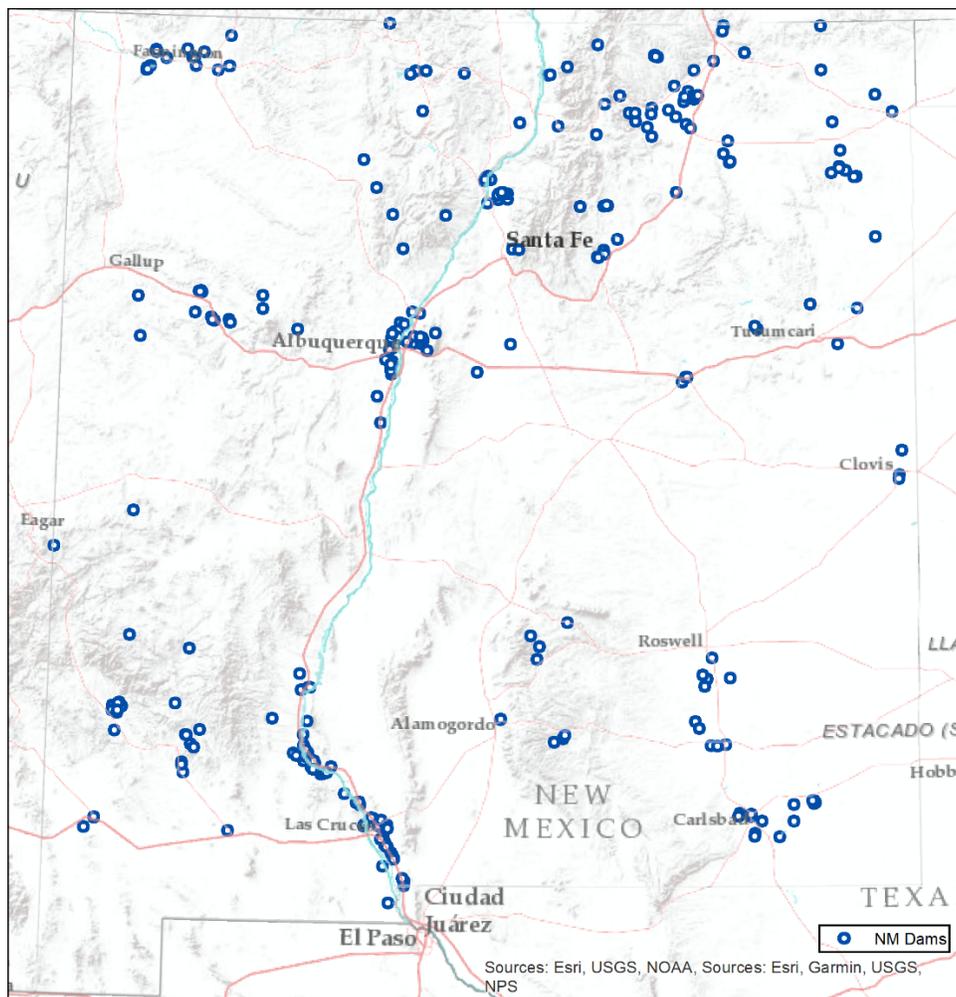


New Mexico Dam Safety Bureau

Evaluation of and Updates to Hydrologic Modeling Practice and Guidance

Workshop No. 1 Summary
November 24, 2020



Prepared for:



Prepared by:



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1.0 Introduction

On November 24, 2020 Gannett Fleming and the New Mexico Office of the State Engineer Dam Safety Bureau (Dam Safety Bureau) met virtually to discuss the overall scope of *Task 1: Establish State of the Practice of the Evaluation of and Updates to Hydrologic Modeling Practice and Guidance Project* for the Dam Safety Bureau’s jurisdictional dams. Those who were present are listed in Table 1.1. After personal introductions, the workshop agenda and overall purpose for the project were discussed.

