). Includes Tipping Bucket Mechanism and 25 Signal Cable with MS-Connector. (Cal: 1mmTip)	$1,012.00	2 ea	$ 2,024.00
5	5950-02	Telemetry Cabinet (Only) w/ Rain Gauge Adapter, 26x17x16	$1,102.00	2 ea	$ 2,204.00
6	5940-02	Cabinet Saddle Brackets (Pair) for 4in Spun Aluminum Pole. Includes U-Bolts	$127.00	2 pr	$ 254.00
7	7410-12	4 Vandal Cone for Cabinet Bracket U-Bolts	$48.00	2 ea	$ 96.00

Quotation

High Sierra Electronics, Inc.

High Sierra Electronics, Inc.
155 Spring Hill Dr., Suite 106
Grass Valley, CA 95945
Phone: 530-273-2080
Email: sales@hsierra.com

Order #	Date
S186674	01/26/2022

Item #	Number	Description	Unit Price	Qty Ordered	Total Price
8	5306-01	Solar Panel (3 Amp 55 W); Includes: 25 ft Cable, Mounting Bracket for 4 in Pole	$753.00	2 ea	$ 1,506.00
9	5611-00	Battery; 12 V, 100 Amp Hour, Sealed AGM	$381.00	2 ea	$ 762.00
10	7135-12	GPS Antenna Kit for Cabinet, No LPD; 5' RG58 Antenna Cable TNC to N-Type, 7131-00 Antenna, 7133-00 Mounting Bkt.	$290.00	2 ea	$ 580.00
11	7110-00	Omni Antenna; VHF 169-173 MHz, 3dB Gain	$123.00	2 ea	$ 246.00
12	7150-17	Antenna Cable (Omni); Includes: 23 ft RG58 Cable with (M) PL-259 and (M) BNC Connector and (M) Type-N to (F) BNC Adapter. Use with Traffic Cabinet Mount	$67.00	2 ea	$ 134.00
13	7300-03	Antenna Mast, 5 ft with Silver Finish	$34.00	2 ea	$ 68.00
14	6640-00	15 PSI Pressure Transducer with 0-5V Output. Submersible Cable, Desiccant Box (6x6x4), Signal Conditioning Module, and 12ft Signal Cable. Note: Estimated 200' of Submersible Cable per Sensor.	$1,709.00	2 ea	$ 3,418.00
15		Subtotal - MASTER Stations			$ 23,850.00
16		Subtotal - REMOTE Stations w/Gates			$ 23,850.00
17	HWDS A2 Remote, BGO	ALERT2 Advanced Warning Station w/ Barrier Gate Operator, kit for concrete foundation, complete.	$0.00	8 ea	$ 0.00
18	7410-20	Traffic Pole Assembly: Includes; 16 ft Pole, Breakaway Base with Extended Neck, Locking Collar, 4 in. Cap and Anchor Bolts, Nuts and Washer Kit for concrete foundation.	$1,216.00	8 ea	$ 9,728.00
19	3582-34	ALERT2 HydroMet Controller (Remote); Model 3512-00 HydroMet Data Logger, Model 3701-00 VHF (148 to 174 MHz) Radio, and Model 5315-01 Solar Charger Load Control. Mounted on L-Panel Assembly. Use with Barrier Gate Operator Control and Monitoring. Note: Radio frequency pending FCC license assistance.	$5,174.00	8 ea	$ 41,392.00
20	5826-01	Signal Light; Includes: (1) 12 in Dia. Red LED Signal Light, Housing, Cap Visor and Mounting Hardware for 4" Pole	$282.00	16 ea	$ 4,512.00

Quotation

High Sierra Electronics, Inc.

High Sierra Electronics, Inc.
155 Spring Hill Dr., Suite 106
Grass Valley, CA 95945
Phone: 530-273-2080
Email: sales@hsierra.com

Order #	Date
S186674	01/26/2022

Item #	Number	Description	Unit Price	Qty Ordered	Total Price
21	5940-00	Cabinet (Only); 26x17x16 in, Door Handle and Key Lock. Mounting Brackets Sold Separately.	$946.00	8 ea	$ 7,568.00
22	5940-02	Cabinet Saddle Brackets (Pair) for 4in Spun Aluminum Pole. Includes U-Bolts	$127.00	8 pr	$ 1,016.00
23	7410-12	4 Vandal Cone for Cabinet Bracket U-Bolts	$48.00	8 ea	$ 384.00
24	5306-01	Solar Panel (3 Amp 55 W); Includes: 25 ft Cable, Mounting Bracket for 4 in Pole	$753.00	8 ea	$ 6,024.00
25	5611-00	Battery; 12 V, 100 Amp Hour, Sealed AGM	$381.00	16 ea	$ 6,096.00
26	7135-12	GPS Antenna Kit for Cabinet, No LPD; 5' RG58 Antenna Cable TNC to N-Type, 7131-00 Antenna, 7133-00 Mounting Bkt.	$290.00	8 ea	$ 2,320.00
27	7110-00	Omni Antenna; VHF 169-173 MHz, 3dB Gain	$123.00	8 ea	$ 984.00
28	7150-17	Antenna Cable (Omni); Includes: 23 ft RG58 Cable with (M) PL-259 and (M) BNC Connector and (M) Type-N to (F) BNC Adapter. Use with Traffic Cabinet Mount	$67.00	8 ea	$ 536.00
29	7300-03	Antenna Mast, 5 ft with Silver Finish	$34.00	8 ea	$ 272.00
30	7300-04	Mast to Pole Mounting Kit (Pair); Up to 5 in OD	$197.00	8 ea	$ 1,576.00
31	2620-40	Road Sign: WATCH FOR WATER ON ROAD; 36 x 36 in	$288.00	8 ea	$ 2,304.00
32	5850-01	Sign Brackets (Pair) for 4 in Pole Mount. Used with Model 5850-00	$44.00	8 ea	$ 352.00
33	9080-01	Barrier Gate Operator Interface Unit (BGOIU); Includes: HSE BGO Interface Controller, 5830-03 Aurora Gate Arm Beacon and Parts Kit, and (2) 12 V 18 Amp Hr Batteries. Unit supports local One-Button Control for local activation or deactivation.	$2,684.00	8 ea	$ 21,472.00
34	9080-00	Barrier Gate Operator; Yellow, Gearbox Operator, APEX Controller, 25 ft Wishbone Arm, AC or 24 VDC Operation. Requires Concrete Foundation. Use with Model 9080-01 BGOIU.	$11,075.00	8 ea	$ 88,600.00
35	9080-30	Tape, Conspicuity; 150 Foot Roll. High Visibility Long Service Life Tape for Barrier Gate Arms.	$385.00	8 ea	$ 3,080.00

Quotation

High Sierra Electronics, Inc.

High Sierra Electronics, Inc.
155 Spring Hill Dr., Suite 106
Grass Valley, CA 95945
Phone: 530-273-2080
Email: sales@hsierra.com

Order #	Date
S186674	01/26/2022

Item #	Number	Description	Unit Price	Qty Ordered	Total Price
36		Subtotal - REMOTE Stations with 2/ea Gates (per site)			$ 198,216.00
37	7190-01	4" Dia 12' Galvanized Sched 40 Pole	$223.00	1 ea	$ 223.00
38	3316-02	ALERT2 Data Transmitter; (6) Analog, (5) Digital and SDI-12 Inputs, Data Logging with 16 GB SD Card, VHF 148 to 174 MHz Radio,12 V 12 Amp Hr Battery, in 10 x 8 x 6 in NEMA Enclosure. (Specify Radio Freq) Note: Radio frequency pending FCC license assistance.	$3,000.00	1 ea	$ 3,000.00
39	7135-11	GPS Antenna Kit for Cabinet; 5' RG58 Antenna Cable TNC to N-Type, 7131-00 Antenna, 7133-00 Mounting Bkt, 7201-00 LPD, 3' RG58 Transmitter Cable N-Type to SMA.	$472.00	1 ea	$ 472.00
40	2400-15	Rain Gauge Top Section for Slotted Standpipe (12 Diameter). Includes Tipping Bucket Mechanism and 25 Signal Cable with MS-Connector. (Cal: 1mmTip)	$1,012.00	1 ea	$ 1,012.00
41	6640-00	15 PSI Pressure Transducer with 0-5V Output. Submersible Cable, Desiccant Box (6x6x4), Signal Conditioning Module, and 12ft Signal Cable. Note: 150' of Submersible Cable.	$1,577.50	1 ea	$ 1,577.50
42	5301-03	Solar Panel (100 mA 16.5 V); Includes: 13.7 V Output Voltage Regulator, 12 ft Power Cable with 3- pin MS Connector, Mounting Bracket, and Hardware	$221.00	1 ea	$ 221.00
43	7110-00	Omni Antenna; VHF 169-173 MHz, 3dB Gain	$123.00	1 ea	$ 123.00
44	7150-02	Antenna Cable (RG58); Includes: 12 ft RG58 Cable with (M) PL-259 and (M) N-Type Connectors, 10.8 ft RG58 Cable with (M) BNC and (M) N-Type Connectors. Use for Model 71007110 with existing Lightning Protection.	$84.00	1 ea	$ 84.00
45	7200-00	Antenna Lightning Protector (Non-Rotated); N-Type F both sides.	$119.00	1 ea	$ 119.00
46		Subtotal - GAUGING STATION (north watershed)			$ 6,831.50

Quotation

High Sierra Electronics, Inc.

High Sierra Electronics, Inc.
155 Spring Hill Dr., Suite 106
Grass Valley, CA 95945
Phone: 530-273-2080
Email: sales@hsierra.com

Order #	Date
S186674	01/26/2022

Item #	Number	Description	Unit Price	Qty Ordered	Total Price
47	3345-24	ALERT2 Base Station Transceiver; Includes; HSE 2U DesktopRack Mount Enclosure, Encoder and Decoder Subsystems w/RSSI Indicator, VHF 148 to 174 MHz Radio, (Specify Radio Frequency) Note: Radio frequency pending FCC license assistance.	$5,555.00	1 ea	$ 5,555.00
48	7101-00	Antenna (Omni) with VHF 6 dB Directional High Gain, 21 ft length. Ships via truck freight.	$1,320.00	1 ea	$ 1,320.00
49	7150-12	Antenna Cable (RG58 to RG8); Includes: 50 ft RG8 Cable with (M) N-Type and (M) PL-259 Connectors, 10.8 ft RG58 Cable with (M) BNC and (M) N-Type Connectors. Use for Model 71007110 with existing Lightning Protection.	$274.00	1 ea	$ 274.00
50	7135-11	GPS Antenna Kit for Cabinet; 5' RG58 Antenna Cable TNC to N-Type, 7131-00 Antenna, 7133-00 Mounting Bkt, 7201-00 LPD, 3' RG58 Transmitter Cable N-Type to SMA.	$472.00	1 ea	$ 472.00
51	7170-01	Antenna VHF Bandpass Single Cavity Filter, 148 to 174 MHz. Specify Frequency	$956.00	1 ea	$ 956.00
52	Materials	Installation Materials Note: Additional hardware & cable for mounting antenna on building.	$390.00	1 ea	$ 390.00
53	8410-06	OneRain Contrail Server 50 sensors, cloud-hosted services within US, 12-month annual subscription. Note: Annual subscription fee of 6K.	$6,000.00	1 ea	$ 6,000.00
54	8400-03	Contrail software installation and configuration done remotely, working with the agency and IT staff. Price is charged only once for any quantity of servers at initial setup.	$3,000.00	1 ea	$ 3,000.00
55	8400-04A	Contrail Training; Administration Webinar Training, session lasting 4 hours.	$1,000.00	1 ea	$ 1,000.00
56		Subtotal - BASE STATION & SOFTWARE			$ 18,967.00

Quotation

High Sierra Electronics, Inc.

