MEMORANDUM OF AGREEMENT

Project Name:	Fremont County Risk Mapping Assessment and Planning (MAP) Project – Phase 2 Data Development		
Regarding:	Community Partnership and Study Agreement	*Date:*	December 13, 2021
Community	Fremont County and Incorporated Communities		
Community Contacts	Carrie Wilson, Town of Rockvale Clerk, clerk@rockvale.org, 719.784.4125 Dave Barnes, Town of Rockvale Mayor, d.barnes@rockvale.org, 719.431.7067 Jerry Farringer, Town of Williamsburg Floodplain Administrator, jfarringer@gmail.com, 719.784.4571 John Bechtelheimer, Town of Coal Creek Mayor, Coalcreektown@gmail.com, 719.784.6150 John Grooms, Town of Brookside Planning/Zoning Officer, townhallbrookside@bresnan.net, 719.276.3436 Kim Swearingen, City of Canon City Engineer/FPM, kaswearingen@canoncity.org, 719.276.5291 Sean Garrett, City of Florence Planning Director, sean.garrett@florencecolorado.org, 719.784.4848 x227 Wyatt Sanders, Fremont County Building Official and FPA, wyatt.sanders@fremontco.com, 719-276-7460		
Project Contacts:	Terri Fead, CWCB Floodplain Mapping Coordinator: terri.fead@state.co.us, 303.866.3441 x3230 Marta Blanco Castaño, CWCB Flood Mapping Program Assistant: marta.blancocastano@state.co.us, 303.866.3441 x3225 Christine Gaynes, FEMA Region VIII Civil Engineer, christine.gaynes@fema.dhs.gov, 202.480.1265 Chris Ide, Wood – Project Manager, christopher.ide@woodplc.com, 303.742.5337 Josh Hill, Wood – Project Engineer, joshua.hill@woodplc.com, 303.503.2705		

The Colorado Water Conservation Board (CWCB), in partnership with the Federal Emergency Management Agency (FEMA) and their contractor, Wood, are currently working with Fremont County and Communities for a flood risk study update. A Phase 1 project has already been completed, including two-dimensional (2D) Base Level Engineering (BLE) analyses throughout the county. A Discovery/Phase 2 Kickoff Meeting where BLE results were shared with Fremont County and Incorporated Communities (referred to as The Communities) was held on November 30, 2021. Additionally, the Arkansas River was already studied using detailed and approximate methods throughout Fremont County as part of a multi-county Physical Map Revision (PMR) project. The hydrologic and hydraulic analyses on the Arkansas were completed and approved by FEMA, but the resulting floodplain mapping will be included as part of this Fremont County flood risk study update. A meeting was held to review the scope of this effort on April 15, 2020. The information presented at these meetings was also provided in reports and supplemental data shared with the communities.

Following the completion of this Phase 1 Risk MAP effort, the Phase 2 of the Risk MAP project was initiated. Survey to be used in the Phase 2 portion of the project began to be collected during Fall 2021. This Memorandum of Agreement (MOA) serves to formally document the selected scope and methodology, and inform all study partners on expectations while working together.

Purpose of the MOA

This MOA serves as an agreement with The Communities that:

- Detailed and approximate flood studies will commence
- The Communities will partner with CWCB, FEMA, and relevant project stakeholders (e.g., Wood, U.S. Army Corps of Engineers/USACE)
- The Communities were informed of and generally agree with the selected technical approach (this does not mean that Communities agree with the results that will be produced, but rather agreement is being provided on the general approach to be taken).
- The Communities will provide the support items identified under "community responsibilities"

This MOA also serves to document the following items:

- Specifics of the flood study scope and approach.
- That CWCB has coordinated and will continue to coordinate with the appropriate Community contacts and floodplain administrators regarding the project study scope and process; and
- This MOA includes FEMA's Standard Identification (SID) 620 as an enclosure. Signing this MOA fulfills the FEMA requirements pertaining to notifying communities of a study and selected engineering models and methodologies.