Table 1.1: Workshop No. 1 Attendees

Dam Safety Bureau	Gannett Fleming
Bud Brock	Amanda Hess
Sushil Chaudhary	Gregory Richards
James Head	Paul Schweiger
David Heber	Seth Thompson
Chuck Thompson	

1.1 Project Introduction and Client Goals

In New Mexico, the most current hydrologic guidelines available to dam owners and engineering consultants were published in a white paper titled *Hydrologic Analysis for Dams* by the Dam Safety Bureau on August 15, 2008. This paper discusses the steps in a typical hydrologic analysis for a dam. For each step, considerations for various methods are discussed and preferred and typical methods are highlighted. Since the publication of these guidelines, New Mexico completed a Regional Extreme Precipitation Study (CO-NM REPS). This study provides New Mexico with regional probable maximum precipitation (PMP) data and precipitation frequency estimates.

The purpose of this project is to provide New Mexico with guidance to help them better use the CO-NM REPS data for hydrologic design and also provide concise hydrologic modeling guidelines that encourage consistency and facilitate review. The CO-NM REPS data provides an opportunity to incorporate risk-based decision making into the guidelines, an approach that is currently gaining traction among other state and federal dam safety agencies.

The Dam Safety Bureau expressed the desire to understand where the industry is at and where it is heading regarding hydrologic guidelines. They want to be more confident that they are recommending hydrologic methods that are appropriately conservative while providing cost-efficient designs. Currently, the Dam Safety Bureau’s hydrologic guidelines allow for the use of various methods. This has been found to create confusion among consultants and regulators. Moving forward, the Dam Safety Bureau is looking for a more concise, preferred hydrologic

methodology along with tools to encourage consistency and facilitate review. Updated guidelines will likely allow for a deterministic, conservative approach while also allowing for more advanced approaches if desired or necessary.

2.0 Scope of Work

An overview of the Project’s scope of work was discussed, this scope is outlined below:

Task 1: Establish State of the Practice

Task 2: Analyze Data and Develop Recommendations for Updated Guidelines

Task 3: Develop Guidelines and Deliverables.

The scope of work specific to Task 1 was broken down further as follows:

- **Workshop 1 (November 24, 2020)**
 - Data Collection
 - Hydrologic Guidelines
 - Hydrologic Methods
 - NM Dam Inventory
 - Stakeholder Questionnaire and Correspondence
- **Workshop 2 (December 17, 2020)**
 - Data Evaluation
- **Workshop 3 (January 15, 2021)**
 - Documentation

The stakeholder questionnaire and data collection subtasks were discussed in detail. A summary of these discussions follows.

3.0 Data Collection

Data collection efforts will include collecting, reading, and cataloging information on western states’ hydrologic regulations and guidelines, available hydrologic methods, regional and historic storm events, and New Mexico’s dam inventory. These data will then be evaluated to establish the state of the practice and ultimately be used as the basis for development of updated New Mexico hydrologic guidance documentation.

3.1 State Regulations and Guidelines

This portion of the project will require a detailed review of New Mexico’s current hydrologic guidelines to understand the status quo. Gannett Fleming will then gather, read, catalog, and look for commonalities among other state and federal entities’ guidelines. The states that will be studied are Arizona, Colorado, Montana, Nevada, Oklahoma, Texas, Utah, and Washington, with a special emphasis on Colorado, Montana, and Washington who are all applying risk-based hydrologic methods. The federal entities to be studied are the United States Bureau of Reclamation (USBR), United States Army Corps of Engineers (USACE), and Natural Resources Conservation Service (NRCS). This data collection process will also involve targeted interviews with state/federal dam safety representatives to understand their current practice and application of hydrologic methodology and potential plans to update hydrologic guidelines.

The Dam Safety Bureau expressed interest in evaluating USBR methodology. A discussion ensued about USBR having more resources available than most other entities, which allows them to undertake a complex, sophisticated approach to hydrologic modeling. Because of this, their current practices may not be achievable for most dams regulated by the state. It was noted that past guidance documents provided by the USBR, although not used by them currently, may still apply and should be considered.