High Sierra Electronics, Inc.
155 Spring Hill Dr., Suite 106
Grass Valley, CA 95945
Phone: 530-273-2080
Email: sales@hsierra.com

Order #	Date
S186674	01/26/2022

Item #	Number	Description	Unit Price	Qty Ordered	Total Price
57	Project-Mgmt	Dedicated Project Manager at HSE to serve as primary interface with Owners representative in all matters pertaining to execution of the project. Note: Includes Network Design by Developing ALERT2 ID and TDMA Plan based on current sites and expansion plans.	$1,740.00	1 ..	$ 1,740.00
58	SiteSurvey	Survey of site(s) to evaluate suitability of site for intended use, document any safety and environmental concerns, and determine site preparation and equipment required. Priced per hour plus materials, travel and sustenance.	$3,635.60	1 ..	$ 3,635.60
59	FCC-Assist	FCC Licensing Assistance, See Statement of Work for details.	$2,784.00	1 ..	$ 2,784.00
60	8310-01	Data Services, Data Connectivity Set-up (Hourly rate)	$129.00	4 ea	$ 516.00
61	Install-HSE	Installation Service performed by certified HSE Technician(s). Work will be scheduled through HSE's Project Management team after coordination with site owner. See attached SCOPE of WORK for additional details and information.	$123,513.60	1 ..	$ 123,513.60
62		Subtotal - SERVICES			$ 132,189.20
63	Shipping Estimate	Shipping Estimate; actual amount will be billed.	$2,780.00	1 $	$ 2,780.00
64		Note: Optional Cost for 1 Year of Preventative Maintenance by Two (2) Certified HSE Technicians consisting of 2 Site Visits (example: Spring / Fall). $21,651.20 Annually (includes mobilizaton and daily per diem)			
65		Note: Optional In-Person Training Class for up to 10 Students. 6-Hour workshop. Price = $3,565.60 (Includes mobilization and daily per diem) and all course materials.			

Quotation

High Sierra Electronics, Inc.
High Sierra Electronics, Inc.
155 Spring Hill Dr., Suite 106
Grass Valley, CA 95945
Phone: 530-273-2080
Email: sales@hsierra.com

Order #	Date
S186674	01/26/2022

Subtotal:	**$382,833.70**
Sales Tax:	**$0.00**
Total:	**$382,833.70**

Quote Valid for 60 Days

Approval:_____ Date:_____

By ordering, receiving, or accepting HSE provided products and/or services, Buyer agrees to these General Terms and Conditions of Sale incorporated by reference and available at: https://www.hsierra.com/download/general-terms-conditions-sale/

Proposal for El Paso, Texas

Flood Early Warning System

SUBMITTED BY
Sue Swenor
Sales Manager – Texas & Oklahoma
[Phone: 1.512.931.9530 | Email: sue.swenor@aem.eco

DATE
July 11, 2022

Background

There are 13 primary HUC12 watersheds responsible for runoff production and contributing to flood risk in the City of El Paso, shown in Table 1. The predominant flood risk in El Paso is from the Rio Grande River. The flooding risk associated with the Rio Grande River is monitored and mitigated by an international agreement between the United States and Mexico, and thus no additional monitoring of this river is recommended. The remaining flood risk in El Paso is produced from smaller ephemeral streams and unnamed tributaries of the Rio Grande River (Figure 1).

Table 1. Primary HUC12 watersheds in El Paso, TX.

HUC 12 ID	To HUC 12	Main Flooding sources in El Paso other than the Rio Grande River
130301020802	130301020804	Anthony Wash and Unnamed Tributaries of Rio Grande
130301020804	130301020904	Unnamed Tributaries of Rio Grande
130301020902	130301020904	Unnamed Tributaries of Rio Grande
130301020904	130301020905	Unnamed Tributary of Rio Grande
130301020905	130301020906	Unnamed Tributaries of Rio Grande
130301020906	130401000107	Unnamed Tributaries of Rio Grande
130401000101	130401000103	Ephemeral streams
130401000102	130401000107	No defined channels
130401000103	130401000107	Ephemeral streams
130401000107	130401000203	Unnamed Tributaries of Rio Grande
130401000203	130401000204	Unnamed Tributaries of Rio Grande and Ephemeral streams
130401000204	130401000307	Unnamed Tributaries of Rio Grande
130401000307	130401000410	Unnamed Tributaries of Rio Grande

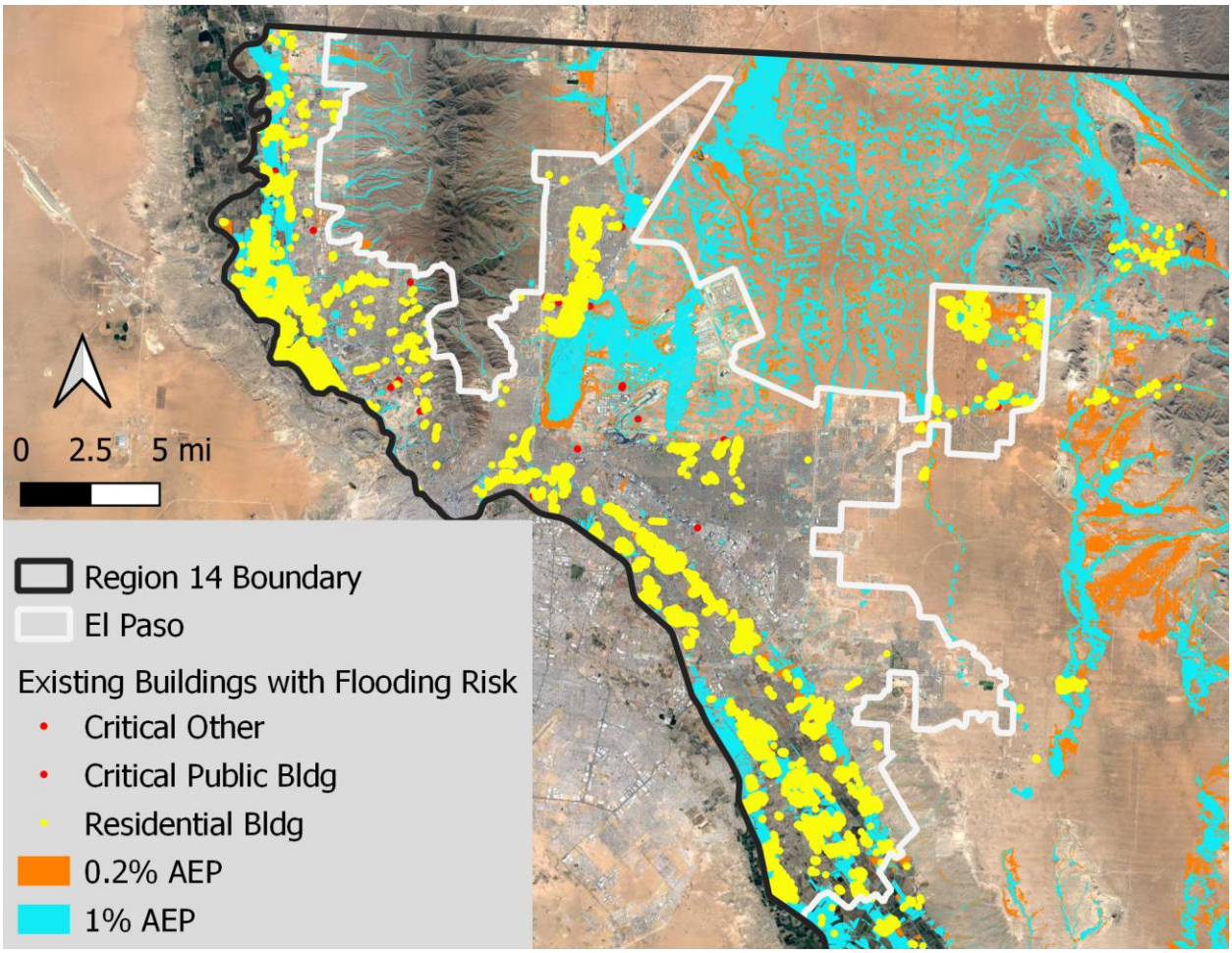


Figure 1. Flooding risk in El Paso, Texas.

The primary radar source for El Paso is KEPZ (Santa Teresa, New Mexico), with a secondary radar source of KHDX (Holloman Air Force Base, New Mexico) available for backup (Figure 2). Additionally, there are two NWS-ASOS rain gauges in El Paso and 14 additional gauges in the surrounding area. There are 2 HADS rain gauges within the City and 27 HADS rain gauges in the surrounding area. In addition to the NWS-ASOS stations and HADS rain gauges there are four TWDB Mesonet stations, four West TX Mesonet rain gauges, and three USGS rain gauges in the surrounding area.

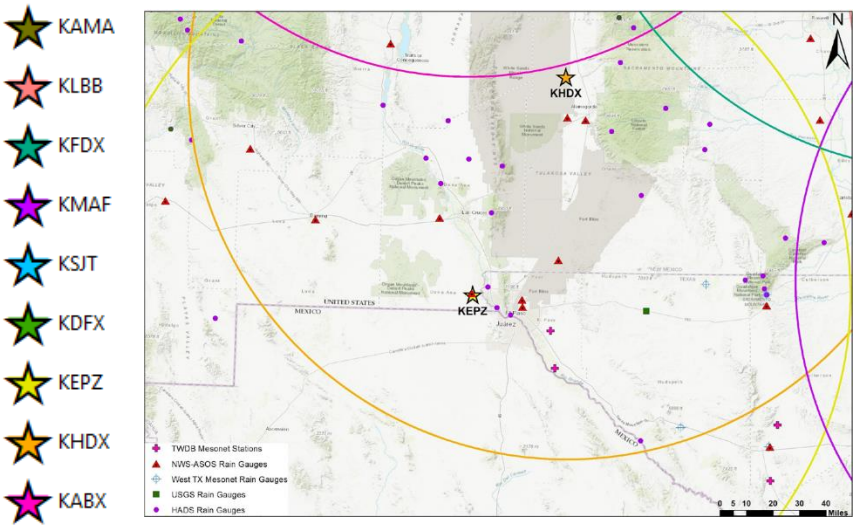


Figure 2. Radar coverage and rain gauge locations for El Paso, Texas.

Scope of Services

Vieux & Associates, an AEM brand, proposes two levels of service to comprise a Flood Early Warning System for the City of El Paso, Texas.

Level 1 of the Flood Early Warning System recommends a rain gauge network analysis to assess the current rain gauge network in the City of El Paso and make recommendations to move rain gauges to better locations or to add additional rain gauges to fill in network gaps. A double mass analysis and a technical memorandum will accompany the rain gauge network analysis. Additionally, pressure transducer sensors, which measure water elevation, are recommended to be installed at highways that cross arroyos and at dam pools and tipping bucket rain gauges, following the rain gauge analysis, are recommended for installation. Base stations are recommended for automatic transmission of sensor data. Finally, a monthly subscription for automated email alerts that provide the rainfall forecast along with measurement from the sensors is recommended. The rainfall forecast product that will be provided is the High Resolution Rapid Refresh model, which is an 18-hour quantitative precipitation forecast produced by the National Weather Service, as well as the 72-hour quantitative precipitation forecast produced by the National Weather Service. An alert threshold analysis will be utilized establish region-specific alert thresholds for the automated email alerts.

