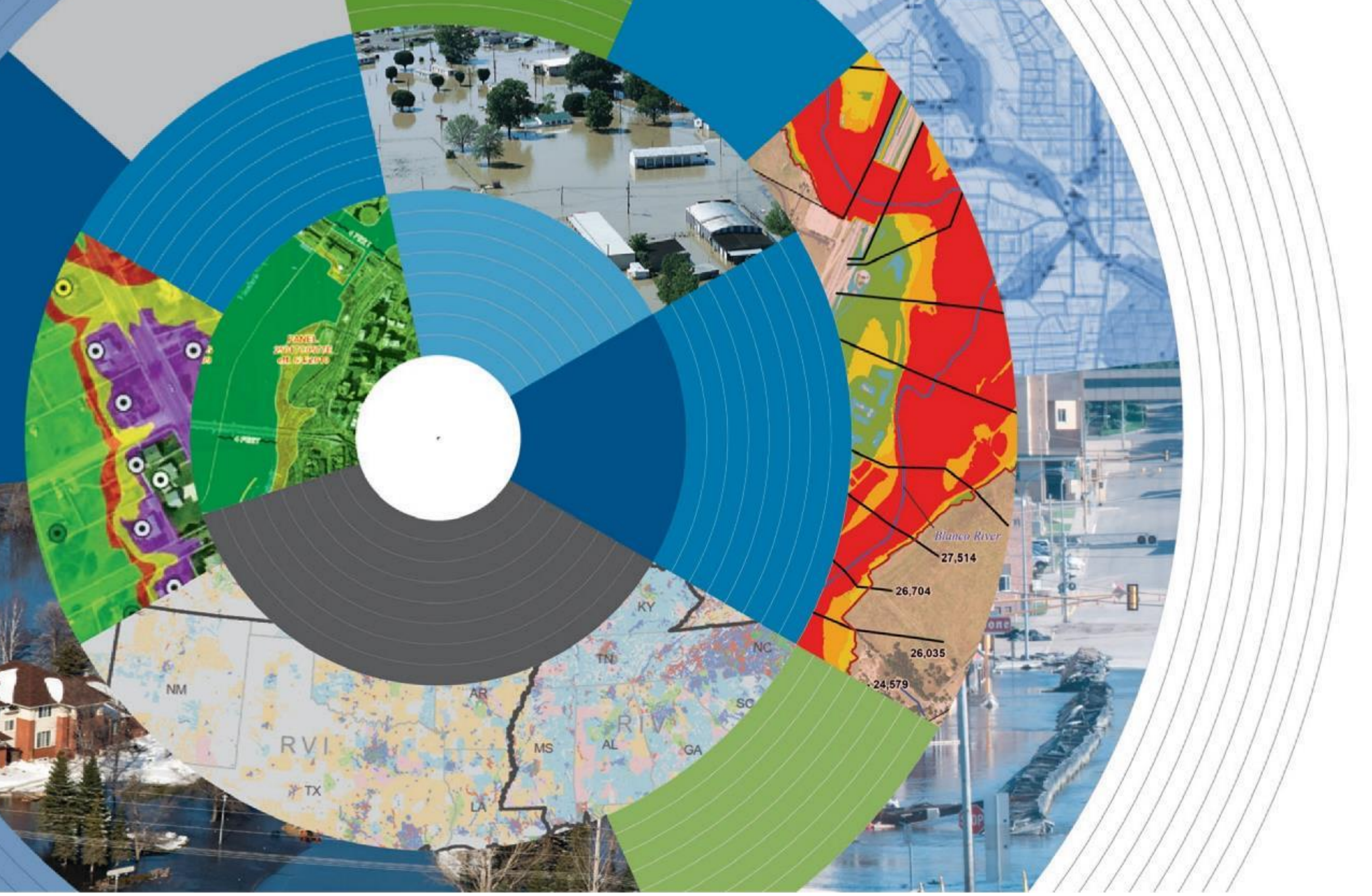

Base Level Engineering Report

Running Water Draw (HUC8 12050005)

Texas Water Development Board

April 2024

Version 2.0

Report Prepared for:

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Document History

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Enter MIP URL (K: Drive Location) here for future use.

Revision History

Version Number	Version Date	Summary of Changes	Author
1.0	February 2022	Initial Production	FTN/FNI
2.0	April 2024	Updated Section 4.0	FTN/FNI

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Executive Summary

The Texas Water Development Board (TWDB) contracted with the Freese and Nichols, Inc. (FNI) team in September 2021 to develop Base Level Engineering for multiple HUC8 Watersheds within the State. FTN Associates, Ltd., as a subcontractor and member of the FNI Team, will complete a Base Level Engineering (BLE) analysis for the Running Water Draw HUC-8 in Northwest Texas, to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHAs). This BLE study will provide significant data for several Texas counties previously lacking modernized flood models.

The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory-quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals.

The source digital terrain data used for surface model development in support of hydrologic and hydraulic analysis as well as mapping activities were leveraged from various local, State, and Federal partners.

Flood discharges and water surface elevations for this study were calculated by utilizing the rain-on-grid two-dimensional (2-D) modeling capabilities of the Hydrologic Engineering Center's River Analysis System (HEC-RAS), which translates rainfall into runoff based on an underlying terrain and various other physically based parameters. 2D HEC-RAS models were developed in accordance with the 2019 FEMA Region 6 Base Level Engineering Submittal Guidance, which relies heavily on *HEC-RAS River Analysis System, 2D Modeling Users' Manual 5.0* (Bruner, 2016). All models were developed in the HEC-RAS program version 6.1.0.

The stream mile network that was validated for these watersheds was compiled using FEMA's Community Needs Management Strategy (CNMS) inventory. CNMS is an inventory of flood hazard studies and flood hazard mapping needs for areas where a study is needed. This data is helpful for community officials in analyzing and depicting flood hazards to enhance the understanding of flood risks. Communities may use this information to make informed decisions on their planning and flood mitigation efforts. Table 1 lists the stream miles associated with this validation analysis.

Table 1: Summary of Stream Miles

Source	Stream Miles
CNMS	**882.6**
NHD (High)	**392.9**
Total	**1275.5**

The full inventory of Zone A studies in the watershed were classified in CNMS. Total miles validated in CNMS are summarized in Table 2 and illustrated in Figure 1 below.

Table 2: Zone A Validation Results

Validation Status	Status Type	Total Miles
VALID	NVUE COMPLIANT	7.3
UNVERIFIED	TO BE STUDIED	875.3

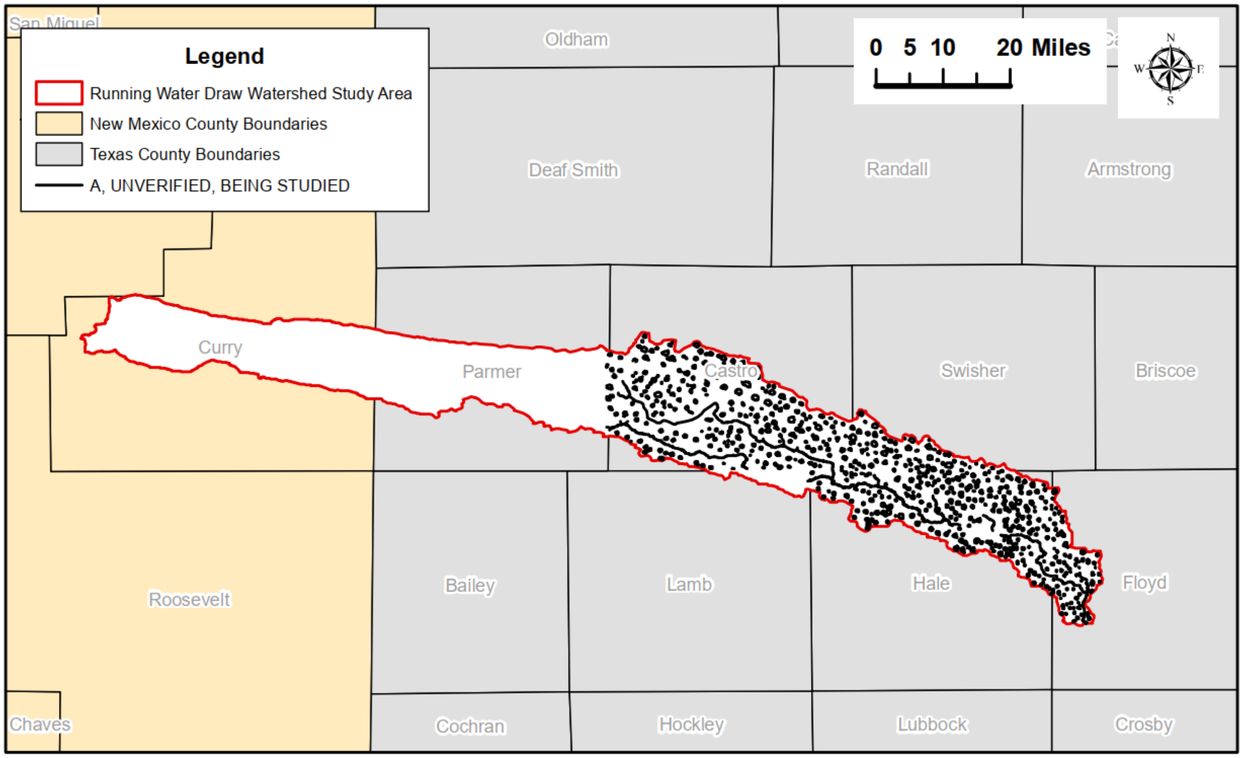

Figure 1: Running Water Draw HUC8 CNMS Validation Results

1.0 Introduction

Recent innovations and efficiencies in floodplain mapping have allowed the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) to develop a process called Base Level Engineering (BLE), which can be used to address current program challenges, including the validation of Zone A studies and the availability of flood risk data in the early stages of a Flood Risk Project. The BLE process involves using best available data and incorporating automated techniques with traditional model development procedures to produce regulatory quality flood hazard boundaries for the 1-percent annual chance event as well as estimates of flood hazard boundaries for multiple recurrence intervals. The cost for developing the data and estimates resulting from the BLE process are lower than standard flood production costs. The BLE results may be used for eventual production of regulatory and non-regulatory products.