Regarding the degree of changes to current regulations desired, the Dam Safety Bureau feels comfortable working within their current regulations. They are generally comfortable with their current hazard classifications as they are consistent with the Federal Emergency Management Agency’s (FEMA) recommendations. However, they are open to explore opportunities for improvement to regulations to incorporate risk-based approaches. There was some concern about high hazard dams with rural downstream areas being held to the same standard as high hazard dams with urban downstream areas, where failure consequences could be far greater. The Dam Safety Bureau also expressed interest in following a similar risk-based pattern as Colorado and better applying their CO-NM REPS study with updated guidelines.

Currently in New Mexico, significant hazard dams are to have a spillway design flood (SDF) of either the 50% or 75% probable maximum precipitation (PMP) event depending on size classification. The SDF for high hazard dams is the PMP event. However, an incremental damage assessment (IDA) can be performed to potentially reduce the SDF if the IDA finds that incremental downstream damages caused by dam failure are minimal above a specified SDF (typically expressed as a percentage of the PMP).

With the new CO-NM REPS study, the Dam Safety Bureau has found that the probability of occurrence of a PMP event can vary greatly throughout the state. For significant and high hazard dams with SDFs specified as percentages of the PMP, this creates a double standard regarding

SDF probability of occurrence. The Dam Safety Bureau expressed interest in moving away from using percentages of the PMP as SDFs and to start using a more standardized annual exceedance, probability-based storm event, which is now possible because of the CO-NM REPS data. This leads to a more risk-based approach to guidelines and decision making. In applying risk-based methods, dam owners, consultants, and regulators need to be sure to apply the ALARP principle, which is to reduce risk as low as reasonably possible.

The Dam Safety Bureau expressed an interest in learning more about planned changes in Colorado's mountain hydrology guidelines but also specified that rain-on-snow/rapid snowmelt events are not of big concern in New Mexico with only few dams at high enough elevations for that to be considered. The previous Colorado guidelines developed by Sabol 2008 have been deemed overly conservative for mountain regions. The Dam Safety Bureau is familiar with the Sabol 2008 document, which is based on available methods tailored to the state of Colorado.

3.2 Hydrologic Methods

An overview of hydrologic methods was given with an emphasis on developing regionalized methods for New Mexico. Similar regions to the PMP transposition and precipitation-frequency (L-Moment statistical analysis) zones used in the CO-NM REPS study could be used in this study. Other regions to consider include USACE and USGS regional hydrologic boundaries. Gannett Fleming asked if there are any hydrologically unique areas in the state that need to be considered or accounted for within the updated guidelines. The Dam Safety Bureau is aware of one dam in a karstic area in the southeastern corner of the state but did not otherwise know of any unique watersheds or hydrologic conditions that would warrant additional research or special treatment in the new guidelines.

Historical data will also be collected to test and validate the preferred approach to updating New Mexico's hydrologic guidelines. Gannett Fleming asked about important historical events that should be used for validation. The Bureau of Dam Safety indicated that the CO-NM REPS used various historical storm events that should be considered. More recent events occurring in 2013 and 2014 will also be considered. Another source of data is the 2008 USGS study used to develop regional regression equations for estimating peak discharge. The Dam Safety Bureau will also share historical flood information that may not be readily available online with Gannett Fleming.

Gannett Fleming also suggested developing an envelope curve for drainage area vs. PMF inflow, or other relevant hydrologic parameters for dams within the state to help assist the Dam Safety Bureau's review process. This curve would allow the Dam Safety Bureau to perform an initial check for reasonableness. In the end, any recommendations regarding hydrologic methods should be based on well documented assumptions tied to watershed parameters. The goal is to get to a point where everyone is in the same ballpark.

3.3 New Mexico Dam Inventory

Gannett Fleming compiled preliminary statistics on New Mexico’s dam inventory and reported that 95% of New Mexico’s dams have drainage areas less than 100 square miles (mi²), and 68% of dams have drainage area’s less than 10 mi² (see Figure 3.1). This data will help focus efforts on hydrologic methods that will be most applicable to New Mexico’s dams.