Level 2 of the Flood Early Warning System recommends monthly subscription of Near Real Time (NRT) Gauge-Adjusted Radar Rainfall (GARR), which is delivered via the Vieux Information Platform (VIP) and accessed via a secure login. NRT GARR is a spatially continuous rainfall product that is superior to individual radar rainfall or gauge rainfall measurement, and is produced through automated, real time quality control of gauge and radar data at a 15-minute temporal resolution over a gridded 1x1-km domain. Forecast HRRR and NDFD will also be hosted on the VIP platform for seamless visualization.

Cost Proposal

The quoted cost proposal for Level 1 and Level 2 of the Flood Early Warning System is listed below. The quote is valid until January 1, 2023.

No.	Item	Unit	Amount	Quantity	Total
1	Rain Gauge Network and Alert Threshold Analysis	One Time, Labor Included	$102,520	1	$102,520
	Includes double mass analysis & technical memorandum				
2	Automated Email Alerts				
	HRRR Forecast	Monthly	$500	12	$6,000
	NDFD Forecast	Monthly	$500	12	$6,000
	In Situ Sensors (up to 15)	Monthly	$500	12	$6,000
	Configuration & Set Up	One Time, Labor Included	$900	1	$900
3	Tipping Bucket Rain Gauge				
	Standpipe Assembly. Includes Omni Antenna with Cable Set and Lightning Protection	Each	$1,416	1	$1,416
	ALERT Data Transmitter with 12-volt 12-amp hour battery & Cellular Modem	Each	$3,707	1	$3,707

	GPS Antenna with Cable Set and Mounting Bracket	Each	$472	1	$472
	Tipping Bucket Rain Gauge Top Section	Each	$1,012	1	$1,012
4	Pressure Transducer Sensor				
	10mA solar panel with voltage regulator and mounting bracket	Each	$221	1	$221
	Pressure transducer with 35' submersible cable, desiccant box, and 12' signal cable	Each	$1,183	1	$1,183
	Estimated 115' of additional submersible cable for a total length of 150;	Each	$3.00	115	$345
	Interface converter for PT	Each	$278	1	$278
5	Base Station				
	ALERT Data Transceiver with Port Server	Each	$5,555	1	$5,555.00
	Contrail Server (annual subscription)	Each	$12,000.00	1	$12,000.00
	Set-up Configuration & Online 4-hr Training	Each	$4,000.00	1	$4,000.00
	Directional Antenna with Mounting Hardware & Cable	Each	$3,200.00	1	$3,200.00
				Level 1 Total Fixed Price[1] =	**$154,809.00**
6	Vieux NRT GARR Bundle				
	VIP Configuration	One Time	$2,000	1	$2,000
	NRT GARR Configuration	One Time	$3,000	1	$3,000
	NRT GARR Delivery	Monthly, Labor Included	$6,000	12	$72,000
	NRT GARR & VIP Maintenance, VIP Subscription, & Project Management	Monthly, Labor Included	$3,000	12	$36,000
				Level 2 Total Fixed Price[2] =	**$113,000**

[1]The Level 1 Total Fixed Price assumes 12 months for the automated email alerts and complete set-up for 1 tipping bucket rain gauge and 1 pressure transducer sensor. The number of months for automated email alerts and quantity of tipping bucket rain gauges and pressure transducer sensors is an estimate for the purpose of this quote and can be adjusted according to the recommendations made as part of the rain gauge network analysis.

[2]The level 2 Total Fixed Price assumes 12 months of subscription for NRT GARR delivery, maintenance, subscription, and project management. The number of months is an estimate for the purpose of this quote and can be adjusted accordingly.

Appendix

Hardware

A tipping bucket rain gauge is recommended to provide precipitation measurements according to National Weather Service standards. The tipping bucket rain gauge consists of an aluminum 12-inch diameter powder coated housing and a tipping bucket mechanism, available in 1-mm or 0.01-inch tip increments. The accuracy of the recommended tipping bucket rain gauge is ±1.5% for 0-3.6 inches/hour of rainfall.

The pressure transducer sensor is submersible and provides high accuracy of a wide range of operating conditions, making it ideally suited to environmental monitoring applications such as surface water, streams, and reservoirs. These sensors feature a compensated temperature range of 14° to 178°F, a durable stainless-steel housing, and a dual output (analog and RS-485). Each sensor is calibrated with an accuracy of ±0.1% and is field programmable.

The base station is necessary to convey data from the tipping bucket rain gauge and submersible pressure transducer in real time. A 2-way ALERT2 base station transceiver is recommended, which uses a single model for receiving messages and transmitting command messages over the ALERT2 network. This base station is compatible with the Contrail software platform, which can be used to visualize measured field data in near real time.

Rain Gauge Network and Alert Threshold Analysis

A rain gauge network analysis will be conducted that evaluates the existing rain gauge network, placement of existing gauges, and makes recommendations for the installation (including location and number) of new rain gauges to create a full coverage rain gauge network. For existing rain gauges, a double mass analysis will be conducted to evaluate station performance and identify any blockages. The findings from the rain gauge network analysis will be documented in a technical memorandum. The alert threshold analysis will be conducted to analyze historical rainfall events and identify up to 5 rainfall events (including size and duration) for a flood triggering event.

Automated Email Alerts

Automated email alerts will be generated when a pre-defined rainfall threshold is exceeded based upon rainfall information for the area from the High Resolution Rapid Refresh (HRRR) model or as measured by in-situ rain gauges. HRRR is a longer-term quantitative precipitation forecast (QPF), maintained by the National Weather Service, and provides a forecast up to 18 hours. HRRR is provided in a gridded format, and is generated by numerical

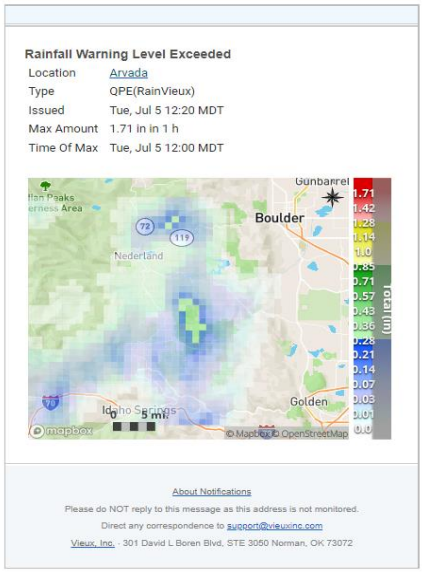


Figure 3. An example automated email alert.

weather prediction models which Vieux improves by filling gaps in the operational data stream to enhance reliability.

The area of coverage will include the City of El Paso and its nearby surrounding areas, up to a radius of 15 km from the city center. The rainfall thresholds are user-defined, and up to 5 thresholds can be set to trigger automated email alerts.

Images from an example email alert are shown in Figure 3. The example automated email alert displays the alert location, maximum storm depth, time of the maximum, and alert type (e.g., HRRR). A map of the radar with a rainfall depth legend accompanies the email alert.

Proposal for Pecos, Texas

Flood Early Warning System

SUBMITTED BY
Sue Swenor
Sales Manager – Texas & Oklahoma
[Phone: 1.512.931.9530 | Email: sue.swenor@aem.eco

DATE
June 6, 2022

Background

There are two primary HUC12 watersheds responsible for runoff production and contribute to flood risk in the City of Pecos: Mosquito Lake and Lateral Number One-Pecos River. Mosquito Lake watershed encompasses the majority of Pecos. The flooding risk generated from the Mosquito Lake watershed is predominantly pluvial flooding because only the headwaters are located in Pecos. The main flooding risk generated from the Lateral Number One-Pecos River watershed in Pecos is the Pecos River. The contributing drainage area for the Pecos River in Pecos is approximately 22,000 square miles. Efforts to develop an early warning system for Pecos River could use USGS Gauge 08419000 as an upstream boundary condition. Several ephemeral streams in the Lateral Number One-Pecos River also produce a flooding risk in Pecos. These streams are fed from upstream drainage areas in HUC 12 watersheds 130700010902 and 130700010901.

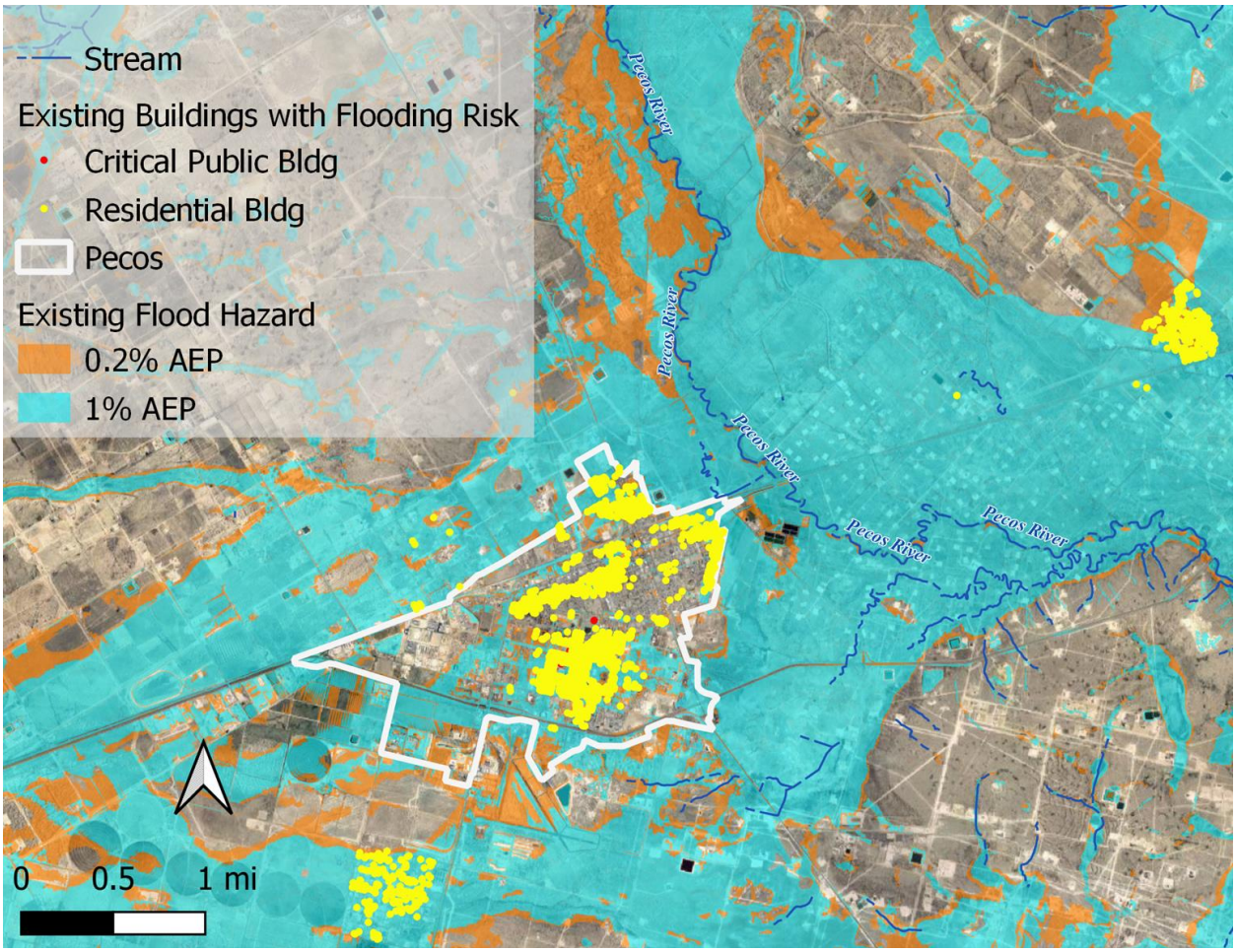


Figure 1. Flooding risk in Pecos, Texas.

