
East Barre Dam in July 2023

Study Committee on Dam Emergency Operations Planning

Report to the General Assembly

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Executive Summary

As damaging flood events have become more frequent in Vermont, Vermonters have become more in tune to the damage and damage potential that floodwaters pose to their wellbeing and communities. Along Vermont's rivers and waterways, there are over a thousand dams that are aging as Vermont's communities continue to grow in the floodplains and valleys below. This report was prepared during the Summer of 2025, one and two years removed from the devastating floods of July 10, 2023, and July 10, 2024.

Act 121 established the Study Committee on Dam Emergency Operations Planning (the Committee) to review and make recommendations on how to improve regional emergency operations planning for hazards caused by dam failure. The Committee was tasked with studying how to shift responsibility for emergency planning from individual municipalities to regional authorities, how to improve regional implementation of dam emergency response plans, and how to fund dam emergency planning at the regional level. Specifically, Act 121 focused on the State's HIGH hazard potential dams. These are dams where failure or mis-operation will probably cause loss of a human life. While the failure of a HIGH hazard potential dam may also cause economic loss, environmental damage, disruption of lifeline facilities, and impact other local concerns, these considerations are not considered in determining this hazard potential classification. As of the writing of this report, Vermont has seventy-four (74) dams that are classified as HIGH hazard potential dams which put an estimated 35,000 Vermonters at risk in the event of a dam failure at these dams. The Vermont Department of Environmental Conservation (DEC) Dam Safety Program (DSP) regulates 50 of the dams classified as HIGH Hazard Potential Dams.

The Committee acknowledges that the failure of a HIGH hazard potential dam has a low likelihood of occurrence but can be a very high consequence event. The keys to limiting the loss of life from the failure or mis-operation of a HIGH hazard potential dam are emergency action planning by the dam owner and emergency operations planning by the downstream municipalities. The dam owner prepares what is known as an Emergency Action Plan (EAP), which is an ongoing, written plan that identifies the areas that would likely be inundated by the failure of a dam and identifies the actions that should be taken by the dam owner to protect life, property, lifelines, and the environment in the event of a dam failure or threatening condition at the dam. When an EAP is prepared, it is provided to the regulatory body overseeing the dam and the municipality in which the dam is located. It is then the municipality's responsibility to prepare a dam failure Emergency Operation Plan (EOP) to prepare emergency responders for the potential of a dam failure. EOPs are

incorporated into larger municipal emergency management plans and should be tested regularly, along with the EAP, and the EOP should also be updated regularly as needed.

The Committee identified numerous challenges that exist in Vermont that hinder the preparation and implementation of dam failure EOPs. In general, the challenges include the lack of regional authorities or county government in Vermont, the varied levels of federal funding and financial support for emergency management efforts, inundation areas that impact multiple municipalities, some dams being subject to federal Critical Energy/Electric Infrastructure Information (CEII) rules, and that there are four separate entities that regulate dams in Vermont; two State and two Federal regulators. For municipalities the challenges include, the varied ranges of planning and implementation capabilities (with the most limited municipalities being the most rural), volunteers and the cycling of personnel in and out of emergency management roles, limited time to invest in such a low probability event, the lack of an incentives to generate a dam failure EOP, and historically no funding and very limited technical assistance has been provided to assist municipalities in preparing a dam failure EOP. Additional challenges include, not all HIGH hazard potential dams have an EAP or an up-to-date EAP, and municipalities are not mandated to prepare dam failure EOPs.

The Committee met for nine meetings and discussed four potential options for improving dam failure emergency operations planning. Where the options vary is with who, or what entity, helps facilitate the development of a dam failure EOP. The first option is the existing process which provides limited assistance to facilitate the development of a dam failure EOP and can be improved upon with modest changes to make it more effective. The other three options include facilitation and assistance from Vermont's Regional Planning Commissions (RPCs), Vermont Emergency Management (VEM) Regional Coordinators, or a contractor and would require significant funding and State staff support to implement. The responsibilities that would be conveyed to facilitators include determining who should be at the planning meetings, scheduling the meetings, setting agendas and taking meeting minutes, and ensuring that the outcome of the meetings is the development of an actionable dam failure EOP. Regardless of the option, the Committee is recommending that dam failure emergency operation planning and EOP preparation remain the municipality's responsibility. With regards to funding, all four options need additional funding and support and the three options utilizing facilitators would require significant funding for implementation. The existing process could be improved with limited funding and is considered a viable option to go forward if little or no funding is allocated for this effort. Regardless of the option chosen, the Committee concluded that the EOP

preparation effort for HIGH hazard potential dams should be prioritized by the estimated population at risk (PAR), a calculation found in the dam's EAP.

The Committee was also tasked with evaluating legislative changes that could improve emergency operations planning. The Committee did not identify legislative changes that would further this initiative in Vermont, so none were recommended.

The Committee acknowledges the shortcomings of the existing dam failure emergency operations planning efforts and recommends funding be provided to facilitate EOP development. In the future, funding should be provided for assistance with the facilitation of the development and implementation of dam failure EOPs given the increased incidence of flooding in Vermont. To determine the amount of funding needed, the Committee recommends a pilot project to produce and implement EOPs for one or two State-owned dams in order to test the EOP development and implementation process and to determine more accurate costs. Some emergency operations plan development projects related to dam failures may be eligible for federal emergency preparedness and planning funding from the State Homeland Security Program (SHSP), a federal grant program administered by the Vermont Department of Public Safety Homeland Security Unit. It should be noted that both DEC and VEM staff and each department's Business Offices have limited capacity and would require additional resources to bid out and manage this pilot project and any other effort undertaken as a result of this study. If funding is not available for either a pilot project or for the facilitation of the development and implementation of EOPs, the Committee recommends improving the existing process of providing templates and tools for municipalities to develop dam failure EOPs.

State-Owned Lake Sadawga Dam in Whitingham – Tropical Storm Irene Flooding in September 2011

Table of Contents

State-Owned Waterbury Dam with the Flood Control Gates Closed in December of 2023

All photos included in this report are file photos from the Vermont Department of Environmental Conservation Dam Safety Program files and are of State or Municipally owned HIGH Hazard Potential Dams

List of Figures and Tables

List of Appendixes

The Spillway Riser at Municipally Owned Star Lake Dam in Mount Holly

Act 121 Overview

Act 121 (2024 Acts and Resolves, No. 121, Section 22) established the Study Committee on Dam Emergency Operations Planning (the Committee) to review and make recommendations on how to improve regional emergency operation planning for hazards caused by a potential dam failure. The Committee was tasked with studying how to shift responsibility for emergency planning from individual municipalities to regional authorities, how to improve regional implementation of dam emergency response plans, and how to fund dam emergency planning at the regional level. As required by Act 121, the Committee was made up of one member of the Department of Environmental Conservation's (DEC) Dam Safety Program (DSP), two members of Vermont's Regional Planning Commissions (RPCs), one member of the Vermont Department of Public Safety's Division of Emergency Management (VEM), two dam owners, and one or more municipal emergency management directors or incident commanders with experience in dam emergency operation planning.

The Committee acknowledges that the failure of a HIGH hazard potential dam has a low likelihood of occurrence but can be a very high consequence event. With the increasing frequency and intensity of severe weather events and aging dam infrastructure in Vermont, effective Emergency Action and Emergency Operations Planning are critical to preparing and protecting public safety from such dam failure events.

Wrightsville Reservoir in Middlesex and Montpelier at Flood Stage in July 2024

Legislative Charge

Per Act 121, the Study Committee on Dam Emergency Operations Planning was authorized to conduct up to eight meetings to complete the following:

1) *Identify those dams in the State of Vermont that are classified as HIGH-hazard dams;*
2) *Summarize the existing responsibilities of individual municipalities to prepare for and implement existing emergency response plans, including how those responsibilities are funded and whether placing responsibility with individual municipalities is appropriate;*
3) *Identify the regional planning commissions in which a dam identified under subdivision (1) of this subsection are located;*
4) *Recommend the content for a regional emergency action plan for each dam identified under subdivision (1) of this subsection, including identifying necessary evacuations, how evacuees will be sheltered and provided care, and the location of emergency management centers for each dam;*
5) *recommend who should prepare a regional emergency action plan for each dam identified under subdivision (1) of this subsection, including the basis for the recommendation and the role that regional planning commissions should play in the preparation of the plans;*
6) *Estimate the cost of the production of regional emergency action plans for dams; and*
7) *Estimate the cost for regional planning commissions and municipalities to implement an emergency action plan, including a recommended source of the funding.*

Finally, the Committee was tasked with generating this written report to the General Assembly with its findings and recommendations for legislative action, with proposed legislative action submitted as draft legislation, if applicable.

Lowell Lake Dam – A HIGH Hazard Potential Dam Owned by the Vermont Dept. of Forests, Parks & Recreation

Committee Members

Benjamin Green, PE	Section Chief, Vermont DEC DSP (*Committee Chairperson*)
Michaela Foody	Regional Coordinator, VEM (*Committee Vice Chair*)
Chris Campany	Executive Director, Windham Regional Commission
Christian Meyer	Executive Director, Central Vermont Regional Planning Commission
John Tedesco	Generation Project Coordinator, Green Mountain Power
Scott Johnstone	General Manager, Morrisville Water & Light
Jan Sotirakis	Emergency Management Director, Town of Chittenden
William Lovett	Fire Chief & Emergency Management Director, City of Rutland

Meeting Facilitator and Primary Report Author:

Michael Nahmias	Project Manager, Vermont DEC DSP

Other Interested Parties and Meeting Attendees:

Marc Mihaly	State Representative, Vermont House of Representatives
Charles Martin	Deputy Secretary, Vermont Agency of Natural Resources
Jason Batchelder	Commissioner, Vermont DEC
Neil Kamman	Deputy Commissioner, Vermont DEC
Arion Thiboumery	Dam Owner, Vermont Independent Power Producers Association
Dan Koenemann	District Manager, Winooski Natural Resources Conservation District
Michael Billingsly	Emergency Management Director, Town of Plainfield
Laura Vallett	Environmental Compliance Lead, Green Mountain Power
Maggie O'Brien	Regional Planner, Rutland Regional Planning Commission
Steven Hanna	Dam Safety Engineer, Vermont DEC DSP
Sarah Moore	Program Administrator, Vermont DEC DSP

Historic 1938 Photos of the Downstream (left) and Upstream (right) Embankments of the East Barre Dam

Meeting Summaries

This section provides a brief summary of each meeting conducted by the Study Committee on Dam Emergency Operations Planning. Further discussion is provided in the *Discussion* section of this report, and the full meeting notes can be found in **Appendix B**.

- **Meeting #1 – November 11, 2024:** Kickoff Meeting; Introductions; Discuss legislative charge; Committee Organization; Work Plan Discussion
- **Meeting #2 – December 16, 2024:** Presentation by the Vermont DEC DSP on Dam Safety Emergency Action Plans (EAPs)
- **Meeting #3 – January 27, 2025:** Presentation by VEM on Local Emergency Management Plans (LEMPs)
- **Meeting #4 – February 18, 2025:** Presentation by the Town of Chittenden on the development of their Chittenden Dam Emergency Operations Plan (EOP)
- **Meeting #5 – March 10, 2025:** Discuss EAPs versus EOPs; Discuss minimum requirements of EAPs and EOPs; Discuss regional emergency planning; Establish next steps for final 3 meetings
- **Meeting #6 – April 7, 2025:** Review EAP vs. EOP table; Discuss report outline
- **Meeting #7 – May 12, 2025:** Review initial report draft
- **Meeting #8 – July 14, 2025:** Discuss second report draft and address comments
- **Meeting #9 – August 18, 2025:** Final Report presented to the Committee for vote

Elizabeth Mine Tailing Pile 1 Dam in Strafford – A HIGH Hazard Potential Dam Impounding mine tailings and contaminated groundwater and surface runoff which is treated before being discharged to Copperas Brook

Background Information

According to the Vermont Dam Inventory (VDI), an online database maintained by DSP of all known dams in the State, and the National Inventory of Dams (NID), the State of Vermont has seventy-four (74) dams that are classified as HIGH hazard potential as of the date of this report. A HIGH hazard potential dam is defined as a dam where failure or mis-operation will probably cause loss of human life. Loss of human life estimates due to dam failures in Vermont varies by dam and can be as few as 1 to several thousand people. Dam failures can be caused by natural disasters, such as flooding causing overtopping of a dam, structural issues, or human causes such as inadequate maintenance. Critical infrastructure such as dams can also be the target of terrorists.

Hazard potential classification is dynamic and changes over time due to changes in development downstream of dams in potential dam failure inundation areas. It should also be noted that dam hazard potential classification assignment is the responsibility of the dam safety regulator and has no relationship to the condition of the dam. In Vermont there are four regulators of dams; the Vermont DEC DSP who regulates approximately 1,005 non-power, non-federal dams; the Vermont Public Utility Commission (PUC) who regulates approximately 29 power producing, non-federal dams; the Federal Energy Regulatory Commission (FERC) who regulates approximately 91 power producing dams with a federal license or exemption; and about 21 dams that are Federally owned and are essentially self-regulated by that federal entity, such as the United States Army Corps of Engineers (USACE), the United States Forest Service, or others. The hazard potential classification system that the Vermont DSP uses follows National Dam Safety standards and includes HIGH hazard potential (probable life loss), SIGNIFICANT hazard potential (no probable life loss, but considerable damage to property, lifelines, or the environment), and LOW hazard potential (no probable life loss but potential for minor damage to property, lifelines, or the environment).

Of the 74 dams classified as HIGH hazard potential dams in Vermont, 50 dams are regulated by the Vermont DEC, 4 dams are regulated by the Vermont PUC, 13 dams are regulated by FERC, and 7 dams are owned and regulated by the USACE (these dams are referred to as 'Federal' in this report). These HIGH hazard potential dams are owned by private dam owners (35 dams), municipal governments (23 dams), the State of Vermont (9 dams), and the Federal Government (7 dams). The primary purpose of these HIGH hazard potential dams includes recreation (35 dams), hydroelectric power (18 dams), flood control (11 dams), drinking water supply (9 dams), and impounding mine tailings (1 dam).

Two charts are provided with this report to display the breakdown of HIGH hazard potential dams by what entity regulates the dam (**Figure 1**) and by ownership type (**Figure 2**). A map of all HIGH hazard potential dams in Vermont is included in **Figure 3**. A table of all HIGH hazard potential dams by their location within RPC boundaries is provided as **Appendix A** and a summary table showing the total numbers of HIGH hazard potential dams located within each RPC is provided as **Table 1**.

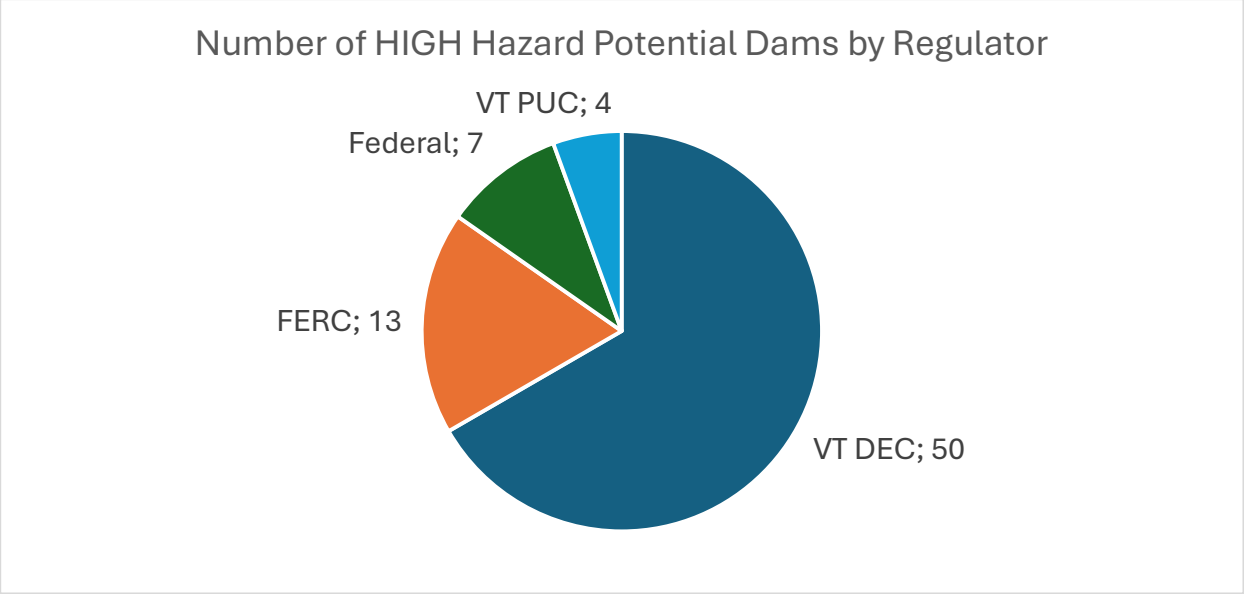

Figure 1: Chart of Vermont HIGH Hazard Potential Dams by Regulatory Authority

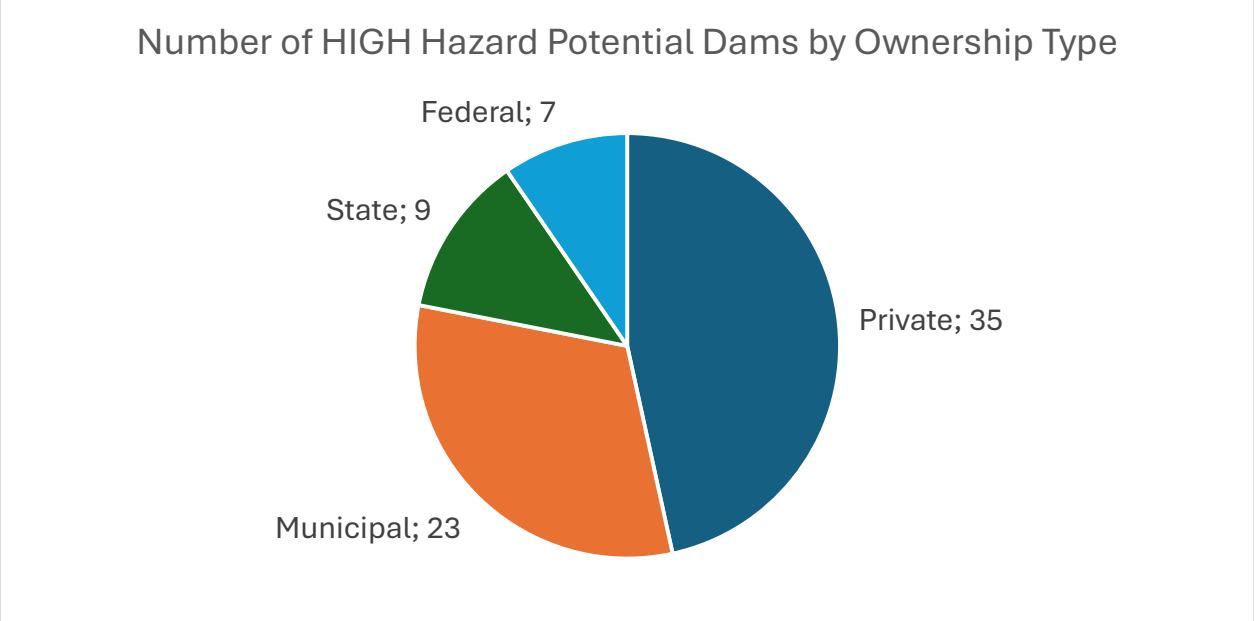

Figure 2: Chart of Vermont HIGH Hazard Potential Dams by Ownership Type

Regional Planning Commission	Number of HIGH Hazard Potential Dams
Windham Regional Commission	18
Two Rivers-Ottauquechee Regional Commission	11
Central Vermont Regional Planning Commission	10
Mount Ascutney Regional Commission	8
Northeast Vermont Development Association	7
Lamoille County Planning Commission	6
Chittenden County Regional Planning Commission	5
Rutland Regional Planning Commission	4
Addison County Regional Planning Commission	2
Northwest Regional Planning Commission	2
Bennington County Regional Commission	1
TOTAL	**74**

Table 1: HIGH Hazard Potential Dams by Regional Planning Commission (sorted highest number of dams to lowest); A table of all HIGH hazard potential dams by regional planning commission, including dam name and municipality the dam is located in, is provided as **Appendix A**.

Photo from the Johnson State Lower Dam Rehabilitation Project in 2012

Figure 3: Map of Vermont's HIGH Hazard Potential Dams

Definitions

The legislation that created this Committee uses the terms '*municipality*' and '*regional emergency action plans*' throughout the legislation. Rather than differentiate between the various types of municipal government and quasi-governmental entities in Vermont that make up the municipal landscape, the Committee chose to use the term municipality throughout the report. On the other end of the spectrum, due to the dam safety industry-specific definition of the term 'emergency action plan,' the Committee decided to differentiate between the two long-standing dam safety and emergency management terms, as shown below, and is not carrying forward the use of the term '*regional emergency action plans*' in this report. Note that the definitions shown in this section are defined in either State rule or Vermont statute and may vary slightly from the definitions established by other federal regulatory authorities such as FERC.

Emergency Action Plan (EAP) – An ongoing, written plan prepared by a *dam owner* that identifies the area (or region) that would likely be inundated by the failure of a dam and identifies the actions that should be taken by the dam owner to protect life, property, lifelines, and the environment in the event of a dam failure or threatening condition at the dam. The plan is usually implemented in cooperation with the local, regional, and State emergency personnel. (§ 37-103 of the Vermont Dam Safety Rule)

Emergency Operations Plan (EOP) – An ongoing plan prepared by *local emergency managers* and maintained by various jurisdictional levels for responding to a wide variety of potential hazards. It is a response-oriented plan that describes how people and property will be protected; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies, and other resources available; and outlines how all actions will be coordinated. A dam failure EOP can be prepared by local emergency managers once an EAP has been prepared by a dam owner.

Other General Dam Safety and Emergency Management Definitions:

HIGH Hazard Potential Dam – a dam where failure or mis-operation will probably cause loss of a human life. While the failure of a HIGH hazard potential dam may also cause economic loss, environmental damage, disruption of lifeline facilities, and impact other local concerns, these considerations are not considered in determining this hazard potential classification. (§ 37-103 of the Vermont Dam Safety Rule)

Dam Failure – the collapse of a dam resulting in the uncontrolled release of all or a portion of the reservoir contents. (§ 37-103 of the Vermont Dam Safety Rule)

Dam Failure Flood Inundation Map – a map that delineates the area that could be flooded by a particular dam failure condition. These maps are generated using complex hydrological and hydraulic models and show the areas downstream that could be inundated by floodwaters in the event of various failures of the dam like a sunny day failure or dam mis-operation, for example.

Hydrologic and Hydraulic Analysis (H&H) – the analytical process of computing the inflow to a reservoir and outflow from a dam under normal and storm conditions and to determine flows in the event of failure. (§ 37-103 of the Vermont Dam Safety Rule)

Emergency Management Director (EMD) – an appointed individual in each Vermont town or city who has direct responsibility for the organization, administration, and coordination of the local organization for emergency management, subject to the direction and control of the executive officer or legislative branch. Generally, the EMD identifies the resources and organization that would be used to support incident command; manages the creation and maintenance of the Local Emergency Management Plan and may also participate in the development of the Local Hazard Mitigation Plan; manages the maintenance of the Local Emergency Operations Center; facilitates Emergency Management meetings with municipal stakeholders to discuss current emergency management plans, organization, equipment, training, and exercises; coordinates citizen preparedness initiatives; and coordinates volunteer recruitment. In the event of an emergency, the EMD leads the Local Emergency Operations Center to coordinate the municipal response. This includes collaborating with the Incident Commander, distributing public information, and procuring and requesting equipment and resources. (20 V.S.A. § 6)

Incident Commander (IC) – A first responder responsible for the overall management of an incident and determines which Command or General Staff positions to staff in order to maintain a manageable span of control and ensure appropriate attention to the necessary incident management functions. The IC is typically the most senior fire department official on the scene but could also be an Emergency Medical Services (EMS) or law enforcement official depending on the scope of the incident. For an incident involving multiple agencies and jurisdictions, a Unified Command consisting of multiple ICs may be established.