Gannett Fleming also requested a list of dams that could be used to compile a representative sample that will be used to analyze and calibrate various hydrologic methods. The Dam Safety Bureau indicated that several New Mexico dams were used in the CO-NM REPS study that could also be of use here.

DAM DRAINAGE AREAS (sq. mi.)

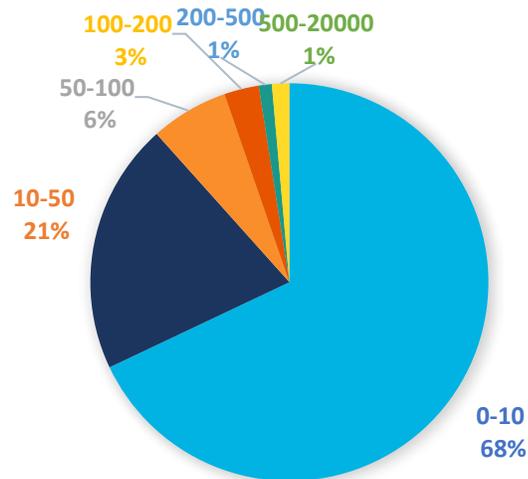


Figure 3.1: New Mexico Dams’ drainage areas.

4.0 Stakeholder Questionnaire

To understand the stakeholders’ knowledge of, experience with, and opinions on New Mexico’s current hydrologic guidelines and hydrologic modeling methods, a questionnaire will be developed and distributed. The Dam Safety Bureau has emails for most stakeholders for questionnaire distribution and suggested posting a link to the questionnaire on their website. The primary stakeholders are users of the proposed guidelines: dam owners and their consulting engineers. The questionnaire will be sent out prior to Workshop No. 2 to allow sufficient time to gather and analyze responses as part of Task 1. The idea of a follow-up questionnaire during Tasks 2 or 3 was also discussed. This follow-up questionnaire would be more targeted based on findings during Task 1 and could solicit feedback on a draft hydrologic guidance document.

Potential questionnaire content was also discussed. An introductory paragraph explaining the purpose of the questionnaire will be included. The questionnaire will also solicit the stakeholder’s background and experience with hydrologic modeling. It was discussed that some questions may not be relevant to all stakeholders; therefore, the questionnaire will contain a note instructing stakeholders to pass on a specific question or the entire questionnaire to a proxy (e.g. consulting engineer). Potential draft questions discussed are listed below:

- What issues or concerns do you have with the existing hydrologic guidelines and Dam Safety Bureau review process? What would you like to see changed?
- What do you like about the existing hydrologic guidelines and Dam Safety Review Process?
- What is(are) your preferred method(s) of analyzing hydrology for a dam?
- What hydrologic method(s) do you feel best represent(s) watersheds in New Mexico?
- What is your experience level with [insert specific hydrologic method]?
- Is there a hydrologic methodology that you believe should be considered in updated Dam Safety Bureau hydrologic guidelines?
- Would you be comfortable applying a risk-based approach to determine the design flood for a dam?
- Do you consider designing for the probable maximum flood (PMF) to be overly conservative?
- Are you interested in reviewing and having opportunity to provide comment on draft updates to dam safety guidelines for the New Mexico Office of the State Engineer Dam Safety Bureau?

This draft list will be further revised to ensure the questionnaire is concise and effective at providing the information desired.

5.0 Project Communication and Schedule

Lastly, project communication preferences and project schedule were discussed. Gannett Fleming will maintain close contact with the Dam Safety Bureau in between workshops. Gannett Fleming has also given the Dam Safety Bureau a directory on SharePoint to upload references that should be considered in the updated hydrologic guidelines. The Dam Safety Bureau has also been given access to view the information collected and stored on SharePoint by Gannett Fleming.

The next steps for the project, prior to Workshop No. 2, are to first develop and distribute the questionnaire and to continue to collect, read, and catalog data to help establish the current state of the practice.

Workshop No. 2 is scheduled for December 17, 2020 from 8:00 am to 2:00 pm (MST)

Workshop No. 3 is scheduled for January 15, 2021 from 8:00 am to 2:00 pm (MST)