Only one radar source, KMAF (Midland, Texas), provides coverage to Pecos, Texas. The City sits on the very edge of the radar's coverage radius, shown in Figure 2, and there is no backup radar. There is no radar coverage to the south of the City of Alpine.

There are limited rain gauges in the immediate vicinity of Pecos, although there are 12 NWS-ASOS rain gauges in the area surrounding the City. In addition to the NWS-ASOS stations

there are eight TWDB Mesonet stations, 12 West TX Mesonet rain gauges, seven USGS Rain Gauges, and 14 HADS rain gauges in the surrounding area.

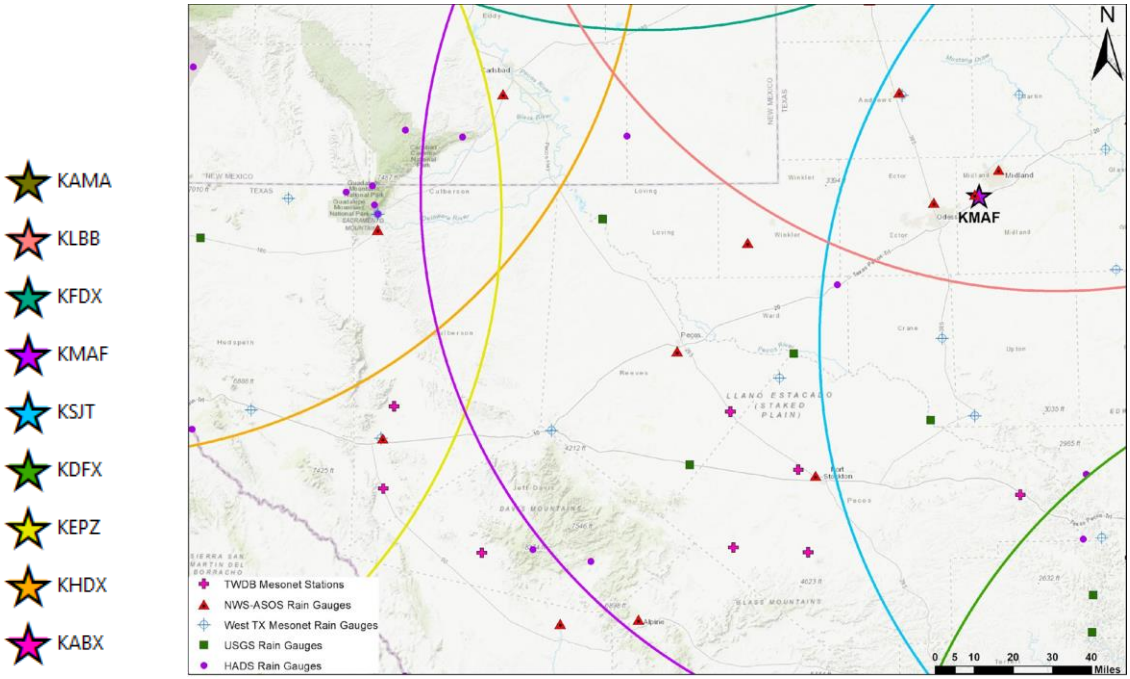


Figure 2. Radar coverage and rain gauge locations for Pecos, Texas.

Scope of Services

Vieux & Associates, an AEM brand, proposes one level of service to comprise a Flood Early Warning System for the City of Pecos, Texas.

Level 1 of the Flood Early Warning System recommends the installation of new hardware for in situ measurement of rainfall and water elevation combined with a monthly subscription for automated email alerts that provide the rainfall forecast along with measurement from the sensors, if the sensors are connected to a cellular network to transmit data in real time. The rainfall forecast product that will be provided is the High Resolution Rapid Refresh model, which is an 18-hour quantitative precipitation forecast produced by the National Weather Service. Additionally, a rain gauge network and alert threshold analysis is recommended to evaluate the current rain gauge network, make recommendations for the installation of additional hardware along with specifications for a low cost, compact weather station, and establish region-specific alert thresholds for the automated email alerts. More information about these services can be found in the Appendix.

Cost Proposal

The quoted cost proposal for Level 1 of the Flood Early Warning System is listed below. The quote is valid until January 1, 2023.

No.	Item	Unit	Amount	Quantity	Total
1	Automated Email Alerts				
	HRRR Forecast	Recurring Monthly	$500	12	$6,000
	In Situ Sensors (up to 15 sensors if transmitting data in real time over a cellular network)	Recurring Monthly	$500	12	$6,000
	Alert Configuration & Set Up	Labor	$900	1	$900
2	Rain Gauge Network and Alert Threshold Analysis	Labor	$40,680	1	$40,680
3	Wireless Weather Station with Console for Measuring Rainfall, Temp/RH, Wind Speed Note: Requires AC Power	Each	$910.00	1	$910.00
	Mounting Hardware	Each	$150.00	1	$150.00
				Level 1 Total Fixed Price[1] =	**$54,640.00**

*The Level 1 Total Fixed Price assumes 12 months for the automated email alerts and complete set-up for one wireless weather station. The number of months for automated email alerts and quantity of weather stations is an estimate for the purpose of this quote and can be adjusted according to the recommendations made as part of the rain gauge network analysis.

Appendix

Hardware

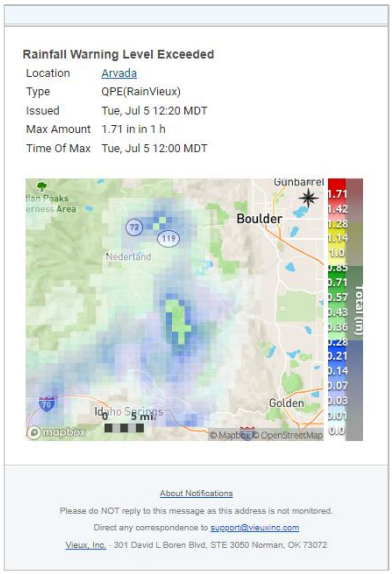
A compact, low-cost weather station that provides measurements of precipitation, temperature, relative humidity, wind speed and direction, and barometric pressure is recommended. The hardware package for this station includes a small desktop console for viewing real-time data so decision makers can take appropriate action. Each weather station can be configured to transmit data in real time using a data plan from any cellular provider; without a data plan, the data can be collected and viewed on the console. Note that without a data plan, data collected from this weather station cannot be included in the automated email alerts.

Rain Gauge Network and Alert Threshold Analysis

A rain gauge network analysis will be conducted that evaluates the existing rain gauge network, placement of existing gauges, and makes recommendations for the installation (including location and number) of new rain gauges to create a full coverage rain gauge network. The findings from the rain gauge network analysis will be documented in a technical memorandum. The alert threshold analysis will be conducted to analyze historical rainfall events and identify up to 5 rainfall events (including size and duration) for a flood triggering event.

Automated Email Alerts

Automated email alerts will be generated when a pre-defined rainfall threshold is exceeded based upon rainfall information for the area from the High Resolution Rapid Refresh (HRRR) model or as measured by in-situ rain gauges (if the gauges are connected to a cellular plan for data transmittal). HRRR is a longer-term quantitative precipitation forecast (QPF), maintained by the National Weather Service, and provides a forecast up to 18 hours. HRRR is provided in a gridded format, and is generated by numerical weather prediction models which Vieux improves by filling gaps in the operational data stream to enhance reliability.



The area of coverage will include the City of Pecos and its nearby surrounding areas, up to a radius of 15 km from the city center. The rainfall thresholds are user-defined, and up to 5 thresholds can be set to trigger automated email alerts.

Images from an example email alert are shown in Figure 3. The example automated email alert displays the alert location, maximum storm depth, time of the maximum, and alert type (e.g., HRRR). A map of the radar with a rainfall depth legend accompanies the email alert.

Figure 3. An example automated email alert.

Proposal for Alpine, Texas

Flood Early Warning System

SUBMITTED BY
Sue Swenor
Sales Manager – Texas & Oklahoma
[Phone: 1.512.931.9530 | Email: sue.swenor@aem.eco

DATE
July 11, 2022

Background

There are three primary HUC12 watersheds responsible for runoff production and contribute to flood risk in the City of Alpine: Headwaters Alpine Creek, Ramirez Tank-Alpine Creek, and Moss Creek. Ramirez Tank-Alpine Creek watershed covers approximately 40 acres on the northern edge of the City. The current flood risk generated from this watershed is low, but the risk level could increase if property development continues in this area. The Headwater Alpine Creek watershed encompasses the majority of Alpine and includes three main flooding sources: Paisano Creek, Alpine Creek, and an unnamed tributary to Alpine Creek (Figure 1). Moss Creek covers the southern portion of the City of Alpine and also provides flood risk in this area of the City.

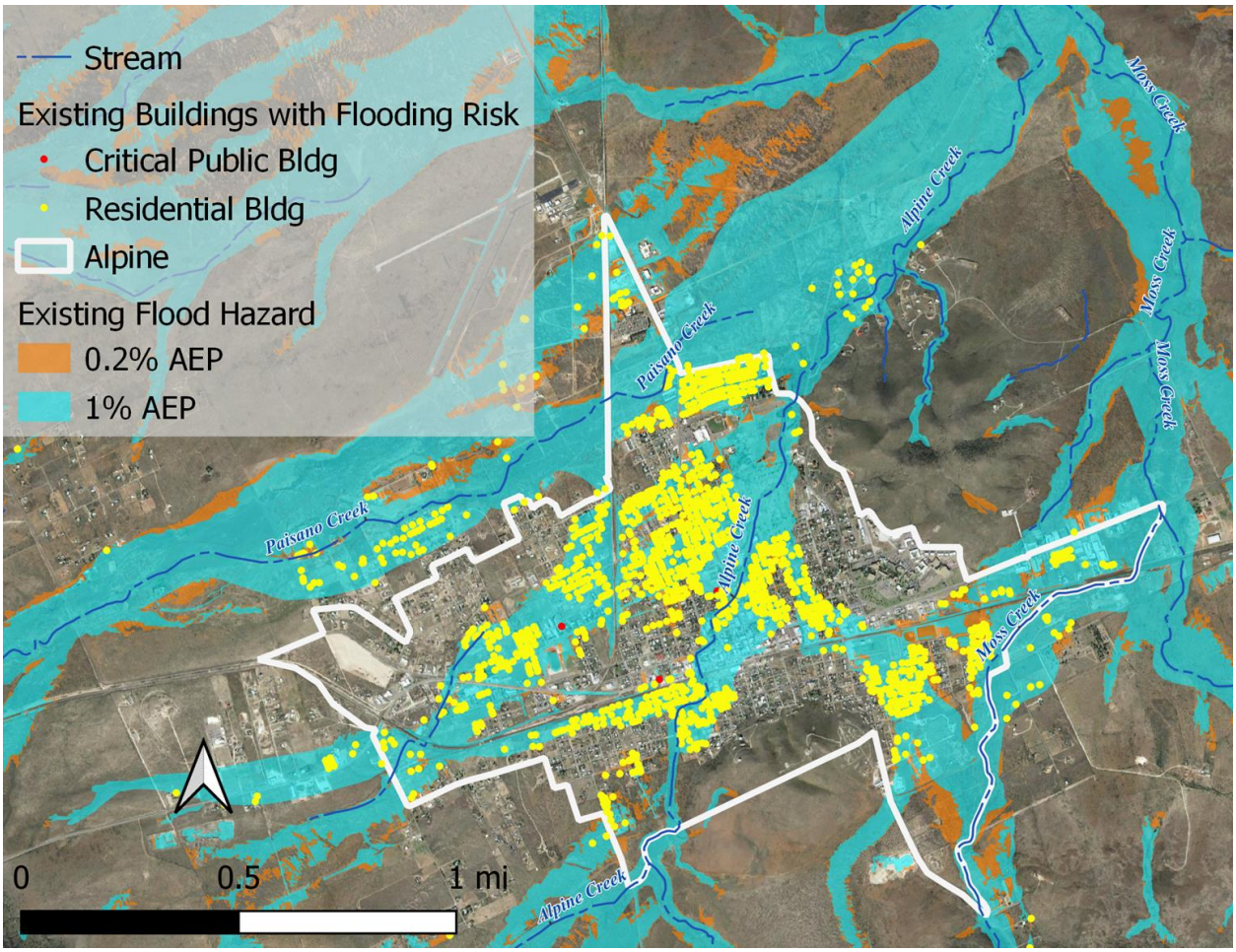


Figure 1. Flooding risk in Alpine, Texas.