Local Emergency Management Plan (LEMP) – The LEMP is an all-hazards emergency management plan for a municipality that establishes lines of responsibility during a disaster as well as identifying high risk populations, shelter locations, established procedures, and resources available during an emergency. (20 V.S.A. § 6(c))

Local Emergency Management Plan Annex ("Emergency Annex") – An annex to a municipality's LEMP that provides specific procedures, protocols, and roles for responding to a particular type of emergency or hazard. An Emergency Annex, combined with the LEMP, is a type of EOP.

Overflowing Spillway Chute at Thurman Dix Reservoir Dam in Orange in July 2024
This municipally owned HIGH Hazard Potential Dam impounds the City of Barre's water supply

Guiding Principles

The Committee identified the following guiding principles:

- Consistency in emergency management and planning should be strived for, to the greatest extent practicable.
- EAPs and EOPs are proactive emergency planning documents and their effectiveness in a dam safety emergency is directly attributed to the level of effort invested.
- Improved natural disaster and flood forecasting and dam safety compliance of critical dams are needed for a better chance at acceptable outcomes from extreme loading events.
- There is a need to increase dam safety awareness amongst municipalities. Municipalities should be encouraged to have a dam failure EOP in the annex of their LEMP.
- At the local level, there needs to be support from municipal leadership for emergency preparedness and for the ongoing updates of EOPs.
- An EAP is a dam owner's plan where the most important actions in the plan are communicating the dam incident/failure situation with the downstream municipalities and trying to prevent or delay dam failure. EOPs are municipal plans that act on the dam owner's communications to protect people and property from dam failures or incidents.
- A regularly updated EAP that meets applicable regulatory standards is needed for EOPs to be effectively updated regularly and for the EOP to be effective.
- Trust building between the dam owner and operator, ICs, EMDs, and other emergency planners is an important first step in emergency planning. Effective relationship building and collaboration is the key to success in planning.
- An EOP is developed (at a minimum) using the worst-case scenario inundation map from the EAP.
- In dam failure emergency operation planning, the planning team should include the local EMD and other public safety officials because they have the local knowledge needed to contribute to the drafting and implementation of these plans.
- An outside facilitator taking an organization and logistics role in dam EOP development may be helpful by bringing together public safety and emergency management stakeholders of impacted communities for collaboration, scheduling meetings, developing agendas, keeping planning activities on track, and ensuring that the EOP is submitted to the appropriate authorities for review and/or acceptance.

- A plan is just a plan without the ongoing commitment to act on the plan going forward. There needs to be training, drills, and tabletop exercises to ensure the effective implementation of any dam failure EOP in the event of a dam failure.
- Any assistance in producing a dam failure EOP should be provided based on a risk-based prioritization, meaning dams with the highest risk and probability of adverse outcomes and high consequences should be prioritized over dams that present a lower risk.

These guiding principles emerged from the collaborative work and discussion between Committee members and meeting attendees and reflect ideas critical to the future success of the development, implementation, and maintenance of effective dam failure EOPs. These principles provided the framework for the solutions the Committee developed to address the shortcomings in dam failure EOP production and implementation in Vermont.

Spring 2011 Overtopping of Stiles Pond Dam, a Municipally Owned HIGH Hazard Potential Dam in Waterford

Challenges Identified by the Committee

The Committee shared these common challenges regarding Dam Safety emergency preparedness and operations:

- In the absence of county-level government and other regional authorities in Vermont, clearer distinctions are needed in roles amongst the State, municipalities, dam owners, and the public regarding their responsibilities in emergency preparedness and response.
- As of this writing, there is uncertainty around both the continuation and amount of federal financial support for emergency management and preparedness which could impact basic operations at all levels of government. This report is written assuming current operations, capacity, and planning tools will remain in place, but federal funding outcomes, and related State budgeting decisions, could ultimately impact the ability to carry out the recommendations contained herein.
- Municipal dam emergency operations planning and implementation capabilities vary widely across Vermont.
- Success in emergency preparedness requires maintaining a strong relationship between municipal emergency management personnel, the dam owner and operator, and the public. Effective communication is crucial for preparing and implementing EOPs in the event of a dam-related emergency, as there is often a short time between a dam failure and the subsequent downstream flooding.
- Many of the personnel involved will be volunteers and having to rely on volunteer capacity for continuously updating EOPs is a challenge. Personnel in these roles often cycle in and out of their roles, leading to constant changes. Due to this, it may be difficult to retain personnel with experience and training on implementing the EOP. Ideally, three or more emergency management personnel should be proficient in the implementation of the dam failure EOP.
- More funding opportunities are needed to assist municipalities in emergency preparedness, particularly regarding the commitment of volunteer and/or staff time needed to plan for and respond to risks associated with HIGH hazard potential dams.
- It can be difficult to convince municipalities and emergency management personnel to invest in emergency planning for events with a low probability of occurrence such as dam failures and related incidents.
- There is currently varying capacity amongst municipalities with many not having the bandwidth to complete plans and exercises that do not provide any immediate benefit for the Town and may see this effort as a burden.

- There is no incentive for a municipality to develop dam failure EOPs. There is also no mandate requiring municipalities to develop and maintain dam failure EOPs.
- Dam failure flood inundation mapping often overlaps town, regional, county, and even State lines, making it difficult to set clear boundaries for emergency planning and implementation.
- RPCs only work with their member municipalities and may not be able to work with municipalities outside of their membership area on EOPs or other planning efforts.
- Not all HIGH hazard potential dams currently have an EAP or have an up-to-date EAP and population at risk (PAR) estimating methodology used in EAPs has varied greatly from detailed computer-aided analyses to more rudimentary methods.
- There are four separate entities currently regulating dams in Vermont. Two are State entities, the Vermont DEC's DSP and the PUC, and two are federal agencies, including the FERC and the other federally owned dams that are self-regulated. Additionally, in 2028, all dams previously regulated by Vermont's PUC and not subject to federal regulations will transfer to the Vermont DEC for all Dam Safety regulatory matters.
- Federal dams may have Critical Energy/Electric Infrastructure Information (CEII) that generally may not be shared with the public. This may include EAPs and inundation maps depending on the specific federal regulator and the content of the document.
- While the topic of dam failure flooding and emergency planning may have been an important initiative at this time of this legislation following two Summers with devastating floods, the drive to improve the planning efforts may subside as time goes on as the topic falls from the forefront of the legislature's priorities.
- Vermont's Public Safety landscape has numerous limitations and variabilities as not all municipalities have a dedicated or contracted fire department, EMS Service, and/or police department. Additionally, not all first response services are municipal, some are private, non-profit, or regional, and some are not based in Vermont.
- There is a lack of Business Office staff capacity at both DEC and VEM. These staff are needed to support any effort to grant funding to municipalities or contract with contractors to help facilitate any efforts to prepare and implement EOPs.

Additionally, the Committee interviewed an EMD from Townshend, Vermont who shared their Town's experience responding to the July 2023 flooding. Townshend is a downstream community to two of the HIGH Hazard potential dams identified in this report, Ball Mountain Dam and Townshend Dam. The EMD corroborated many of the challenges identified by the Committee related to the volunteer nature of emergency management work and lack of resources and bandwidth at the rural, small-town level to be able to produce, implement, and maintain an effective EOP.

Discussion

The Committee convened for nine meetings from November 2024 through August 2025. This section summarizes pertinent Committee discussions. The meetings kicked off with an introductory meeting with a general discussion on Dam Emergency Operations planning as it currently exists and identifying common thoughts amongst the Committee. The DSP introduced the Committee to the Vermont Dam Inventory (VDI), which is a publicly available database with detailed information of all of the known dams in Vermont, and presented maps and tables to display the list of HIGH hazard potential dams that would inundate Vermont communities in the event of a dam failure. The Committee reviewed the legislative charge and discussed each task generating a list of challenges and common thoughts.

The second and third meetings included a presentation by the DSP regarding EAPs and their content and development and a presentation by VEM on LEMPs. The DSP presented two examples of an EAP, one from a HIGH potential dam and one from a SIGNIFICANT hazard potential dam. The Committee discussed preventative measures that dam owners could take to reduce the risk of failure during a forecasted flood event, dam fees and their role in reminding dam owners of their responsibilities, complexities regarding emergency communications, and other general ideas on how to improve EAPs. The general thoughts on EAP improvements included providing a standardized template for EAPs, requiring EAPs to be updated every two years, requiring inundation mapping for a wider range of scenarios, requiring a greater level of detail on dam failure flood inundation maps (to include downstream infrastructure, major roadways, bridges, etc.) included in EAPs, and how to best share this information with the public.

VEM's presentation on LEMPs started with defining the roles of municipal emergency management personnel, such as the EMD and IC, as well as discussing the various plans that government units use to prepare for emergencies and coordinate their response. EMDs and members of public safety agencies that contribute to updating the LEMP and other emergency plans are primarily made up of volunteers, especially in rural Vermont towns where many dams are located. In general, the LEMP establishes the location of the Municipal Emergency Operations Center (EOC), identifies who has EOC activation authority, identifies the EOC staff positions and responsibilities, provides facility information for each potential EOC location, identifies emergency purchasing agents, provides a list of municipality-owned resources, identifies communities requiring additional coordination, describes public information and warning systems, provides facility information for each potential shelter, and lists the local contacts for the local emergency management team. The LEMP is typically updated annually after Town Meeting Day. Most Vermont

municipalities comply with the LEMP requirements. A current LEMP is also required for municipalities to receive increased State reimbursement through the Emergency Relief and Assistance Fund (ERAF) which provides State funding to match Federal Emergency Management Agency (FEMA) Public Assistance after federally declared disasters. It was noted that no such incentive exists to incentivize municipalities to develop dam failure EOPs.

In the fourth meeting, Committee members learned how Chittenden, Vermont, a small town in Rutland County, prepared an EOP for the Green Mountain Power (GMP) owned Chittenden Dam. Chittenden Dam is a HIGH-hazard potential dam located on East Creek that was built in the early 1900s. The dam is currently regulated by the PUC. From the dam failure flood inundation maps included in the EAP prepared by GMP, it is estimated that approximately 118 homes in Chittenden, and many others further downstream, could be inundated with flood waters if the dam were to fail. The inundation area includes Chittenden and several downstream municipalities including Pittsford, Rutland Town, and Rutland City. Discussion included the importance of mutual aid plans and relying on adjacent communities to access parts of the inundation area that are cutoff from their own municipality's emergency responders, the importance of effective inundation mapping scenarios and the necessary detail on the dam failure inundation maps to guide the development of an EOP, what situational-based scenarios should be included in an EOP, what CEII can be shared with the public, and how to educate and inform the public regarding dam failure hazards. Chittenden's EMD first identified the need for additional emergency operations planning when GMP provided the EAP for Chittenden Dam and the emergency notification tree initially included just one notification to the Chittenden Town Clerk, whose emergency response duties and office hours are limited. Chittenden's EMD assembled a team, known as the Chittenden Reservoir Emergency Action Planning (CREAP) team, that included downstream EMDs, dam owner representatives, mutual aid association members, the local ambulance district, and State emergency management personnel including State Police, State Dispatch, and the Urban Search and Rescue Team. CREAP meets regularly to generate more detailed emergency notification trees, discuss possible dam emergency scenarios, understand dam failure inundation maps, generate emergency evacuation plans and mutual aid plans, obtain sirens to alert downstream property owners of the dam emergency, and to perform tabletop exercise and siren tests. The Rutland Regional Planning Commission provided support to CREAP's effort by coordinating and hosting meetings and tabletop exercises, providing support to member municipalities in developing EOPs, co-hosting quarterly meetings, and finalizing and distributing meeting agendas and minutes to the CREAP team.

During subsequent meetings, the Committee discussed high-level issues such as EAP and EOP minimum requirements and criteria (An EAP vs. EOP requirements comparison table is provided as **Appendix C**), emergency communications, regional and State emergency planning resources, and the concept of a new hazard potential classification, ULTRA-HIGH hazard potential dams. The Committee was made aware of the State of California's dam hazard potential classification system which includes an 'EXTREMELY HIGH' hazard potential classification for their dams. In California, the definition of an EXTREMELY HIGH Hazard potential dam is a dam that if it were to fail, is expected to cause loss of at least one human life and may result in an inundation area with a population of 1,000 persons or more, or inundation of facilities or infrastructure, the inundation of which poses a significant threat to public safety. It is the Committee's understanding that California is the only State to have adopted an EXTREMELY HIGH hazard potential classification, which is therefore unique and outside of national dam safety standards. The classification was reportedly developed because many of California's HIGH hazard potential dams are located on or near major tectonic plate boundaries resulting in increased earthquake and geologic hazards near major population centers. In addition, the 2017 partial spillway failure of Oroville Dam in Oroville, CA (the nation's tallest dam at approximately 770 feet tall) that prompted the evacuation of approximately 190,000 people located downstream of the dam also reportedly contributed to the development of the EXTREMELY HIGH hazard potential classification. Conversely, Vermont does not have the challenging geology and earthquake prone areas, the high number of large dams, nor the significant population densities of California. The Committee discussed how the addition of a strongly worded hazard classification like EXTREMELY or ULTRA HIGH is generally inconsistent with the principles of hazard communication and may alarm the public needlessly. The Committee discussed prioritizing the HIGH hazard dams by population at risk (PAR) to effectively use limited resources to target dams within the HIGH hazard class with the highest PAR as opposed to adding a hazard classification.

Findings and Recommendations

The Study Committee on Dam Emergency Operations Planning has the following findings and recommendations based on the tasks assigned to the Committee in Act 121. Below is a list of legislative charges followed by a summary of the Committee's work to address the charge. Please note that in this section, the Committee uses the EOP and EAP as defined in this report as opposed to how it was defined in Act 121.

1) *Identify those dams in the State of Vermont that are classified as HIGH-hazard dams.*

   A table of the HIGH-hazard potential dams that would impact the State of Vermont in the event of a dam failure is provided in **Appendix A**.

2) *Summarize the existing responsibilities of individual municipalities to prepare for and implement existing [dam failure EOPs], including how those responsibilities are funded and whether placing responsibility with individual municipalities is appropriate.*

   Per 20 V.S.A. § 6, individual municipalities are responsible for annually updating their LEMP, which may include any annexes and specific EOPs that have been created for specific hazards that exist in their community. Annexes are like an appendix where other plans like EOPs can be listed and referenced. VEM previously provided grant funds to RPCs to assist municipalities in preparing or updating their LEMPs. Now, Regional Coordinators work directly with town or city officials to update LEMPs. The municipality's direct participation in drafting LEMPs, All Hazard Mitigation Plans (AHMPs), annexes to their LEMPs, and EOPs are essential and appropriate to their success in implementation. These efforts are currently supported by Federal funding and the future availability of this funding to the State of Vermont is currently unknown.

   The Committee identified concerns regarding the lack of regional authorities in Vermont to shift these responsibilities to as there is not a county-level government in Vermont and there are no regional emergency authorities. Additionally, RPCs are not experts in emergency response and do not participate in the implementation of LEMPs or EOPs. The Committee has concluded that individual municipalities, including their EMD, fire departments, first responders, public works departments, road crews, and others, are essential to the development of an effective LEMP, Annex, and EOPs. Local officials know their municipality best, including where resources are located, who owns certain properties, where there are access ways that are not

necessarily town roads, trails, or State roads, what properties are occupied full-time, and how to access locations when perhaps main roads are not passable. The EMD and first responders will be implementing the EOP when the specific hazard has arisen and must be knowledgeable on what is in the plan and how to implement the plan. Keeping this responsibility with individual municipalities and the individuals who are to respond to an event like this is imperative to the safety of downstream residents and property owners in the event of a dam failure.

3) *Identify the regional planning commission in which [HIGH-hazard potential dams] are located*.

   A table of high-hazard potential dams sorted by RPC can be found in **Appendix A**.

4) *Recommend the content for a regional emergency action plan for each [HIGH-hazard potential dam] in Vermont, including identifying necessary evacuations, how evacuees will be sheltered and provided care, and the location of emergency management centers for each dam*.

   It is the opinion of the Committee that regional emergency action plans do not make sense as Vermont does not have regional or county-level governments to implement and maintain these plans. Rather the Committee found that the already existing EAP and EOP/Dam Annex system works best for dam owners, individual municipalities, and most importantly first responders and the safety of downstream residents and property owners. A table comparing the content of EAPs to the content of EOPs is provided as **Appendix C**. The main issue identified by the Committee is that the existing system is essentially unfunded and not mandated. The Committee agrees that a regional approach is needed in terms of mutual assistance needed to respond to a dam emergency or failure. This means that first responders and resources from, and included in, adjacent municipalities may be able to respond more effectively and may be best suited to shelter evacuees and provide care due to the likelihood that the municipality where the dam is located may have impacts to their roadways, village centers, and municipal infrastructure.

5) *Recommend who should prepare an [EOP] for each [HIGH-hazard potential dam in Vermont], including the basis for the recommendation and the role that regional planning commissions should play in the preparation of the plans*.

Dam owners prepare, update, and maintain EAPs. The dam owner provides the EAP to the municipality where the dam is located and to downstream municipalities that would be inundated by a dam failure. Currently, the municipality is responsible for analyzing the information in the EAP and is put in the position to consider developing an EOP based on the information provided. The Committee discussed several options for how these responsibilities could be managed. On the following pages, four potential options are described, followed by a list of pros and cons. It should be noted that the Committee did not consider the regional emergency operations plan as a viable option going forward due to the challenges identified in this report. Therefore, this is not included as a potential option in the list below. The Committee discussed how with all of these options a system is needed to track HIGH hazard potential dams and their EAPs and whether the downstream municipalities have an up-to-date EOP. Currently, neither VEM nor DEC are tracking this, and neither is notifying municipalities that it is their responsibility to develop an EOP.

Silver Lake Dam - This State-owned HIGH Hazard Potential Dam has a roadway on the crest of the dam

Option 1 – Municipality prepares Municipality-Specific EOP

This option is basically the existing process, but it formalizes the requirement that municipalities complete the dam failure EOP. For this to be successful, HIGH hazard potential dam owners also need to generate and maintain an up-to-date EAP for their dam and be available to coordinate and educate municipalities on its contents. From there, it is the municipality's responsibility to generate an EOP for this specific hazard to be included as an annex to their LEMP. This option could be optimized by providing EAPs to downstream municipalities along with a guidance sheet, templates, and contact information for VEM and DSP who could assist with either developing the EOP (VEM) or interpreting the EAP (DSP).

Pros: Municipal officials are most knowledgeable about their municipality's resources, familiarity with adjacent municipalities and their contacts, nearby and potentially impacted property owners, and more.

Municipal officials will be the first responders and, usually, the IC for a dam failure event and will have to be knowledgeable of the EOP to implement it effectively.

An EOP template already exists in the form of a Dam Emergency LEMP Annex template and can be modified to fit specific situations.

In the event that no additional funding is made available, this is the status quo approach.

Cons: Municipalities are largely assisted by volunteers without the capacity, time, expertise, or resources to prepare EOPs and update EOPs regularly.

It is unknown how many municipalities have prepared EOPs for dam failures as this metric is not currently tracked.

Smaller municipalities are generally at their capacity when it comes to applying for and implementing any grant funds, so providing funding to municipalities to draft EOPs may be impractical, and some small municipalities may not apply for and accept funding due to limited capacity.

No funding currently is provided to the municipalities to support this effort.

There is no requirement requiring dam failure EOPs be maintained.

Training and guidance documents need to be developed to help guide municipal officials produce and implement effective dam failure EOPs.

It may be difficult to envision the benefit to the municipality in undertaking this effort given the very low likelihood of dam failure.

Option 2 – RPC assists municipalities with municipality-specific EOP preparation

This option keeps the municipality as responsible for their municipality-specific EOP but tasks RPCs with facilitating the process and generating the EOP document on behalf of the municipalities. Grant funding as well as training would be provided to RPCs to assist municipalities in preparing EOPs. RPCs would have the option to use the grant funding to hire a contractor or use their own in-house staff to complete this work with the municipalities. VEM Regional Coordinators and DSP staff would be available to assist and provide guidance. It is uncertain which Department's Business Office will grant these funds, and which Department will manage the project.

Pros: EOPs remain municipality-specific which allows for easy implementation by local ICs, EMDs, and key personnel listed in the LEMP.

RPCs have experience analyzing maps and preparing plans and have GIS capabilities.

RPCs are currently partially supported by grants from VEM for their emergency management efforts.

RPCs have experience assisting municipalities with the preparation of LEMPs and AHMPs whether it be by using in-house staff or hiring qualified contractors.

RPCs are well-versed in facilitating meetings.

RPCs are better suited than municipalities to receive grant funding and reliably carrying out the grant requirements.

RPCs facilitate Regional Emergency Management Committees (REMCs) that meet regularly and have contacts for EMDs in their member municipalities.

RPCs can coordinate meetings amongst multiple communities to ensure the EOPs consider each municipality's needs.

Cons: Skillsets vary between RPCs.

RPCs will not work in municipalities that are not member municipalities, so if a dam failure inundation zone crosses multiple RPC territories, multiple RPCs will have to be involved in preparing EOPs for a single dam.

The capacity of RPC staff may be a concern.

VEM and DEC Business Office staff have little capacity.

Uncertainty regarding which Department would oversee and manage this project.

Option 3 – VEM Regional Coordinators assist municipalities with preparing EOPs

In this option, VEM Regional Coordinators would take the lead on working with municipalities to draft municipality-specific EOPs. VEM Regional Coordinators would be trained in evaluating EAPs by the DSP and would use a template to create the EOPs with the assistance of municipality staff. DSP staff would be available to assist VEM with reading inundation maps and understanding dam-specific EAPs

Pros: VEM Regional Coordinators have the most experience and training of anyone listed in any of these options in preparing various sorts of emergency management and emergency response plans.

VEM already works closely with municipal EMDs, ICs, and stakeholders regularly to assess and update plans and annexes to plans.

EOPs remain municipality-specific which allows for easy implementation by local ICs, EMDs, and key personnel listed in the LEMP.

This option would likely result in the most consistency between the plans generated across the State.

VEM Regional Coordinators also have territories and some inundation zones from dam failures across territory lines. VEM Regional Coordinators regularly assist other regions and do not have the same constraints as RPCs.

Cons: VEM Regional Coordinators do not have the capacity to do this additional work, and additional staff will be needed.

VEM does not have GIS capabilities and will need this to help municipalities analyze dam failure inundation maps and develop actionable EOPs.

Lake Paran Dam in Bennington is owned by the Vermont Agency of Transportation

Option 4 – A Contractor/Consultant is hired to develop EOPs for all HIGH hazard potential dams

In this option, the State would put out a request for proposal (RFP), or RFPs, by region to retain a contractor to arrange meetings with impacted municipalities and generate EOPs. This could be bid out as a statewide effort or bid out by RPC territory. This would allow a bidder to apply for certain regions or allow for RPCs to bid on their region. It could also be a flexible RFP which could allow a bidder to apply for a region or two, or the entire State. The contractor(s) would need to be well versed in evaluating EAPs and preparing EOPs. It is uncertain which Department's Business Office will oversee the funding and contracting for this project and which Department will manage the project.