This Project may take multiple years to complete, so it is important to have a record of key decisions and coordination efforts. It is also important to have concurrence from the Communities regarding the project approach, agreement to partner, and the breakout of required actions, which we are requesting in the form of a signature at the bottom of *EITHER* this form, or a corresponding Google Form linked within this memo.

Project Objective

The Project involves conducting new flood hazard analyses, producing new or updated flood risk information and datasets, and generating special flood hazard area (SFHA) delineations for select streams in Fremont County, CO. These streams are currently not considered "Valid" in FEMA's Coordinated Needs Management Strategy (CNMS) database, or were identified by communities as needing study or a restudy. This project is commencing the official Data Development Phase in December of 2021 and its resulting products and deliverables are expected to form the basis for a regulatory update for all studied streams under FEMA's Risk Mapping, Assessment and Planning (Risk MAP) Program.

The regulatory update (through the Preliminary and Post Preliminary Phases 3 and 4) is being funded with FEMA's Fiscal Year 2021 funds. **Results from this study are recommended to inform and support revisions to the effective floodplains shown on FEMA's Flood Insurance Rate Maps (FIRMs) for Fremont County and Incorporated Communities.** This could result in identification of both potential increases and decreases in base flood elevations (BFEs), SFHAs (areas subject to inundation during a 1-percent-annual-chance flood), and floodway delineations (where applicable). The project may also result in new SFHA delineations where there is currently no effective mapping.

Homes identified in these SFHAs that have federally backed mortgages or loans will be required to obtain flood insurance. Throughout this Project, CWCB and Wood plan to partner with Federal, State, local government entities, and other relevant stakeholders to collaborate on project efforts to identify flood risk, increase flood awareness, and assist in identifying risk mitigation actions.

Areas to be Studied

During the Phase 1 project, 2D BLE hydraulic modeling was conducted for a complete coverage of Fremont County (roughly 1,530 square miles). Draft floodplain delineations were provided for all drainages in the county, of which flooding sources with a tributary area greater than or equal to 1 square mile are typically considered usable for Zone A approximate regulatory purposes. While not all of these flooding sources will be mapped on a FEMA FIRM, the information may be used as best available information for local floodplain and emergency management to encourage safer, informed planning and development practices.

The focus of this Phase 2 flood study is to produce detailed mapping (Zone AE) as well as refined approximate mapping (Zone A) for specific reaches, which is different than the approximate watershed-based approach employed in the prior Phase 1. The Phase 2 detailed and approximate reaches are summarized in the table below and are displayed in Figure 1 as well as in the ArcGIS Online map accompanying this memo.

The proposed hydraulic modeling approach for each reach studied utilizes the USACE's Hydrologic Engineering Center's Riverine Analysis System (HEC-RAS) version 6.1. One dimensional (1D) and two dimensional (2D) methodologies were selected based on stream characteristics and input from the Community. Floodways will be delineated for all detailed reaches unless otherwise requested.

Figure 1 and Table 1 below present the flood sources scoped for the Phase 2 portion of this project as well as detailed information about the effective mapping and proposed studies. Additional details and the precise limits for each reach can be viewed using the corresponding ArcGIS Online map shared with this memo. **If the Community would like to revise the proposed study reaches, include additional reaches, or modify the type of study or modeling methods proposed for use (e.g. 1D vs 2D, with or without floodway), we request that you contact us or provide concurrence by January 13th, 2022.**