As described in Title 42 of the Code of Federal Regulations, Chapter III, Section 4101(e), once every five years, FEMA must evaluate whether the information on Flood Insurance Rate Maps (FIRMs) reflects the current risks in flood prone areas. FEMA makes this determination of flood hazard data validity by examining flood study attributes and change characteristics, as specified in the Validation Checklist of the Coordinated Needs Management Strategy (CNMS) Technical Reference. The CNMS Validation Checklist provides a series of critical and secondary checks to determine the validity of flood hazard areas studied by detailed methods (e.g., Zone AE, AH, or AO). While the critical and secondary elements in CNMS provide a comprehensive method of evaluating the validity of Zone AE studies, a cost-effective approach for evaluating Zone A studies has been lacking.

In addition to the need for Zone A validation guidance, FEMA standards require flood risk data to be provided in the early stages of a Flood Risk Project. FEMA Program Standard SID #29 requires that during Discovery, data must be identified that illustrates potential changes in flood elevation and mapping that may result from the proposed project scope. If available data does not clearly illustrate the likely changes, an analysis is required that estimates the likely changes. This data and any associated analyses should be shared, and results should be discussed with stakeholders. An important goal of the BLE process is the scalability of the results. Scalability means that the results of a BLE analysis can not only be used for CNMS evaluations of Zone A studies but can also be leveraged throughout the Risk MAP program. The data resulting from a BLE analysis can be updated as needed and used for the eventual production of regulatory and non-regulatory products, outreach and risk communication, and MT-1 processing. Leveraging this data outside the Risk MAP program may also be valuable to external stakeholders.

TWDB contracted the Freese and Nichols team to complete a BLE analysis for the Running Water Draw Watershed in Northwest Texas to support FEMA's Discovery process and validation of effective Zone A Special Flood Hazard Areas (SFHA). The study extents include portions of Curry, Parmer, Castro, Lamb, Swisher, Hale, and Floyd Counties, and include the following communities: the Cities of Dimmitt, Hart, Bovina, Plainview, and the town of Edmonson. The study area consists of five HUC-10 basins: Running Water Draw, Town of Sunnyside-Running Water Draw, Town of Dimmitt-North Fork, Slaton Draw-Running Water Draw, and Duncan Lake-Running Water Draw. Figure 2 shows the location of the Running Water Draw HUC-10 basins with respect to the counties and communities mentioned above.

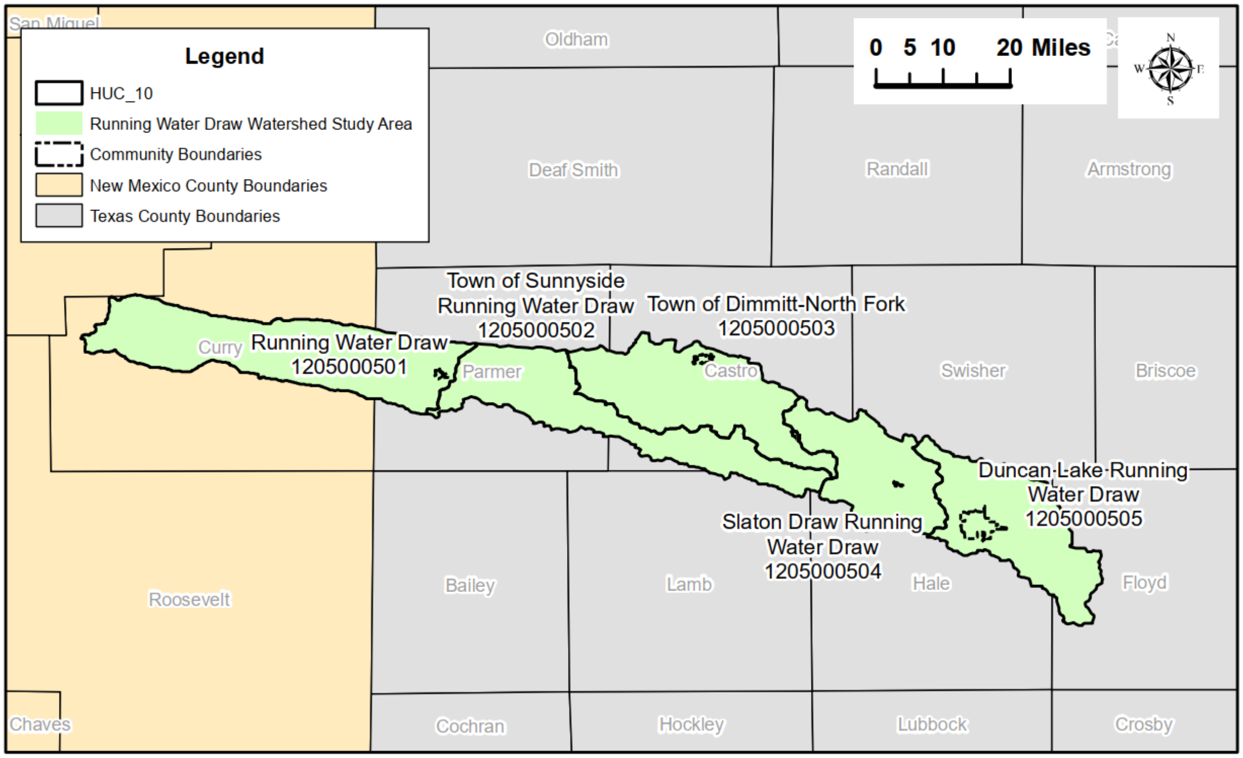

Figure 2: Running Water Draw Watershed HUC-10 Basins

The Base Level Engineering assessment prepared cursory engineering analysis for approximately 882 miles of stream reaches within the Running Water Draw Watershed with a minimum drainage area tolerance of one square mile. The Running Water Draw Watershed contains distinct topography for its watershed. The distinct topographies correlate to unique flood infrastructure for each of the subregions. The Texas headwater areas for each subregion are dominated by the playa lake system, while the New Mexico headwater area is dominated by a combination of playas and riverine characteristics (e.g., comprised primarily of rivers and streams). Due to the varied natural infrastructure, stream reach delineations were only extended through the riverine subregions. The playa lakes are generally hydraulically disconnected, and therefore, stream reaches were not created for these features. These regions of the watershed are colloquially referred to as “on the caprock” to describe the geographical transition. The BLE analysis was completed using a 2D grid to represent the watershed and therefore the entire watershed was included in hydrologic and hydraulic modeling. The following sections will summarize the BLE process and will discuss the results along with their recommended use.

2.0 2D BLE Modeling Inputs and Controls

Section 2.0 discusses the fundamental components required to execute a 2D BLE analysis for the Running Water Draw (HUC 12050005) Watershed. Inputs including elevation data, hydrology from rain-on-grid and inflow hydrographs, and hydraulic analyses and variables are defined in the following sections. The HEC-RAS 6.1.0 rain-on-grid utility was applied in the production of these Texas 2D BLE products.

2.1 Topographic Data

A high-resolution Digital Elevation Model (DEM) derived from Light Detection and Ranging (LiDAR) provides a detailed representation of the Earth's surface. DEMs are one of the fundamental components for 2D engineering analyses and are used to direct the hydrology through the model area. The seamless DEMs developed to support the 2D BLE modeling and analysis, within the Running Water Draw watershed, were executed using the following steps:

- Available 1-meter DEMs within each watershed were inventoried and sourced from FEMA, NOAA, and USGS;
- Seamless DEMs were produced using GIS spatial analyst and 3D analyst tools and resampled to 10-foot resolution; and,
- Quality Assurance (QA) and Quality Control (QC) measures were implemented to ensure topographic data meets quality standards of the project.

Additional documentation regarding DEMs including coverage, accuracy, acquisition dates, and source contact/agency are presented in the figures, tables, and text in the sections below.

2.1.1 Inventory

DEMs were inventoried for the Running Water Draw Watershed, including an approximate 1-mile buffer around the watershed boundary. Figure 2 depicts the datasets identified and leveraged for the watershed. Data from FEMA, NOAA, and USGS were queried to build the inventory with the most current and available data sources.