Pros: This is likely the most efficient option in terms of having EOPs prepared for every municipality that could be impacted by a HIGH hazard potential dam failure.

Flexibility in the bidding process would allow RPCs to bid, as a contractor, on an RFP for preparing EOPs in their region.

If one contractor completes all EOPs under one contract, the EOPs would be standardized in their format.

Cons: Likely the costliest option.

Personnel at the State level with capabilities to do this work are not included.

Considerable staff time at DEC between the Business Office and DSP project management staff is needed to carry out this effort.

Facilitating meetings with over 100 municipalities and relevant stakeholders to carry out this mission will be difficult.

Concerns on EOP quality given the short duration contract approach. Less opportunity for building institutional knowledge.

VEM and DEC Business Office staff have little capacity.

Uncertainty regarding which Department would oversee and manage this project.

Discussion

First, the Committee is recommending that dam failure emergency operation planning and EOP preparation remains the municipality's responsibility. Where the options vary is with who, if any entity, helps facilitate the development of a dam failure EOP. Option #1 is the existing process with limited assistance provided to facilitate the development of a dam failure EOP and can be improved upon with modest changes to make it more effective. With regards to whom facilitates and assists municipalities in developing the dam failure EOP in the other options, Option #2 tasks RPCs, Option #3 tasks VEM Regional Coordinators, and Option #4 tasks a contractor. The responsibilities that would be conveyed to facilitators include determining who should be at the meeting, scheduling the meetings, setting agendas and taking meeting minutes, and ensuring that the outcome of the meetings is the development of an actionable dam failure EOP. With regards to funding, Option #2, #3, and #4 would require significant funding for implementation. Option #1 could be improved with limited funding and is considered the viable option to go forward if little or no funding is allocated for this effort. Regardless of the option chosen, the prioritization of HIGH Hazard Dams by PAR should be considered. The higher consequence HIGH hazard potential dams that could cause more potential life loss in the event of a dam failure should be prioritized for EAP and EOP assistance. It is estimated that over 35,000 Vermonters live in the dam failure inundation areas downstream of Vermont's 50 DEC-regulated, HIGH hazard potential dams. A chart comparing PAR ranges for the 50 HIGH hazard potential dams regulated by the Vermont DEC is provided as **Appendix D**, which also includes a listing of dams by PAR range.

6) *Estimate the cost of the production of [dam failure EOPs] for [HIGH-hazard potential] dams.*

As currently configured, little is known about the costs for developing a dam failure EOP using the existing process. Costs for developing a dam failure EOP for a HIGH-hazard potential dam may vary widely. For example, some of Vermont's HIGH Hazard Potential dams have dam failure inundation maps that span numerous municipalities which would require very robust, municipality-specific EOPs with participation from each individual impacted and adjacent downstream community and their respective emergency response organizations. A series of milestones needed for the production of a dam failure EOP were generated based on the experience of the members from the CREAP team. The list below is a list of milestones that would generally be needed for the production of an EOP.

Milestone 1: EAP Review by Each Municipality
Local EMDs receive EAP from the local dam owner or operator.

Milestone 2: Kickoff Meeting with Each Municipality
EMD meets with the dam owner to ask general questions, introduce each other, and develop a working relationship. The EMD determines what neighboring and downstream communities, and other emergency response agencies should be at future meetings and form a group to develop the dam failure EOP.

Milestone 3: Standing Meetings with Each Municipality
EMD and others meet regularly with each other to develop an EOP. If needed, DSP or VEM are available for technical assistance.

Milestone 4: Finalize EOP for Each Municipality
The group finalizes the EOP and submits EOP to VEM and attaches the EOP to their LEMP's Emergency Annex.

If the State were to distribute funding for the above effort, additional costs would be incurred for in-State financial management, grant management, and agreement negotiations and a State project manager or administrator would be needed to administer the program. Additional costs that may be incurred are town staff and their salaries, volunteer participation in plan development and compensating them for their time to incentivize participation, State officials to train the contractors or facilitators, travel for town staff, volunteers, and State officials to attend meetings, meeting space, food for meetings, and so forth.

Appendix E provides a table of costs related to the production of an EOP. The range of costs of EOP development was estimated to be between $10,000 and $30,000 per EOP produced per municipality but could vary further. The table includes numerous assumptions, and it should be noted that further study is needed to determine refined cost estimates for EOP funding, development, and implementation. If this is the direction chosen by the legislature, the Committee recommends a pilot project to produce EOPs for one or two State-owned dams in order to test the process and to determine more accurate costs.

7) *Estimate the cost for regional planning commissions and municipalities to implement a [dam failure EOP], including a recommended source of funding.*

As currently configured, little is known about the per municipality costs for implementing and updating a dam failure EOP. Costs will vary widely. Below is a list

of milestones that need to be completed to implement and update an EOP following production. Some milestones are one-time tasks while others are ongoing tasks.

Milestone 1: Plan EOP Implementation Trainings
The team that developed the initial EOP reviews the EOP and determines which emergency response organizations, firefighters, police, local emergency services, etc. need to be trained on the implementation of the dam failure EOP.

Milestone 2: Develop a notification system (if needed)
If needed, consult with experts to determine if the existing notification system is appropriate. If not, develop an adequate system to effectively alert the population at risk of an imminent dam failure.

Milestone 3: Train local first responders (ongoing)
First responders are trained in the concept of the dam failure EOP and its implementation; these can be hosted centrally but in certain areas, these meetings may need to be held separately and in several towns.

Milestone 4: Tabletop exercise, public outreach & annual exercises (ongoing)
Now the plan is tested. A 'test' dam failure, known as a tabletop exercise, takes place and the EOP is activated (if the dam owner is involved, they may test their EAP's effectiveness at this same time). The group observes how the EOP is implemented and discusses it with other first responders. This may include a hot-wash-style meeting following the exercise. Public engagement campaigns at local events and meetings should be utilized to inform the public of the response plans.

Milestone 5: Post-EOP Adoption Standing Meetings (ongoing)
The group should meet at least twice annually, once to perform an annual tabletop exercise and once to review the EOP and discuss any changes. The notification system should be tested during these meetings as well.

Milestone 6: Update EOP & Public Engagement (ongoing)
When the dam owner updates their EAP or on a timeframe determined by the group, the EOP will need to be updated to reflect the latest land use, inundation failure mapping and more. This update would require multiple meetings in succession until the EOP has been updated. Some EOPs may need to be updated annually. Engage with the public regarding the plan through public education.

Like above, if the State were to distribute funding for the above effort, additional costs would be incurred for in-State financial management, grant management, and agreement negotiations and a State project manager or administrator would be

needed to administer the program. Additional costs that may be incurred are town staff and their salaries, volunteer participation in exercises and trainings and compensating them for their time to incentivize participation, State officials to attend exercises, travel for State officials to potentially attend exercises, meeting space, food for meetings, and so forth.

Appendix E provides a table of costs related to the implementation and ongoing updates and maintenance of an EOP. The range of estimated costs of EOP development and implementation was estimated to be between $25,000 and $55,000 per EOP per municipality with annual ongoing implementation costs ranging from $10,000 to $30,000 per year per EOP per municipality. These costs do not include the costs of any sort of warning system such as sirens to warn the public of the imminent threat. The table includes numerous assumptions, and it should be noted that further study is needed to determine refined cost estimates for EOP funding, development, and implementation. If this is the direction chosen by the legislature, the Committee recommends a pilot project for the implementation of EOPs for one or two State-owned dams in order to test the process and to determine more accurate costs.

Chestnut Hill Reservoir Dam in Brattleboro was originally built in 1884 to provide water service to the Town

Potential Legislative Action Findings and Recommendations

Per Act 121, the Study Committee on Dam Emergency Operations Planning *"…shall submit a written report to the General Assembly with its findings and any recommendations for legislative action. Any recommendation for legislative action shall be as draft legislation."* Below are summaries of the two topics the Committee discussed as possible recommendations for legislative action.

ULTRA-HIGH Hazard Potential Dam Classification:

Below is a list of pros and cons related to the discussion the Committee had related to adding a new hazard potential classification to the existing hazard classifications used in Vermont. This classification would be known as the ULTRA-HIGH hazard potential dam and would only include the dams with the highest PAR in the event of dam failure.

Pros: Provide the ability to apply more stringent standards to dams with greater downstream population at risk and hazards. Proponents noted that this could come in the way of enhancements above the minimum standards for EAPs.

Cons: This new hazard potential classification is not nationally recognized and outside the industry norm. While it is sensible in California with its unique geologic hazards, large dams, and high population centers, Vermont does not share those geologic hazards, has far fewer large dams, and much smaller population centers.

Vermont would have to develop a different set of criteria around potential life loss and population at risk that would likely vary from California's. The value of this to Vermont and addressing dam failure emergency planning and responding is not clear.

The designation would not effectively apply to all dams in Vermont given the dam safety regulatory landscape. For example, the Winooski River Basin flood control dams may be candidates for the new hazard potential classification, as would the Connecticut River Basin flood control dams. However, the former are regulated at the State level by the DSP while the latter are self-regulated at the Federal level by the USACE. While adjusting State law is possible, adjusting federal law and placing additional requirements on the USACE is unlikely to be successful or productive.

The use of modifiers in regulation and risk communication, such as "extremely" or "ultra", is not recommended due to lack of precision. It is more effective to State the specific risk.

There are more effective ways that do not require legislation to prioritize dams by risk for things like EOP development within the existing hazard potential classification system.

The Committee concluded that the introduction of additional hazard potential classification, other classifications, or point systems would not advance the Vermont DSP's mission to reduce risks to life, property, and the environment from dam incidents and dam failure. Therefore, the Committee does not recommend a legislative change to include an additional hazard classification.

Joint Powers Authority Concept:

The chairperson of the Committee, Benjamin Green, interviewed Tim Washburn (retired) formerly of the Sacramento Area Flood Control Agency (SAFCA) regarding California's Dam Safety classification system (related to the ULTRA-HIGH hazard dam classification above). During that conversation, California's Joint Powers Authority (JPA) was discussed. Following the conversation, the JPA concept was brought forward to the Committee for discussion as a potential topic for legislative action. A summary of the conversation is below:

> *Amongst the largest threats to dams are flooding events. Improved forecasting has been very helpful in the ability to plan for and contend with floods as there is a greater ability to plan and "not get caught" through improved prediction and advance warnings. The more time a dam owner and community have to prepare, in general, the better the outcomes. Dams that are up to design standards should provide predictable performance and handle floods safely while the performance of dams that do not meet standards is questionable. In California, one way that resources were pooled to plan for and respond to flooding issues downstream of dams (failure, high releases, etc.) is the Joint Powers Authority or JPA. JPAs typically include municipalities, county government, and levee owners/operators in a dam failure flood inundation zone, but not federal dam owners who cannot participate. The primary responsibility of the JPA is to protect citizens during flooding events. The JPA is a multi-entity agreement that allows the group to act collectively, while keeping power local. JPA's are State legislated, and the State compels the entities into these agreements and provides minimum standards that must be met to receive certain levels of federal and State aid. The State first requires that JPAs cooperate in the development and implementation of a plan then further integrate overtime to improve cooperation and cost sharing. JPAs can levy taxes, which spread costs over much larger populations and make it more reasonable, sharing costs fairly across varying levels of exposure levels (nearest the dam's worst impacts, less but still notable further away).*

The Committee did not think the JPA model was appropriate for Vermont for numerous reasons including lack of regional government, lack of sufficient populations to support the model, lack of public support for another layer of taxation, and uncertainty regarding the level of effort needed to establish JPA's.

The Committee did not discuss any other suggestions for legislative change and believes that many minor changes and improvements to Dam Safety Emergency Action Planning can be incorporated into existing processes and future rule updates.

A Vermont DEC Dam Safety Inspector at St. Albans North Reservoir in 2025
HIGH Hazard Potential Dams in Vermont are inspected once every two years

Conclusions

The State of Vermont has 74 dams that are classified as HIGH hazard potential dams. Of the 74 dams classified as HIGH hazard potential, 50 dams are regulated by the Vermont DEC, 4 dams are regulated by the Vermont PUC, 13 dams are regulated by FERC, and 7 dams are owned and regulated by the USACE (Federal). These HIGH hazard potential dams are owned by private dam owners (35 dams), municipal governments (23 dams), the State of Vermont (9 dams), and the Federal Government (7 dams). The primary purpose of these HIGH hazard potential dams includes recreation (35 dams), hydroelectric power (18 dams), flood control (11 dams), drinking water supply (9 dams), and mine tailings (1 dam).

All HIGH-hazard potential dams must have regularly updated EAPs that meet applicable regulatory standards as the building block to planning for dam failures and the development of an EOP. Dam Owners must remain available to coordinate EAPs with Local EMDs/ICs and educate them on the plan. Success in developing an effective EOP is built on trust, open communication, and the common goal of protecting public safety. Increased funding could improve outcomes. Without increased funding, some systematic improvements can be made, but success will be more challenging. One systematic change that should be implemented immediately is the prioritization of HIGH hazard dams by PAR. The higher consequence HIGH hazard potential dams that could cause more potential life loss in the event of a dam failure should be prioritized for EAP and EOP assistance.

The Committee acknowledges the shortcomings of the existing dam failure emergency operations planning efforts and recommends funding be provided to facilitate EOP development and implementation. The Committee considered four options to improve emergency operations planning for HIGH hazard potential dams in Vermont with one being the improvement of the existing system. The other three options include facilitators which could be RPCs, VEM Regional Coordinators, or a contractor. Significant funding would be needed for facilitators to assist with dam failure EOP development either by hiring additional staff or granting money to RPCs or providing funding for this effort to be completed by an outside contractor. To determine the amount of funding needed, the Committee recommends a pilot project to produce and implement EOPs for one or two State-owned dams in order to test the EOP development and implementation process and to determine more accurate costs. Some EOP production and implementation projects related to dam failures as a result of terrorism may be eligible for federal emergency preparedness and planning funding from the State Homeland Security Program (SHSP), a federal grant program administered by the Vermont Department of Public Safety Homeland Security Unit. Depending on the current Fiscal Year's grant opportunity, the emergency operations

planning and/or implementation efforts for the pilot project may be allowable for SHSP funding. It should be noted that both DEC and VEM staff and each department's Business Offices have limited capacity and would require additional resources to bid out and manage this pilot project and any other effort undertaken as a result of this study. If funding is not made available for either the pilot project or for the facilitation of the development and implementation of EOPs, the Committee recommends improving the existing process of providing templates and tools for municipalities to develop dam failure EOPs.

Lastly, the Committee was tasked with evaluating potential legislative changes that could improve dam failure emergency operations planning. The Committee discussed two ideas for legislative change: the addition of a dam hazard potential classification known as the ULTRA-HIGH classification and the JPA concept. After discussion, the Committee determined both potential legislative changes would not advance the Vermont's mission to reduce risks to life, property, and the environment from dam incidents and dam failure.

This HIGH Hazard Potential Dam in Mendon impounds the City of Rutland's drinking water supply reservoir

Appendix A:

Table of HIGH Hazard Potential Dams by Regional Planning Commission

Regional Planning Commission	Dam Name	Municipality
Addison County Regional Planning Commission	Sugar Hill Reservoir	Goshen
	Silver Lake	Leicester
Bennington County Regional Commission	Lake Paran	Bennington
Chittenden County Regional Planning Commission	Indian Brook Reservoir	Essex
	Lake Iroquois	Hinesburg
	Lower Pond	Hinesburg
	Clark Falls	Milton
	Peterson	Milton
Central Vermont Regional Planning Commission	East Barre	Barre
	West Hill Pond	Cabot
	Marshfield No. 6	Cabot
	Wrightsville	Middlesex
	Middlesex No. 2	Middlesex
	Thurman W. Dix Reservoir	Orange
	Warren Lake	Warren
	Waterbury	Waterbury
	Nichols	Woodbury
	East Long Pond	Woodbury
Lamoille County Planning Commission	South Pond	Eden
	Green River Reservoir	Hyde Park
	Johnson State Lower	Johnson
	Lake Mansfield	Stowe
	Stowe Upper Golf Course	Stowe
	Wolcott	Wolcott

Regional Planning Commission	Dam Name	Municipality
Mount Ascutney Regional Commission	Jewell Brook Site No. 1	Ludlow
	Jewell Brook Site No. 2	Ludlow
	Jewell Brook Site No. 3	Ludlow
	Jewell Brook Site No. 5	Ludlow
	Okemo Snow Pond	Ludlow
	North Springfield	Springfield
	North Branch	Weathersfield
	Windsor Upper	Windsor
Northeastern Vermont Regional Development Association	Comerford	Barnet
	West Charleston	Charleston
	Newport No. 1	Derby
	Mackville Pond	Hardwick
	Institute Pond	Lyndon
	Stiles Pond	Waterford
	Moore	Waterford
Northwest Regional Planning Commission	St. Albans North Reservoir	Fairfax
	St. Albans South Reservoir	Fairfax
Rutland Regional Planning Commission	Chittenden Reservoir	Chittenden
	Star Lake	Mount Holly
	Rutland City Reservoir	Rutland Town
	Snowshed Pond	Killington
Two Rivers-Ottauquechee Regional Commission *(continued on next page)*	Silver Lake	Barnard
	Bradford	Bradford
	Blodgett	Bradford
	Keyser	Chelsea

Regional Planning Commission	Dam Name	Municipality
Two Rivers-Ottauquechee Regional Commission *(continued from previous page)*	Wright Reservoir	Hartford
	Wilder	Hartford
	North Hartland	Hartland
	Woodward Reservoir	Plymouth
	Crescent Lake	Sharon
	Elizabeth Mine TP-1	Stratford
	Union Village	Thetford
Windham Regional Commission	Pleasant Valley Reservoir	Brattleboro
	Chestnut Hill Reservoir	Brattleboro
	Snow Lake	Dover
	Sweet Pond	Guilford
	Ball Mountain	Jamaica
	Lowell Lake	Londonderry
	Searsburg	Searsburg
	Somerset	Somerset
	Townshend	Townshend
	Wantastiquet Lake	Weston
	Harriman	Whitingham
	Lake Clara	Whitingham
	Lake Sadawga	Whitingham
	Ryder Pond	Whitingham
	Jacksonville Pond	Whitingham
	Lake Sadawga West Dike	Whitingham
	West Lake	Wilmington
	Mahoney Pond	Winhall

Appendix B:

Meeting Notes

Appendix C:

Table comparing the Minimum Requirements of the
Emergency Action Plan (EAP) and the Emergency Operations Plan (EOP)

Appendix D:

Population at Risk Chart for DEC-Regulated HIGH Hazard Potential Dams

Appendix E:

EOP Production and Implementation Cost Comparison Table

Executive Summary

As damaging flood events have become more frequent in Vermont, Vermonters have become more in tune to the damage and damage potential that floodwaters pose to their wellbeing and communities. Along Vermont's rivers and waterways, there are over a thousand dams that are aging as Vermont's communities continue to grow in the floodplains and valleys below. This report was prepared during the Summer of 2025, one and two years removed from the devastating floods of July 10, 2023, and July 10, 2024.

Act 121 established the Study Committee on Dam Emergency Operations Planning (the Committee) to review and make recommendations on how to improve regional emergency operations planning for hazards caused by dam failure. The Committee was tasked with studying how to shift responsibility for emergency planning from individual municipalities to regional authorities, how to improve regional implementation of dam emergency response plans, and how to fund dam emergency planning at the regional level. Specifically, Act 121 focused on the State's HIGH hazard potential dams. These are dams where failure or mis-operation will probably cause loss of a human life. While the failure of a HIGH hazard potential dam may also cause economic loss, environmental damage, disruption of lifeline facilities, and impact other local concerns, these considerations are not considered in determining this hazard potential classification. As of the writing of this report, Vermont has seventy-four (74) dams that are classified as HIGH hazard potential dams which put an estimated 35,000 Vermonters at risk in the event of a dam failure at these dams. The Vermont Department of Environmental Conservation (DEC) Dam Safety Program (DSP) regulates 50 of the dams classified as HIGH Hazard Potential Dams.

The Committee acknowledges that the failure of a HIGH hazard potential dam has a low likelihood of occurrence but can be a very high consequence event. The keys to limiting the loss of life from the failure or mis-operation of a HIGH hazard potential dam are emergency action planning by the dam owner and emergency operations planning by the downstream municipalities. The dam owner prepares what is known as an Emergency Action Plan (EAP), which is an ongoing, written plan that identifies the areas that would likely be inundated by the failure of a dam and identifies the actions that should be taken by the dam owner to protect life, property, lifelines, and the environment in the event of a dam failure or threatening condition at the dam. When an EAP is prepared, it is provided to the regulatory body overseeing the dam and the municipality in which the dam is located. It is then the municipality's responsibility to prepare a dam failure Emergency Operation Plan (EOP) to prepare emergency responders for the potential of a dam failure. EOPs are

incorporated into larger municipal emergency management plans and should be tested regularly, along with the EAP, and the EOP should also be updated regularly as needed.

The Committee identified numerous challenges that exist in Vermont that hinder the preparation and implementation of dam failure EOPs. In general, the challenges include the lack of regional authorities or county government in Vermont, the varied levels of federal funding and financial support for emergency management efforts, inundation areas that impact multiple municipalities, some dams being subject to federal Critical Energy/Electric Infrastructure Information (CEII) rules, and that there are four separate entities that regulate dams in Vermont; two State and two Federal regulators. For municipalities the challenges include, the varied ranges of planning and implementation capabilities (with the most limited municipalities being the most rural), volunteers and the cycling of personnel in and out of emergency management roles, limited time to invest in such a low probability event, the lack of an incentives to generate a dam failure EOP, and historically no funding and very limited technical assistance has been provided to assist municipalities in preparing a dam failure EOP. Additional challenges include, not all HIGH hazard potential dams have an EAP or an up-to-date EAP, and municipalities are not mandated to prepare dam failure EOPs.

The Committee met for nine meetings and discussed four potential options for improving dam failure emergency operations planning. Where the options vary is with who, or what entity, helps facilitate the development of a dam failure EOP. The first option is the existing process which provides limited assistance to facilitate the development of a dam failure EOP and can be improved upon with modest changes to make it more effective. The other three options include facilitation and assistance from Vermont's Regional Planning Commissions (RPCs), Vermont Emergency Management (VEM) Regional Coordinators, or a contractor and would require significant funding and State staff support to implement. The responsibilities that would be conveyed to facilitators include determining who should be at the planning meetings, scheduling the meetings, setting agendas and taking meeting minutes, and ensuring that the outcome of the meetings is the development of an actionable dam failure EOP. Regardless of the option, the Committee is recommending that dam failure emergency operation planning and EOP preparation remain the municipality's responsibility. With regards to funding, all four options need additional funding and support and the three options utilizing facilitators would require significant funding for implementation. The existing process could be improved with limited funding and is considered a viable option to go forward if little or no funding is allocated for this effort. Regardless of the option chosen, the Committee concluded that the EOP

preparation effort for HIGH hazard potential dams should be prioritized by the estimated population at risk (PAR), a calculation found in the dam's EAP.

The Committee was also tasked with evaluating legislative changes that could improve emergency operations planning. The Committee did not identify legislative changes that would further this initiative in Vermont, so none were recommended.