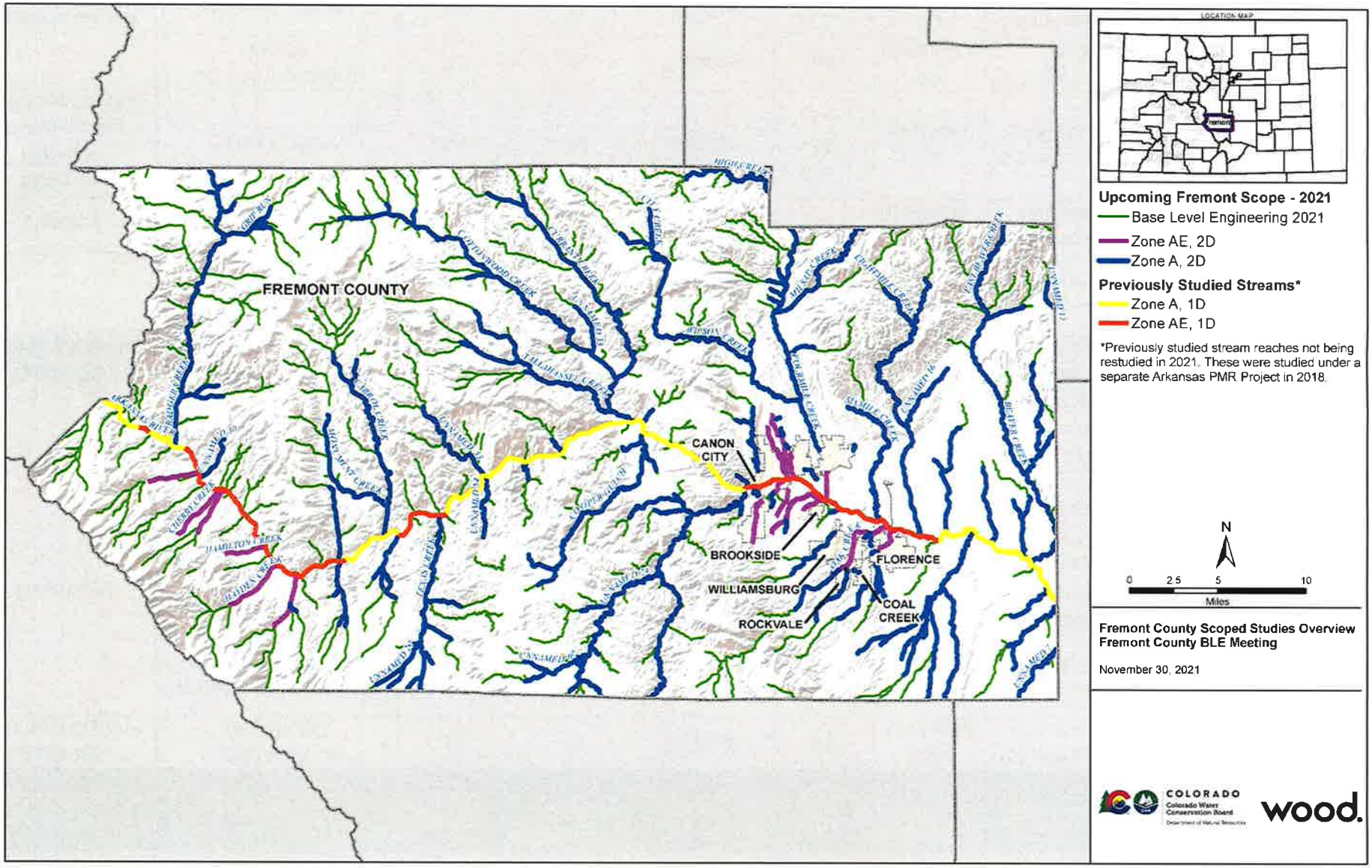


Figure 1: BLE & Scoped Phase II Reaches

Table 1: Study Reach Information*

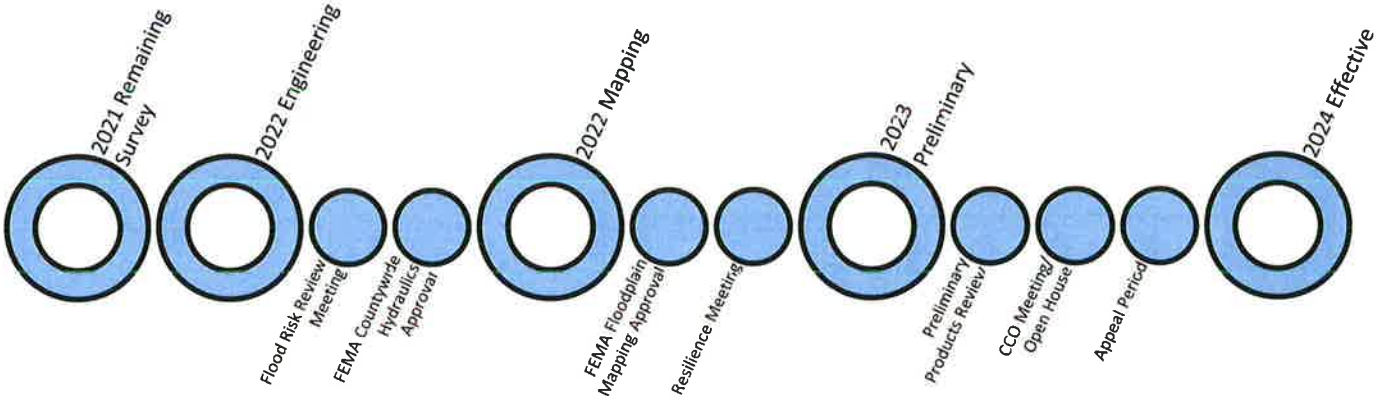
Affected Communities	Stream Reach	Length (miles)	Effective Mapping Zone	Study Type	Updated Zone	Hydraulic Modeling Approach	Upstream Limit	Downstream Limit
Brookside, Fremont County	UNNAMED 2 (Brookside)	1.6	A	Upgrade	AE	2D Unsteady	0.1 miles upstream of Locust Street	Confluence with the Arkansas River
Canon City	NE CANON DRAIN AREA (WEST) SPLIT FLOW	0.3	AE	Restudy	AE	2D Unsteady	Split with NE Canon Drain Area (West)	Confluence with NE Canon Drain Area (East)
	SE CANON DRAINAGE	1.0	AE	Restudy	AE	2D Unsteady	Just upstream of 4th Street	Confluence with the Arkansas River
	UNNAMED STREAM 2 (Orchard Ave)	1.6	A	Upgrade	AE	2D Unsteady	0.2 miles upstream of Central Avenue	Confluence with the Arkansas River
	WEST BRANCH FORKED GULCH	3.0	AE	Restudy	AE	2D Unsteady	0.8 miles upstream of Greenhorn Drive	Confluence with Forked Gulch