Only one radar source, KMAF (Midland, Texas), provides coverage to Alpine, Texas. The City sits on the very edge of the radar's coverage radius, shown in Figure 2, and there is no backup radar. There is no radar coverage to the south of the City of Alpine.

There is one NWS-ASOS rain gauge currently operational in Alpine, and five additional gauges in the surrounding areas (Figure 2). In addition to the NWS-ASOS stations, there are

seven TWDB Mesonet stations, two West Texas Mesonet rain gauges, two USGS rain gauges, and seven HADS rain gauges in the areas surrounding Alpine.

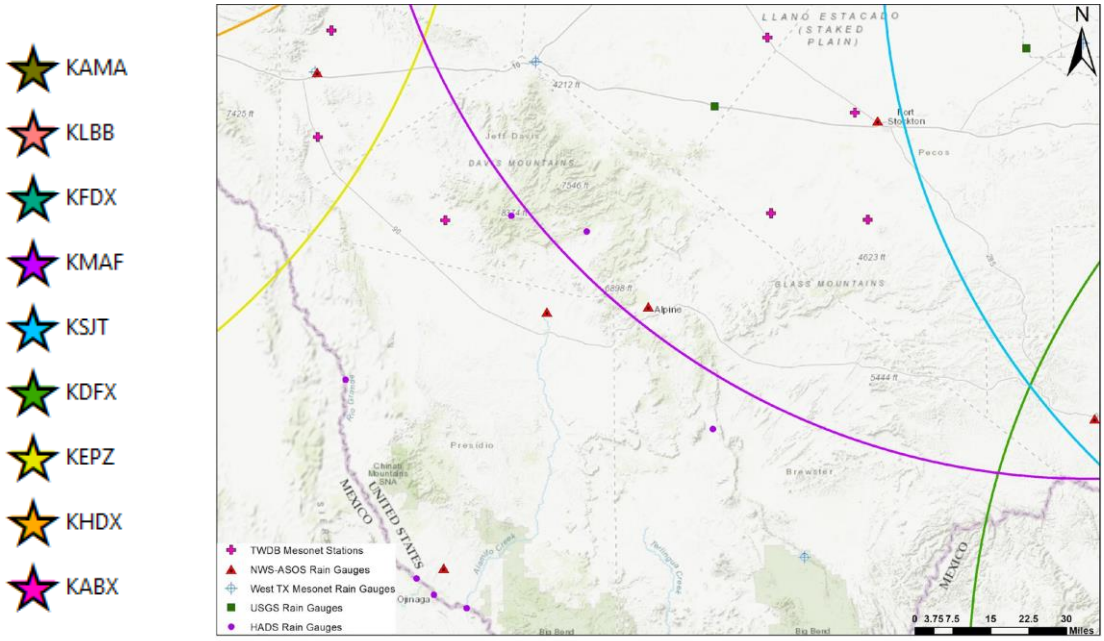


Figure 2. Radar coverage and rain gauge locations for Alpine, Texas.

Scope of Services

Vieux & Associates, an AEM brand, proposes one level of service to comprise a Flood Early Warning System for the City of Alpine, Texas.

Level 1 of the Flood Early Warning System recommends the installation of new hardware for in situ measurement of rainfall and water elevation combined with a monthly subscription for automated email alerts that provide the rainfall forecast along with measurement from the sensors, if the sensors are connected to a cellular network to transmit data in real time. The rainfall forecast product that will be provided is the High Resolution Rapid Refresh model, which is an 18-hour quantitative precipitation forecast produced by the National Weather Service. Additionally, a rain gauge network and alert threshold analysis is recommended to evaluate the current rain gauge network, make recommendations for the installation of additional hardware along with specifications for a low cost, compact weather station, and establish region-specific alert thresholds for the automated email alerts. More information about these services can be found in the Appendix.

Cost Proposal

The quoted cost proposal for Level 1 of the Flood Early Warning System is listed below. The quote is valid until January 1, 2023.

No.	Item	Unit	Amount	Quantity	Total
1	Automated Email Alerts				
	HRRR Forecast	Recurring Monthly	$500	12	$6,000
	In Situ Sensors (up to 15 sensors if transmitting data in real time over a cellular network)	Recurring Monthly	$500	12	$6,000
	Alert Configuration & Set Up	Labor	$900	1	$900
2	Rain Gauge Network and Alert Threshold Analysis	Labor	$40,680	1	$40,680
3	Wireless Weather Station with Console for Measuring Rainfall, Temp/RH, Wind Speed Note: Requires AC Power	Each	$910.00	1	$910.00
	Mounting Hardware	Each	$150.00	1	$150.00
				Level 1 Total Fixed Price[1] =	**$54,640.00**

*The Level 1 Total Fixed Price assumes 12 months for the automated email alerts and complete set-up for one wireless weather station. The number of months for automated email alerts and quantity of weather stations is an estimate for the purpose of this quote and can be adjusted according to the recommendations made as part of the rain gauge network analysis.

Appendix

Hardware

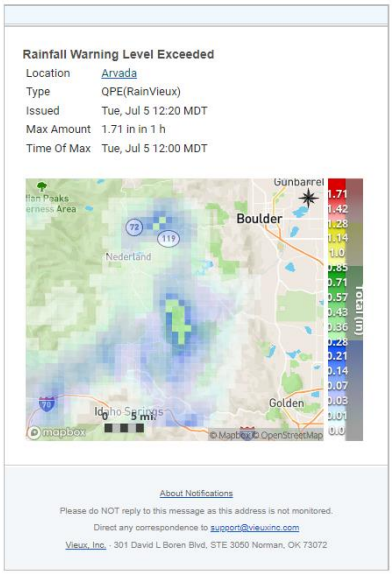
A compact, low-cost weather station that provides measurements of precipitation, temperature, relative humidity, wind speed and direction, and barometric pressure is recommended. The hardware package for this station includes a small desktop console for viewing real-time data so decision makers can take appropriate action. Each weather station can be configured to transmit data in real time using a data plan from any cellular provider; without a data plan, the data can be collected and viewed on the console. Note that without a data plan, data collected from this weather station cannot be included in the automated email alerts.

Rain Gauge Network and Alert Threshold Analysis

A rain gauge network analysis will be conducted that evaluates the existing rain gauge network, placement of existing gauges, and makes recommendations for the installation (including location and number) of new rain gauges to create a full coverage rain gauge network. The findings from the rain gauge network analysis will be documented in a technical memorandum. The alert threshold analysis will be conducted to analyze historical rainfall events and identify up to 5 rainfall events (including size and duration) for a flood triggering event.

Automated Email Alerts

Automated email alerts will be generated when a pre-defined rainfall threshold is exceeded based upon rainfall information for the area from the High Resolution Rapid Refresh (HRRR) model or as measured by in-situ rain gauges (if the gauges are connected to a cellular plan for data transmittal). HRRR is a longer-term quantitative precipitation forecast (QPF), maintained by the National Weather Service, and provides a forecast up to 18 hours. HRRR is provided in a gridded format, and is generated by numerical weather prediction models which Vieux improves by filling gaps in the operational data stream to enhance reliability.



The area of coverage will include the City of Alpine and its nearby surrounding areas, up to a radius of 15 km from the city center. The rainfall thresholds are user-defined, and up to 5 thresholds can be set to trigger automated email alerts.

Images from an example email alert are shown in Figure 3. The example automated email alert displays the alert location, maximum storm depth, time of the maximum, and alert type (e.g., HRRR). A map of the radar with a rainfall depth legend accompanies the email alert.

Figure 3. An example automated email alert.

Proposal for Presidio, Texas

Flood Early Warning System

SUBMITTED BY
Sue Swenor
Sales Manager – Texas & Oklahoma
[Phone: 1.512.931.9530 | Email: sue.swenor@aem.eco

DATE
July 11, 2022

Background

There are two primary HUC12 watersheds responsible for runoff production and contribute to flood risk in the City of Presidio: Arroyo Monias-Cibolo Creek and Arroyo Tortola-Rio Grande. Arroyo Tortola-Rio Grande encompasses the majority of Presidio. The flooding risk generated from the Arroyo Tortola-Rio Grande watershed is predominantly from the Rio Grande River and several unnamed arroyos. The main flooding risk generated from the Arroyo Monias-Cibolo Creek watershed in Presidio is Cibolo Creek (Figure 1).