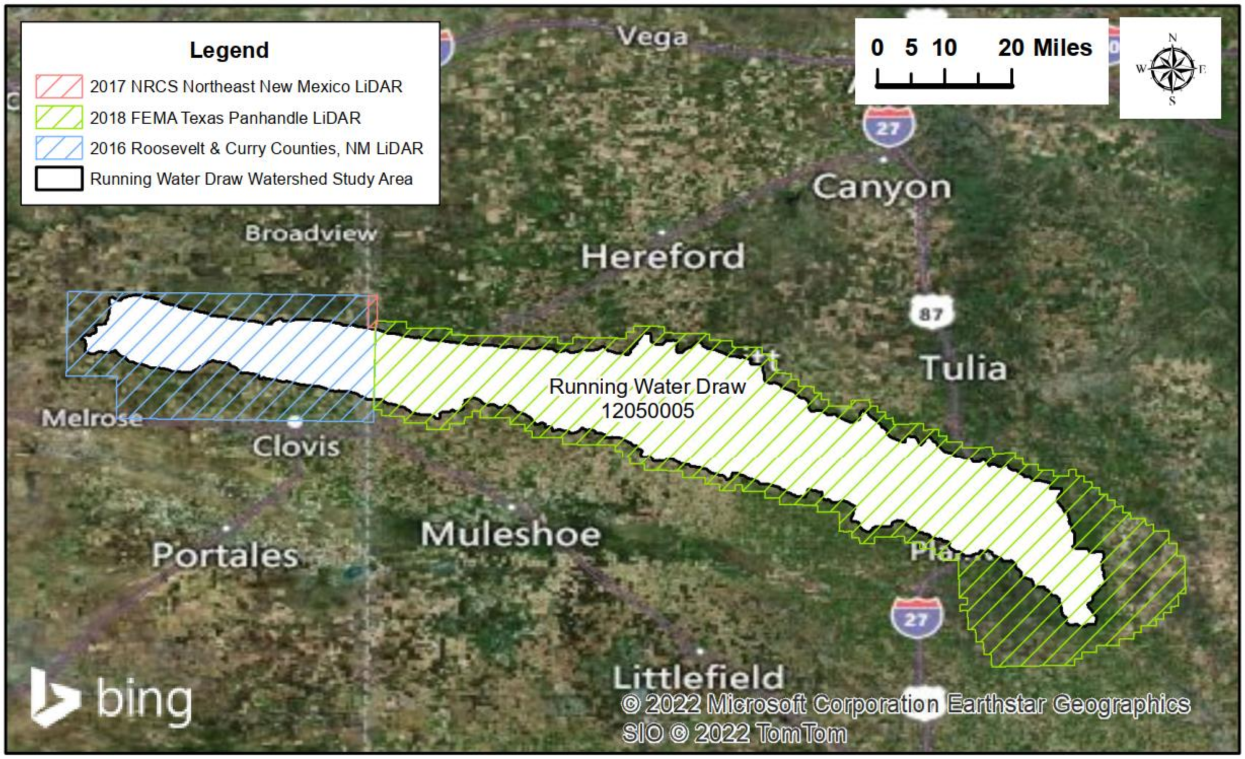

Figure 3: Running Water Draw Watershed BLE Source Terrain Data

2.1.2 Evaluation

A data coverage assessment was conducted to check for data gaps, extent, accuracy, and completeness. A review of related documentation, reports, indexes, and metadata associated with the leveraged datasets ensured each dataset meets FEMA accuracy requirements for topographic data as defined in the FEMA 2020 BLE Region 6 Submittal Guidance document. Table 3 presents the complete list of source elevation data and attributes leveraged for the Running Water Draw watershed.

Table 3: Source Topographic Data (DEMs) Leveraged for Running Water Draw Watershed

Counties	Year	Description	Data Type	3DEP Quality Level	Vertical Accuracy (RMSE)	Source/Owner	Approximate Footprint (Sq. Mi.)
Parmer, Castro, Lamb, Swisher, Hale, Floyd	2018	FEMA Texas Panhandle LiDAR	Airborne LiDAR	2	4.8 cm	USGS	1901
Curry	2017	NRCS Northeast New Mexico LiDAR	Airborne LiDAR	2	4.3 cm	USGS	5
Curry	2016	Roosevelt & Curry Counties, NM LiDAR	Airborne LiDAR	2	N/A	USGS	664

2.1.2.1 Watershed Source Terrain Data

The source elevation data for the Running Water Draw watershed were 1-meter DEMs derived from the 2018 FEMA Texas Panhandle LiDAR data, 2017 NRCS Northeast New Mexico LiDAR, and 2016 Roosevelt & Curry Counties, NM LiDAR. Figure 3 depicts the extent of the data defined in Table 3.

<u>USGS 2018 FEMA Texas Panhandle LiDAR</u>

The 2018 FEMA Texas Panhandle LiDAR was acquired between February 9, 2018 to September 3, 2019. The vertical accuracy for the dataset is reported to be 4.3 cm RMSEz at a 95% confidence level, which meets project accuracy specifications of the National Standard for Spatial Data Accuracy (NSSDA). These accuracies meet FEMA standards for floodplain reevaluation studies and map modernization programs designed to update the Flood Insurance Rate Maps (FIRM).

<u>2017 NRCS Northeast New Mexico LiDAR</u>

The 2017 NRCS Northeast New Mexico LiDAR was acquired between November 20, 2017 and February 11, 2018. The vertical accuracy for the dataset is reported to be 10 cm RMSEz at a 95% confidence level, which meets project accuracy specifications of the National Standard for Spatial Data Accuracy (NSSDA). These accuracies meet FEMA standards for floodplain reevaluation studies and map modernization programs designed to update the Flood Insurance Rate Maps (FIRM).

<u>2016 Roosevelt & Curry Counties, NM LiDAR</u>

The 2016 Roosevelt & Curry Counties, NM LiDAR was acquired between November 2015 and March 25, 2016. The vertical accuracy for the dataset is not listed per the US Interagency Elevation Inventory website; however, it is listed as Quality Level 2 or better, which meets project accuracy specifications of the NSSDA. These accuracies meet FEMA standards for floodplain reevaluation studies and map modernization programs designed to update the Flood Insurance Rate Maps (FIRM).

2.1.3 Data Development Methodology

DEMs were processed for the Running Water Draw watershed for the BLE modeling effort. Tools within ArcGIS were used to apply horizontal projection transformations and vertical datum shifts. The DEMs were projected horizontally to North American Datum of 1983 (NAD83), State Plane Coordinate System (SPCS) Texas North (4201) in feet. Additionally, all DEMs were adjusted vertically to NAVD88 in feet.

2.1.4 DEM QA/QC

2.1.4.1 DEM Quality Assurance

Seamless DEMs developed for use in the White watershed BLE analyses were developed and independently assured to meet QA standards of the project. QA standards during the data development process included, but were not limited to the following:

- Horizontal Projection Check (NAD83 SPCS 4202 FT)
- Vertical Datum Check (NAVD88 FT)
- Resolution Check (1-meter to 10-foot resolution)
- Seamless Data Check to ensure the DEM files are consistent and seamless along source data edges

2.1.4.2 DEM Quality Control

QC measures were implemented following the development process of the seamless DEMs and included visual observations using hillshade, color rendering, and/or other visual aids to review and identify potential impactful anomalies within the DEM surfaces. This QC step included, but was not limited to the following:

- Seamless Data Check to ensure no voids along the edges and between the prioritized datasets
- NoData Value Check to ensure no null values
- Manual Elevation Check using hillshade rasters to find erroneous elevation issues

Following these QA/QC steps, the final DEM data developed for the Running Water Draw Watershed are assured to meet FEMA standards and present a representative surface developed from leveraged elevation data for the purposes of this BLE project.

Stream centerlines were delineated to 1 square mile within each watershed and were cutoff at the caprock and/or first playa. Stream centerlines were smoothed and generalized.

2.2 2D BLE Methods

The following sections describe the methodology used in the 2D BLE analysis of the Running Water Draw Watershed. This section includes discussion regarding the overall approach along with hydrologic and hydraulic methodologies and results.

2.2.1 Model Areas

The Running Water Draw Watershed covers a total area of approximately 1,511 square miles. While possible to model the entire HUC8 in a single 2D HEC-RAS model, the large area would lead to excessively long model run times and inhibit the model's usability for future users. To combat this issue and simplify model development, the study team divided the Running Water Draw HUC8 into several smaller models, consisting of a single HUC10 or group of HUC10s within the larger HUC8. Table 4 and Figure 4 present the grouping of HUC10s for each 2D model. As described in Section 2.2.2 Model and Boundary Condition Setup, these models remain interconnected via external boundary conditions, so no runoff volume is lost through the subdivision of the HUC8.

Table 4: Running Water Draw Model Areas

Model	HUC10(s)	HUC10 Name(s)	Area (Sq. Mi.)
1205000501	1205000501	Running Water Draw	409
1205000502_3	1205000502, 1205000503	Town of Sunnyside-Running Water Draw, Town of Dimmitt-North Fork	611
1205000504	1205000504	Slaton Draw-Running Water Draw	214
1205000505	1205000505	Duncan Lake-Running Water Draw	277