The Committee acknowledges the shortcomings of the existing dam failure emergency operations planning efforts and recommends funding be provided to facilitate EOP development. In the future, funding should be provided for assistance with the facilitation of the development and implementation of dam failure EOPs given the increased incidence of flooding in Vermont. To determine the amount of funding needed, the Committee recommends a pilot project to produce and implement EOPs for one or two State-owned dams in order to test the EOP development and implementation process and to determine more accurate costs. Some emergency operations plan development projects related to dam failures may be eligible for federal emergency preparedness and planning funding from the State Homeland Security Program (SHSP), a federal grant program administered by the Vermont Department of Public Safety Homeland Security Unit. It should be noted that both DEC and VEM staff and each department's Business Offices have limited capacity and would require additional resources to bid out and manage this pilot project and any other effort undertaken as a result of this study. If funding is not available for either a pilot project or for the facilitation of the development and implementation of EOPs, the Committee recommends improving the existing process of providing templates and tools for municipalities to develop dam failure EOPs.

State-Owned Lake Sadawga Dam in Whitingham – Tropical Storm Irene Flooding in September 2011

Table of Contents

State-Owned Waterbury Dam with the Flood Control Gates Closed in December of 2023

All photos included in this report are file photos from the Vermont Department of Environmental Conservation Dam Safety Program files and are of State or Municipally owned HIGH Hazard Potential Dams

List of Figures and Tables

List of Appendixes

The Spillway Riser at Municipally Owned Star Lake Dam in Mount Holly

Act 121 Overview

Act 121 (2024 Acts and Resolves, No. 121, Section 22) established the Study Committee on Dam Emergency Operations Planning (the Committee) to review and make recommendations on how to improve regional emergency operation planning for hazards caused by a potential dam failure. The Committee was tasked with studying how to shift responsibility for emergency planning from individual municipalities to regional authorities, how to improve regional implementation of dam emergency response plans, and how to fund dam emergency planning at the regional level. As required by Act 121, the Committee was made up of one member of the Department of Environmental Conservation's (DEC) Dam Safety Program (DSP), two members of Vermont's Regional Planning Commissions (RPCs), one member of the Vermont Department of Public Safety's Division of Emergency Management (VEM), two dam owners, and one or more municipal emergency management directors or incident commanders with experience in dam emergency operation planning.

The Committee acknowledges that the failure of a HIGH hazard potential dam has a low likelihood of occurrence but can be a very high consequence event. With the increasing frequency and intensity of severe weather events and aging dam infrastructure in Vermont, effective Emergency Action and Emergency Operations Planning are critical to preparing and protecting public safety from such dam failure events.

Wrightsville Reservoir in Middlesex and Montpelier at Flood Stage in July 2024

Legislative Charge

Per Act 121, the Study Committee on Dam Emergency Operations Planning was authorized to conduct up to eight meetings to complete the following:

1) *Identify those dams in the State of Vermont that are classified as HIGH-hazard dams;*
2) *Summarize the existing responsibilities of individual municipalities to prepare for and implement existing emergency response plans, including how those responsibilities are funded and whether placing responsibility with individual municipalities is appropriate;*
3) *Identify the regional planning commissions in which a dam identified under subdivision (1) of this subsection are located;*
4) *Recommend the content for a regional emergency action plan for each dam identified under subdivision (1) of this subsection, including identifying necessary evacuations, how evacuees will be sheltered and provided care, and the location of emergency management centers for each dam;*
5) *recommend who should prepare a regional emergency action plan for each dam identified under subdivision (1) of this subsection, including the basis for the recommendation and the role that regional planning commissions should play in the preparation of the plans;*
6) *Estimate the cost of the production of regional emergency action plans for dams; and*
7) *Estimate the cost for regional planning commissions and municipalities to implement an emergency action plan, including a recommended source of the funding.*

Finally, the Committee was tasked with generating this written report to the General Assembly with its findings and recommendations for legislative action, with proposed legislative action submitted as draft legislation, if applicable.

Lowell Lake Dam – A HIGH Hazard Potential Dam Owned by the Vermont Dept. of Forests, Parks & Recreation

Committee Members

Benjamin Green, PE	Section Chief, Vermont DEC DSP (*Committee Chairperson*)
Michaela Foody	Regional Coordinator, VEM (*Committee Vice Chair*)
Chris Campany	Executive Director, Windham Regional Commission
Christian Meyer	Executive Director, Central Vermont Regional Planning Commission
John Tedesco	Generation Project Coordinator, Green Mountain Power
Scott Johnstone	General Manager, Morrisville Water & Light
Jan Sotirakis	Emergency Management Director, Town of Chittenden
William Lovett	Fire Chief & Emergency Management Director, City of Rutland

Meeting Facilitator and Primary Report Author:

Michael Nahmias	Project Manager, Vermont DEC DSP

Other Interested Parties and Meeting Attendees:

Marc Mihaly	State Representative, Vermont House of Representatives
Charles Martin	Deputy Secretary, Vermont Agency of Natural Resources
Jason Batchelder	Commissioner, Vermont DEC
Neil Kamman	Deputy Commissioner, Vermont DEC
Arion Thiboumery	Dam Owner, Vermont Independent Power Producers Association
Dan Koenemann	District Manager, Winooski Natural Resources Conservation District
Michael Billingsly	Emergency Management Director, Town of Plainfield
Laura Vallett	Environmental Compliance Lead, Green Mountain Power
Maggie O'Brien	Regional Planner, Rutland Regional Planning Commission
Steven Hanna	Dam Safety Engineer, Vermont DEC DSP
Sarah Moore	Program Administrator, Vermont DEC DSP

Historic 1938 Photos of the Downstream (left) and Upstream (right) Embankments of the East Barre Dam

Meeting Summaries

This section provides a brief summary of each meeting conducted by the Study Committee on Dam Emergency Operations Planning. Further discussion is provided in the *Discussion* section of this report, and the full meeting notes can be found in **Appendix B**.

- **Meeting #1 – November 11, 2024:** Kickoff Meeting; Introductions; Discuss legislative charge; Committee Organization; Work Plan Discussion
- **Meeting #2 – December 16, 2024:** Presentation by the Vermont DEC DSP on Dam Safety Emergency Action Plans (EAPs)
- **Meeting #3 – January 27, 2025:** Presentation by VEM on Local Emergency Management Plans (LEMPs)
- **Meeting #4 – February 18, 2025:** Presentation by the Town of Chittenden on the development of their Chittenden Dam Emergency Operations Plan (EOP)
- **Meeting #5 – March 10, 2025:** Discuss EAPs versus EOPs; Discuss minimum requirements of EAPs and EOPs; Discuss regional emergency planning; Establish next steps for final 3 meetings
- **Meeting #6 – April 7, 2025:** Review EAP vs. EOP table; Discuss report outline
- **Meeting #7 – May 12, 2025:** Review initial report draft
- **Meeting #8 – July 14, 2025:** Discuss second report draft and address comments
- **Meeting #9 – August 18, 2025:** Final Report presented to the Committee for vote

Elizabeth Mine Tailing Pile 1 Dam in Strafford – A HIGH Hazard Potential Dam Impounding mine tailings and contaminated groundwater and surface runoff which is treated before being discharged to Copperas Brook

Background Information

According to the Vermont Dam Inventory (VDI), an online database maintained by DSP of all known dams in the State, and the National Inventory of Dams (NID), the State of Vermont has seventy-four (74) dams that are classified as HIGH hazard potential as of the date of this report. A HIGH hazard potential dam is defined as a dam where failure or mis-operation will probably cause loss of human life. Loss of human life estimates due to dam failures in Vermont varies by dam and can be as few as 1 to several thousand people. Dam failures can be caused by natural disasters, such as flooding causing overtopping of a dam, structural issues, or human causes such as inadequate maintenance. Critical infrastructure such as dams can also be the target of terrorists.

Hazard potential classification is dynamic and changes over time due to changes in development downstream of dams in potential dam failure inundation areas. It should also be noted that dam hazard potential classification assignment is the responsibility of the dam safety regulator and has no relationship to the condition of the dam. In Vermont there are four regulators of dams; the Vermont DEC DSP who regulates approximately 1,005 non-power, non-federal dams; the Vermont Public Utility Commission (PUC) who regulates approximately 29 power producing, non-federal dams; the Federal Energy Regulatory Commission (FERC) who regulates approximately 91 power producing dams with a federal license or exemption; and about 21 dams that are Federally owned and are essentially self-regulated by that federal entity, such as the United States Army Corps of Engineers (USACE), the United States Forest Service, or others. The hazard potential classification system that the Vermont DSP uses follows National Dam Safety standards and includes HIGH hazard potential (probable life loss), SIGNIFICANT hazard potential (no probable life loss, but considerable damage to property, lifelines, or the environment), and LOW hazard potential (no probable life loss but potential for minor damage to property, lifelines, or the environment).

Of the 74 dams classified as HIGH hazard potential dams in Vermont, 50 dams are regulated by the Vermont DEC, 4 dams are regulated by the Vermont PUC, 13 dams are regulated by FERC, and 7 dams are owned and regulated by the USACE (these dams are referred to as 'Federal' in this report). These HIGH hazard potential dams are owned by private dam owners (35 dams), municipal governments (23 dams), the State of Vermont (9 dams), and the Federal Government (7 dams). The primary purpose of these HIGH hazard potential dams includes recreation (35 dams), hydroelectric power (18 dams), flood control (11 dams), drinking water supply (9 dams), and impounding mine tailings (1 dam).

Two charts are provided with this report to display the breakdown of HIGH hazard potential dams by what entity regulates the dam (**Figure 1**) and by ownership type (**Figure 2**). A map of all HIGH hazard potential dams in Vermont is included in **Figure 3**. A table of all HIGH hazard potential dams by their location within RPC boundaries is provided as **Appendix A** and a summary table showing the total numbers of HIGH hazard potential dams located within each RPC is provided as **Table 1**.

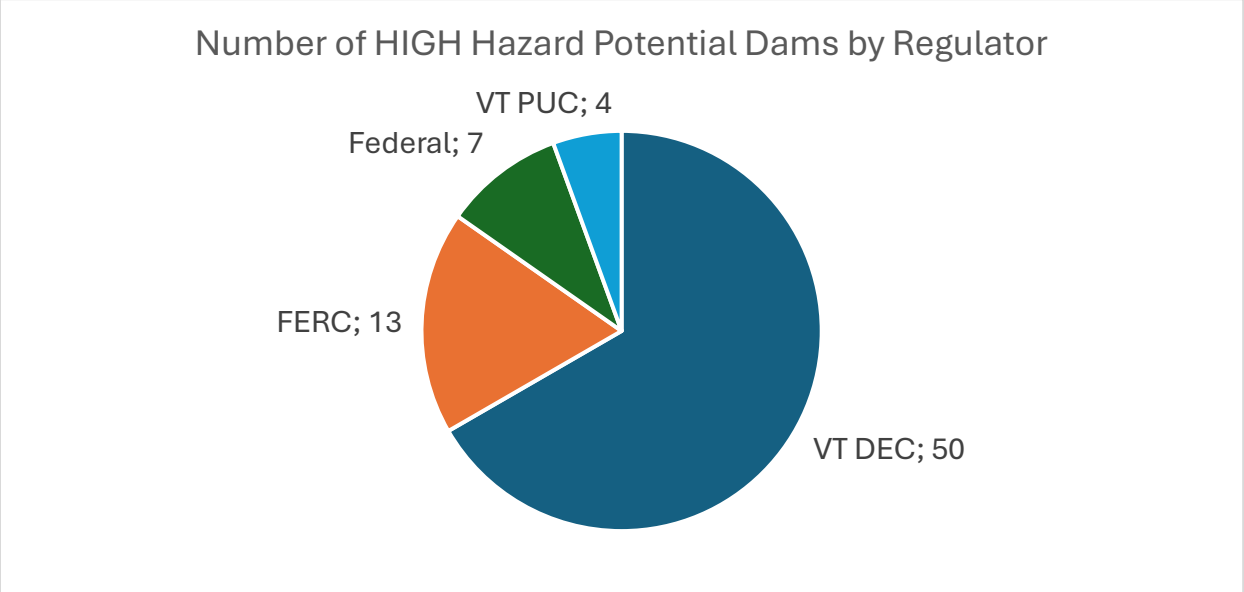

Figure 1: Chart of Vermont HIGH Hazard Potential Dams by Regulatory Authority

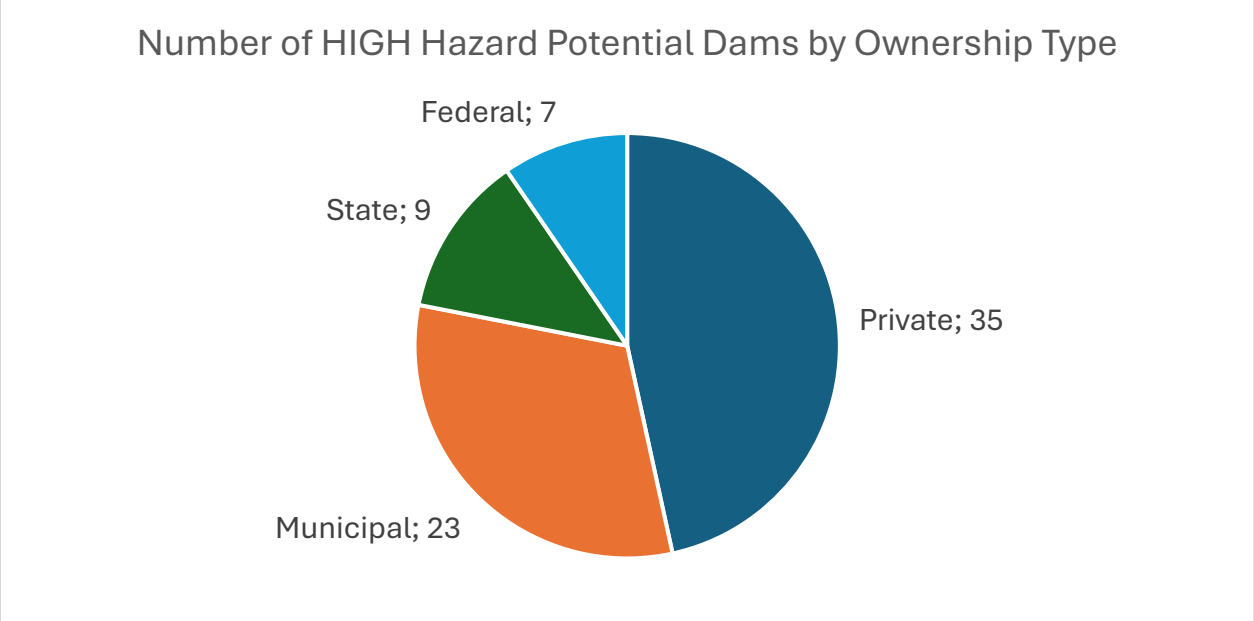

Figure 2: Chart of Vermont HIGH Hazard Potential Dams by Ownership Type

Regional Planning Commission	Number of HIGH Hazard Potential Dams
Windham Regional Commission	18
Two Rivers-Ottauquechee Regional Commission	11
Central Vermont Regional Planning Commission	10
Mount Ascutney Regional Commission	8
Northeast Vermont Development Association	7
Lamoille County Planning Commission	6
Chittenden County Regional Planning Commission	5
Rutland Regional Planning Commission	4
Addison County Regional Planning Commission	2
Northwest Regional Planning Commission	2
Bennington County Regional Commission	1
TOTAL	**74**

Table 1: HIGH Hazard Potential Dams by Regional Planning Commission (sorted highest number of dams to lowest); A table of all HIGH hazard potential dams by regional planning commission, including dam name and municipality the dam is located in, is provided as **Appendix A**.

Photo from the Johnson State Lower Dam Rehabilitation Project in 2012

Figure 3: Map of Vermont's HIGH Hazard Potential Dams

Definitions

The legislation that created this Committee uses the terms '*municipality*' and '*regional emergency action plans*' throughout the legislation. Rather than differentiate between the various types of municipal government and quasi-governmental entities in Vermont that make up the municipal landscape, the Committee chose to use the term municipality throughout the report. On the other end of the spectrum, due to the dam safety industry-specific definition of the term 'emergency action plan,' the Committee decided to differentiate between the two long-standing dam safety and emergency management terms, as shown below, and is not carrying forward the use of the term '*regional emergency action plans*' in this report. Note that the definitions shown in this section are defined in either State rule or Vermont statute and may vary slightly from the definitions established by other federal regulatory authorities such as FERC.

Emergency Action Plan (EAP) – An ongoing, written plan prepared by a *dam owner* that identifies the area (or region) that would likely be inundated by the failure of a dam and identifies the actions that should be taken by the dam owner to protect life, property, lifelines, and the environment in the event of a dam failure or threatening condition at the dam. The plan is usually implemented in cooperation with the local, regional, and State emergency personnel. (§ 37-103 of the Vermont Dam Safety Rule)

Emergency Operations Plan (EOP) – An ongoing plan prepared by *local emergency managers* and maintained by various jurisdictional levels for responding to a wide variety of potential hazards. It is a response-oriented plan that describes how people and property will be protected; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies, and other resources available; and outlines how all actions will be coordinated. A dam failure EOP can be prepared by local emergency managers once an EAP has been prepared by a dam owner.

Other General Dam Safety and Emergency Management Definitions:

HIGH Hazard Potential Dam – a dam where failure or mis-operation will probably cause loss of a human life. While the failure of a HIGH hazard potential dam may also cause economic loss, environmental damage, disruption of lifeline facilities, and impact other local concerns, these considerations are not considered in determining this hazard potential classification. (§ 37-103 of the Vermont Dam Safety Rule)

Dam Failure – the collapse of a dam resulting in the uncontrolled release of all or a portion of the reservoir contents. (§ 37-103 of the Vermont Dam Safety Rule)

Dam Failure Flood Inundation Map – a map that delineates the area that could be flooded by a particular dam failure condition. These maps are generated using complex hydrological and hydraulic models and show the areas downstream that could be inundated by floodwaters in the event of various failures of the dam like a sunny day failure or dam mis-operation, for example.

Hydrologic and Hydraulic Analysis (H&H) – the analytical process of computing the inflow to a reservoir and outflow from a dam under normal and storm conditions and to determine flows in the event of failure. (§ 37-103 of the Vermont Dam Safety Rule)

Emergency Management Director (EMD) – an appointed individual in each Vermont town or city who has direct responsibility for the organization, administration, and coordination of the local organization for emergency management, subject to the direction and control of the executive officer or legislative branch. Generally, the EMD identifies the resources and organization that would be used to support incident command; manages the creation and maintenance of the Local Emergency Management Plan and may also participate in the development of the Local Hazard Mitigation Plan; manages the maintenance of the Local Emergency Operations Center; facilitates Emergency Management meetings with municipal stakeholders to discuss current emergency management plans, organization, equipment, training, and exercises; coordinates citizen preparedness initiatives; and coordinates volunteer recruitment. In the event of an emergency, the EMD leads the Local Emergency Operations Center to coordinate the municipal response. This includes collaborating with the Incident Commander, distributing public information, and procuring and requesting equipment and resources. (20 V.S.A. § 6)

Incident Commander (IC) – A first responder responsible for the overall management of an incident and determines which Command or General Staff positions to staff in order to maintain a manageable span of control and ensure appropriate attention to the necessary incident management functions. The IC is typically the most senior fire department official on the scene but could also be an Emergency Medical Services (EMS) or law enforcement official depending on the scope of the incident. For an incident involving multiple agencies and jurisdictions, a Unified Command consisting of multiple ICs may be established.

Local Emergency Management Plan (LEMP) – The LEMP is an all-hazards emergency management plan for a municipality that establishes lines of responsibility during a disaster as well as identifying high risk populations, shelter locations, established procedures, and resources available during an emergency. (20 V.S.A. § 6(c))

Local Emergency Management Plan Annex ("Emergency Annex") – An annex to a municipality's LEMP that provides specific procedures, protocols, and roles for responding to a particular type of emergency or hazard. An Emergency Annex, combined with the LEMP, is a type of EOP.

Overflowing Spillway Chute at Thurman Dix Reservoir Dam in Orange in July 2024
This municipally owned HIGH Hazard Potential Dam impounds the City of Barre's water supply

Guiding Principles

The Committee identified the following guiding principles:

- Consistency in emergency management and planning should be strived for, to the greatest extent practicable.
- EAPs and EOPs are proactive emergency planning documents and their effectiveness in a dam safety emergency is directly attributed to the level of effort invested.
- Improved natural disaster and flood forecasting and dam safety compliance of critical dams are needed for a better chance at acceptable outcomes from extreme loading events.
- There is a need to increase dam safety awareness amongst municipalities. Municipalities should be encouraged to have a dam failure EOP in the annex of their LEMP.
- At the local level, there needs to be support from municipal leadership for emergency preparedness and for the ongoing updates of EOPs.
- An EAP is a dam owner's plan where the most important actions in the plan are communicating the dam incident/failure situation with the downstream municipalities and trying to prevent or delay dam failure. EOPs are municipal plans that act on the dam owner's communications to protect people and property from dam failures or incidents.
- A regularly updated EAP that meets applicable regulatory standards is needed for EOPs to be effectively updated regularly and for the EOP to be effective.
- Trust building between the dam owner and operator, ICs, EMDs, and other emergency planners is an important first step in emergency planning. Effective relationship building and collaboration is the key to success in planning.
- An EOP is developed (at a minimum) using the worst-case scenario inundation map from the EAP.
- In dam failure emergency operation planning, the planning team should include the local EMD and other public safety officials because they have the local knowledge needed to contribute to the drafting and implementation of these plans.
- An outside facilitator taking an organization and logistics role in dam EOP development may be helpful by bringing together public safety and emergency management stakeholders of impacted communities for collaboration, scheduling meetings, developing agendas, keeping planning activities on track, and ensuring that the EOP is submitted to the appropriate authorities for review and/or acceptance.

- A plan is just a plan without the ongoing commitment to act on the plan going forward. There needs to be training, drills, and tabletop exercises to ensure the effective implementation of any dam failure EOP in the event of a dam failure.
- Any assistance in producing a dam failure EOP should be provided based on a risk-based prioritization, meaning dams with the highest risk and probability of adverse outcomes and high consequences should be prioritized over dams that present a lower risk.

These guiding principles emerged from the collaborative work and discussion between Committee members and meeting attendees and reflect ideas critical to the future success of the development, implementation, and maintenance of effective dam failure EOPs. These principles provided the framework for the solutions the Committee developed to address the shortcomings in dam failure EOP production and implementation in Vermont.

Spring 2011 Overtopping of Stiles Pond Dam, a Municipally Owned HIGH Hazard Potential Dam in Waterford

Challenges Identified by the Committee

The Committee shared these common challenges regarding Dam Safety emergency preparedness and operations:

- In the absence of county-level government and other regional authorities in Vermont, clearer distinctions are needed in roles amongst the State, municipalities, dam owners, and the public regarding their responsibilities in emergency preparedness and response.
- As of this writing, there is uncertainty around both the continuation and amount of federal financial support for emergency management and preparedness which could impact basic operations at all levels of government. This report is written assuming current operations, capacity, and planning tools will remain in place, but federal funding outcomes, and related State budgeting decisions, could ultimately impact the ability to carry out the recommendations contained herein.
- Municipal dam emergency operations planning and implementation capabilities vary widely across Vermont.
- Success in emergency preparedness requires maintaining a strong relationship between municipal emergency management personnel, the dam owner and operator, and the public. Effective communication is crucial for preparing and implementing EOPs in the event of a dam-related emergency, as there is often a short time between a dam failure and the subsequent downstream flooding.
- Many of the personnel involved will be volunteers and having to rely on volunteer capacity for continuously updating EOPs is a challenge. Personnel in these roles often cycle in and out of their roles, leading to constant changes. Due to this, it may be difficult to retain personnel with experience and training on implementing the EOP. Ideally, three or more emergency management personnel should be proficient in the implementation of the dam failure EOP.
- More funding opportunities are needed to assist municipalities in emergency preparedness, particularly regarding the commitment of volunteer and/or staff time needed to plan for and respond to risks associated with HIGH hazard potential dams.
- It can be difficult to convince municipalities and emergency management personnel to invest in emergency planning for events with a low probability of occurrence such as dam failures and related incidents.
- There is currently varying capacity amongst municipalities with many not having the bandwidth to complete plans and exercises that do not provide any immediate benefit for the Town and may see this effort as a burden.