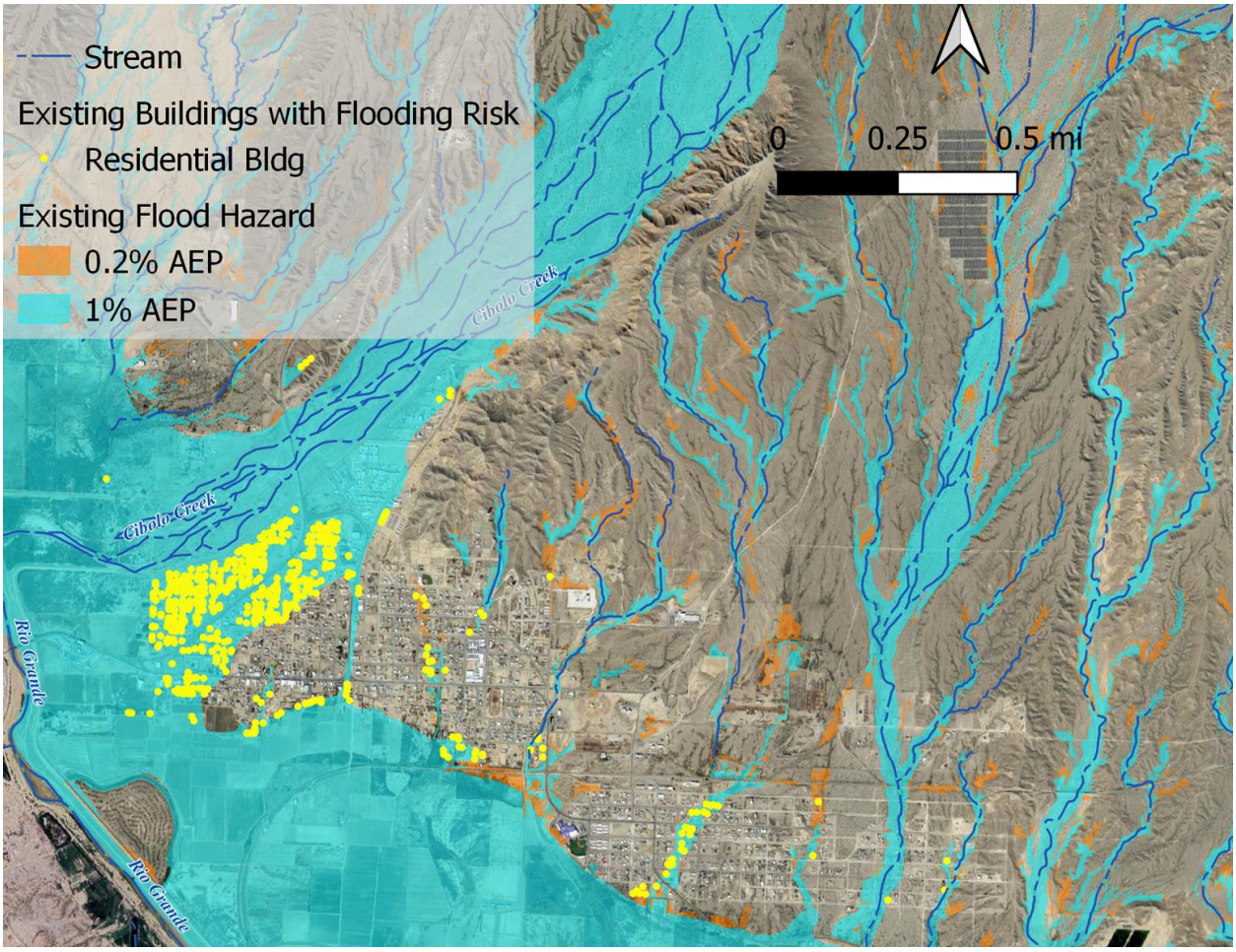


Figure 1. Flooding risk in Presidio, Texas.

There is no NEXRAD radar coverage for Presidio, Texas. However, there are three NWS-ASOS rain gauges in the area surrounding the City. In addition to the NWS-ASOS stations there are two TWDB Mesonet stations, one West TX Mesonet rain gauges, and seven HADS rain gauges in the surrounding area.

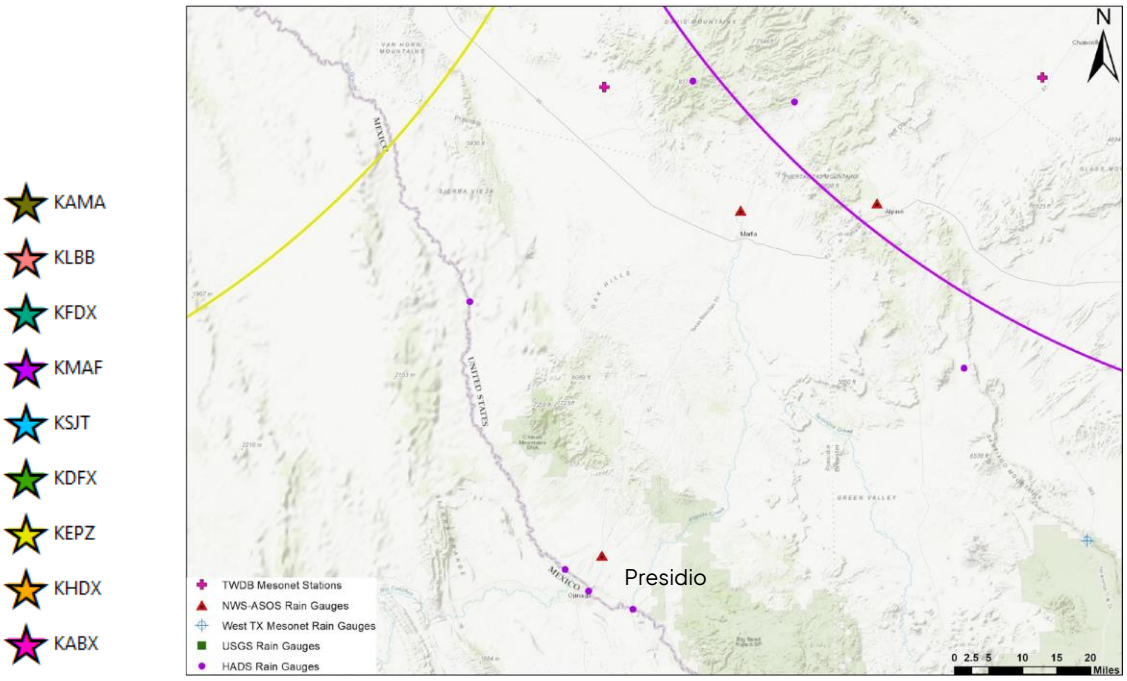


Figure 2. Radar coverage and rain gauge locations for Presidio Texas.

Scope of Services

Vieux & Associates, an AEM brand, proposes one level of service to comprise a Flood Early Warning System for the City of Presidio, Texas.

Level 1 of the Flood Early Warning System recommends the installation of new hardware for in situ measurement of rainfall and water elevation combined with a monthly subscription for automated email alerts that provide the rainfall forecast along with measurement from the sensors, if the sensors are connected to a cellular network to transmit data in real time. The rainfall forecast product that will be provided is the High Resolution Rapid Refresh model, which is an 18-hour quantitative precipitation forecast produced by the National Weather Service. Additionally, a rain gauge network and alert threshold analysis is recommended to evaluate the current rain gauge network, make recommendations for the installation of additional hardware along with specifications for a low cost, compact weather station, and establish region-specific alert thresholds for the automated email alerts. More information about these services can be found in the Appendix.

Cost Proposal

The quoted cost proposal for Level 1 of the Flood Early Warning System is listed below. The quote is valid until January 1, 2023.

No.	Item	Unit	Amount	Quantity	Total
1	Automated Email Alerts				
	HRRR Forecast	Recurring Monthly	$500	12	$6,000
	In Situ Sensors (up to 15 sensors if transmitting data in real time over a cellular network)	Recurring Monthly	$500	12	$6,000
	Alert Configuration & Set Up	Labor	$900	1	$900
2	Rain Gauge Network and Alert Threshold Analysis	Labor	$40,680	1	$40,680
3	Wireless Weather Station with Console for Measuring Rainfall, Temp/RH, Wind Speed Note: Requires AC Power	Each	$910.00	1	$910.00
	Mounting Hardware	Each	$150.00	1	$150.00
				Level 1 Total Fixed Price[1] =	**$54,640.00**

*The Level 1 Total Fixed Price assumes 12 months for the automated email alerts and complete set-up for one wireless weather station. The number of months for automated email alerts and quantity of weather stations is an estimate for the purpose of this quote and can be adjusted according to the recommendations made as part of the rain gauge network analysis.

Appendix

Hardware

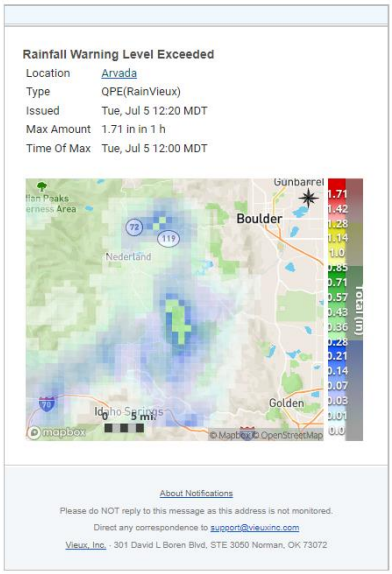
A compact, low-cost weather station that provides measurements of precipitation, temperature, relative humidity, wind speed and direction, and barometric pressure is recommended. The hardware package for this station includes a small desktop console for viewing real-time data so decision makers can take appropriate action. Each weather station can be configured to transmit data in real time using a data plan from any cellular provider; without a data plan, the data can be collected and viewed on the console. Note that without a data plan, data collected from this weather station cannot be included in the automated email alerts.

Rain Gauge Network and Alert Threshold Analysis

A rain gauge network analysis will be conducted that evaluates the existing rain gauge network, placement of existing gauges, and makes recommendations for the installation (including location and number) of new rain gauges to create a full coverage rain gauge network. The findings from the rain gauge network analysis will be documented in a technical memorandum. The alert threshold analysis will be conducted to analyze historical rainfall events and identify up to 5 rainfall events (including size and duration) for a flood triggering event.

Automated Email Alerts

Automated email alerts will be generated when a pre-defined rainfall threshold is exceeded based upon rainfall information for the area from the High Resolution Rapid Refresh (HRRR) model or as measured by in-situ rain gauges (if the gauges are connected to a cellular plan for data transmittal). HRRR is a longer-term quantitative precipitation forecast (QPF), maintained by the National Weather Service, and provides a forecast up to 18 hours. HRRR is provided in a gridded format, and is generated by numerical weather prediction models which Vieux improves by filling gaps in the operational data stream to enhance reliability.



The area of coverage will include the City of Presidio and its nearby surrounding areas, up to a radius of 15 km from the city center. The rainfall thresholds are user-defined, and up to 5 thresholds can be set to trigger automated email alerts.

Images from an example email alert are shown in Figure 3. The example automated email alert displays the alert location, maximum storm depth, time of the maximum, and alert type (e.g., HRRR). A map of the radar with a rainfall depth legend accompanies the email alert.

Figure 3. An example automated email alert.

Proposal for Fort Stockton, Texas

Flood Early Warning System

SUBMITTED BY
Sue Swenor
Sales Manager – Texas & Oklahoma
[Phone: 1.512.931.9530 | Email: sue.swenor@aem.eco

DATE
July 11, 2022

Background

There are three primary HUC12 watersheds responsible for runoff production and contribute to flood risk in the City of Fort Stockton: Headwaters Comanche Creek, Fivemile Mesa-Comanche Creek, and City of Fort Stockton-Twomile Hill. The Headwaters Comanche Creek watershed covers the southern portion of Fort Stockton, and the main flooding risk generated from this watershed is Comanche Creek and its tributaries (Figure 1). Comanche Creek flows north into the Fivemile Mesa-Comanche Creek watershed, and is the main flood risk for Fort Stockton in the Fivemile Mesa-Comanche Creek watershed. The flooding risk generated from the City of Fort Stockton-Twomile Hill watershed is pluvial flooding, because only the headwaters are located in Fort Stockton.