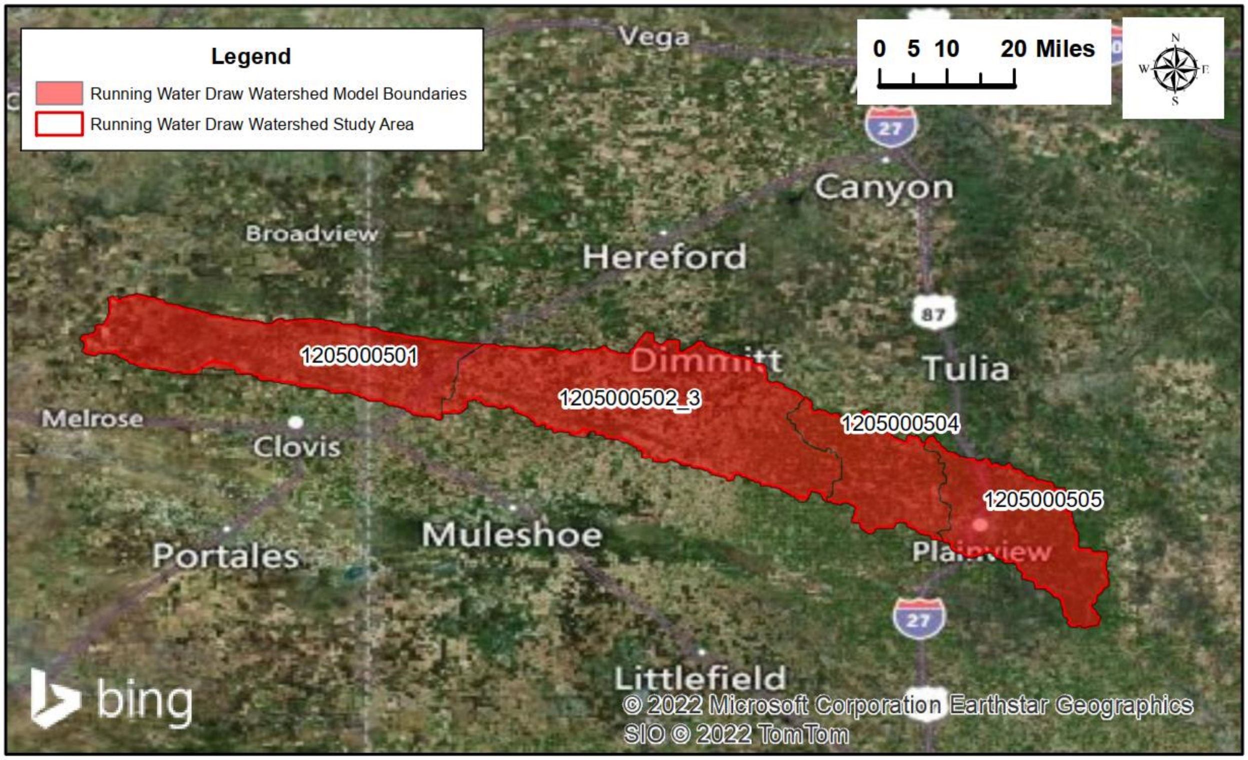

Figure 4: Running Water Draw Model Areas

2.2.2 Model and Boundary Condition Setup

HEC-RAS 2D rain-on-grid modeling requires two main components, a 2D computational mesh and inflow hydrology. HUC10 boundaries were used to establish the 2D computational mesh boundaries within the Running Water Draw HUC8, according to the groupings presented in Table 4. Inflow hydrology can be applied through various methods in HEC-RAS 2D modeling, but hydrology methods are limited to two categories for the Running Water Draw HUC8. These are flow hydrographs and precipitation time-series. Section 2.2.3.1 Precipitation for HEC-RAS 2D describes the development the precipitation data applied to each model. Precipitation, rather than excess precipitation, was applied directly to the 2D mesh because simplistic hydrologic losses can be accounted for entirely within HEC-RAS version 6.1.0.

External boundary conditions were applied along each model area's boundary where a transfer of flow (inflow or outflow) may occur. The upstream area of each model, where applicable, has an inflow hydrograph applied that accounts for outflow from the upstream model area. For example, the 1205000502_03 model has an inflow hydrograph at its upstream end that applies the outflow from the 1205000501 model.

A normal depth boundary condition was utilized along all basin outflows that uses an approximate energy grade-line slope estimated from the LiDAR terrain data.

2.2.3 2D Computational Mesh and Settings

The HEC-RAS 2D computational mesh defines both the extent and level of detail of 2D hydraulic results. The density and detail of the 2D mesh is the primary component that defines the resolution of hydraulic results (e.g., more detail-finer results, less detail-coarser results). A more detailed mesh may provide finely resolved and accurate results, but it can lead to excessively long computation times which are prohibitive to future use of BLE models. To provide a balance between mesh detail and model performance, the base mesh for each model was developed using 200’x200’ cells. The mesh was refined through the addition of breaklines along roadways, reservoirs, stream centerlines, and other topographically significant features. The mesh for each model area was developed in a manner that allows for automatic regeneration of the mesh by future users, without the need for manual cell edits.

Hydraulic results are also influenced by the many computational settings used in each HEC-RAS simulation. Of the available settings, the two most influential to results are the computational timestep and the equation set. Each model uses a 30-second computational timestep and applies the Diffusion Wave equation set. All other computational settings were kept at their default values as sensitivity analyses were conducted early in the modeling process and showed little to no impact on model results.

2.2.3 Hydrology

Hydrologic data for the Running Water Draw Watershed was derived from NOAA Atlas 14, Volume 11 Version 2.0 precipitation data, which was obtained from NOAA’s Precipitation Frequency Data Server. Spatial variation of precipitation depths was accounted for by developing area-weighted average depths for each model area presented in Table 4. For contributing basins outside of the study area, inflows were applied through an external boundary condition at the upstream boundary Running Water Draw watershed. The flow hydrograph for the contributing basin was obtained from the 2D BLE model of the respective watershed. The 10%, 4%, 2%, 1%-minus, 1%, 1%-plus, and 0.2% annual exceedance probability events were simulated in the Running Water Draw Watershed.

2.2.3.1 Precipitation for HEC-RAS 2D

The average NOAA Atlas 14 precipitation-frequency depths for each model area in Table 4 were converted to a precipitation time-series dataset within a simplified HEC-HMS v4.8 model. A frequency storm was created within HEC-HMS for each event listed in Section 2.2.3 Hydrology. Each frequency storm utilized the parameters listed in Table 5. The precipitation-frequency depths for each model area and simulation event are summarized in

Table 6 - Table 8: 1205000504– Precipitation-Frequency Depths

Duration (min)	Percent Annual Chance Precipitation Depth (in)						
	10%	4%	2%	1%-	1%	1%+	0.2%
5	0.62	0.76	0.88	0.79	1.01	1.24	1.35
15	1.22	1.51	1.75	1.55	2.00	2.45	2.67
60	2.05	2.55	2.95	2.62	3.38	4.13	4.49
120	2.42	2.99	3.45	2.81	3.94	5.06	5.23
180	2.63	3.24	3.73	3.05	4.24	5.43	5.63
360	3.00	3.69	4.23	3.50	4.80	6.11	6.36

720	3.40	4.18	4.80	4.01	5.45	6.88	7.21
1440	3.86	4.74	5.43	4.59	6.17	7.74	8.13

. A precipitation time-series was then extracted from the HEC-HMS models and utilized in the HEC-RAS 2D simulations.

In addition to the recurrence interval precipitation depths, NOAA Atlas 14 also provides 90% confidence limits for each reported precipitation depth. The 90% confidence intervals correspond to +/- 1.645 standard deviations. The 1%-minus and 1%-plus events utilize the 1% precipitation depths +/- 1.645 standard deviations.

Table 5: HEC-HMS Frequency Storm Parameters

Parameter	Value
Annual-Partial Conversion	None
Storm Duration	1-day
Intensity Duration	5-minute
Intensity Position	50%
Area Reduction	None
Storm Area	-

Table 6: 1205000501– Precipitation-Frequency Depths

Duration (min)	Percent Annual Chance Precipitation Depth (in)						
	10%	4%	2%	1%-	1%	1%+	0.2%
5	0.59	0.73	0.83	0.74	0.95	1.15	1.25
15	1.17	1.43	1.65	1.47	1.87	2.28	2.45
60	1.96	2.40	2.76	2.46	3.14	3.82	4.12
120	2.28	2.81	3.24	2.69	3.70	4.71	4.91
180	2.47	3.04	3.51	2.93	4.01	5.10	5.37
360	2.81	3.46	3.99	3.38	4.57	5.77	6.15
720	3.20	3.92	4.50	3.84	5.14	6.43	6.88
1440	3.66	4.47	5.12	4.41	5.81	7.21	7.72

Table 7: 1205000502_3 – Precipitation-Frequency Depths

Duration (min)	Percent Annual Chance Precipitation Depth (in)						
	10%	4%	2%	1%-	1%	1%+	0.2%
5	0.60	0.74	0.85	0.75	0.96	1.18	1.28
15	1.18	1.46	1.67	1.48	1.90	2.32	2.52
60	1.99	2.45	2.81	2.49	3.19	3.90	4.22
120	2.34	2.88	3.31	2.71	3.76	4.81	4.96
180	2.54	3.13	3.59	2.97	4.09	5.21	5.38
360	2.90	3.57	4.10	3.42	4.65	5.89	6.12
720	3.29	4.03	4.61	3.95	5.23	6.51	6.89
1440	3.73	4.55	5.20	4.43	5.89	7.35	7.76

Table 8: 1205000504– Precipitation-Frequency Depths

Duration (min)	Percent Annual Chance Precipitation Depth (in)						
	10%	4%	2%	1%-	1%	1%+	0.2%
5	0.62	0.76	0.88	0.79	1.01	1.24	1.35
15	1.22	1.51	1.75	1.55	2.00	2.45	2.67
60	2.05	2.55	2.95	2.62	3.38	4.13	4.49
120	2.42	2.99	3.45	2.81	3.94	5.06	5.23
180	2.63	3.24	3.73	3.05	4.24	5.43	5.63
360	3.00	3.69	4.23	3.50	4.80	6.11	6.36
720	3.40	4.18	4.80	4.01	5.45	6.88	7.21
1440	3.86	4.74	5.43	4.59	6.17	7.74	8.13

Table 9: 1205000505– Precipitation-Frequency Depths

Duration (min)	Percent Annual Chance Precipitation Depth (in)						
	10%	4%	2%	1%-	1%	1%+	0.2%
5	0.63	0.79	0.92	0.83	1.07	1.31	1.45
15	1.25	1.56	1.83	1.64	2.11	2.59	2.87
60	2.14	2.68	3.12	2.79	3.60	4.41	4.86
120	2.54	3.16	3.66	2.98	4.20	5.42	5.68
180	2.76	3.43	3.96	3.23	4.53	5.82	6.13
360	3.17	3.91	4.50	3.71	5.13	6.56	6.94
720	3.59	4.45	5.13	4.16	5.86	7.56	7.88
1440	4.07	5.04	5.82	4.93	6.65	8.37	8.87

2.2.3.2 Hydrologic Losses

Hydrologic losses were calculated within HEC-RAS according to the SCS Curve Number method. Curve numbers were calculated by intersecting the National Land Cover Dataset (NLCD) 2019 with soils data obtained from the USDA Soil Survey Geographic Database (SSURGO). A curve number was then assigned to each resultant value of the intersected land cover classification and hydrologic soil group, as presented in Table 10. Default Curve Numbers were originally applied to the model, but the Antecedent Runoff Condition II (ARC II) values were lowered by 15 to better match gage peak flows. These parameters represent the Curve Numbers applied to the HEC-RAS 2D models, which correspond to ARC II, or average antecedent moisture conditions. The values presented in Table 10 represent adjusted CN values that were utilized in the 10%, 4%, 2%, 1%, and 0.2% events. The initial abstraction ratio for the default CN layer was set to 0.20.