- There is no incentive for a municipality to develop dam failure EOPs. There is also no mandate requiring municipalities to develop and maintain dam failure EOPs.
- Dam failure flood inundation mapping often overlaps town, regional, county, and even State lines, making it difficult to set clear boundaries for emergency planning and implementation.
- RPCs only work with their member municipalities and may not be able to work with municipalities outside of their membership area on EOPs or other planning efforts.
- Not all HIGH hazard potential dams currently have an EAP or have an up-to-date EAP and population at risk (PAR) estimating methodology used in EAPs has varied greatly from detailed computer-aided analyses to more rudimentary methods.
- There are four separate entities currently regulating dams in Vermont. Two are State entities, the Vermont DEC's DSP and the PUC, and two are federal agencies, including the FERC and the other federally owned dams that are self-regulated. Additionally, in 2028, all dams previously regulated by Vermont's PUC and not subject to federal regulations will transfer to the Vermont DEC for all Dam Safety regulatory matters.
- Federal dams may have Critical Energy/Electric Infrastructure Information (CEII) that generally may not be shared with the public. This may include EAPs and inundation maps depending on the specific federal regulator and the content of the document.
- While the topic of dam failure flooding and emergency planning may have been an important initiative at this time of this legislation following two Summers with devastating floods, the drive to improve the planning efforts may subside as time goes on as the topic falls from the forefront of the legislature's priorities.
- Vermont's Public Safety landscape has numerous limitations and variabilities as not all municipalities have a dedicated or contracted fire department, EMS Service, and/or police department. Additionally, not all first response services are municipal, some are private, non-profit, or regional, and some are not based in Vermont.
- There is a lack of Business Office staff capacity at both DEC and VEM. These staff are needed to support any effort to grant funding to municipalities or contract with contractors to help facilitate any efforts to prepare and implement EOPs.

Additionally, the Committee interviewed an EMD from Townshend, Vermont who shared their Town's experience responding to the July 2023 flooding. Townshend is a downstream community to two of the HIGH Hazard potential dams identified in this report, Ball Mountain Dam and Townshend Dam. The EMD corroborated many of the challenges identified by the Committee related to the volunteer nature of emergency management work and lack of resources and bandwidth at the rural, small-town level to be able to produce, implement, and maintain an effective EOP.

Discussion

The Committee convened for nine meetings from November 2024 through August 2025. This section summarizes pertinent Committee discussions. The meetings kicked off with an introductory meeting with a general discussion on Dam Emergency Operations planning as it currently exists and identifying common thoughts amongst the Committee. The DSP introduced the Committee to the Vermont Dam Inventory (VDI), which is a publicly available database with detailed information of all of the known dams in Vermont, and presented maps and tables to display the list of HIGH hazard potential dams that would inundate Vermont communities in the event of a dam failure. The Committee reviewed the legislative charge and discussed each task generating a list of challenges and common thoughts.

The second and third meetings included a presentation by the DSP regarding EAPs and their content and development and a presentation by VEM on LEMPs. The DSP presented two examples of an EAP, one from a HIGH potential dam and one from a SIGNIFICANT hazard potential dam. The Committee discussed preventative measures that dam owners could take to reduce the risk of failure during a forecasted flood event, dam fees and their role in reminding dam owners of their responsibilities, complexities regarding emergency communications, and other general ideas on how to improve EAPs. The general thoughts on EAP improvements included providing a standardized template for EAPs, requiring EAPs to be updated every two years, requiring inundation mapping for a wider range of scenarios, requiring a greater level of detail on dam failure flood inundation maps (to include downstream infrastructure, major roadways, bridges, etc.) included in EAPs, and how to best share this information with the public.

VEM's presentation on LEMPs started with defining the roles of municipal emergency management personnel, such as the EMD and IC, as well as discussing the various plans that government units use to prepare for emergencies and coordinate their response. EMDs and members of public safety agencies that contribute to updating the LEMP and other emergency plans are primarily made up of volunteers, especially in rural Vermont towns where many dams are located. In general, the LEMP establishes the location of the Municipal Emergency Operations Center (EOC), identifies who has EOC activation authority, identifies the EOC staff positions and responsibilities, provides facility information for each potential EOC location, identifies emergency purchasing agents, provides a list of municipality-owned resources, identifies communities requiring additional coordination, describes public information and warning systems, provides facility information for each potential shelter, and lists the local contacts for the local emergency management team. The LEMP is typically updated annually after Town Meeting Day. Most Vermont

municipalities comply with the LEMP requirements. A current LEMP is also required for municipalities to receive increased State reimbursement through the Emergency Relief and Assistance Fund (ERAF) which provides State funding to match Federal Emergency Management Agency (FEMA) Public Assistance after federally declared disasters. It was noted that no such incentive exists to incentivize municipalities to develop dam failure EOPs.

In the fourth meeting, Committee members learned how Chittenden, Vermont, a small town in Rutland County, prepared an EOP for the Green Mountain Power (GMP) owned Chittenden Dam. Chittenden Dam is a HIGH-hazard potential dam located on East Creek that was built in the early 1900s. The dam is currently regulated by the PUC. From the dam failure flood inundation maps included in the EAP prepared by GMP, it is estimated that approximately 118 homes in Chittenden, and many others further downstream, could be inundated with flood waters if the dam were to fail. The inundation area includes Chittenden and several downstream municipalities including Pittsford, Rutland Town, and Rutland City. Discussion included the importance of mutual aid plans and relying on adjacent communities to access parts of the inundation area that are cutoff from their own municipality's emergency responders, the importance of effective inundation mapping scenarios and the necessary detail on the dam failure inundation maps to guide the development of an EOP, what situational-based scenarios should be included in an EOP, what CEII can be shared with the public, and how to educate and inform the public regarding dam failure hazards. Chittenden's EMD first identified the need for additional emergency operations planning when GMP provided the EAP for Chittenden Dam and the emergency notification tree initially included just one notification to the Chittenden Town Clerk, whose emergency response duties and office hours are limited. Chittenden's EMD assembled a team, known as the Chittenden Reservoir Emergency Action Planning (CREAP) team, that included downstream EMDs, dam owner representatives, mutual aid association members, the local ambulance district, and State emergency management personnel including State Police, State Dispatch, and the Urban Search and Rescue Team. CREAP meets regularly to generate more detailed emergency notification trees, discuss possible dam emergency scenarios, understand dam failure inundation maps, generate emergency evacuation plans and mutual aid plans, obtain sirens to alert downstream property owners of the dam emergency, and to perform tabletop exercise and siren tests. The Rutland Regional Planning Commission provided support to CREAP's effort by coordinating and hosting meetings and tabletop exercises, providing support to member municipalities in developing EOPs, co-hosting quarterly meetings, and finalizing and distributing meeting agendas and minutes to the CREAP team.

During subsequent meetings, the Committee discussed high-level issues such as EAP and EOP minimum requirements and criteria (An EAP vs. EOP requirements comparison table is provided as **Appendix C**), emergency communications, regional and State emergency planning resources, and the concept of a new hazard potential classification, ULTRA-HIGH hazard potential dams. The Committee was made aware of the State of California's dam hazard potential classification system which includes an 'EXTREMELY HIGH' hazard potential classification for their dams. In California, the definition of an EXTREMELY HIGH Hazard potential dam is a dam that if it were to fail, is expected to cause loss of at least one human life and may result in an inundation area with a population of 1,000 persons or more, or inundation of facilities or infrastructure, the inundation of which poses a significant threat to public safety. It is the Committee's understanding that California is the only State to have adopted an EXTREMELY HIGH hazard potential classification, which is therefore unique and outside of national dam safety standards. The classification was reportedly developed because many of California's HIGH hazard potential dams are located on or near major tectonic plate boundaries resulting in increased earthquake and geologic hazards near major population centers. In addition, the 2017 partial spillway failure of Oroville Dam in Oroville, CA (the nation's tallest dam at approximately 770 feet tall) that prompted the evacuation of approximately 190,000 people located downstream of the dam also reportedly contributed to the development of the EXTREMELY HIGH hazard potential classification. Conversely, Vermont does not have the challenging geology and earthquake prone areas, the high number of large dams, nor the significant population densities of California. The Committee discussed how the addition of a strongly worded hazard classification like EXTREMELY or ULTRA HIGH is generally inconsistent with the principles of hazard communication and may alarm the public needlessly. The Committee discussed prioritizing the HIGH hazard dams by population at risk (PAR) to effectively use limited resources to target dams within the HIGH hazard class with the highest PAR as opposed to adding a hazard classification.

Findings and Recommendations

The Study Committee on Dam Emergency Operations Planning has the following findings and recommendations based on the tasks assigned to the Committee in Act 121. Below is a list of legislative charges followed by a summary of the Committee's work to address the charge. Please note that in this section, the Committee uses the EOP and EAP as defined in this report as opposed to how it was defined in Act 121.

1) *Identify those dams in the State of Vermont that are classified as HIGH-hazard dams.*

   A table of the HIGH-hazard potential dams that would impact the State of Vermont in the event of a dam failure is provided in **Appendix A**.

2) *Summarize the existing responsibilities of individual municipalities to prepare for and implement existing [dam failure EOPs], including how those responsibilities are funded and whether placing responsibility with individual municipalities is appropriate.*

   Per 20 V.S.A. § 6, individual municipalities are responsible for annually updating their LEMP, which may include any annexes and specific EOPs that have been created for specific hazards that exist in their community. Annexes are like an appendix where other plans like EOPs can be listed and referenced. VEM previously provided grant funds to RPCs to assist municipalities in preparing or updating their LEMPs. Now, Regional Coordinators work directly with town or city officials to update LEMPs. The municipality's direct participation in drafting LEMPs, All Hazard Mitigation Plans (AHMPs), annexes to their LEMPs, and EOPs are essential and appropriate to their success in implementation. These efforts are currently supported by Federal funding and the future availability of this funding to the State of Vermont is currently unknown.

   The Committee identified concerns regarding the lack of regional authorities in Vermont to shift these responsibilities to as there is not a county-level government in Vermont and there are no regional emergency authorities. Additionally, RPCs are not experts in emergency response and do not participate in the implementation of LEMPs or EOPs. The Committee has concluded that individual municipalities, including their EMD, fire departments, first responders, public works departments, road crews, and others, are essential to the development of an effective LEMP, Annex, and EOPs. Local officials know their municipality best, including where resources are located, who owns certain properties, where there are access ways that are not

necessarily town roads, trails, or State roads, what properties are occupied full-time, and how to access locations when perhaps main roads are not passable. The EMD and first responders will be implementing the EOP when the specific hazard has arisen and must be knowledgeable on what is in the plan and how to implement the plan. Keeping this responsibility with individual municipalities and the individuals who are to respond to an event like this is imperative to the safety of downstream residents and property owners in the event of a dam failure.

3) *Identify the regional planning commission in which [HIGH-hazard potential dams] are located*.

   A table of high-hazard potential dams sorted by RPC can be found in **Appendix A**.

4) *Recommend the content for a regional emergency action plan for each [HIGH-hazard potential dam] in Vermont, including identifying necessary evacuations, how evacuees will be sheltered and provided care, and the location of emergency management centers for each dam*.

   It is the opinion of the Committee that regional emergency action plans do not make sense as Vermont does not have regional or county-level governments to implement and maintain these plans. Rather the Committee found that the already existing EAP and EOP/Dam Annex system works best for dam owners, individual municipalities, and most importantly first responders and the safety of downstream residents and property owners. A table comparing the content of EAPs to the content of EOPs is provided as **Appendix C**. The main issue identified by the Committee is that the existing system is essentially unfunded and not mandated. The Committee agrees that a regional approach is needed in terms of mutual assistance needed to respond to a dam emergency or failure. This means that first responders and resources from, and included in, adjacent municipalities may be able to respond more effectively and may be best suited to shelter evacuees and provide care due to the likelihood that the municipality where the dam is located may have impacts to their roadways, village centers, and municipal infrastructure.

5) *Recommend who should prepare an [EOP] for each [HIGH-hazard potential dam in Vermont], including the basis for the recommendation and the role that regional planning commissions should play in the preparation of the plans*.

Dam owners prepare, update, and maintain EAPs. The dam owner provides the EAP to the municipality where the dam is located and to downstream municipalities that would be inundated by a dam failure. Currently, the municipality is responsible for analyzing the information in the EAP and is put in the position to consider developing an EOP based on the information provided. The Committee discussed several options for how these responsibilities could be managed. On the following pages, four potential options are described, followed by a list of pros and cons. It should be noted that the Committee did not consider the regional emergency operations plan as a viable option going forward due to the challenges identified in this report. Therefore, this is not included as a potential option in the list below. The Committee discussed how with all of these options a system is needed to track HIGH hazard potential dams and their EAPs and whether the downstream municipalities have an up-to-date EOP. Currently, neither VEM nor DEC are tracking this, and neither is notifying municipalities that it is their responsibility to develop an EOP.

Silver Lake Dam - This State-owned HIGH Hazard Potential Dam has a roadway on the crest of the dam

Option 1 – Municipality prepares Municipality-Specific EOP

This option is basically the existing process, but it formalizes the requirement that municipalities complete the dam failure EOP. For this to be successful, HIGH hazard potential dam owners also need to generate and maintain an up-to-date EAP for their dam and be available to coordinate and educate municipalities on its contents. From there, it is the municipality's responsibility to generate an EOP for this specific hazard to be included as an annex to their LEMP. This option could be optimized by providing EAPs to downstream municipalities along with a guidance sheet, templates, and contact information for VEM and DSP who could assist with either developing the EOP (VEM) or interpreting the EAP (DSP).

Pros: Municipal officials are most knowledgeable about their municipality's resources, familiarity with adjacent municipalities and their contacts, nearby and potentially impacted property owners, and more.

Municipal officials will be the first responders and, usually, the IC for a dam failure event and will have to be knowledgeable of the EOP to implement it effectively.

An EOP template already exists in the form of a Dam Emergency LEMP Annex template and can be modified to fit specific situations.

In the event that no additional funding is made available, this is the status quo approach.

Cons: Municipalities are largely assisted by volunteers without the capacity, time, expertise, or resources to prepare EOPs and update EOPs regularly.

It is unknown how many municipalities have prepared EOPs for dam failures as this metric is not currently tracked.

Smaller municipalities are generally at their capacity when it comes to applying for and implementing any grant funds, so providing funding to municipalities to draft EOPs may be impractical, and some small municipalities may not apply for and accept funding due to limited capacity.

No funding currently is provided to the municipalities to support this effort.

There is no requirement requiring dam failure EOPs be maintained.

Training and guidance documents need to be developed to help guide municipal officials produce and implement effective dam failure EOPs.

It may be difficult to envision the benefit to the municipality in undertaking this effort given the very low likelihood of dam failure.

Option 2 – RPC assists municipalities with municipality-specific EOP preparation

This option keeps the municipality as responsible for their municipality-specific EOP but tasks RPCs with facilitating the process and generating the EOP document on behalf of the municipalities. Grant funding as well as training would be provided to RPCs to assist municipalities in preparing EOPs. RPCs would have the option to use the grant funding to hire a contractor or use their own in-house staff to complete this work with the municipalities. VEM Regional Coordinators and DSP staff would be available to assist and provide guidance. It is uncertain which Department's Business Office will grant these funds, and which Department will manage the project.

Pros: EOPs remain municipality-specific which allows for easy implementation by local ICs, EMDs, and key personnel listed in the LEMP.

RPCs have experience analyzing maps and preparing plans and have GIS capabilities.

RPCs are currently partially supported by grants from VEM for their emergency management efforts.

RPCs have experience assisting municipalities with the preparation of LEMPs and AHMPs whether it be by using in-house staff or hiring qualified contractors.

RPCs are well-versed in facilitating meetings.

RPCs are better suited than municipalities to receive grant funding and reliably carrying out the grant requirements.

RPCs facilitate Regional Emergency Management Committees (REMCs) that meet regularly and have contacts for EMDs in their member municipalities.

RPCs can coordinate meetings amongst multiple communities to ensure the EOPs consider each municipality's needs.

Cons: Skillsets vary between RPCs.

RPCs will not work in municipalities that are not member municipalities, so if a dam failure inundation zone crosses multiple RPC territories, multiple RPCs will have to be involved in preparing EOPs for a single dam.

The capacity of RPC staff may be a concern.

VEM and DEC Business Office staff have little capacity.

Uncertainty regarding which Department would oversee and manage this project.

Option 3 – VEM Regional Coordinators assist municipalities with preparing EOPs

In this option, VEM Regional Coordinators would take the lead on working with municipalities to draft municipality-specific EOPs. VEM Regional Coordinators would be trained in evaluating EAPs by the DSP and would use a template to create the EOPs with the assistance of municipality staff. DSP staff would be available to assist VEM with reading inundation maps and understanding dam-specific EAPs

Pros: VEM Regional Coordinators have the most experience and training of anyone listed in any of these options in preparing various sorts of emergency management and emergency response plans.

VEM already works closely with municipal EMDs, ICs, and stakeholders regularly to assess and update plans and annexes to plans.

EOPs remain municipality-specific which allows for easy implementation by local ICs, EMDs, and key personnel listed in the LEMP.

This option would likely result in the most consistency between the plans generated across the State.

VEM Regional Coordinators also have territories and some inundation zones from dam failures across territory lines. VEM Regional Coordinators regularly assist other regions and do not have the same constraints as RPCs.

Cons: VEM Regional Coordinators do not have the capacity to do this additional work, and additional staff will be needed.

VEM does not have GIS capabilities and will need this to help municipalities analyze dam failure inundation maps and develop actionable EOPs.

Lake Paran Dam in Bennington is owned by the Vermont Agency of Transportation

Option 4 – A Contractor/Consultant is hired to develop EOPs for all HIGH hazard potential dams

In this option, the State would put out a request for proposal (RFP), or RFPs, by region to retain a contractor to arrange meetings with impacted municipalities and generate EOPs. This could be bid out as a statewide effort or bid out by RPC territory. This would allow a bidder to apply for certain regions or allow for RPCs to bid on their region. It could also be a flexible RFP which could allow a bidder to apply for a region or two, or the entire State. The contractor(s) would need to be well versed in evaluating EAPs and preparing EOPs. It is uncertain which Department's Business Office will oversee the funding and contracting for this project and which Department will manage the project.

Pros: This is likely the most efficient option in terms of having EOPs prepared for every municipality that could be impacted by a HIGH hazard potential dam failure.

Flexibility in the bidding process would allow RPCs to bid, as a contractor, on an RFP for preparing EOPs in their region.

If one contractor completes all EOPs under one contract, the EOPs would be standardized in their format.

Cons: Likely the costliest option.

Personnel at the State level with capabilities to do this work are not included.

Considerable staff time at DEC between the Business Office and DSP project management staff is needed to carry out this effort.

Facilitating meetings with over 100 municipalities and relevant stakeholders to carry out this mission will be difficult.

Concerns on EOP quality given the short duration contract approach. Less opportunity for building institutional knowledge.

VEM and DEC Business Office staff have little capacity.

Uncertainty regarding which Department would oversee and manage this project.

Discussion

First, the Committee is recommending that dam failure emergency operation planning and EOP preparation remains the municipality's responsibility. Where the options vary is with who, if any entity, helps facilitate the development of a dam failure EOP. Option #1 is the existing process with limited assistance provided to facilitate the development of a dam failure EOP and can be improved upon with modest changes to make it more effective. With regards to whom facilitates and assists municipalities in developing the dam failure EOP in the other options, Option #2 tasks RPCs, Option #3 tasks VEM Regional Coordinators, and Option #4 tasks a contractor. The responsibilities that would be conveyed to facilitators include determining who should be at the meeting, scheduling the meetings, setting agendas and taking meeting minutes, and ensuring that the outcome of the meetings is the development of an actionable dam failure EOP. With regards to funding, Option #2, #3, and #4 would require significant funding for implementation. Option #1 could be improved with limited funding and is considered the viable option to go forward if little or no funding is allocated for this effort. Regardless of the option chosen, the prioritization of HIGH Hazard Dams by PAR should be considered. The higher consequence HIGH hazard potential dams that could cause more potential life loss in the event of a dam failure should be prioritized for EAP and EOP assistance. It is estimated that over 35,000 Vermonters live in the dam failure inundation areas downstream of Vermont's 50 DEC-regulated, HIGH hazard potential dams. A chart comparing PAR ranges for the 50 HIGH hazard potential dams regulated by the Vermont DEC is provided as **Appendix D**, which also includes a listing of dams by PAR range.

6) *Estimate the cost of the production of [dam failure EOPs] for [HIGH-hazard potential] dams.*

As currently configured, little is known about the costs for developing a dam failure EOP using the existing process. Costs for developing a dam failure EOP for a HIGH-hazard potential dam may vary widely. For example, some of Vermont's HIGH Hazard Potential dams have dam failure inundation maps that span numerous municipalities which would require very robust, municipality-specific EOPs with participation from each individual impacted and adjacent downstream community and their respective emergency response organizations. A series of milestones needed for the production of a dam failure EOP were generated based on the experience of the members from the CREAP team. The list below is a list of milestones that would generally be needed for the production of an EOP.

Milestone 1: EAP Review by Each Municipality
Local EMDs receive EAP from the local dam owner or operator.

Milestone 2: Kickoff Meeting with Each Municipality
EMD meets with the dam owner to ask general questions, introduce each other, and develop a working relationship. The EMD determines what neighboring and downstream communities, and other emergency response agencies should be at future meetings and form a group to develop the dam failure EOP.

Milestone 3: Standing Meetings with Each Municipality
EMD and others meet regularly with each other to develop an EOP. If needed, DSP or VEM are available for technical assistance.

Milestone 4: Finalize EOP for Each Municipality
The group finalizes the EOP and submits EOP to VEM and attaches the EOP to their LEMP's Emergency Annex.

If the State were to distribute funding for the above effort, additional costs would be incurred for in-State financial management, grant management, and agreement negotiations and a State project manager or administrator would be needed to administer the program. Additional costs that may be incurred are town staff and their salaries, volunteer participation in plan development and compensating them for their time to incentivize participation, State officials to train the contractors or facilitators, travel for town staff, volunteers, and State officials to attend meetings, meeting space, food for meetings, and so forth.

Appendix E provides a table of costs related to the production of an EOP. The range of costs of EOP development was estimated to be between $10,000 and $30,000 per EOP produced per municipality but could vary further. The table includes numerous assumptions, and it should be noted that further study is needed to determine refined cost estimates for EOP funding, development, and implementation. If this is the direction chosen by the legislature, the Committee recommends a pilot project to produce EOPs for one or two State-owned dams in order to test the process and to determine more accurate costs.

7) *Estimate the cost for regional planning commissions and municipalities to implement a [dam failure EOP], including a recommended source of funding.*

As currently configured, little is known about the per municipality costs for implementing and updating a dam failure EOP. Costs will vary widely. Below is a list

of milestones that need to be completed to implement and update an EOP following production. Some milestones are one-time tasks while others are ongoing tasks.

Milestone 1: Plan EOP Implementation Trainings
The team that developed the initial EOP reviews the EOP and determines which emergency response organizations, firefighters, police, local emergency services, etc. need to be trained on the implementation of the dam failure EOP.