Canon City, Fremont County	MUDD GULCH	1.7	AE	Restudy	AE	2D Unsteady	0.3 miles downstream of Fourmile Lane	Confluence with the Arkansas River
	NE CANON DRAIN AREA (EAST)	4.4	AE	Restudy	AE	2D Unsteady	0.7 miles upstream of York Avenue	Confluence with the Arkansas River
	NE CANON DRAIN AREA (WEST)	3.1	AE	Restudy	AE	2D Unsteady	0.6 miles upstream of North Street	Confluence with NE Canon Drain Area (East)
Florence	COAL CREEK	1.9	AE	Restudy	AE	2D Unsteady	0.4 miles upstream of Union Drive	Confluence with the Arkansas River
Florence, Rockvale, Williamsburg, Fremont County	OAK CREEK	5.1	AE	Restudy	AE	2D Unsteady	0.3 miles upstream of Mesa Avenue	Confluence with the Arkansas River
Fremont County	BIG COTTONWOOD CREEK	3.4	A	Upgrade	AE	2D Unsteady	3.2 miles upstream of CR 39	Confluence with the Arkansas River
	CHERRY CREEK	3.5	A	Upgrade	AE	2D Unsteady	1.8 miles upstream of Kelso Road	Confluence with the Arkansas River
	HAMILTON CREEK	2.4	A	Upgrade	AE	2D Unsteady	2.0 miles uptream of CR 45	Confluence with the Arkansas River