Table 10: Land Use-Soils-CN Matrix

Land Use Grid Code	NLCD Land Use Description	Hydrologic Soil Group			
		A	B	C	D
11	Open Water	99	99	99	99
21	Developed Open Space	34	54	64	69
22	Developed Low Intensity	46	60	68	72
23	Developed Medium Intensity	66	73	76	78
24	Developed High Intensity	74	77	79	80
31	Barren Land	24	46	59	65
41	Deciduous Forest	15	40	55	62
42	Evergreen Forest	15	40	55	62
43	Mixed Forest	15	40	55	62
52	Shrub Scrub	15	33	50	58
71	Herbaceous	34	47	59	70
81	Hay Pasture	24	46	59	69
82	Cultivated Crops	36	52	61	65
90	Woody Wetlands	57	65	72	78
95	Emergent Herbaceous Wetlands	57	65	72	78

The 1%-minus and 1%-plus events utilize CNs that correspond to dry (ARC1.5) and wet (ARCIII) antecedent moisture conditions. The values presented in Table 10 were adjusted according to the methodology presented in NRCS's National Engineering Handbook and referenced in Appendix A of FEMA Region 6's BLE Submittal Guidance. CN1.5 and CNIII values are documented in Table 11 and Table 12, respectively. The initial abstraction ratio for the CN1.5 and CNIII layers was set to 0.20.

Table 11: Land Use-Soils-CN1.5 Matrix

Land Use Grid Code	NLCD Land Use Description	Hydrologic Soil Group			
		A	B	C	D
11	Open Water	98	98	98	98
21	Developed Open Space	26	44	54	60
22	Developed Low Intensity	37	50	58	63
23	Developed Medium Intensity	56	64	67	69
24	Developed High Intensity	65	68	71	72
31	Barren Land	18	37	49	55
41	Deciduous Forest	11	31	45	52
42	Evergreen Forest	11	31	45	52
43	Mixed Forest	11	31	45	52
52	Shrub Scrub	11	25	41	48
71	Herbaceous	26	38	49	61
81	Hay Pasture	18	37	49	60
82	Cultivated Crops	28	42	51	55
90	Woody Wetlands	47	55	63	69
95	Emergent Herbaceous Wetlands	47	55	63	69

Table 12: Land Use-Soils-CNIII Matrix

Land Use Grid Code	NLCD Land Use Description	Hydrologic Soil Group			
		A	B	C	D
11	Open Water	100	100	100	100
21	Developed Open Space	54	73	81	84
22	Developed Low Intensity	66	78	84	86
23	Developed Medium Intensity	82	87	89	90
24	Developed High Intensity	88	89	91	91
31	Barren Land	42	66	77	82
41	Deciduous Forest	30	60	74	79
42	Evergreen Forest	30	60	74	79
43	Mixed Forest	30	60	74	79
52	Shrub Scrub	30	53	70	76
71	Herbaceous	54	67	77	85
81	Hay Pasture	42	66	77	84
82	Cultivated Crops	56	71	78	82
90	Woody Wetlands	75	82	86	90
95	Emergent Herbaceous Wetlands	75	82	86	90

2.2.4 Hydraulics

Hydraulic analysis of the Running Water Draw Watershed was conducted in HEC-RAS v6.1.0 using a rain-on-grid modeling approach. This section describes the development of hydraulic input data and its implementation in the 2D model.

2.2.4.1 Roughness Coefficients

A manning's roughness layer was developed for the 2D mesh by applying typical values associated with NLCD land cover classifications. In addition to the base manning's roughness layer from the NLCD data, manning's roughness values were refined along stream centerlines to override excessively high channel roughness values resulting from the NLCD layer. Channel roughness values were assigned according to a review of aerial imagery and generally range from 0.04 – 0.06. Table 13 documents the typical roughness values assigned to each NLCD land cover classification, which correspond with the 2019 FEMA Region 6 Base Level Engineering Submittal Guidance document.

Table 13: NLCD 2019 Manning's Roughness

Land Use Grid Code	NLCD Land Use Description	Minimum Manning's N	Maximum Manning's N	Selected Manning's N
11	Open Water	0.025	0.05	0.03
21	Developed Open Space	0.03	0.05	0.04
22	Developed Low Intensity	0.06	0.12	0.06
23	Developed Medium Intensity	0.08	0.16	0.08
24	Developed High Intensity	0.12	0.2	0.12
31	Barren Land	0.023	0.03	0.03
41	Deciduous Forest	0.10	0.20	0.1
42	Evergreen Forest	0.08	0.16	0.1
43	Mixed Forest	0.08	0.20	0.1
52	Shrub Scrub	0.07	0.16	0.07
71	Herbaceous	0.025	0.05	0.035
81	Hay Pasture	0.025	0.05	0.045
82	Cultivated Crops	0.02	0.05	0.045
90	Woody Wetlands	0.045	0.15	0.10
95	Emergent Herbaceous Wetlands	0.05	0.085	0.07

2.2.4.2 Breaklines and Hydraulic Structures

Breaklines were used within the 2D mesh to align cell faces along stream centerlines, roadway and railroad embankments, and other hydraulically significant features. Roadway centerlines were initially identified within ArcGIS and then imported into HEC-RAS as breaklines. Hydraulically significant culvert crossings at roadways were identified based on embankment height, volume behind the embankment, and contributing area. For hydraulically significant features, v-notches were added at the culvert crossing to approximate the capacity of the culvert. Adding v-notches to the significant roadway embankments aids in appropriately accounting for storage within the watershed. **Error! Reference source not found.** shows an example of a v-notch breakline.

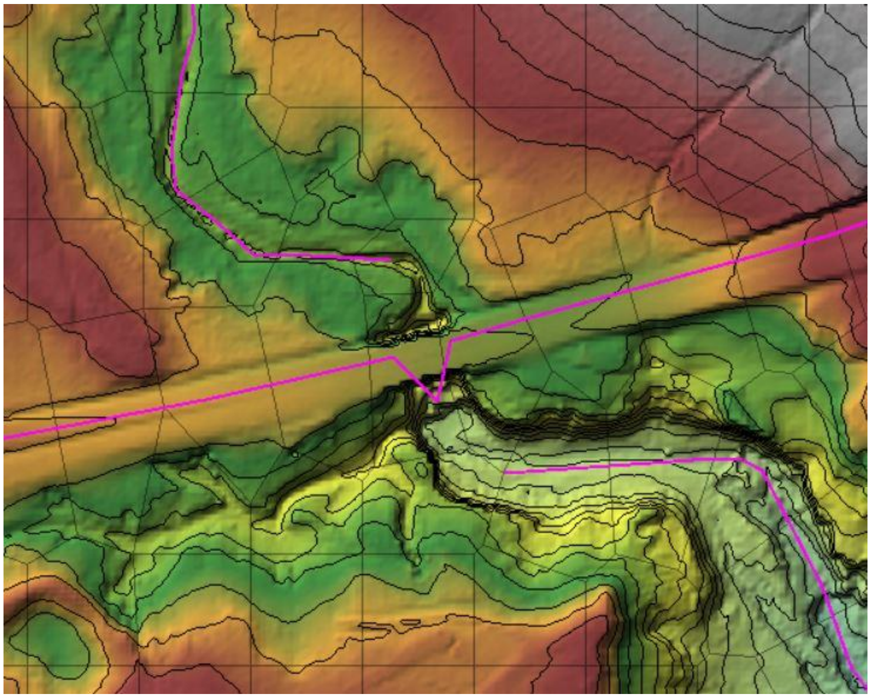

Figure 5: V-Notch Breakline Example

2.2.4.3 Initial Conditions

Initial conditions in the Running Water Draw Watershed are influenced by the dominance of playa lakes in overland areas along the caprock. The applicability of an initial water surface elevation within the playas was investigated during a sensitivity analysis. The study team referenced City of Lubbock criteria and *Playa Lakes in the Southern High Plains: Runoff, Infiltration, and Recharge* (Weinberg et.al, 2021) when determining an appropriate initial condition for the playa lakes. The study team created an initial condition run that applies 2" of rainfall that is then allowed to infiltrate and flow completely out of each model area. A restart file was generated at the end of this simulation, which was then applied as the initial conditions of each frequency event simulation.

As documented in Section 2.3.2 Sensitivity Analysis, additional investigation is recommended to determine the appropriate playa initial conditions. The 2D BLE analysis relies on the LiDAR terrain to account for storage. Additional investigation into the playa conditions at the time of the LiDAR flight would be necessary to determine precise dry volume for each playa. The final BLE frequency event simulations discussed below utilized the conditions captured by the LiDAR as initial conditions.

2.3 Model Results

The results of this study produced an SFHA that provides additional and/or new mapping across most of the Running Water Draw HUC8. The estimated SFHA boundaries can serve as an estimate for flood risk in the area, which has not been previously studied. The discharge rates measured at key locations in the watershed compare reasonably well with the stream gage analysis. These results provide context for flood risk within the watershed and should be verified through community meetings before being applied to a regulatory product.

2.3.1 Stream Gage Analysis

There are two known USGS gages within the Running Water Draw watershed. To generate a point of comparison, the study team completed a flood frequency analysis according to Bulletin 17B and Bulletin 17C guidelines for the stream gages listed in Table 14 and presented in Figure 6. The Plainview gage (08080700) had two gaps in data spanning from 1953 – 1957 and 1978 – 2005, which prevented a complete period of record 17C analysis from being run. Therefore, 17C analyses were run for both spans of data. The results for each analysis can be found in

Table 15: Gage Analysis Method Comparison. After review of each of the 17C analyses were completed, it was decided that performing a 17B flood frequency analysis for the full period of record was needed to avoid skews in data from wet and dry periods. The results of this analysis are presented in

. The Friona gage (08080650) did not have any data gaps in its period of record; however, it only had continuous records from 2005 – 2020, which coincides with a general drought period in West Texas.