Milestone 2: Develop a notification system (if needed)
If needed, consult with experts to determine if the existing notification system is appropriate. If not, develop an adequate system to effectively alert the population at risk of an imminent dam failure.

Milestone 3: Train local first responders (ongoing)
First responders are trained in the concept of the dam failure EOP and its implementation; these can be hosted centrally but in certain areas, these meetings may need to be held separately and in several towns.

Milestone 4: Tabletop exercise, public outreach & annual exercises (ongoing)
Now the plan is tested. A 'test' dam failure, known as a tabletop exercise, takes place and the EOP is activated (if the dam owner is involved, they may test their EAP's effectiveness at this same time). The group observes how the EOP is implemented and discusses it with other first responders. This may include a hot-wash-style meeting following the exercise. Public engagement campaigns at local events and meetings should be utilized to inform the public of the response plans.

Milestone 5: Post-EOP Adoption Standing Meetings (ongoing)
The group should meet at least twice annually, once to perform an annual tabletop exercise and once to review the EOP and discuss any changes. The notification system should be tested during these meetings as well.

Milestone 6: Update EOP & Public Engagement (ongoing)
When the dam owner updates their EAP or on a timeframe determined by the group, the EOP will need to be updated to reflect the latest land use, inundation failure mapping and more. This update would require multiple meetings in succession until the EOP has been updated. Some EOPs may need to be updated annually. Engage with the public regarding the plan through public education.

Like above, if the State were to distribute funding for the above effort, additional costs would be incurred for in-State financial management, grant management, and agreement negotiations and a State project manager or administrator would be

needed to administer the program. Additional costs that may be incurred are town staff and their salaries, volunteer participation in exercises and trainings and compensating them for their time to incentivize participation, State officials to attend exercises, travel for State officials to potentially attend exercises, meeting space, food for meetings, and so forth.

Appendix E provides a table of costs related to the implementation and ongoing updates and maintenance of an EOP. The range of estimated costs of EOP development and implementation was estimated to be between $25,000 and $55,000 per EOP per municipality with annual ongoing implementation costs ranging from $10,000 to $30,000 per year per EOP per municipality. These costs do not include the costs of any sort of warning system such as sirens to warn the public of the imminent threat. The table includes numerous assumptions, and it should be noted that further study is needed to determine refined cost estimates for EOP funding, development, and implementation. If this is the direction chosen by the legislature, the Committee recommends a pilot project for the implementation of EOPs for one or two State-owned dams in order to test the process and to determine more accurate costs.

Chestnut Hill Reservoir Dam in Brattleboro was originally built in 1884 to provide water service to the Town

Potential Legislative Action Findings and Recommendations

Per Act 121, the Study Committee on Dam Emergency Operations Planning *"…shall submit a written report to the General Assembly with its findings and any recommendations for legislative action. Any recommendation for legislative action shall be as draft legislation."* Below are summaries of the two topics the Committee discussed as possible recommendations for legislative action.

ULTRA-HIGH Hazard Potential Dam Classification:

Below is a list of pros and cons related to the discussion the Committee had related to adding a new hazard potential classification to the existing hazard classifications used in Vermont. This classification would be known as the ULTRA-HIGH hazard potential dam and would only include the dams with the highest PAR in the event of dam failure.

Pros: Provide the ability to apply more stringent standards to dams with greater downstream population at risk and hazards. Proponents noted that this could come in the way of enhancements above the minimum standards for EAPs.

Cons: This new hazard potential classification is not nationally recognized and outside the industry norm. While it is sensible in California with its unique geologic hazards, large dams, and high population centers, Vermont does not share those geologic hazards, has far fewer large dams, and much smaller population centers.

Vermont would have to develop a different set of criteria around potential life loss and population at risk that would likely vary from California's. The value of this to Vermont and addressing dam failure emergency planning and responding is not clear.

The designation would not effectively apply to all dams in Vermont given the dam safety regulatory landscape. For example, the Winooski River Basin flood control dams may be candidates for the new hazard potential classification, as would the Connecticut River Basin flood control dams. However, the former are regulated at the State level by the DSP while the latter are self-regulated at the Federal level by the USACE. While adjusting State law is possible, adjusting federal law and placing additional requirements on the USACE is unlikely to be successful or productive.

The use of modifiers in regulation and risk communication, such as "extremely" or "ultra", is not recommended due to lack of precision. It is more effective to State the specific risk.

There are more effective ways that do not require legislation to prioritize dams by risk for things like EOP development within the existing hazard potential classification system.

The Committee concluded that the introduction of additional hazard potential classification, other classifications, or point systems would not advance the Vermont DSP's mission to reduce risks to life, property, and the environment from dam incidents and dam failure. Therefore, the Committee does not recommend a legislative change to include an additional hazard classification.

Joint Powers Authority Concept:

The chairperson of the Committee, Benjamin Green, interviewed Tim Washburn (retired) formerly of the Sacramento Area Flood Control Agency (SAFCA) regarding California's Dam Safety classification system (related to the ULTRA-HIGH hazard dam classification above). During that conversation, California's Joint Powers Authority (JPA) was discussed. Following the conversation, the JPA concept was brought forward to the Committee for discussion as a potential topic for legislative action. A summary of the conversation is below:

> *Amongst the largest threats to dams are flooding events. Improved forecasting has been very helpful in the ability to plan for and contend with floods as there is a greater ability to plan and "not get caught" through improved prediction and advance warnings. The more time a dam owner and community have to prepare, in general, the better the outcomes. Dams that are up to design standards should provide predictable performance and handle floods safely while the performance of dams that do not meet standards is questionable. In California, one way that resources were pooled to plan for and respond to flooding issues downstream of dams (failure, high releases, etc.) is the Joint Powers Authority or JPA. JPAs typically include municipalities, county government, and levee owners/operators in a dam failure flood inundation zone, but not federal dam owners who cannot participate. The primary responsibility of the JPA is to protect citizens during flooding events. The JPA is a multi-entity agreement that allows the group to act collectively, while keeping power local. JPA's are State legislated, and the State compels the entities into these agreements and provides minimum standards that must be met to receive certain levels of federal and State aid. The State first requires that JPAs cooperate in the development and implementation of a plan then further integrate overtime to improve cooperation and cost sharing. JPAs can levy taxes, which spread costs over much larger populations and make it more reasonable, sharing costs fairly across varying levels of exposure levels (nearest the dam's worst impacts, less but still notable further away).*

The Committee did not think the JPA model was appropriate for Vermont for numerous reasons including lack of regional government, lack of sufficient populations to support the model, lack of public support for another layer of taxation, and uncertainty regarding the level of effort needed to establish JPA's.

The Committee did not discuss any other suggestions for legislative change and believes that many minor changes and improvements to Dam Safety Emergency Action Planning can be incorporated into existing processes and future rule updates.

A Vermont DEC Dam Safety Inspector at St. Albans North Reservoir in 2025
HIGH Hazard Potential Dams in Vermont are inspected once every two years

Conclusions

The State of Vermont has 74 dams that are classified as HIGH hazard potential dams. Of the 74 dams classified as HIGH hazard potential, 50 dams are regulated by the Vermont DEC, 4 dams are regulated by the Vermont PUC, 13 dams are regulated by FERC, and 7 dams are owned and regulated by the USACE (Federal). These HIGH hazard potential dams are owned by private dam owners (35 dams), municipal governments (23 dams), the State of Vermont (9 dams), and the Federal Government (7 dams). The primary purpose of these HIGH hazard potential dams includes recreation (35 dams), hydroelectric power (18 dams), flood control (11 dams), drinking water supply (9 dams), and mine tailings (1 dam).

All HIGH-hazard potential dams must have regularly updated EAPs that meet applicable regulatory standards as the building block to planning for dam failures and the development of an EOP. Dam Owners must remain available to coordinate EAPs with Local EMDs/ICs and educate them on the plan. Success in developing an effective EOP is built on trust, open communication, and the common goal of protecting public safety. Increased funding could improve outcomes. Without increased funding, some systematic improvements can be made, but success will be more challenging. One systematic change that should be implemented immediately is the prioritization of HIGH hazard dams by PAR. The higher consequence HIGH hazard potential dams that could cause more potential life loss in the event of a dam failure should be prioritized for EAP and EOP assistance.

The Committee acknowledges the shortcomings of the existing dam failure emergency operations planning efforts and recommends funding be provided to facilitate EOP development and implementation. The Committee considered four options to improve emergency operations planning for HIGH hazard potential dams in Vermont with one being the improvement of the existing system. The other three options include facilitators which could be RPCs, VEM Regional Coordinators, or a contractor. Significant funding would be needed for facilitators to assist with dam failure EOP development either by hiring additional staff or granting money to RPCs or providing funding for this effort to be completed by an outside contractor. To determine the amount of funding needed, the Committee recommends a pilot project to produce and implement EOPs for one or two State-owned dams in order to test the EOP development and implementation process and to determine more accurate costs. Some EOP production and implementation projects related to dam failures as a result of terrorism may be eligible for federal emergency preparedness and planning funding from the State Homeland Security Program (SHSP), a federal grant program administered by the Vermont Department of Public Safety Homeland Security Unit. Depending on the current Fiscal Year's grant opportunity, the emergency operations

planning and/or implementation efforts for the pilot project may be allowable for SHSP funding. It should be noted that both DEC and VEM staff and each department's Business Offices have limited capacity and would require additional resources to bid out and manage this pilot project and any other effort undertaken as a result of this study. If funding is not made available for either the pilot project or for the facilitation of the development and implementation of EOPs, the Committee recommends improving the existing process of providing templates and tools for municipalities to develop dam failure EOPs.

Lastly, the Committee was tasked with evaluating potential legislative changes that could improve dam failure emergency operations planning. The Committee discussed two ideas for legislative change: the addition of a dam hazard potential classification known as the ULTRA-HIGH classification and the JPA concept. After discussion, the Committee determined both potential legislative changes would not advance the Vermont's mission to reduce risks to life, property, and the environment from dam incidents and dam failure.

This HIGH Hazard Potential Dam in Mendon impounds the City of Rutland's drinking water supply reservoir

Appendix A:

Table of HIGH Hazard Potential Dams by Regional Planning Commission

Regional Planning Commission	Dam Name	Municipality
Addison County Regional Planning Commission	Sugar Hill Reservoir	Goshen
	Silver Lake	Leicester
Bennington County Regional Commission	Lake Paran	Bennington
Chittenden County Regional Planning Commission	Indian Brook Reservoir	Essex
	Lake Iroquois	Hinesburg
	Lower Pond	Hinesburg
	Clark Falls	Milton
	Peterson	Milton
Central Vermont Regional Planning Commission	East Barre	Barre
	West Hill Pond	Cabot
	Marshfield No. 6	Cabot
	Wrightsville	Middlesex
	Middlesex No. 2	Middlesex
	Thurman W. Dix Reservoir	Orange
	Warren Lake	Warren
	Waterbury	Waterbury
	Nichols	Woodbury
	East Long Pond	Woodbury
Lamoille County Planning Commission	South Pond	Eden
	Green River Reservoir	Hyde Park
	Johnson State Lower	Johnson
	Lake Mansfield	Stowe
	Stowe Upper Golf Course	Stowe
	Wolcott	Wolcott

Regional Planning Commission	Dam Name	Municipality
Mount Ascutney Regional Commission	Jewell Brook Site No. 1	Ludlow
	Jewell Brook Site No. 2	Ludlow
	Jewell Brook Site No. 3	Ludlow
	Jewell Brook Site No. 5	Ludlow
	Okemo Snow Pond	Ludlow
	North Springfield	Springfield
	North Branch	Weathersfield
	Windsor Upper	Windsor
Northeastern Vermont Regional Development Association	Comerford	Barnet
	West Charleston	Charleston
	Newport No. 1	Derby
	Mackville Pond	Hardwick
	Institute Pond	Lyndon
	Stiles Pond	Waterford
	Moore	Waterford
Northwest Regional Planning Commission	St. Albans North Reservoir	Fairfax
	St. Albans South Reservoir	Fairfax
Rutland Regional Planning Commission	Chittenden Reservoir	Chittenden
	Star Lake	Mount Holly
	Rutland City Reservoir	Rutland Town
	Snowshed Pond	Killington
Two Rivers-Ottauquechee Regional Commission *(continued on next page)*	Silver Lake	Barnard
	Bradford	Bradford
	Blodgett	Bradford
	Keyser	Chelsea

Regional Planning Commission	Dam Name	Municipality
Two Rivers-Ottauquechee Regional Commission *(continued from previous page)*	Wright Reservoir	Hartford
	Wilder	Hartford
	North Hartland	Hartland
	Woodward Reservoir	Plymouth
	Crescent Lake	Sharon
	Elizabeth Mine TP-1	Stratford
	Union Village	Thetford
Windham Regional Commission	Pleasant Valley Reservoir	Brattleboro
	Chestnut Hill Reservoir	Brattleboro
	Snow Lake	Dover
	Sweet Pond	Guilford
	Ball Mountain	Jamaica
	Lowell Lake	Londonderry
	Searsburg	Searsburg
	Somerset	Somerset
	Townshend	Townshend
	Wantastiquet Lake	Weston
	Harriman	Whitingham
	Lake Clara	Whitingham
	Lake Sadawga	Whitingham
	Ryder Pond	Whitingham
	Jacksonville Pond	Whitingham
	Lake Sadawga West Dike	Whitingham
	West Lake	Wilmington
	Mahoney Pond	Winhall

Appendix B:

Meeting Notes

VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
Montpelier, VT 05620-3510

Meeting Notes

Subject: Dam Safety Action Planning – Legislative Study Committee
Committee Meeting One
Day/Time: November 13, 2024, 1:00 pm to 3:00 pm
Location: One National Life Drive, Davis 3, LIMESTONE
Prepared By: Sarah Moore, VT DEC Dam Safety Program (DSP)

Attendee List:

In-Person
Representative Marc Mihaly
Neil Kamman – DEC WID
Ben Green – DEC DSP
Chris Campany – Regional Planning Commission
Christian Meyer – Regional Planning Commission
Michaela Foody – VEM
John Tedesco – GMP
Scott Johnstone – Morrisville Power & Light, Hardwick Electric
Charles Martin - DLL
Steven Hanna – DEC DSP
Sarah Moore – DEC DSP

Online
Jason Batchelder – DEC Commissioner
Jan Sotirakis – Chittenden Emergency Management Director
Bill Lovett – Fire Chief of Rutland

General Thoughts and Introductions:

Mark Mihaly –

- Would like to see more distinct roles in governmental and town emergency preparedness.
- Would also like more funding opportunities for towns preparing for flood/dam failure-related emergencies.
- Better communication between emergency management and towns/civilians is needed.

Charles Martin –

- Would like to be more prepared in predicting the likelihood of high-risk events and being prepared when those events happen.

Neil Kamman –

- Would like this meeting to be primarily a meet and greet and to set up the work for this charge.

Jan Sotirakis –

- Is looking forward to providing advice and experience to this group as she has worked in dam safety for nine years.

Bill Lovett –

- Can give advice as someone who took over ownership of an unsatisfactory condition dam and had to learn the roles and responsibilities that job came with.

Michaela Foody –

- Is looking forward to providing any insight regarding emergency preparedness.

John Tedesco –

- Provide experience and advice as someone who has a broad range of experience with dam safety and emergency management
- Has a strong understanding of the operations of dams and how to be best prepared in an emergency.

Scott Johnstone –

- Provide experience as someone actively updating dam emergency action plans and is aware of the risks associated with high-hazard dams.

Steven Hanna –

- Provide experience and advice as someone working with the DSP for about ten years.

Chris Campany –

- Would like to see towns have better evacuation routes in place.
- Would like to see a better connection between emergency managers and the general public.
- Would like emergency managers and the public to pay more attention to other catastrophes to prepare better should one happen in their town.

Christian Meyer –

- Would like to focus on all potential dam failures. If larger dams are failing, there are certainly smaller ones that are failing, too.

Ben Green –

- Would like to provide expertise and advice as someone who knows both the ownership roles and the roles of dam regulation.

Review and Discussion of the Statutory Charge:

At the request of Neil, Ben reviewed the statutory charge of the committee and provided some basic insight on each of the tasks which was discussed with the group.

1. Identify HIGHHazard Potential Dams in Vermont
    a. The DSP is responsible for maintaining the Vermont Dam Inventory (VDI), which is a web-based database of all known dams in the State. VDI includes basic data on the dams and more recently includes a downloadable copy of the most recent periodic inspection report, Emergency Action Plan or Dam Failure Flood Inundation Maps (if available), and photographs of the dam (when information is not designated as Critical Information).
    b. Vermont currently has 73 HIGHhazard potential dams which are regulated by DEC, PUC, FERC, or FED.
    c. DEC regulates the majority of the HIGH hazard potential dams, but individual, local/municipal, and federal owners are also involved.
    d. The definition of a HIGHhazard potential dam is that if that dam should fail, loss of life is probable. The definition of a HIGH hazard potential dam is essentially the same regardless of the dam safety regulator. It should be noted that if dam failure could result in flow depths and velocities that would result in probable loss of just one life, that is a HIGH hazard potential dam just the same for which probable loss of life could be many.
2. Identify existing responsibilities of municipal Emergency Managers and how they prepare, implement, and fund dam emergencies.
    a. Identify how currently in the State dam emergency planning and implementation is handled.
    b. Dam emergency planning and implementation capability appears to vary widely across the State from well-funded and organized to disorganized and underfunded.
3. Identify Regional Planning Commissions and how many High Hazard potential dams are in each region.

a. There are eleven planning commissions over the 73 HIGHhazard potential dams in Vermont.
b. Dam Failure Flood Inundation mapping often overlaps corporate, regional, and county lines, which makes setting clear boundaries for emergency planning and implementation difficult.

4. Recommendations for the content of regional dam emergency plans
    a. The objective would be to identify the criteria and or a template or guidelines for regional planning to make the process more standardized and consistent.
    b. It is important to establish clear roles and responsibilities for regional managers, towns, and dam owners.
    c. Those involved with dam emergency planning and implementation should meet regularly, and build relationships and trust to be most effective
    d. Quality weather forecasting and understanding how to and where to get this information is critical to effective dam management.
5. Recommendation on what entity should prepare regional dam emergency plans
    a. When preparing plans, being on the same page regarding terminology is essential.
        i. Local Emergency Management Response Plans – specifically, if an emergency happened, what should be done?
        ii. Hazard Mitigation Planning focuses on comparing the likelihood of a hazard and its potentially devastating effects and having the town devise tasks to mitigate that hazard.
        iii. Emergency Action Plan – an emergency action plan for dam failure
        iv. Encourage towns to have dam emergency preparedness in their annexes
    b. There is a wide gap between well-prepared and unprepared towns when it comes to dam emergencies. Many towns would benefit from technical and financial assistance in planning and implementation.
    c. Towns should be encouraged to include dams in their local hazard planning.
6. Develop cost estimates for regional dam emergency planning
    a. This will be challenging and likely require providing a wide-ranging estimate to bracket all cases.
7. Develop cost estimates for the implementation of dam emergency plans
    a. The initial response in a dam emergency is the responsibility of towns. Outside aid systems are only available post-event.
    b. Many towns do not have adequate funding for dam emergency planning or implementation.
    c. Emergency communication devices should be considered HIGH hazard dams with high populations at risk or short flood travel times. For example, the Town of Chittenden spent money on emergency sirens in areas downstream of Chittenden Reservoir Dam.

Committee Organization:

1. A Chair and Vice Chair are recommended for this group to lead and guide the Committee. The following members volunteered and were approved by the Committee by consensus.

    - Chair – Ben Green
    - Vice Chair – Michaela Foody

2. Committee Operating Principles :
    1. Decision Making: Democratic Consensus decisions
    2. Shared File Storage: Teams file share site will be used. Before creating the share site, a Committee contact sheet with all members will be distributed.
    3. Additional Committee Membership:
        a. USACE manager of CT River Flood Control Dams
        b. Plainfield EMD – Marc to reach out.
        c. Town of Ludlow – DEC to reach out
        d. Arion Thimboumery – Owner of Marshfield 4 Dam – Mihaly to reach out
        e. Potential small-town advocate

Workplan Discussion and Development:

- The goal is to endeavor to protect life in the event of a dam failure or incident through more effective regionally based planning, implementation, and funding. Some questions to explore include:
    - Who should take the lead/be responsible for planning?
    - Who should take the lead/be responsible for implementing the plan?
    - How will this be funded and how much will it cost?
- Costs of implementing dam emergency plans can be hard to predict.
    - What can be to be more proactive prior to emergencies.
    - What funding can be allocated for items that towns will 1eed in a disaster emergency?
        - What items are needed for predicting, alerting, evacuation, shelter, survival of emergencies
        - Create a list of these items in the annex and the potential costs, start tracking what expenses have been incurred from day one and potentially charge FEMA – pay upfront, get reimbursed by FEMA later.
- How can potentially be done to better prepare dams for flooding or severe loading conditions?
    - In preparation for a flooding event can the rules, licences, and guidelines around manipulating flows and water levels be softened to protect dams and improve flood control?

Next Steps and Scheduling Follow-up:

DISCUSS ACHEIVABLE TIMELINE FOR COMMITTEE'S WORK - look for report by 12/2025 for the year of the biennium. If there are $$ proposals, those could go into Member/Senator proposals in big bill.

Next Steps and Scheduling Follow-up.

- DECIDE ON APPROACH TO SCHEDULING - ROLE OF JOHN MCKELVIE
- Next mtg before Holidays. NCK to communicate.

VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
Montpelier, VT 05620-3510

Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Two
Day/Time: December 16, 2024, 12:30 pm to 2:30 pm
Location: One National Life Drive, Davis 3, Greenstone Room
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

In-Person
Representative Marc Mihaly
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Michael Billingsly – Plainfield Emergency Management Director
Ben Green – PE – Section Chief, DEC Dam Safety Program
Steven Hanna – Dam Safety Engineer – DEC Dam Safety Program
Sarah Moore – Program Administrator – DEC Dam Safety Program

Online
Neil Kamman - Director of the Water Investment Division
Arion Thiboumery – Dam Owner, Vermont Independent Power Producers Association of Vermont
Scott Johnstone - General Manager of Morrisville Water & Light (MWL) and Interim Manager of Hardwick Electric
Michaela Foody - Vermont Emergency Management (VEM)
Bill Lovett - Fire Chief of Rutland
John Tedesco - Green Mountain Power (GMP) – Generation Project Coordinator
Dan Koenemann – Winooski District Manager

Welcome and Introductions

New Members:
Arion Thiboumery - Dam Owner, Vermont Independent Power Producers Association of Vermont
Michael Billingsly - Plainfield Emergency Management Director
Dan Koenemann - Winooski District Manager

Review and Approval of Minutes of 11/13/2024 Meeting

There are no additional notes of the last meeting minutes.

Dam Safety Emergency Action Plans – Presnted by Ben Green

- The Vermont Dam Safety Program posted all available Emergency Action Plans (EAPs), inundation maps, and hydrologic and hydraulic (H&H) analyses on the Vermont Dam Inventory. This information is updated regularly. Currently, the publicly viewable data pertains to non-federal/non-hydropower dams regulated by the State of Vermont. We do not publish information on dams with Critical Energy/Electric Infrastructure Information (CEII).

- HIGH Hazard Potential EAP Example (Wrightsville)
    - An EAP identifies potential emergency conditions at a dam and specific actions to be followed to minimize loss of life and property damage from a dam incident or failure. It includes actions to be taken by the Dam

Owner to moderate or alleviate the problem, necessary communication and coordination with emergency management authorities, procedures for the Dam Owner to follow regarding the issuance of warnings and notifications to emergency management authorities, and flood inundation maps to help identify critical infrastructure and population at risk, and delineation of responsibilities of those involved.