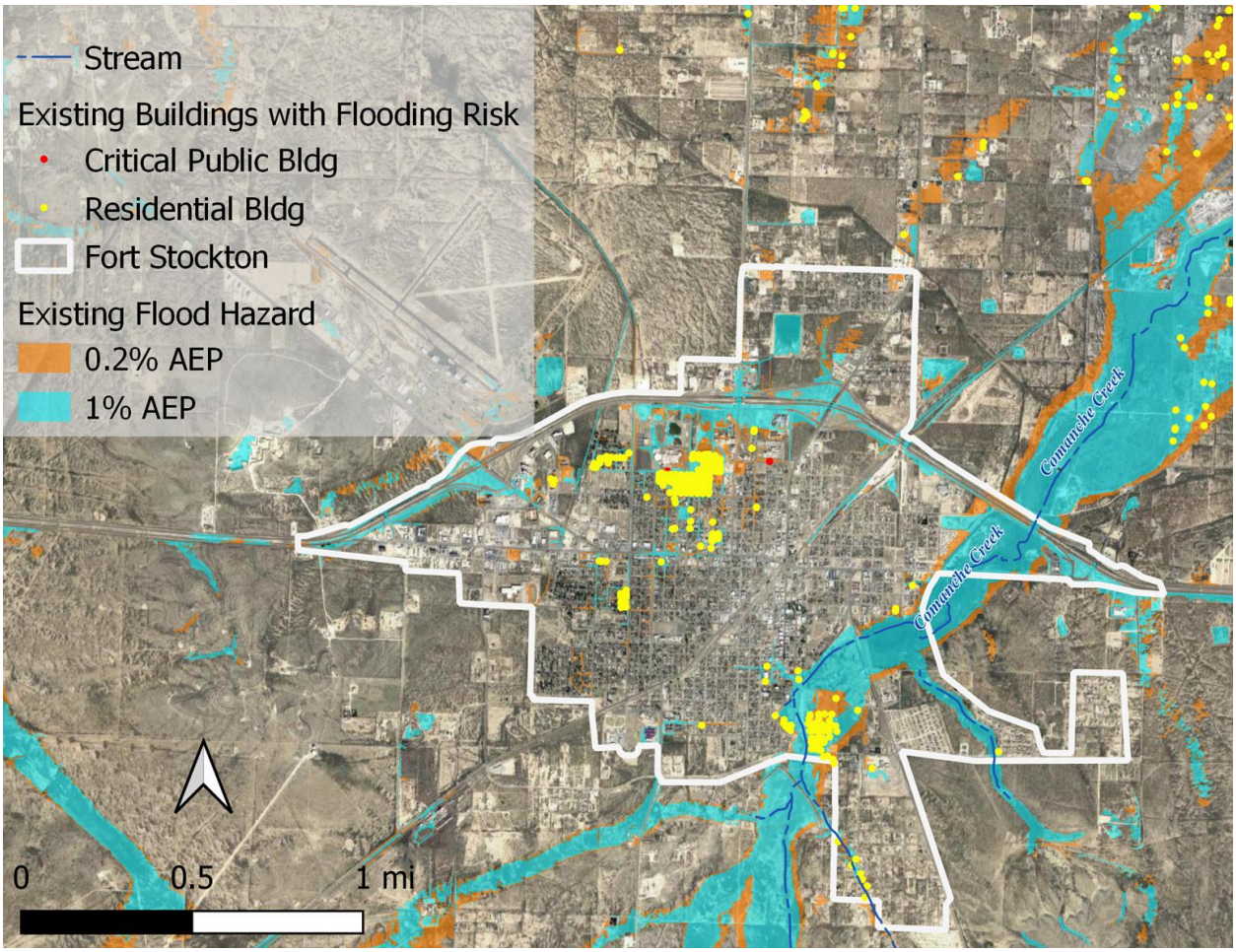


Figure 1. Flooding risk in Fort Stockton, Texas.

Only one radar source, KMAF (Midland, Texas), provides coverage to Fort Stockton, Texas. The City sits just outside the coverage radar for KSJT (John Murtha Johnstown Cambria County Airport, Texas), shown in Figure 2, and there is no backup radar.

There is one NWS-ASOS rain gauge in Fort Stockton (Figure 2) and 11 additional gauges in the surrounding area. In addition to the NWS-ASOS stations there are ten TWDB Mesonet stations, eight West TX Mesonet rain gauges, seven USGS rain gauges, and 12 HADS rain gauges in the surrounding area.

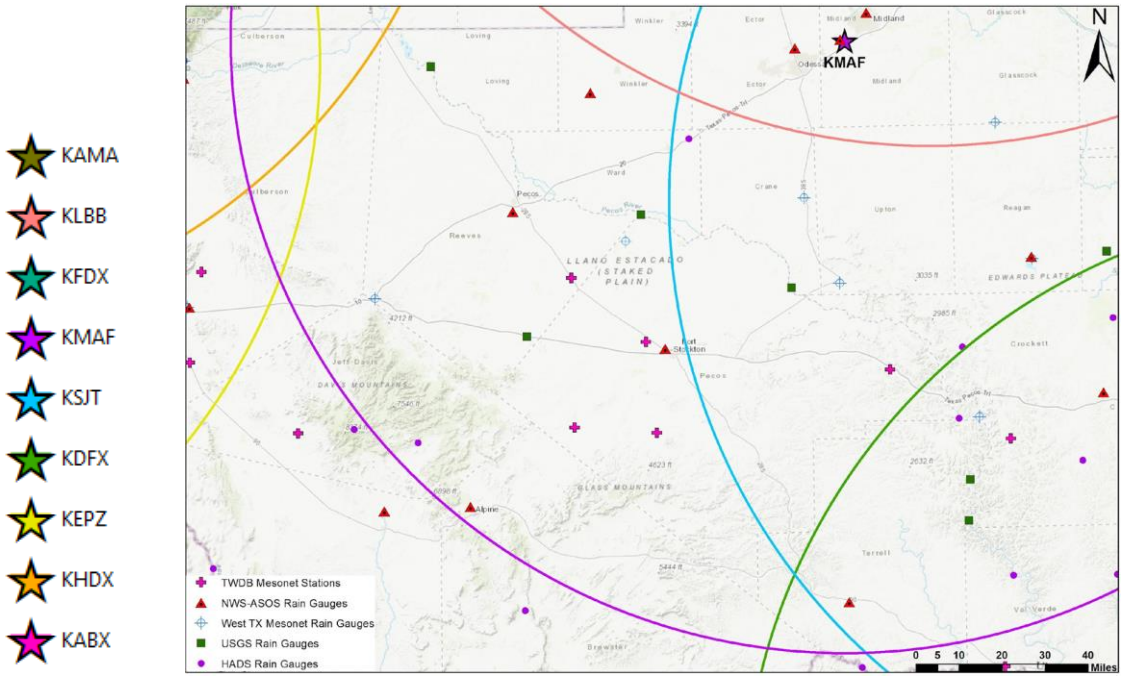


Figure 2. Radar coverage and rain gauge locations for Fort Stockton, Texas.

Scope of Services

Vieux & Associates, an AEM brand, proposes one level of service to comprise a Flood Early Warning System for the City of Ft. Stockton, Texas.

Level 1 of the Flood Early Warning System recommends the installation of new hardware for in situ measurement of rainfall and water elevation combined with a monthly subscription for automated email alerts that provide the rainfall forecast along with measurement from the sensors, if the sensors are connected to a cellular network to transmit data in real time. The rainfall forecast product that will be provided is the High Resolution Rapid Refresh model, which is an 18-hour quantitative precipitation forecast produced by the National Weather Service. Additionally, a rain gauge network and alert threshold analysis is recommended to evaluate the current rain gauge network, make recommendations for the installation of additional hardware along with specifications for a low cost, compact weather station, and establish region-specific alert thresholds for the automated email alerts. More information about these services can be found in the Appendix.

Cost Proposal

The quoted cost proposal for Level 1 of the Flood Early Warning System is listed below. The quote is valid until January 1, 2023.

No.	Item	Unit	Amount	Quantity	Total
1	Automated Email Alerts				
	HRRR Forecast	Recurring Monthly	$500	12	$6,000
	In Situ Sensors (up to 15 sensors if transmitting data in real time over a cellular network)	Recurring Monthly	$500	12	$6,000
	Alert Configuration & Set Up	Labor	$900	1	$900
2	Rain Gauge Network and Alert Threshold Analysis	Labor	$40,680	1	$40,680
3	Wireless Weather Station with Console for Measuring Rainfall, Temp/RH, Wind Speed Note: Requires AC Power	Each	$910.00	1	$910.00
	Mounting Hardware	Each	$150.00	1	$150.00
				Level 1 Total Fixed Price[1] =	**$54,640.00**

*The Level 1 Total Fixed Price assumes 12 months for the automated email alerts and complete set-up for one wireless weather station. The number of months for automated email alerts and quantity of weather stations is an estimate for the purpose of this quote and can be adjusted according to the recommendations made as part of the rain gauge network analysis.

Appendix

Hardware

A compact, low-cost weather station that provides measurements of precipitation, temperature, relative humidity, wind speed and direction, and barometric pressure is recommended. The hardware package for this station includes a small desktop console for viewing real-time data so decision makers can take appropriate action. Each weather station can be configured to transmit data in real time using a data plan from any cellular provider; without a data plan, the data can be collected and viewed on the console. Note that without a data plan, data collected from this weather station cannot be included in the automated email alerts.

Rain Gauge Network and Alert Threshold Analysis

A rain gauge network analysis will be conducted that evaluates the existing rain gauge network, placement of existing gauges, and makes recommendations for the installation (including location and number) of new rain gauges to create a full coverage rain gauge network. The findings from the rain gauge network analysis will be documented in a technical memorandum. The alert threshold analysis will be conducted to analyze historical rainfall events and identify up to 5 rainfall events (including size and duration) for a flood triggering event.

Automated Email Alerts

Automated email alerts will be generated when a pre-defined rainfall threshold is exceeded based upon rainfall information for the area from the High Resolution Rapid Refresh (HRRR) model or as measured by in-situ rain gauges (if the gauges are connected to a cellular plan for data transmittal). HRRR is a longer-term quantitative precipitation forecast (QPF), maintained by the National Weather Service, and provides a forecast up to 18 hours. HRRR is provided in a gridded format, and is generated by numerical weather prediction models which Vieux improves by filling gaps in the operational data stream to enhance reliability.

The area of coverage will include the City of Fort Stockton and its nearby surrounding areas, up to a radius of 15 km from the city center. The rainfall thresholds are user-defined, and up to 5 thresholds can be set to trigger automated email alerts.

Images from an example email alert are shown in Figure 3. The example automated email alert displays the alert location, maximum storm depth, time of the maximum, and alert type (e.g., HRRR). A map of the radar with a rainfall depth legend accompanies the email alert.

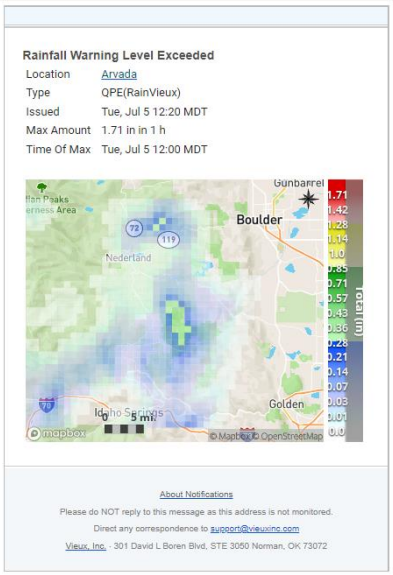


Figure 3. An example automated email alert.

Proposal for Marfa, Texas

Flood Early Warning System

SUBMITTED BY
Sue Swenor
Sales Manager – Texas & Oklahoma
[Phone: 1.512.931.9530 | Email: sue.swenor@aem.eco

DATE
July 11, 2022

Background

There are three primary HUC12 watersheds responsible for runoff production and contribute to flood risk in the City of Marfa: Cuervo Draw-Alamito Creek, Fourmile Draw-Alamito Creek, and Ponder Draw. The Fourmile Draw-Alamito Creek watershed covers the southern portion of Marfa, and the main flooding risk generated from this watershed is an unnamed tributary of Alamito Creek. The main flooding risk generated from the Fourmile Draw-Alamito Creek watershed is an unnamed tributary of Alamito Creek. Alamito Creek is the main flooding risk for Marfa in the Cuervo Draw-Alamito Creek watershed. The contributing drainage area for Alamito Creek in Marfa includes two additional HUC12 watersheds: North Fork Alamito Creek and South Fork Alamito Creek. Efforts to develop a early warning system for Alamito Creek should consider all three HUC12 basins contributing drainage area to the segment of Alamito Creek in Marfa because Alamito Creek is ungauged upstream of Marfa.