Table 14: USGS Stream Gages near Running Water Draw HUC8

USGS Stream Gage	Period of Record	HUC8
08080700 – Running Water Draw at Plainview, TX	1939 – 2022	12050005 – Running Water Draw
08080650 – Running Water Draw at SH 214 nr Friona, TX	2005 - 2020	12050002 – Running Water Draw

Table 15: Gage Analysis Method Comparison

USGS Stream Gage	Time Period	Gage Analysis Method	10% (cfs)	4% (cfs)	2% (cfs)	1% (cfs)	0.2% (cfs)
08080700	Entire Period	Bulletin 17B	1,043	2,501	4,262	6,742	16,073
08080700	1939 – 1953 (Wet Period)	Bulletin 17C	2,003	7,927	20,336	49,217	327,919
08080700	1957 – 1978	Bulletin 17C	2,637	5,014	7,493	10,662	21,235
08080650	2005 – 2020 (Dry Period)	Bulletin 17C	476	757	1,030	1,365	2,449

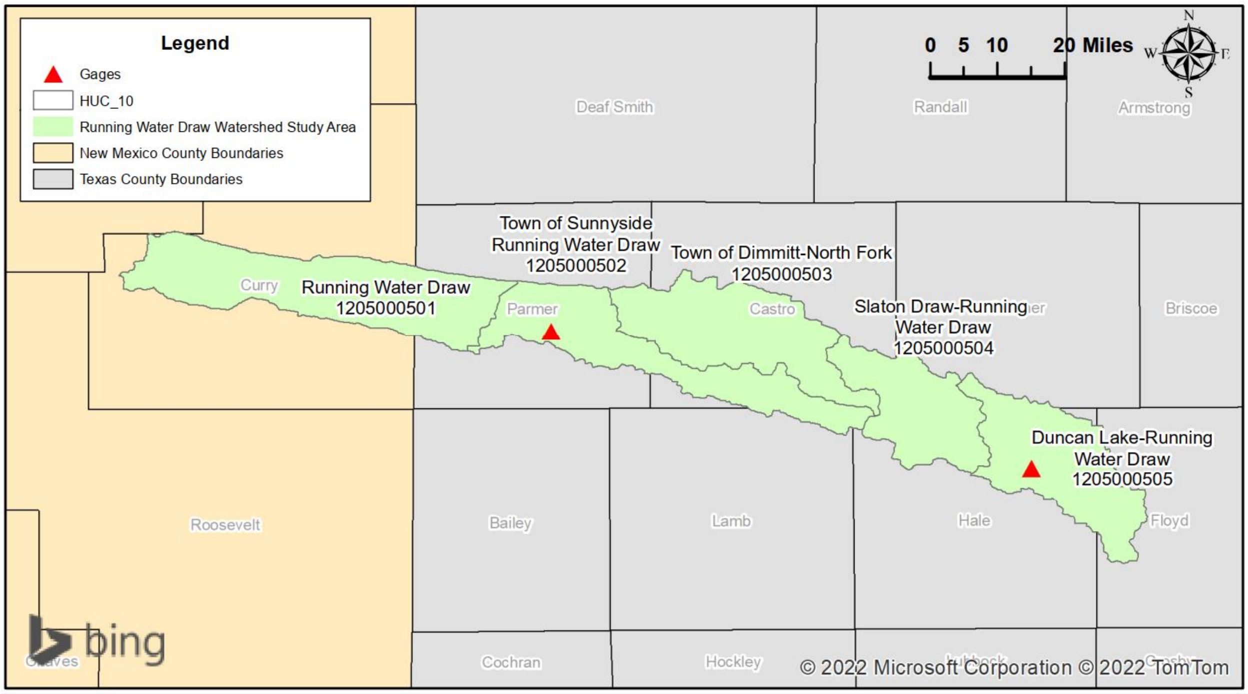

Figure 6: USGS Stream Gages in Running Water Draw HUC8

2.3.2 Sensitivity Analysis

To evaluate which model parameters significantly impact results, multiple sensitivity analyses were run. These sensitivities included variation of model equations (e.g., Diffusion Wave vs. Full Momentum), variation of Minimum Infiltration Rates, and varying CN values. While many of the analyses yielded minimal changes in the model results, it was noted that changing from the default Curve Numbers made large changes in model results. After reviewing initial results and consulting drainage documents, the Antecedent Runoff Condition II (ARC II) values were lowered to better match gage calculations peak flows. After running two Scenarios where the CN values were lowered by 15 and then by 20, it was observed that the CN values lowered by 15 produced conservative yet close results when compared to the stream gages shown in Section 2.3.1 Stream Gage Analysis. A comparison between the HEC-RAS model results and the statistical peak flows for the Gage 08080700 and Gage 08080650 can be found in Table 16 and Table 17.

When calibrating the models, FTN made the decision to place primary focus on the Plainview gage. The Friona Gage has a significantly shorter period of record. Additionally, the record fall during a period of drought. As seen in Figure 7, the Fiona Gage period of record (2005 to 2020), does not include some of the larger events that the Plainview gage has experienced. For these reasons, the Friona gage SPP analysis is likely skewed to produce smaller flow results. This would explain the large percent differences calculated between the SPP analysis and the model results.

The USGS published rating curve for Gage 08080700 was compared to the modeled stage-discharge relationship in Table 18 and Figure 8 to validate the CN adjustments. The results of the BLE model align reasonably well with the USGS rating curve. There was not a USGS rating curve for Gage 08080650, so no comparison was made.

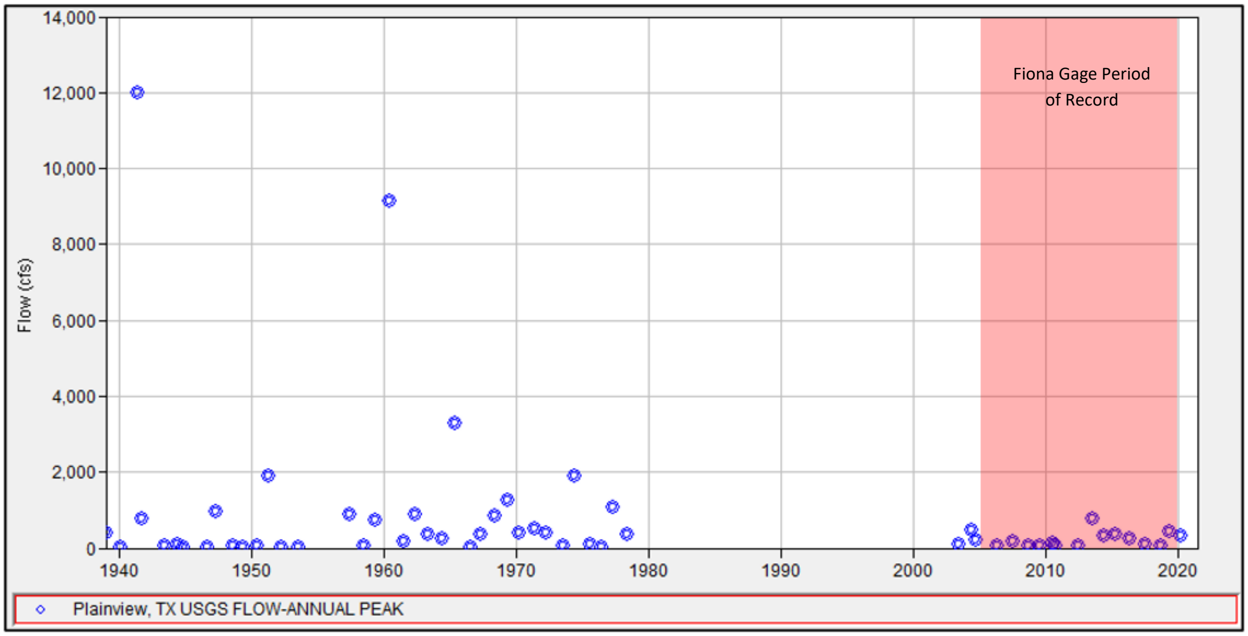

Figure 7: USGS Gage 08080700, Running Water Draw at Plainview, TX – Annual Peak Streamflow

Table 16: Statistical Analysis Results – USGS Gage 08080650, Running Water Draw at SH 214 nr Friona, TX

	10% (cfs)	4% (cfs)	2% (cfs)	1% (cfs)	0.2% (cfs)
HEC-RAS Model	4,825	7,736	10,538	14,270	26,729
SSP Analysis	1,043	2,501	4,262	6,742	16,073
Percent Difference	129%	102%	85%	72%	50%

Table 17: Statistical Analysis Results – USGS Gage 08080700, Running Water Draw at Plainview, TX

	10% (cfs)	4% (cfs)	2% (cfs)	1% (cfs)	0.2% (cfs)
HEC-RAS Model	4,255	6,256	8,024	10,158	17,357
SSP Analysis	1,645	3,717	6,311	10,182	26,959
Percent Difference	89%	51%	24%	0%	43%

Table 18: USGS Gage 08080700, Running Water Draw at Plainview, TX – Rating Curve Comparison

	10% (ft)	4% (ft)	2% (ft)	1% (ft)	0.2% (ft)
Rating Curve Stage	7.91	8.56	9.15	9.47	10.28[1]
RAS Stage	7.58	8.12	8.57	9.02	10.16