- The general contents of an EAP template are:
  - Basic data includes potentially impacted areas downstream from the dam, a general description of the dam, directions on how to reach the dam with multiple descriptions of different access points, and an emergency action overview.
  - The roles and responsibilities of implementing the plan include the Dam Owner, the Hydro Facility Representative (if applicable), the Incident Commander, Emergency Management Services, and the Dam Operator's Technical Representatives.
  - The Five-Step EAP Process
    1. Event Detection
    2. Emergency Level Determination
    3. Notification and Communication
    4. Expected Actions
    5. Termination
  - Maintenance – EAP Review and Revision includes EAP tabletop exercises, who should have a copy of the EAP and past revisions and updates made.
- One of the most important aspects of any EAP is inundation mapping. This mapping helps those implementing the EAP visualize how various dam incidents and failure scenarios could unfold and the timing and impact on downstream communities, including flood depth, velocity, and travel time.

- <u>SIGNIFICANT Hazard Potential EAP Example (Vatters Pond)</u>
  - Significant Hazard Potential EAPs are becoming more common and will be required with upcoming rules for non-power, non-federal dams. For SIGNIFICANT Hazard Potential dams during failure, loss of life is not probable but there would be significant property, lifeline, and or environmental damage.
  - The majority of SIGNIFICANT Hazard Potential EAPs are a simplified version of the HIGH Hazard Potential template. These plans are created with the help of a program called the Decision System for Water Infrastructure Security (DSS-Wise Lite). DSS-Wise Lite is a web-based program that allows users to set up an automated two-dimensional dam breach/failure model with minimal inputs and provides results, including flood inundation maps, flood arrival times, hydrographs, and other life consequence information.
  - This EAP will include necessary dam information, including directions on accessing said dam, potentially impacted areas, the population at risk, a simplified Emergency Notification Flow Chart, Flood Inundation Mapping, and the general EAP Process.
- <u>Discussion</u>
  - Preventative Measures
    - The ability of a dam owner to lower the reservoir before a predicted rainfall event is still under discussion. However, in the future, it will be mandatory for all dams to have a functioning low-level outlet. While this may not be particularly effective during a flood, having a functional low-level outlet will be beneficial for gradually reducing the reservoir level of a deteriorating dam. This will help prevent failure until the owner can remove the dam or implement rehabilitative measures.
    - Discussion on the importance of owners having resources and information available to recognize when dam removal or rehabilitation would be more beneficial in their ability to maintain their dam.
  - Dam Fees (Such as Annual Dam Registration Fees)
    - Dam owners typically respond negatively when required to pay any fees related to their dam ownership. However, these fees serve an important purpose by reminding dam owners of the responsibilities of having a dam on their property.
  - Complexities Regarding Communication

        - There are many inconsistencies when it comes to getting the message to communities downstream that a dam incident is happening. For example, some people do not have internet access, cell phones, cell phone service, etc. There needs to be a process to get an emergency messaging to all people downstream.
        - In general, VT Alert and similar text notification systems are effective for those with cell phones, and the sirens utilized at Chittenden Reservoir are functional and undergo annual testing. However, it is worth mentioning that there seems to be a trend of the public not valuing frequent emergency alert testing. As the frequency of testing increases, people tend to disregard it more.
        - It's essential to have good relationships with emergency management downstream.
    - General Thoughts on Improvements
        - Provide a standardized EAP template so there is no confusion about what should be included.
        - In the future, owners will be required to update and maintain their EAPs every two years.
        - Inundation mapping should include a wider range of scenarios. Rather than depicting only the worst-case scenario, it would be beneficial to illustrate smaller flooding events.
        - What information can be shared with the public beforehand? Due to its sensitivity, some owners and regulators are hesitant to disclose information to the public.

Local Emergency Plans – Presented by Michaela Foody
***This discussion is postponed until the next meeting due to time constraints**

- Local Plan Structure
- Dam Safety Annex
- Discussion

Next Steps for Workplan Development and Scheduling Next Meeting

- The next meeting will not be until after the New Year, and it will focus mainly on Michaela Foody's presentation of Local Emergency Plans.
- Future meeting plans will include a more detailed discussion by Bill and Jan about Chittenden Emergency Management. We will also explore ways to secure funding for emergency preparedness and address the need for specific emergency management strategies related to dams. The relevant individuals must receive information as promptly as emergency management does during a dam incident.

General Thoughts and Comments

- There is concern about the potential loss of life from ultra-high-hazard dams, which could result in significant fatalities if they fail. The question arises: who should be responsible for the planning, and what would the associated costs be? There is a hesitance to adopt an overly democratic approach, as it may detract from focusing on the dams that pose the greatest risk to human life in the event of failure.
- Although Vermont does not define "Ultra High Hazard Potential Dam," it is understood that the focus for planning solutions should be on dams that pose the highest risk for loss of human life.
- There was a request for inundation mapping that provides a greater level of detail regarding downstream infrastructure and major roadways that could be affected during a dam incident.

Attachments:

- Emergency Action Plan – Wrightsville Dam
- Emergency Action Plan – Vatters Pond Dam
- Introduction to the Vermont Dam Inventory

Link to Vermont Inventory - https://anrweb.vt.gov/DEC/DamsInventory/ListDams.aspx

VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
Montpelier, VT 05620-3510

Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Three
Day/Time: January 27, 2025, 2:00 pm to 3:30 pm
Location: One National Life Drive, Davis 2, Catamount Room
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

In-Person
Representative Marc Mihaly
Neil Kamman – Deputy Commissioner and Director of the Water Investment Division
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Chris Campany - Executive Director Windham Regional Commission
Michael Billingsly – Plainfield Emergency Management Director
Ben Green – PE – Section Chief, DEC Dam Safety Program
Steven Hanna – Dam Safety Engineer – DEC Dam Safety Program
Sarah Moore – Program Administrator – DEC Dam Safety Program
Online
Michaela Foody - Vermont Emergency Management (VEM)
Arion Thiboumery – Dam Owner, Vermont Independent Power Producers Association of Vermont
Jan Sotirakis – Chittenden Emergency Management Director
Bill Lovett - Fire Chief of Rutland City
John Tedesco - Green Mountain Power (GMP) – Generation Project Coordinator
Laura Vallett – Green Mountain Power (GMP) – Environmental Compliance Lead

Greetings/Introductions

- Future meetings are set for the third Monday of each month if everyone's schedule allows it.
- The next meeting is scheduled for February 18, 2025.

Review/Acceptance of Meeting Notes #2

- The comment on page 3 of the last meeting's notes, which states that the public does not value excessive emergency testing and that as more testing occurs, people tend to disregard it, is not true in all cases. Jan Sotirakis mentioned that her community appreciates emergency communication testing. She also pointed out that VT alerts can be sent to landlines and other devices, not just cell phones.

Vermont Local Emergency Management Plans (LEMP) Presentation – Michaela Foody

- Neil has emailed all committee members Michaela's presentation
- Legislation 20 V.S.A. Section 6 requires all municipalities to have an Emergency Management Plan. To help with this requirement, VEM has created a LEMP template that includes the minimum requirements for this plan. This plan must be updated yearly by June 1st.
    - The majority of towns comply with this requirement.
    - The towns that do not comply with minimum requirements generally receive less post incident funding.

Important distinctions and definitions

- Emergency Management Director (EMD)
    - Typically, it is a voluntary position; every town requires one, and each EMD varies in their comfort level with executing the requirements of a LEMP.
    - During an incident, an EMD will generally coordinate information flow between the municipality and the state, coordinate resource acquisition on behalf of the Incident Commander, and maintain a common operating picture for the incident occurring within the town.
    - It is important to note that for an EMD to implement a LEMP successfully, the EMD should not be a Fire Chief, Incident Commander, or any other persons involved with being on site of an incident.
- Incident Commander (IC)
    - Typically, a role in Town such as the Fire Chief.
    - Manages the incident on the ground and decides which command or general staff positions to assign to maintain effective oversight and ensure proper attention to essential incident management functions.
- It is essential for everyone involved in local emergency planning to clearly understand the roles and responsibilities of the IC and the EMD to effectively organize, communicate, and educate all participants in local emergency management.
- Incident Response Plans
    - Specialized emergency plans per topic or situation
- Emergency Operations Plan (EOP)
    - Plan for responding to a variety of potential hazards
- Local Emergency Management Plan (LEMP)
    - A municipality's guidebook to facilitate roles and responsibilities when an incident occurs.
    - LEMP Requirements
        - Emergency Management Planners
        - Municipal Emergency Operations Center (EOC)
        - EOC Activation Authority
        - EOC staff positions and responsibilities
        - Facility information for potential EOC locations
        - Emergency purchasing agent
        - List of town-owned resources
        - Communities requiring additional coordination
        - Public information and warning
        - Local Shelter address
        - Local contacts for the emergency management team
    - LEMP Template – Must be developed with the EMD
- Dam Emergencies Annex – This section will be part of an Incident Response Plan included in the Emergency Operations Plan, a component of the overall LEMP.
    - Local officials use the Dam Owner Emergency Action Plan (EAP) to develop an Incident Response Plan. Most EAPs only address notifying the municipality and others about an incident, which means that while the dam owner informs others of an incident the municipality may not know how to respond afterward.

Next Meeting – Proposed: Jan and Bill Present on Chittenden Reservoir multi-jurisdictional Local Emergency Action Plan

- After this presentation, it could prove helpful to compare Emergency Action Plans (EAPs) and local emergency plans for dams, focusing on key components for responding to dam emergencies.
- We also need to identify who will implement these plans and how towns will obtain the necessary resources. Conducting after-action reports or reviews could be beneficial as well.

VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
Montpelier, VT 05620-3510

Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Four
Day/Time: February 18, 2025, 2:00 pm to 3:30 pm
Location: One National Life Drive, Davis 2, Catamount Room
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

In-Person
Neil Kamman – Deputy Commissioner and Director of the Water Investment Division
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Chris Campany - Executive Director Windham Regional Commission
Michael Billingsly – Plainfield Emergency Management Director
Ben Green – PE – Section Chief, DEC Dam Safety Program
Steven Hanna – Dam Safety Engineer – DEC Dam Safety Program
Sarah Moore – Program Administrator – DEC Dam Safety Program
Michaela Foody - Vermont Emergency Management (VEM)
Michael Nahmias – Project Manager – DEC Dam Safety Program
Online
Arion Thiboumery – Dam Owner, Vermont Independent Power Producers Association of Vermont
Jan Sotirakis – Chittenden Emergency Management Director
Bill Lovett - Fire Chief of Rutland City
John Tedesco - Green Mountain Power (GMP) – Generation Project Coordinator
Scott Johnstone – General Manager of Morrisville Water & Light (MLW) and Interim Manager of Hardwick Electric
Dan Koenemann – District Manager of the Winooski Natural Resources Conservation District
Maggie O'Brian – Emergency Planner at Rutland Regional Planning Commission

Greetings/Introductions

New Committee Member: Michael Nahmias

- New Project Manager for the Dam Safety Program.
- In time, Michael will transition into Neil's role on this Committee.

Review/Acceptance of Meeting Notes #3

Correct the spelling of Chris Campany's last name and redistribute finalized notes from Meeting Three.

Chittenden Reservoir Dam Emergency Action Plan

A presentation from Jan Sotirakis, Bill Lovett, and Maggie O'Brian on how the Town of Chittenden in Rutland County has combined Local Emergency Plans and Dam Safety Emergency Action Plans into a functional Emergency Operations Plan for Chittenden Reservoir Dam.

Gathering all relevant information about a dam is important in creating a successful emergency plan.

Chittenden Dam/Reservoir

- Owner: Green Mountain Power (GMP)
- Location: on East Creek in the town of Chittenden
- Dam History: a hydroelectric power dam built in the early 1900s and is currently regulated by the VT Public Utilities Commission.
- Dam Structural Components: The dam is an earth and rock-fill structure with a concrete overflow spillway. It also includes a gatehouse and two outlet conduits; one gate can be opened manually or electronically, while the other allows water to flow through a penstock. Water levels are maintained below an elevation of 1490 feet, filled during summer, and drawn down during winter.
- Risk: Chittenden Dam is classified as a HIGH hazard potential dam. If the dam fails, there is a likelihood of loss of human life. About 118 homes in the area could be flooded if the dam fails. The floodwaters would also affect Chittenden, East Pittsford, Rutland Town, and Rutland City. The water would continue north into Lake Champlain via Otter Creek.

After gathering relevant information, establishing necessary relationships and communication channels is the next essential step in implementing a successful emergency plan. Jan started meeting with GMP in 2015 to begin to develop open communication and build a trust-based relationship. Before Jan initiated this process, the communication line was limited to the Dam Owner and the Town Clerk, and there was no official plan outlining the actions to take in the event of a dam failure.

Increased meetings with emergency planning groups improved the overall emergency response plan. Jan collaborated with downstream EMDs from affected towns, updated emergency notification charts, secured funding for warning sirens, and worked with VT Alert to reach subscribed and non-subscribed community members in the event of an emergency.

A dam owner creates and distributes an Emergency Action Plan (EAP) specific to dam incidents. For Chittenden Reservoir Dam, the GMP's duties include maintaining the plan, training and testing the EAP, assessing emergency conditions, notifying relevant agencies, terminating the emergency conditions in conjunction with local authorities, and facilitating after-action evaluations and reports.

- The most important aspect of any EAP is the notification chart.

Once a dam owner notifies emergency management agencies, the agency is responsible for issuing public warnings, evacuating inundation areas, establishing evacuation routes and closures, providing security during and after evacuations, setting up shelters for evacuees, facilitating their return, and participating in after-action evaluations.

In response to a dam owner's notification, Emergency Management Agencies execute emergency plans for incidents like dam failures or floods. The Chittenden Reservoir Emergency Action Planning (CREAP) Team then informs relevant parties, including Downstream EMDs, Dam Owner Representatives, County Fire Mutual Aid, District 10 Ambulance District, VT State Police, VT State Dispatch, Regional Planning Commission Emergency Planner, Rutland County Fire Safety, Task Force 1 Urban Search and Rescue, VEM VT Alert, and the retired GMP Dam Engineer, among others deemed necessary.

CREAP is working to strengthen relationships between EMDs and GMP, update emergency notification charts, prepare for dam emergencies, understand flood mapping and town-specific evacuation plans, test warning sirens biannually, improve public communication, and establish mutual aid plans.

An effective EAP for dam failure includes creating inundation maps that identify affected homes, vulnerable facilities, and key roadways and indicate the timing of flooding impacts, flood depths, and velocities. This information helps determine optimal evacuation routes, shelters, and strategies for post-event recovery, allowing emergency planners to prioritize safety effectively.

Key Points of Discussion

Mutual Aid Plans

- If there is an emergency, it's important to have a plan to get people to the flood areas. Know the resources available to you and identify the resources in surrounding towns. Build relationships with these communities so that they are prepared and able to assist effectively in an emergency, such as a potential dam failure.

Inundation Mapping

- Understanding effective inundation mapping scenarios for your town's dam and reservoir is crucial. Consider factors like dam condition, drawdown methods, and potential failure modes. Tailor emergency plans to your community's specific needs, as Jan does with local schools using rivers for education. Ensure inundation maps include reference points, and it is important to be mindful of Critical Energy Infrastructure Information rules and any other requirements to protect sensitive information, if applicable. Share what is allowable and valuable to the public within those requirements.

Information that should be shared with the public

- In discussing effective inundation mapping for public understanding of flood paths, the issue of sensitivity or CEII information arose. For example, due to sensitivity, Jan's inundation map for Chittenden Reservoir Dam omitted certain details that were not meant for public viewing.
    - Benefits of sharing all information included in a typical inundation map.
        - The public would have all available information necessary to plan for a dam failure.
        - Allowing the public to prepare their plans suggests all available information that understaffed emergency management teams depend on individuals to care for themselves while they address more urgent issues during an emergency.
        - Giving the public the reality of the gravity of flood inundation information may push people to be more prepared during an emergency.
    - Challenges in sharing all information that would be included in a typical inundation map
        - Creating unnecessary fear of a dam failure even if it is not likely to happen
        - In some cases, like Chittenden Reservoir Dam, GMP adheres to the CEII model under FERC regulations, so they cannot share all flood inundation information.
    - In cases like Chittenden Reservoir Dam, where GMP does have to follow CEII guidelines, Jan has offered to show households within the inundation zone the sensitive information omitted from the maps for public viewing. Still, she is not to give them a copy. This option is for those interested in obtaining more information for their security during an emergency plan.

Education for the General Public

- It's important for individuals to act since many towns may have limited emergency responders. A key question is where evacuees will go and how they'll get there, influenced by psychological factors. In Vermont, where natural disasters are infrequent, towns often lack the necessary information for effective evacuation plans, so education about flooding and specific dam-related events is vital.

Preparing multiple situation-based plans

- Developing comprehensive situation-based plans is essential for effective emergency management. For instance, in the event of a power outage, it is crucial to outline procedures for safely evacuating individuals from affected areas. Additionally, identifying and mapping the immediate flood zone is vital to ensure the safety of those in vulnerable locations. These plans should detail actionable steps, resources required, and communication strategies to guide responders and keep the community informed during a crisis.

A limited number of personnel

- When calculating the number of people needing evacuation, how do you manage with limited personnel?
    - Rely on individuals to take self-directed action, as many towns are often short-staffed with emergency responders.
    - Ensure people are informed on what to do in emergencies, like dam failures, so responders can focus on more urgent issues.

Emergency Planning Funding

- Towns require additional resources to effectively develop and implement comprehensive emergency planning strategies, rather than solely relying on limited town budgets and the efforts of dedicated volunteers like Jan.

Next Meeting

The next meeting is scheduled for March 10, 2025.

Michaela will provide a Dam Annex Template for review, and Jan will provide the CREAP plan for our review. We will discuss integrating new information to enhance dam safety emergency planning and reviewing Vermont's regional emergency management groups. Additionally, it will be helpful to define the terms *Dam Annex*, *Emergency Action Plan*, and *Emergency Operations Plan*. This clarification will ensure that we can provide towns with a template with all the necessary information.

Key topics include recovery policies, especially regarding the absence of FEMA support, identifying existing regional resources, and discussing funding opportunities. Insights into paying contractors for creating inundation mapping and dam failure analysis, regional response plans, and reality-based planning would also be valuable.

VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
Montpelier, VT 05620-3510

Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Five
Day/Time: March 10, 2025, 2:00 pm to 3:30 pm
Location: One National Life Drive, Davis 2, Catamount Room
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

In-Person
Ben Green – PE – Section Chief, DEC Dam Safety Program - Chair
Michaela Foody - Vermont Emergency Management (VEM) – Vice Chair
Scott Johnstone – General Manager of Morrisville Water & Light (MWL)
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Steven Hanna – Dam Safety Engineer – DEC Dam Safety Program
Michael Nahmias – Project Manager – DEC Dam Safety Program
Sarah Moore – Program Administrator – DEC Dam Safety Program

Online
Niel Kamman – Deputy Commissioner and Director of the Water Investment Division
Michael Billingsly – Plainfield Emergency Management Director
Jan Sotirakis – Chittenden Emergency Management Director
Arion Thiboumery – Dam Owner, Vermont Independent Power Producers Association of Vermont
Bill Lovett - Fire Chief of Rutland City
Dan Koenemann – District Manager of the Winooski Natural Resources Conservation District

Greetings/Introductions

Michael Nahmias took the lead as the meeting facilitator and will continue to do so for future meetings in place of Neil Kamman who has transitioned into the Deputy Commissioner role at DEC.

Review of Past Meeting Topics

Meeting 1: Organization of Committee Structure and Duties
Meeting 2: Dam Safety Emergency Action Plans (EAPs) Review
Meeting 3: Local Emergency Management Plans Review
Meeting 4: Emergency Operations Plans Review

Review of Tasks

- Tabulate High Hazard Potential Dams list by RPC - COMPLETE
- Summarize existing responsibilities of individual municipalities to prepare for and implement existing emergency operations plans for dam emergencies.
- Recommend content for regional emergency operations plans for dams and identify who should prepare them.
- Estimate the cost to produce and implement regional emergency operation plans for dams.
- If legislative changes are suggested in the final report, provide draft legislation

Review/Acceptance of Meeting Notes #4

The following updates/edits were requested on the past meeting notes:

- On page 2, in the fifth bullet point, there are 118 homes listed; please remove the mention of Chittenden from the following line. Please note that Chittenden Reservoir Emergency Action Planning (CREAP) Team included all relevant parties in the second sentence, indicating that everyone is included rather than separated.
- If any corrections are needed after this meeting, participants can request updates via email.
- For future meeting invitations, the date will be at the beginning of the subject line instead of at the end. The same format should be applied to the meeting notes and agendas.

Clarification of Definitions

The following key definitions were discussed. The definitions will be further refined and presented in the final report.

- Emergency Action Plan (EAP): Recently defined in the Dam Safety Rules, it is a document developed by the dam owner that lays out their responsibilities during a dam emergency and includes downstream emergency personnel notifications, dam owner actions, and dam failure flood inundation maps.
- Emergency Operations Plan (EOP): a documents developed by local Incident Commanders and Emergency Management Directors to help prepare for and manage a flood caused by a dam failure or incident. A good EAP is necessary to develop a good EOP.
- Dam Annex: The EOP would become an annex in the Local Emergency Management Plan (LEMP).
- Downstream Communities: Any town located downstream from a dam affected during a dam failure or incident as determined through dam failure flood inundation mapping.

Discussion Key Themes

Emergency Action Plan Minimum Requirements and Criteria

- The key element of an EAP is the notification flow chart that the dam owner must use to communicate an emergency at the dam to relevant downstream emergency personnel. At each level of the notification flow chart, there should be at least three contact points to ensure someone can always be reached. The other key element of EAPs is the dam dam failure flood inundation maps that depict the estimated extents, depths, velocities, and travel times of dam failure floods.
- Occasional testing of the EAP is important for effectiveness. This can be achieved through tabletop or functional exercises.
- Dam Safety rules, regulations, and guidance documents dictate EAP requirements.
- It was suggested that the committee consider recommending an additional dam hazard potential classification, such as “Ultra-High-Hazard” Potential Dams be added to statute/regulations to designate dams that have a higher potential Population-at-Risk (PAR) or life loss from failure than dams with less PAR or life loss. The thought was that EAPs for this “Ultra” classification should be more detailed, including real-time tracking and communication due to the urgency of flood risks to downstream communities. This concept needs to be further researched and debated by the Committee.

Lines of Dam Safety Emergency Communication

- Dam owners must communicate clearly with those on the EAP notification flow chart during EAP testing or an actual activation. Contact information in the notification flow chart must be confirmed before the EAP is finalized and checked/updated on a regular basis.
- Every HIGH-hazard potential dam should have an up-to-date EAP.
- On the EOP side, local communities have vital information and are in charge of managing such an emergency, but need help developing plans as many emergency personnel are overwhelmed with tasks.

Regional Emergency Planning/State Resources/Consultant Resources

- For a large regional plan involving multiple municipalities, each municipality must create its own annex and assess local resources.
- Regional Planning Commissions can assist local EMDs and ICs review inundation mapping to help prioritize actions and support mutual aid networks. However, it is crucial not to replace local knowledge, as regional planners may lack specific community information.
- RPCs have varying skillsets, so providing standardized training on interpreting EAPs and for preparing EOPs would be beneficial and likely critical to success.
- Local municipalities should hold group sessions with dam owners to discuss risks and operational measures.
- Jan from CREAP was consulted on Chittenden's experience with RPC assistance in planning. Although she initially did not work with the RPC, she found later success working with them for assisting with logistics and planning. However, in Jan's view, the role of the RPCs are limited to logistics and planning and they not have a defined role during an event.
- Other options are to use State (VEM) resources or potentially use contracted services to assist in developing EOPs. VEM would need additional resources but could use the framework of their regional coordinators. Consultants could also be used for the task, but there was concerns about continuity, costs, and complexity of management.