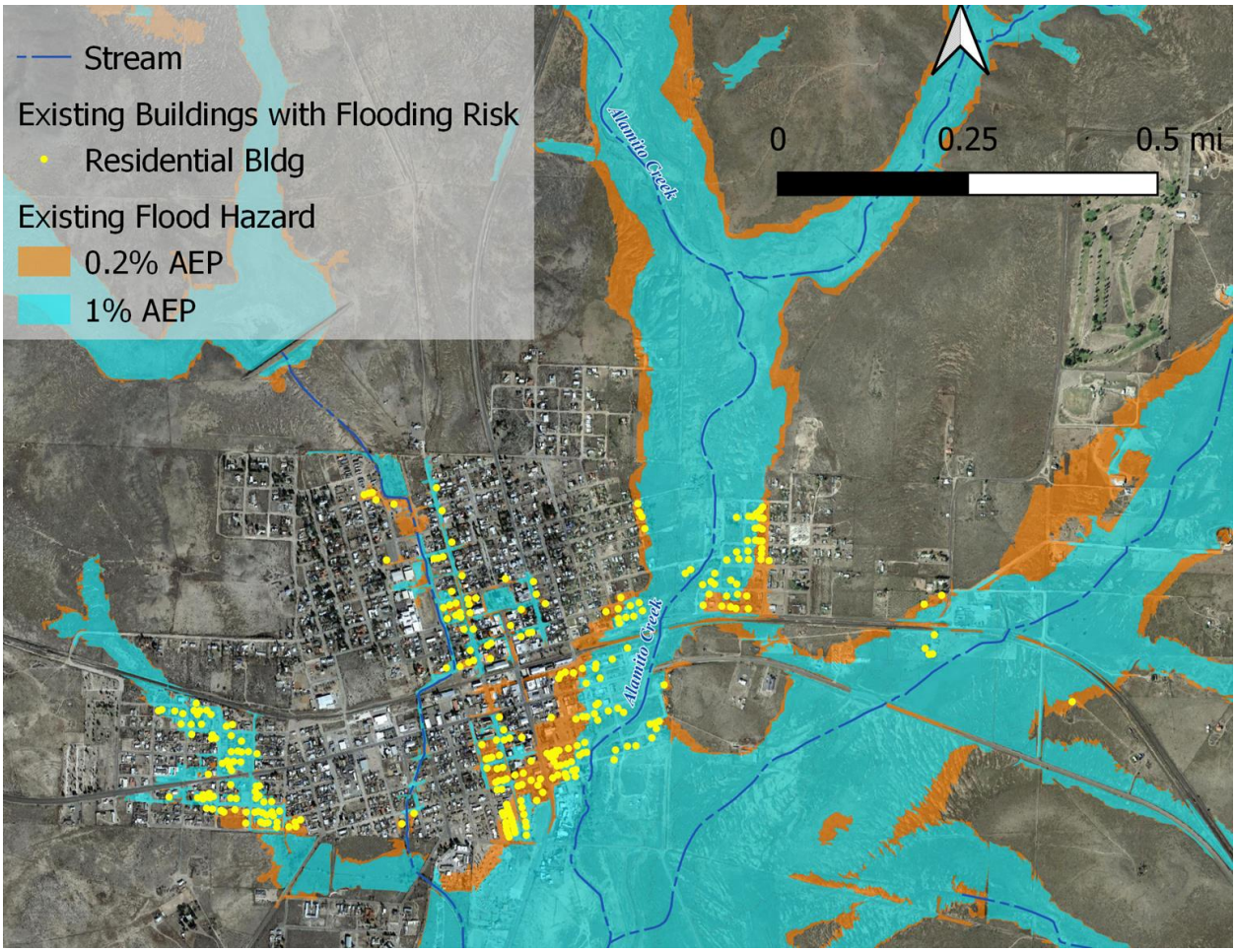


Figure 1. Flooding risk in Marfa, Texas.

There is currently no NEXRAD radar coverage for the City of Marfa because it sits outside the coverage radius of KMAF and KEPZ (Figure 2). However, there are three NWS-ASOS rain gauges in the area surrounding the City. In addition to the NWS-ASOS stations there are

two TWDB Mesonet stations, one West TX Mesonet rain gauges, and seven HADS rain gauges in the surrounding area.

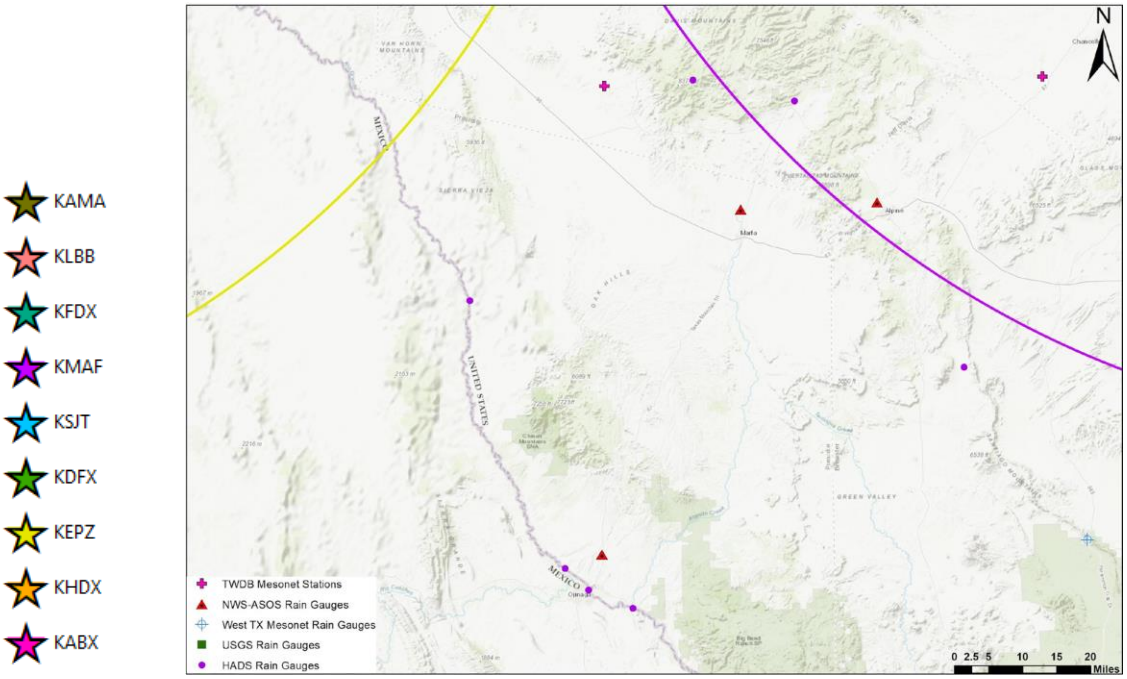


Figure 2. Radar coverage and rain gauge locations for Marfa, Texas.

Scope of Services

Vieux & Associates, an AEM brand, proposes one level of service to comprise a Flood Early Warning System for the City of Marfa, Texas.

Level 1 of the Flood Early Warning System recommends the installation of new hardware for in situ measurement of rainfall and water elevation combined with a monthly subscription for automated email alerts that provide the rainfall forecast along with measurement from the sensors, if the sensors are connected to a cellular network to transmit data in real time. The rainfall forecast product that will be provided is the High Resolution Rapid Refresh model, which is an 18-hour quantitative precipitation forecast produced by the National Weather Service. Additionally, a rain gauge network and alert threshold analysis is recommended to evaluate the current rain gauge network, make recommendations for the installation of additional hardware along with specifications for a low cost, compact weather station, and establish region-specific alert thresholds for the automated email alerts. More information about these services can be found in the Appendix.

Cost Proposal

The quoted cost proposal for Level 1 of the Flood Early Warning System is listed below. The quote is valid until January 1, 2023.

No.	Item	Unit	Amount	Quantity	Total
1	Automated Email Alerts				
	HRRR Forecast	Recurring Monthly	$500	12	$6,000
	In Situ Sensors (up to 15 sensors if transmitting data in real time over a cellular network)	Recurring Monthly	$500	12	$6,000
	Alert Configuration & Set Up	Labor	$900	1	$900
2	Rain Gauge Network and Alert Threshold Analysis	Labor	$40,680	1	$40,680
3	Wireless Weather Station with Console for Measuring Rainfall, Temp/RH, Wind Speed Note: Requires AC Power	Each	$910.00	1	$910.00
	Mounting Hardware	Each	$150.00	1	$150.00
				Level 1 Total Fixed Price[1] =	**$54,640.00**

*The Level 1 Total Fixed Price assumes 12 months for the automated email alerts and complete set-up for one wireless weather station. The number of months for automated email alerts and quantity of weather stations is an estimate for the purpose of this quote and can be adjusted according to the recommendations made as part of the rain gauge network analysis.

Appendix

Hardware

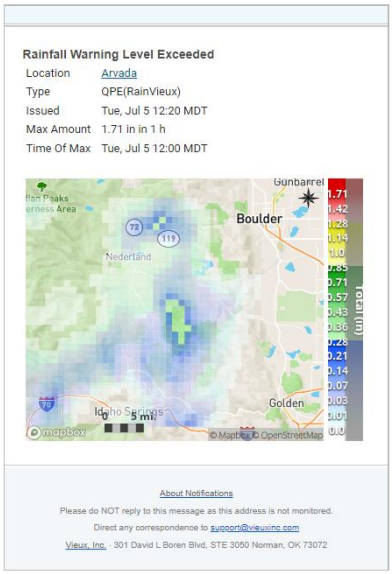
A compact, low-cost weather station that provides measurements of precipitation, temperature, relative humidity, wind speed and direction, and barometric pressure is recommended. The hardware package for this station includes a small desktop console for viewing real-time data so decision makers can take appropriate action. Each weather station can be configured to transmit data in real time using a data plan from any cellular provider; without a data plan, the data can be collected and viewed on the console. Note that without a data plan, data collected from this weather station cannot be included in the automated email alerts.

Rain Gauge Network and Alert Threshold Analysis

A rain gauge network analysis will be conducted that evaluates the existing rain gauge network, placement of existing gauges, and makes recommendations for the installation (including location and number) of new rain gauges to create a full coverage rain gauge network. The findings from the rain gauge network analysis will be documented in a technical memorandum. The alert threshold analysis will be conducted to analyze historical rainfall events and identify up to 5 rainfall events (including size and duration) for a flood triggering event.

Automated Email Alerts

Automated email alerts will be generated when a pre-defined rainfall threshold is exceeded based upon rainfall information for the area from the High Resolution Rapid Refresh (HRRR) model or as measured by in-situ rain gauges (if the gauges are connected to a cellular plan for data transmittal). HRRR is a longer-term quantitative precipitation forecast (QPF), maintained by the National Weather Service, and provides a forecast up to 18 hours. HRRR is provided in a gridded format, and is generated by numerical weather prediction models which Vieux improves by filling gaps in the operational data stream to enhance reliability.



The area of coverage will include the City of Marfa and its nearby surrounding areas, up to a radius of 15 km from the city center. The rainfall thresholds are user-defined, and up to 5 thresholds can be set to trigger automated email alerts.

Images from an example email alert are shown in Figure 3. The example automated email alert displays the alert location, maximum storm depth, time of the maximum, and alert type (e.g., HRRR). A map of the radar with a rainfall depth legend accompanies the email alert.

Figure 3. An example automated email alert.