[1] Calculated using line of best fit equation

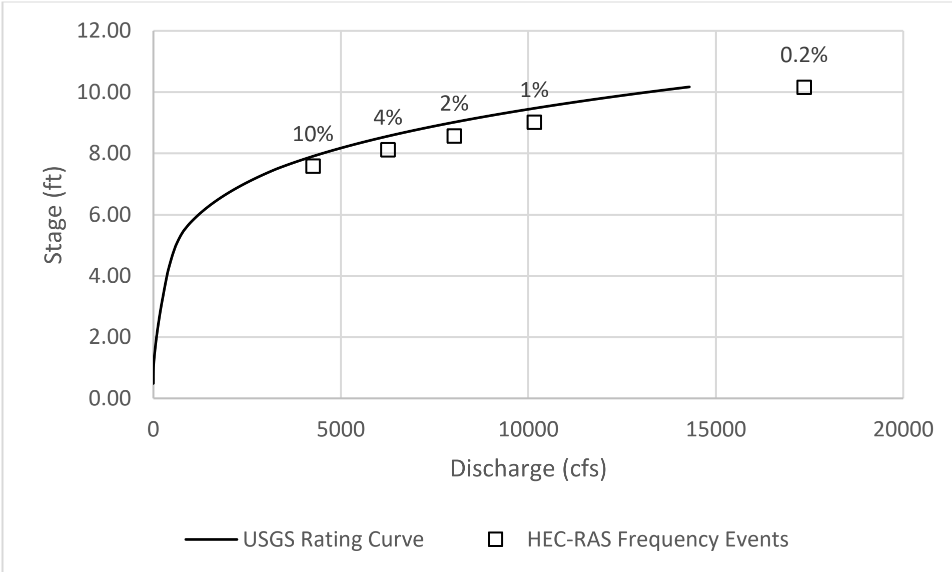

Figure 8: USGS Gage 08080700, Running Water Draw at Plainview, TX – Rating Curve Comparison

2.3.3 Frequency Event Results

The results of the analysis are summarized in for each simulated frequency event. All outlets can be found on Running Water Creek. The peak discharges stay relatively consistent. This can be explained by the long, narrow shape of the watershed and the presence of playas. Additionally, several flood control structures have been built along Running Water Creek. These structures cause water to build upstream and limit the amount of flow released downstream.

As mentioned in Section 2.2.3.2, CN values were built into the model to represent hydrologic losses. Depending on the soil type and land use type, some water will be absorbed into the ground before it reaches the outlet of the model. This would also explain why flows are staying consistent instead of increasing.

There was one detailed study area present, which is in Plainview, Texas. A comparison was made between the lettered cross sections and the BLE model results, which can be found in Table 19. From review, most of the cross sections were within 1.0 ft of the model. While close, some differences should be expected due to the changes in methodology and updates in modeling technology.

Table 19: Frequency Event Peak Discharge Summary (cfs)

Location	10%	4%	2%	1%-	1%	1%+	0.2%
Running Water Draw Outlet	4,716	7,535	10,227	2,767	13,696	52,916	25,639
Town of Sunnyside-Running Water Draw/Town of Dimmitt-North Fork Outlet	4,448	6,626	8,588	2,767	10,930	52,597	19,463
Slaton Draw-Running Water Draw Outlet	4,266	6,264	8,026	2,718	10,149	52,525	17,309
Duncan Lake-Running Water Draw Outlet	4,239	6,291	8,157	2,599	10,425	51,667	18,030

Table 20: Detail Study Area – Model Comparison

Lettered Cross Section	Effective 1% Annual-Chance WSEL	Modeled 1% Annual-Chance WSEL	Difference (Effective – Modeled)
A	3,350.4	3,349.6	-0.8
B	3,350.7	3,350.6	-0.1
C	3,351.0	3,351.2	0.2
D	3,351.7	3,352.8	1.1
E	3,353.7	3,353.3	-0.4
F	3,356.7	3,357.8	1.1
G	3,359.5	3,360.4	0.9
H	3,362.7	3,362.7	0.0
I	3,368.8	3,369.8	1.0
J	3,371.5	3,372.0	0.5
K	3,371.8	3,372.4	0.6
L	3,375.6	3,376.3	0.7
M	3,379.2	3,379.2	0.0

2.3.4 Challenges

The dominance of playa lakes throughout the watershed and lack of stream gages present challenges for the 2D BLE analysis. The precise initial conditions of playa lakes are difficult to simulate within a HEC-RAS 2D model and their natural seasonal variability adds a level of uncertainty to model results. The lack of stream gage records within the Running Water Draw watershed reduces comparison points for the analysis and limits the ability to simulate historical events which could verify the 2D BLE results and approach.

2.3.5 Recommendations

This study provides useful information for flood risk identification and communication among stakeholders within the watershed. This study is scalable, and additional analysis will enhance the product and further inform the implementation of regulatory flood hazard areas. The validity of the 2D BLE analysis should be verified through community meetings prior to being applied as a regulatory product.

3.0 Quality Control

Throughout the BLE analysis, multiple quality checks were performed. These included checks to review the terrain data processing prior to hydraulic model development; hydrologic discharge and model parameter checks; hydraulic checks for complete model coverage, addition of “v-notch” locations to allow for hydraulic connectivity through structures, revisions to dam spillways and top of dams, and revisions to Manning’s “n” values; floodplain mapping cleanup; database quality checks and review; and final submittal reviews. Significant efforts were made to reasonably resolve all items noted prior to submittal. Please see the information included in the Reporting and Documentation > Internal Reviews folder for additional details on the hydraulic review documentation.

4.0 Floodplain Delineation (10%, 1% and 0.2% events)

Following the HEC-RAS analysis, the model results were then imported into the HEC-RAS 6.2 RAS Mapper tool to map floodplain boundaries for the model extent. This tool uses a routine that develops water surface elevation grids based on the 10-foot cell size DEM. The sloping rendering mode was used with the “shallow depth reduces to horizonal” mapping option selected to reduce the effect of cupping and skewed results. For this BLE analysis, mapping results were developed for three (3) events. These events were the 10-, 1-, and 0.2-percent-events. The results of these analyses were used to perform an updated Flood Loss Analysis using the HAZUS program.

The 10-, 1-, and 0.2-percent-event mapping was refined to remove a depth of 0.33 ft or less and mapping pieces smaller than 0.33 acres were removed. The resulting floodplain spatial data were smoothed with smoothing tolerance 2.5x input raster cell size and generalized with a 2-foot tolerance. After the initial boundary edits, the resulting floodplain boundaries were merged into a single watershed map boundary.

Once the map boundaries were cleaned, the resulting rasters (Water Surface Elevation, Depth, etc.) were developed with the raster set to correspond in extent to the cleaned polygon boundary. This ensures that the water surface raster and the floodplain boundary are consistent with each other. The backwater WSE at HUC10 watershed boundaries was extended upstream to produce clean tie-ins, with no drawdowns. The depth raster product was created at the end of the process by performing a raster subtraction with the water surface elevation raster and the ground DEM.

CNMS Validation of Effective Zone A Special Flood Hazard Area (SFHA)

Initial Assessment A1 – Significant Topography Update Check

This check involves determining whether a topographic data source is available that is significantly better than what was used for the effective Zone A modeling and mapping.

For the Running Water Draw Watershed, the effective Zone A topographic data was based upon USGS 24K map products with varying contour levels of contour accuracy. As some of the counties in the watershed have not been mapped since their original Flood Hazard Boundary Maps, it may indicate older versions of USGS topographic data. The current topographic data now available is high resolution LiDAR. Therefore, all streams now fail this check.

Initial Assessment A2 – Check for Significant Hydrology Changes

This check involves first determining whether regression equations were used in the effective study. If they were, then it needs to be determined if new regression equations have become available from the USGS since the date of the effective Zone A study. If newer regression equations exist for the area of interest, then an engineer must determine whether these regression equations would significantly affect the 1-percent-annual-chance flow.

For the Running Water Draw Watershed, the effective Zone A data is based on counties that went through FEMA's Map Modernization (Map Mod) and those that have the original Flood Hazard Boundary Maps (FHBMs) that were first issued. For the Map Mod studies, they are based upon 1995 Regional Regression equations, while it is unknown how the Zone A hydrologic data may have been developed for each stream shown in the old, existing studies. Since that time, new regression equations have been released statewide.

At present, no comparison has been performed to compare the exact differences in discharges in the watershed; however, it is noted that these newer equations have resulted in general fluctuations in discharges ranging from +/- 10 – 20% throughout in the State.

Initial Assessment A3 – Check for Significant Development

This check involves using the National Land Cover Database (NLCD) dataset to assess increased urbanization in the watershed of the Zone A study. The ESRI USA NLCD Impervious Surface Time Series was used to create a raster showing the difference in imperviousness from 2001 to 2016.

For BLE study areas, the effective Zone A data is primarily rural, forested areas that has seen minimal urbanization other than immediately around the larger communities within the watershed. Streams that were located in areas with little to no change passed this check.

Based on the CNMS procedures, no HUC-12 basin passed all three Initial Assessment checks. Therefore, the assessment was ended.

Initial Assessment A4 – Check of Studies Backed by Technical Data

Zone A studies that pass all initial assessment checks described above may be categorized as "Valid" in the CNMS Inventory only if the effective Zone A study is supported by modeling or sound engineering judgment and all regulatory products are in agreement. If the effective Zone A study passes all initial assessment checks, but is not supported by modeling, or if the original engineering method used is unsupported or undocumented, a comparison of the BLE results and effective Zone A's is performed.

While the HUC-12 watershed did not pass the Initial Assessment checks, this information has been provided as additional background data. The Running Water Draw Watershed has Automated H & H modeling developed during Map Modernization in the majority of counties within the watershed to back its current Zone A SFHAs. All Zone A streams fall within these counties, and therefore pass this check.