Affected Communities	Stream Reach	Length (miles)	Effective Mapping Zone	Study Type	Updated Zone	Hydraulic Modeling Approach	Upstream Limit	Downstream Limit
Fremont County	HAYDEN CREEK	3.8	A	Upgrade	AE	2D Unsteady	0.8 miles upstream of Hayden Creek Road	Confluence with the Arkansas River
	STOUT CREEK	3.1	A	Upgrade	AE	2D Unsteady	0.5 miles upstream of CR 46	Confluence with the Arkansas River
	UNNAMED 1 (Howard Creek)	3.0	A	Upgrade	AE	2D Unsteady	2.4 miles upstream of Arrowhead Court	Confluence with the Arkansas River
	UNNAMED 3 (Lincoln Park)	1.8	A	Upgrade	AE	2D Unsteady	1.0 miles upstream of Poplar Avenue	Sherman Avenue
	UNNAMED 4 (Sand Creek)	4.5	A	Upgrade	AE	2D Unsteady	2.3 miles upstream of Cedar Avenue	Confluence with the Arkansas River
Canon City, Coal Creek, Florence, Rockvale, Williamsburg, Fremont County	Zone A Streams	487	Unmapped/ A	New Study/ Restudy	A	2D Unsteady	Various	Various
Total	**142 Reaches**	**536 miles**						

*The Arkansas River reaches were not included in this table because they were previously studied.

Project Schedule

A high-level schedule for the flood risk project is presented below (subject to change).



General Project Approach for Flood Risk Studies

The following methodology will be applied to this study, which is in accordance with applicable FEMA Risk MAP Technical References, Guidelines and Standards for Flood Risk Analysis and Mapping. The flood study tasks vary based on the level of study for the designated reaches, which are outlined in Table 1 and the Scoping Map. Enhanced Level studies (mapped as Zone AE) include survey and field reconnaissance and will eventually result in special flood hazard area (SFHA) delineations with plotted Base Flood Elevations (BFEs) and delineated floodways (unless otherwise requested). Base Level / Approximate (mapped as Zone A) studies do not incorporate field reconnaissance or survey data, rely exclusively on topographic data for terrain information, and will eventually result in model-backed SFHAs without plotted BFEs.

The Project tasks include the following level of effort:

- Field Survey and Reconnaissance – Channel bathymetry and structure survey is being collected for all detailed reaches. Bathymetric survey data is also being collected for approximate reaches along major flooding sources such as the Arkansas River. Survey information collected includes:
  - Documenting the condition and types of hydraulic structures, such as bridges and culverts, and measuring structure dimensions.
  - Measuring channel dimensions and elevations including the bank and overbank areas along specified cross-sections. Cross-sections are spaced every 2,000 to 3,000ft for detailed studies, except where bathymetry is captured at structures, and every 5 miles for approximate studies on major flooding sources.
- Topographic Data – This effort will include generating terrain models using Quality Level 2 Light Detection and Ranging (LiDAR) datasets, which were collected between 2016 and 2018 with 10cm vertical accuracy. If additional topographic data is provided by communities by or before **January 13th, 2022** these data can also be incorporated.
- Hydrology – New or updated hydrological analyses are being completed in conjunction with the BLE analysis and have been submitted to FEMA for review in November 2021. The hydrological analysis method utilized is a rain-on-mesh methodology, which uses NOAA Atlas 14 rainfall data, nested hyetographs, and aerial reduction coefficients to estimate rainfall onto the hydraulic mesh. The hydraulic model then aggregates and routes the run-off. The rain-on-mesh hydrology was calibrated based on local gage data and is reliable for approximate studies.