Initial Assessment A5 – Comparison of BLE and Effective Zone A Floodplains

The BLE/effective Zone A comparison method leverages the existing Floodplain Boundary Standard (FBS) certification procedures described in FEMA Standards ID 113, but with a slight modification. This modified FBS comparison approach uses the 1-percent plus and 1-percent minus flood profiles and horizontal and vertical tolerances described in the First Order Approximation - Methodology, Validation, and Scalability Guidance Procedures (Version 1.5). For the comparison of BLE and effective Zone A in the study area, the following vertical and horizontal tolerances were used to conduct the modified FBS procedure.

Vertical Tolerance: +/- 2.5 feet (one-quarter contour interval of assumed effective topographic source).

Horizontal Tolerance: +/-75 feet (standard horizontal tolerance for BLE comparison testing).

While most of the HUC-12 watersheds did not pass the Initial Assessment checks, this information has been provided as additional background data. For the study area, there was a total of 46 HUC-12 areas that were reviewed. Of these areas, the highest Pass/Fail percentage for any area was 21.6% while the lowest was 2.7%. However, the overall average for all areas was 11.4%. Based on these results, no HUC-12 areas at a passing score, which is expected when dealing with mapping derived from USGS 24K map products versus that or mapping derived from high resolution LiDAR data.

CNMS Validation Results

Based on the validation assessments and BLE comparison results described above, the CNMS inventory of Zone A studies in Lower Ouachita-Smackover Watershed study area has been updated, total miles in each of these categories are summarized in the following tables and illustrated in Figure 1 below.

Table 21: Zone A Validation Results

Validation Status	Status Type	Total Mileage
Valid	Being Studied	0.0
Unverified	Being Studied	868.3

Table 22: BLE Comparison Results

HUC-12 Watershed		Total FBS Points	Fail	Pass	% Pass	BLE Comparison Pass? (>85%)
Watershed Name	HUC12 ID					
Town of Field-Running Water Draw	120500050101	N/A	N/A	N/A	N/A	N/A
Lockmiller & Sons Airport	120500050102	N/A	N/A	N/A	N/A	N/A
120500050103-Running Water Draw	120500050103	N/A	N/A	N/A	N/A	N/A
Garrett Ranch-Running Water Draw	120500050104	N/A	N/A	N/A	N/A	N/A
Town of Claud-Running Water Draw	120500050105	N/A	N/A	N/A	N/A	N/A
120500050106	120500050106	N/A	N/A	N/A	N/A	N/A
Town of Pleasant Hill-Running Water Draw	120500050107	N/A	N/A	N/A	N/A	N/A
Catfish Draw	120500050108	N/A	N/A	N/A	N/A	N/A
Town of Bovina-Running Water Draw	120500050109	N/A	N/A	N/A	N/A	N/A
Town of Parmerton-Running Water Draw	120500050201	N/A	N/A	N/A	N/A	N/A
Town of Hub-Running Water Draw	120500050202	N/A	N/A	N/A	N/A	N/A
120500050203-Running Water Draw	120500050203	N/A	N/A	N/A	N/A	N/A
Town of Big Square-Running Water Draw	120500050204	N/A	N/A	N/A	N/A	N/A
120500050205-Running Water Draw	120500050205	N/A	N/A	N/A	N/A	N/A
Town of Sunnyside-Running Water Draw	120500050206	N/A	N/A	N/A	N/A	N/A
120500050207-Running Water Draw	120500050207	546	488	58	10.6	Fail
Town of Parmerton-Running Water Draw	120500050201	N/A	N/A	N/A	N/A	N/A
Town of Hub-Running Water Draw	120500050202	N/A	N/A	N/A	N/A	N/A
120500050203-Running Water Draw	120500050203	N/A	N/A	N/A	N/A	N/A
Town of Big Square-Running Water Draw	120500050204	N/A	N/A	N/A	N/A	N/A
120500050205-Running Water Draw	120500050205	N/A	N/A	N/A	N/A	N/A
Town of Sunnyside-Running Water Draw	120500050206	N/A	N/A	N/A	N/A	N/A
Lower North Fork Running Water Draw	120500050307	166	159	7	4.2%	Fail
City of Hart	120500050401	N/A	N/A	N/A	N/A	N/A
120500050402-Grisham	120500050402	565	550	15	2.7%	Fail
Valley View Church-Running Water Draw	120500050403	1,240	1,144	96	7.7	Fail
Slaton Draw	120500050404	2,239	2,038	201	9.0	Fail
Heck Cotton Gin-Running Water Draw	120500050405	3,527	2,946	581	16.5	Fail
Town of Plainview-Running Water Draw	120500050501	4,420	3,758	662	15.0	Fail
Town of Finney	120500050502	1,501	1,284	217	14.5	Fail
Town of Aiken	120500050503	2,973	2,687	286	9.6	Fail
120500050504	120500050504	N/A	N/A	N/A	N/A	N/A
Duncan Lake-Running Water Draw	120500050505	3,149	2,470	679	21.6	Fail
Town of Barwise-Running Water Draw	120500050506	2,047	1,765	282	13.9	Fail

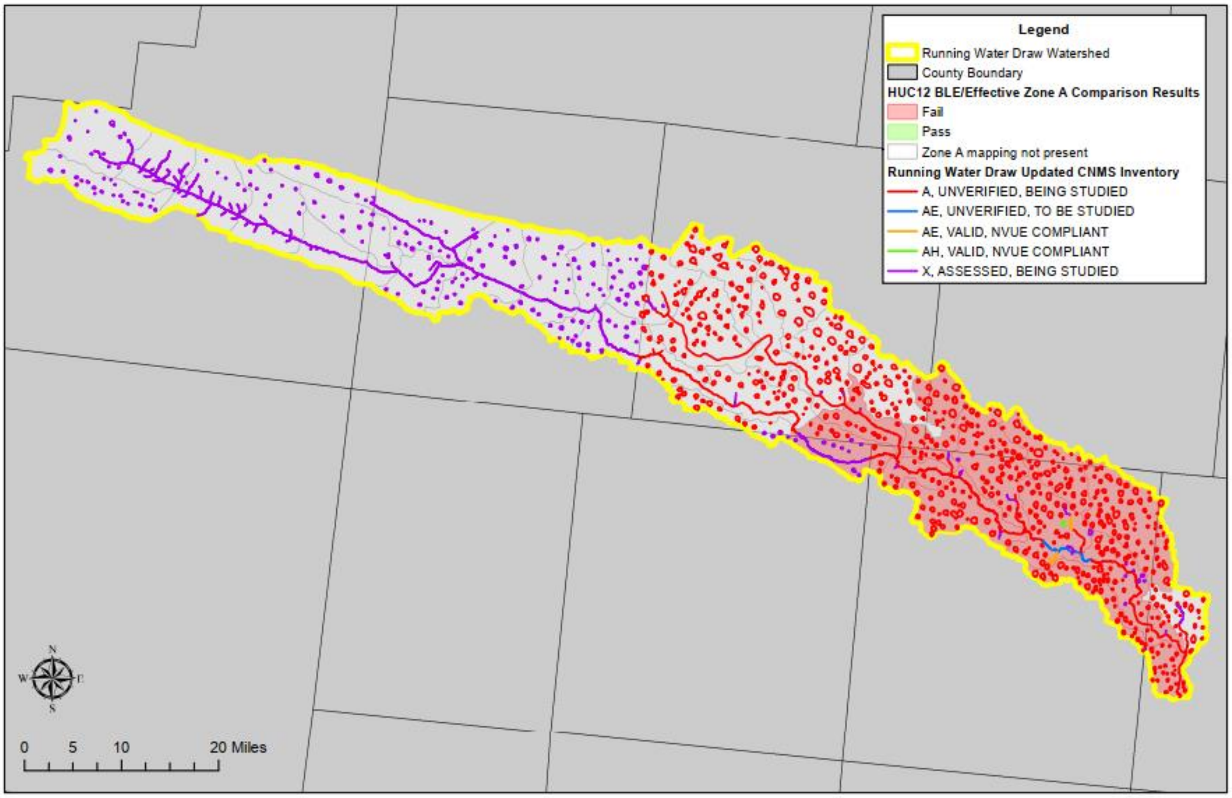

Figure 9: CNMS Validation Results

Flood Risk Analysis

A flood risk analysis was performed for this project. The updated 1-percent annual chance depth grid was used to calculate the potential flood losses. The loss results are stored in the S_FRAC_AR spatial file within the FRD geodatabase. All results are reported in whole dollar values.

Hazus version 6.0 was used for the basic and refined loss analysis.

The losses are reported via census blocks. It is important to note that Hazus version 6.0 uses dasymetric census blocks. Dasymetric mapping removes undeveloped areas (such as areas covered by other bodies of water, wetlands, or forests) from the census blocks, changing their shape and reducing their size in these areas. For more information on dasymetric data visit FEMA's Media Library for the Hazus-MH Data Inventories: Dasymetric vs. Homogenous, or Hazus 3.0 Dasymetric Data Overview.

The Hazus analysis was performed within the project watershed extends for the 100-return period. A summary of results per County for the 1-percent annual chance scenarios are shown in **Table 23**.

Table 23: HAZUS Results for 1% Annual Chance Scenario

County	Full Replacement – Total Loss	Dollar Exposure (Replacement Value) - Buildings	Dollar Exposure (Replacement Value) - Contents
Curry	$992,000.00	$77,974,000.00	$55,393,000.00

Castro	$25,685,000.00	$528,562,000.00	$329,380,000.00
Floyd	$1,132,000.00	$28,846,000.00	$15,657,000.00
Hale	$242,538,000.00	$2,348,453,000.00	$1,534,235,000.00
Lamb	$69,000.00	$2,476,000.00	$1,236,000.00
Parmer	$4,735,000.00	$212,418,000.00	$127,073,000.00
Swisher	$542,000.00	$28,534,000.00	$19,437,000.00
Total	**$275,693,000.00**	**$3,227,263,000.00**	**$2,082,411,000.00**

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