Information about the hydrological method used for each flood source can be found in the attached SID 620 form. The 10%, 4%, 2%, 1%, 1% plus, and 0.2% annual chance events were estimated for all flood sources. For reference, a chart with recurrence intervals and annual chance exceedance percentages is included in Table 2.

Table 2: Recurrence Intervals and Annual Chance Exceedance Probabilities

Recurrence Interval (years)	Annual Exceedance Probability (%)
10	10
25	4
50	2
100	1
100-plus	1+
500	0.2

- Hydraulics – New and Updated hydraulics will include performing detailed and approximate 2D unsteady-state hydraulics using HEC-RAS 6.1. Floodways will be delineated for all detailed reaches (unless otherwise requested). Additional modeling information can be found in Table 1.
- Flood Risk Products – This will include flood hazard mapping spatial files and exhibits containing results of the analysis, as well as non-regulatory products (e.g., changes since last firm [CSLF], areas of mitigation interest [AOMI], etc.). All data will be formatted to meet FEMA's technical references.

Community Responsibilities

Communities participating in the National Flood Insurance Program (NFIP) are typically required to provide updates regarding flood risk, as described in 44 CFR 65.3. CWCB and FEMA are offering support to identify revised flood risks by initiating this project. While providing this support, CWCB and FEMA ask that the community agree to lead the following tasks:

- Identify any other agencies or stakeholders that should be included in the process.
- Provide updates to community leaders and pertinent information to homeowners. Make sure they understand this will result in identified floodplain changes for future phases of the study.
- Provide any prior engineering study or data that should be considered in this analysis before the main study process is underway. This includes identifying any upcoming or ongoing Conditional Letters of Map Revision or Letters of Map Revision (CLOMRs/LOMRs) across the study areas.
- Remain involved with the overall study process and review any information provided to offer concurrence with results, as well as be engaged and ask questions, raise concerns if/when applicable, and communicate with the project team.
- Identify any contact/staff changes related to this project as they occur to avoid communication gaps.
- Sign this MOA and ensure that all new community contacts review and re-submit this agreement.
- Identify any needs to support outreach or project understanding.

Stakeholder coordination is a significant part of this effort. The CWCB will help craft messaging and outreach materials for communities as appropriate, when requested. Some materials that have already been created can be accessed on www.coloradohazardmapping.com. Project information will be included on the project website at the Fremont County Project Page. The next official meeting and communication between the Communities and CWCB will be a Flood Risk Review meeting in spring/summer 2022 to discuss draft hydraulic results and draft floodplains.

Request for Concurrence

Should you have any questions or comments regarding the stated scope of work, please contact Terri Fead, *CWCB Floodplain Mapping Program Coordinator* (terri.fead@state.co.us, 303.866.3441 x3230), Marta Blanco Castaño, *CWCB Flood Mapping Program Assistant* (marta.blancocastano@state.co.us, 303.866.3441 x3225), or Chris Ide, *Wood Project Manager,* (christopher.ide@woodplc.com, 303.742.5337). **Otherwise please indicate your concurrence with the**

above approaches and project understanding by returning a signed copy of this Fact Sheet/Study Memo to the above contacts; OR you may alternatively sign the following Google Form: https://forms.gle/nc1c95JCys8656xt5

Signing indicates concurrence with the general approach and partnership responsibilities but does not imply acceptance of future results nor ownership for their development. It is preferred that two community representative sign; however, it is at the community's discretion who should sign. **We kindly request that you provide concurrence by 1/13/2022**. We appreciate your timely response and look forward to working with you on this Study.

Wyatt Sanders
Printed Name of Floodplain Administrator (FPA)

Fremont County
Community Name

Wyatt Sanders
Signature of FPA

12-15-2021
Date

Dwayne McFall
Printed Name of Community Executive Officer (CEO) or designee

Signature of CEO

12-15-2021
Date