Inundation Mapping

- Mapping should identify homes, businesses, and other critical and sensitive infrastructure in dam failure flood inundation zones. EOPs should use this to develop a plan for public notification and evacuation.
- Inundation mapping should include all downstream communities that experience incremental impacts from dam failure. For instance, if one dam impacts six municipalities, each municipality must assess its resources and develop an EOP to strive to protect public safety.

Idea for Legislative Change

- Ultra-High Hazard Dams: More research and discussion needed, see above.

Next Meeting – April 7, 2025, 2:00 pm – 3:30 pm

Per the legislative charge, there are three meeting remaining (of eight total)

- Meeting Six—Before Meeting Six, Michaela, Ben, and the Dam Safety Program will develop a working draft of the following and provide prior to the meeting for discussion:
    - minimum requirements for EOPs and EAPs.
    - outline of the final legislative report
- Meeting Seven – A draft report will be developed and provided for the committee to review and discuss.
- Meeting Eight – Final discussions and input for report completion will be provided. Following Meeting Eight, the report will be finalized and submitted.

VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
Montpelier, VT 05620-3510

Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Six
Day/Time: April 7, 2025, 2:00 pm to 3:30 pm
Location: One National Life Drive, Davis 2, Catamount Room
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

In-Person
Representative Marc Mihaly
Ben Green – Section Chief, DEC Dam Safety Program - Chair
Michaela Foody – Regional Coordinator – Vermont Emergency Management (vice chair)
Michael Billingsly – Plainfield Emergency Management Director
Scott Johnstone – General Manager of Morrisville Water & Light (MLW)
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Chris Campany - Executive Director, Windham Regional Commission
Steven Hanna – Dam Safety Engineer – DEC Dam Safety Program
Michael Nahmias – Project Manager – DEC Dam Safety Program
Sarah Moore – Program Administrator – DEC Dam Safety Program

Online
Jan Sotirakis – Chittenden Emergency Management Director
Bill Lovett - Fire Chief of Rutland City
Aaron Thiboumery – Dam Owner, Vermont Independent Power Producers Association of Vermont

Greetings/Introductions/Review of Agenda

Agenda:

- Review topics from the previous meeting, EAP vs. EOP discussion, review and discuss "ULTRA" or "EXTREMELY" HIGH-Hazard Potential Dam designation, and discuss and plan next steps of the Committee.

Review and Approval of Meeting Five Notes

- Meeting Five notes were briefly discussed. No corrections or suggestions were submitted.

"ULTRA" or "EXTREMELY" HIGH Hazard Potential Dams

Research and Overall Concept:

- The State of Vermont Hazard Potential Classification system follows a national standard including LOW, SIGNIFICANT, and HIGH Hazard Potential Classifications. HIGH Hazard Potential classification is assigned to dams that would cause probable loss of human life should that dam fail.
- The concept of an EXTREMELY HIGH Hazard Potential Dam classification originated in California. This potential hazard classification is designated for dams whose failure could lead to significant loss of life or inundate areas with a Population at Risk (PAR) of 1,000 or more or be a significant threat to human safety. Many of these dams are also situated near or on tectonic plates, making them vulnerable to damage from seismic activity, which could result in failure. Due to California's dense population, it has been found that approximately half of California's dam

inventory consists of dams classified as HIGH or EXTREMELY High Hazard potential. California is the only state in the nation with this hazard potential classification. Vermont does not have the geologic hazards, population density, or large dams that California has, and would have to create new standards rather than adopt those of California.

- Data was presented regarding dams in Vermont that are classified as HIGH Hazard Potential and have either a FAIR or POOR condition rating. Out of these dams, approximately two of nineteen have an estimated PAR approaching or over 1,000.

	PROS	CONS
Adopting the "ULTRA" or "EXTREMELY" HIGH Hazard Potential Classification	• Increase awareness about the risks associated with dams with a higher PAR than others. • Provide the ability to apply more stringent standards to more hazardous dams. • Most EAPs and EOPs follow standard templates with minimum requirements, such as sunny and rainy-day dam failure flood inundation maps. Having a new classification for dams that have a higher PAR may allow regulators to require a more detailed EAP or additional requirements.	• In developing its Dam Safety Rules, the DSP has been using established Federal Standards for clarity, and the EXTREMELY HIGH designation is only for California. • If we adopt this classification, it will only apply to state-regulated dams, not those regulated by FERC, PUC, or owned by USACE. Many dams that may qualify for this classification are federally owned dams. • The use of descriptor words such as "extreme" and "ultra" is discouraged in hazard communication. Modifiers in regulation and risk communication, such as extremely, are not recommended due to a lack of precision. It is more effective to state the specific risk. • While prioritizing dams and emergency planning based on PAR makes sense, this does not require the additional hazard potential classification. • Vermont would have to determine the criteria for this new classification. • It does not match the federal hazard classification system and industry standards. • When preparing for flood events, it is important to consider the entities involved in the planning process. The response to such situations is primarily managed at the state level, regardless of whether the dam is federally regulated. The general community in Vermont will be actively involved in assisting and addressing the aftermath of a dam failure. Adding a new hazard potential classification could confuse people or instill fear using descriptor words like "extreme."

<u>Potential Alternatives to adopting a new classification</u>

- Given opposition to adding a new classification, the group discussed the possibility of implementing a risk based or PAR based ranking system to help prioritize dams in the state for emergency planning.
- Here are some suggested actions:
  - The committee discussed attempting to target the top 10 "highest risk" dams by criteria including dimensions, various Potential Failure Modes or other Risk Informed Decision Making principles, existing PAR estimates, or using DSS Wise Lite, a desktop flood and inundation analysis program, to estimate PAR.

Regardless of the method used, it was agreed that is should not be overly complicated as to take away from the mission of developing EOPs for these dams.

- The goal is to rank these dams to prioritize the highest risk dams for emergency planning.

Discussion on Who Should Be Responsible for Developing EOPs

- The discussion highlighted the importance of local decision-making in emergency planning, emphasizing community involvement and local emergency teams over regional entities. However, it notes some towns' limited resources, often depending on a single town clerk for guidance.
- Instead of forming a new emergency planning group, the State should help towns create their own plans with the support of Regional Planning Commissions (RPCs). Each town needs a specific plan (EOP) for potential dam failures, especially when these incidents impact multiple communities. RPCs or Vermont Emergency Management (VEM) can aid in developing an EOP.
- Coordination between neighboring towns is essential when planning for a potential dam failure. Many towns lack planning skills and understanding of their emergency roles in the event of a dam failure, which raises concerns about their awareness of the associated risks.

Discussion on Strategies to Assist Municipalities in Developing EOPs

- Towns should adjust their emergency planning based on available funds and the uncertainty of future events. They need to take basic actions, ranging from minimum requirements to the planning that Chittenden has developed. The real issue is not just having a plan but being able to carry it out during an emergency. Towns should be given guidance on how to prepare with the resources they have and how to potentially get the resources they need.
- Towns need to take specific steps as they receive more funding and resources. Many small towns cannot do the detailed planning required for a dam failure. It is important to know the roles of different groups at the regional or state level.
- Prioritize emergency preparedness by equipping communities with tools to develop effective EOPs. Local authorities must understand key steps such as the notification tree, evacuation routes, shelter plans, etc.
- The League of Cities and Towns was discussed as an option for aiding the development of resource kits to improve disaster preparedness. This committee should also clarify key aspects of emergency management, such as authority for evacuations and reservoir drawdowns. Building trust between dam owners, local leaders, and emergency responders is vital for effective EOP development.

Suggestions for Developing a Successful EOP and EAP

- While having a Local Emergency Management Plan (LEMP) is critical, it must be tested through exercises to ensure effectiveness in real scenarios. Communities need tiered recommendations based on available resources, guiding them from basic emergency action requirements to comprehensive EOPs. The challenge often lies not in having a plan but in the ability to implement it during a crisis.
- Additionally, practical testing, including trial runs with state dams may be helpful to develop and refine EAPs and EOPs that prepare communities for potential emergencies.

Next Proposed Meeting – May 12, 2025, 2:00 pm - 3:30 pm

A proposed soft target for the legislative report's completion is this summer or fall. However, the report is not due until December.

For Next Meeting:

- Before the next meeting, DSP will work to advance and send an updated draft of the legislative report for committee members to consider and make suggestions; these comments will be discussed at this meeting.

VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
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Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Seven
Day/Time: May 12, 2025, 2:00 pm to 3:30 pm
Location: One National Life Drive, Davis 2, Catamount Room
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

In-Person
Ben Green – Section Chief, DEC Dam Safety Program – Chair
Michaela Foody – Regional Coordinator – Vermont Emergency Management (vice chair)
Michael Billingsly – Plainfield Emergency Management Director
Scott Johnstone – General Manager of Morrisville Water & Light (MLW)
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Chris Campany - Executive Director, Windham Regional Commission
Steven Hanna – Dam Safety Engineer – DEC Dam Safety Program
Michael Nahmias – Project Manager – DEC Dam Safety Program
Sarah Moore – Program Administrator – DEC Dam Safety Program

Online
Jan Sotirakis – Chittenden Emergency Management Director
John Tedesco – Green Mountain Power
Laura Vallett – Green Mountain Power
Aaron Thiboumery – Dam Owner, Vermont Independent Power Producers Association of Vermont

Review and Acceptance of Meeting 6 Minutes

The EOP Committee approved the meeting 6 minutes with no comments or corrections.

Tasks Completed since Meeting 6.

Michaela inquired about recent activations of Emergency Action Plans (EAPs) and Emergency Operations Plans (EOPs) in towns. Ben consulted Tim Washburn, an expert in emergency operations planning and dam safety, in which a discussion took place about how floods pose a major threat to dams. Improved forecasting helps dam owners plan ahead and avoid surprises. With more preparation time, communities can achieve better outcomes. Dams that meet safety standards should manage floods effectively, while those that don't may be unreliable.

In California, local governments and levee operators combine resources through a Joint Power Authority (JPA) to address flooding downstream of dams. JPAs focus on protecting residents during flood events. They are state-mandated agreements that promote cooperation among local entities while maintaining local control. The state sets minimum standards for qualifying for federal and state aid. JPAs can also levy taxes, spreading costs more fairly among affected communities.

Discussion

- It was stated that Vermont municipalities face challenges with regional planning and resource allocation, as they lack the county-level governance that is seen in California, which facilitates financing and resource distribution.
- Establishing joint power agreements among towns to combine resources could potentially improve planning and funding by increasing collaboration in preparing for a dam emergency. Chittenden has been meeting quarterly for four years to focus on emergency planning, exemplifying this collaboration, though they are not in an official joint power agreement.

Discussion of Report

When drafting the report, we discussed the need to define the referenced authorities clearly. There are concerns about the uncertainty surrounding the assumption of emergency support. If funding is withdrawn from VEM, how will municipalities be able to prepare for emergencies that could jeopardize mutual aid efforts? Chittenden's mutual aid plan does not include FEMA; it relies solely on the goodwill of neighboring towns. While this reflects strong community support, it raises concerns about sustainability due to the absence of formal funding.

Figures

The current map figure is missing Harriman and Bellows Falls, which need to be included. While focusing on Vermont dams, we should also consider dams that border the state and could potentially affect it, particularly regarding inundation zones. For the purposes of this report, dams that are within Vermont borders, including those "on" the border, are included.

Definitions

The Dam Failure Flood Inundation Map - based on a theoretical model, indicating areas predicted by mathematical simulations. These modeled areas may not accurately represent actual flood events, as different scenarios can yield varying inundation outcomes. Including reference images of these models could enhance understanding. Reference images for other definitions may also be helpful.

Guiding Principles

Emergency Action Plans (EAPs) and Emergency Operations Plans (EOPs) should adopt a proactive approach and involve the general public, who often miss out on committees. The CREAP Team, which takes a proactive approach to emergency preparedness, collaborates with surrounding towns and keeps the public informed about emergency preparedness practices that the city is implementing or plans to implement.

A plan is only effective if there is a commitment to execute it; otherwise, it remains theoretical. Additionally, conducting training on the plan is essential to ensure it works as intended when needed.

Challenges Identified by the Committee

Concerns were raised about the uncertainty of emergency support funding, questioning how municipalities could prepare if financial aid from VEM were to decrease, as well as the challenges of relying on volunteers due to high turnover rates. Chittenden has ensured that multiple individuals are trained in emergency management roles to provide continuity and effective planning, referring to this concept as the "3 Deep Rule." They also discussed leveraging homeland security grants, while noting the risks of redundancy and the importance of intergenerational training to prevent the loss of valuable programs when key individuals depart.

Discussion

Dam classification was discussed, particularly for high-hazard dams and their emergency action plans (EAPs). It was suggested that instead of establishing a new classification system, stricter standards for the most hazardous dams would effectively prioritize resources. Clarification is needed in the discussion section, along with figures showing identified high-hazard dams. Introducing new classifications could stigmatize certain dams and fuel anti-hydropower sentiments.

Findings and Recommendations

Emergency preparedness efforts largely depend on federal funding, as many towns lack their local fire departments and rely on regional or private services. In most towns, the local fire chief often serves as the incident commander during emergencies. For towns without their own local fire services, collaboration with regional fire chiefs is important to ensure preparedness for events like dam failures and to assess the impact of inundation zones. Including road foremen and public works directors in emergency management discussions is also important for planning evacuation routes.

Similarly, many towns lack their police departments, prompting a need to clarify the roles of various authorities in Vermont. Although a proposed flowchart was suggested to add clarification to this issue, it was ultimately excluded from the report. Effective implementation of actionable strategies at the local level is necessary. Providing local municipalities with the tools, guidelines, and outlines to create their plans and actionable strategy is important for towns that lack resources, such as a local fire or police department, and other necessary resources.

While every town must have an Emergency Management Director (EMD), these roles often fall on volunteers or existing emergency personnel. Additionally, awareness of GIS limitations within the Vermont Emergency Management framework, particularly in the context of inundation mapping, was noted.

Conclusions

The discussion highlighted the need to differentiate federally funded initiatives, possibly through color coding. It was noted that there is uncertainty if Vermont's Emergency Management Directors (EMDs) are paid, as any compensation might come from other job roles. This raises questions about the costs associated with EMDs.

If an individual is volunteering, they must log all hours worked, as the town may receive funding, but the volunteer won't be compensated. To address this, it was suggested to consider designating emergency management personnel as temporary employees before emergencies occur, or implement a yearly stipend for these roles, emphasizing their value rather than just the cost.

Scheduling and Tasks to be Completed for Next Meeting

The next and final meeting is scheduled for July 14, 2025. This date may be modified based on input from committee members.

By May 30, 2025, have the report review completed and all comments documented on the shared Excel sheet.

Tasks to be completed

- Chris Campany will provide a brief explanation of the uncertainty surrounding the emergency support assumption if funding for VEM is eliminated, as well as how municipalities will prepare for emergencies in the event of its elimination. (received)
- Ben Green, Michael Nahmias, Jan Sotirakis, Bill Lovett, and Christian Meyer will collaborate on the costs and values associated with the Findings and Recommendations section of the report. (Ben and Mike developed draft costs for review by group)
- Michael Mahmias is to incorporate the challenges identified in emergency operations planning by the Townshend fire chief following the July 2023 flood event into the report (completed)
- Ben Green to speak to the person from California that Tim Washburn suggested for more information on the Ultra High Hazard Potential Dams classification. (completed)

VERMONT

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Dam Safety Program
Water Investment Division
1 National Life Drive, Davis 3
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Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Eight
Day/Time: July 14, 2025, 2:00 pm to 3:30 pm
Location: One National Life Drive, Davis 2, Catamount Room
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

In-Person
Representative Marc Mihaly
Ben Green – Section Chief, DEC Dam Safety Program – Chair
Michaela Foody – Regional Coordinator – Vermont Emergency Management (vice chair)
Scott Johnstone – General Manager of Morrisville Water & Light (MLW)
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Chris Campany - Executive Director, Windham Regional Commission
Steven Hanna – Dam Safety Engineer – DEC Dam Safety Program
Michael Nahmias – Project Manager – DEC Dam Safety Program
John Tedesco – Green Mountain Power
Aaron Thiboumery – Dam Owner, Vermont Independent Power Producers Association of Vermont

Online
Jan Sotirakis – Chittenden Emergency Management Director
Sarah Moore – Program Administrator – DEC Dam Safety Program

Welcome and Introductions

This is the final meeting for the Emergency Operations committee before there is a final vote for approval of the report.

Review and Approval of Meeting Seven Minutes

- Emergency preparedness support does not come from FEMA unless a town applies for specific grants regarding emergency preparation.

Final Report Review

Executive Summary

- An Executive Summary was added to the report for the committee to review.

Business Office Disclosure for Challenges Section

- Add a bullet to the section stating that the Business Office for both VT DEC and VEM is at capacity for granting and contracting purposes.
- Due to uncertainties surrounding future federal funding, there may be an increased strain on business offices that are already at capacity. It's important to clarify that, as of now, we have not lost any federal funding. However, this uncertainty could affect baseline operations across all levels of government, impacting operations at their most fundamental level across all state governments.

Discussion

- The committee discussed that it might be worth mentioning the flooding in Texas and the importance of an early warning system.
- Sirens are not always the answer for a warning system; there is a significant financial responsibility for sirens. Towns should consult with their local fire departments and state emergency planning commissions to see what warning system would work best for their communities
    - To determine the time it takes for floodwaters to arrive at people's homes after a dam failure occurs, it's essential to examine each individual dam. This assessment will help identify how much time remains before the floodwaters reach towns. Understanding this timeline can inform the emergency alert systems that a downstream community might implement.
    - There was a discussion about providing towns with information on how residents can access their roofs or adding this recommendation to the report. Reaching higher areas of a house may be crucial during a flooding situation. It is important to train communities in preparedness efforts for dam emergencies. Suppose early warning systems and technologies are implemented in a town. In that case, the community needs to understand how these systems work and how they should respond to an alert from a warning system. It was suggested that this recommendation be added between milestones five and six, titled "Rescue Systems" or "Emergency Response at the Household Level."
        - Towns could benefit from more public education and community engagement about safety in a dam emergency, and that is an idea that could potentially be added to the cost estimate that is presented in the report.
- The discussion of preparing inundation maps for different failure scenarios was brought to the committee's attention; however, its important note that there could be an inundation map for every potential dam failure but there's no way of actually knowing what is going to happen so it may be more helpful to let the people who live in inundation zones understand what they can expect if a failure were to occur and what they may encounter and how they should prepare if there were to be a dam failure.

Population at Risk (PAR) Ranking

- The committee decided that it would be in the best interest of public safety to include the PAR for all HIGH Hazard Potential that the State regulates.
    - If we do not give people the data, then they might assume that it's zero or that they aren't at risk.
    - If we want people to be aware of potential dam emergencies, then they should have that information publicly available.

Conclusions

- Add a list of 50 DEC–regulated HIGH Hazard Potential dams by PAR to the final report, along with an explanation of what PAR is and where/how the data was obtained.
- If the committee decides that we want to go forward with doing legislation, the draft needs to be completed by December 1, 2025, so in September it can be in discussion and be ready for the committee in January.
-

Next Steps

- The committee decided that there should be one last Teams meeting to move forward with a vote to approve the report.
- A final draft of the report to the assembly will be provided to the committee for a final review before the last virtual meeting.

VERMONT

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Dam Safety Program
Water Investment Division
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Meeting Notes

Subject: Dam Safety Emergency Action Planning – Legislative Study Committee
Committee Meeting Nine – Final Meeting
Day/Time: August 18, 2025, 2:00 pm to 3:00 pm
Location: Virtual Meeting via Microsoft Teams
Prepared By: Sarah Moore, VT Department of Environmental Conservation (DEC) Dam Safety Program (DSP)

Committee Members in Attendance
Ben Green – Section Chief, DEC Dam Safety Program – Chair
Michaela Foody – Regional Coordinator – Vermont Emergency Management (vice chair)
Jan Sotirakis – Chittenden Emergency Management Director

Committee Members not in Attendance
Scott Johnstone – General Manager of Morrisville Water & Light (MLW)
Christian Meyer – Executive Director of the Central Vermont Regional Planning Commission
Chris Campany - Executive Director, Windham Regional Commission
John Tedesco – Green Mountain Power
William Lovett – Fire Chief & Emergency Management Director, City of Rutland

Other Meeting Attendees
Michael Nahmias – Project Manager – DEC Dam Safety Program
Sarah Moore – Program Administrator – DEC Dam Safety Program

Review and Discussion of Meeting 8 Minutes

- The committee accepted the Meeting 8 Minutes as written.

Final Review and Discussion of Legislative Report

- The only change that was made from the last version of the report to the final version is that the legislative actions section was split into two separate sections: one for the additional Hazard Potential Classification and one for the Joint Powers Authority. Other than that, all other changes were minor edits and revisions to help with readability.

Final Vote in Approval of the Finalized Version of the Legislative Report

- Today, three committee members attended the meeting: Ben Green, Michaela Foody, and Jan Sotirakis. All committee members present voted to submit the final version of the report to the General Assembly.
- Three committee members who could not attend today's meeting, Scott Johnstone, John Tedesco, and Chris Campany, submitted a written vote in favor of submitting the final version of the report to the General Assembly.
- Two committee members, Christian Meyer and William Lovett, were not present and did not vote.

Final Steps

- Mike Nahmias to add Meeting 8 and Meeting 9 Minutes to the report before submission.
- Submission of the report will go to Charles Martin (ANR) and Neil Kamman (DEC), one of whom will submit the report to the General Assembly.
- Between submission of the report and the start of legislation, there is the possibility of some media coverage.
- When legislation does commence, committee chair members may be asked to testify.

Appendix C:

Table comparing the Minimum Requirements of the
Emergency Action Plan (EAP) and the Emergency Operations Plan (EOP)

EAP vs. EOP - Minimum Requirements Table

Emergency Action Plan (EAP)	Emergency Operations Plan (EOP)
Dam Name (including secondary names)	Dam name
Dam Hazard Potential Classification	Dam location (town and body of water)
Dam Identification #'s (Vermont Dam Inventory #, National Inventory of Dams #, etc.)	Dam identification information (National Inventory of Dams ID, if applicable, and Dam State ID #)
Dam Municipality & County	Dam Owner contact information (to include business and emergency contacts)
General Street Map of location of Dam	Copy of the EAP Notification Tree (taken from EAP)
Dam description including construction type, height, length, year build, latitude/longitude, etc.	Copy of dam operator's alert categories and definitions (taken from EAP)
Dam Owner contact information (e-mail, phone, etc.)	Contact information for regional municipal and public safety officials and organizations (including identified back-up individuals)
Dam Operator contact information (if different from dam owner)	Notification plan for local municipal and public safety officials
Plan or Map of the dam showing locations of pertinent features like spillways, access roads, etc.	Inundation models from EAP
Nearest 911 address for the Dam	Location of local emergency operations center (EOC) or identified regional EOC – If local EOC building or access route is impacted by inundation or evacuation area, identify a regional or backup facility.
Directions to the dam including alternate routes	Incident Command (IC) location (may be different from EOC)
Discussion on Potential Impacted Area (from a major dam failure), including all downstream towns that could experience incremental impacts from dam failure	Communication methods and structure between IC and EOC
Dam Failure Inundation Map – Sunny Day Failure	Regional Emergency Service Organizations mutual aid plan and individual Service responsibilities

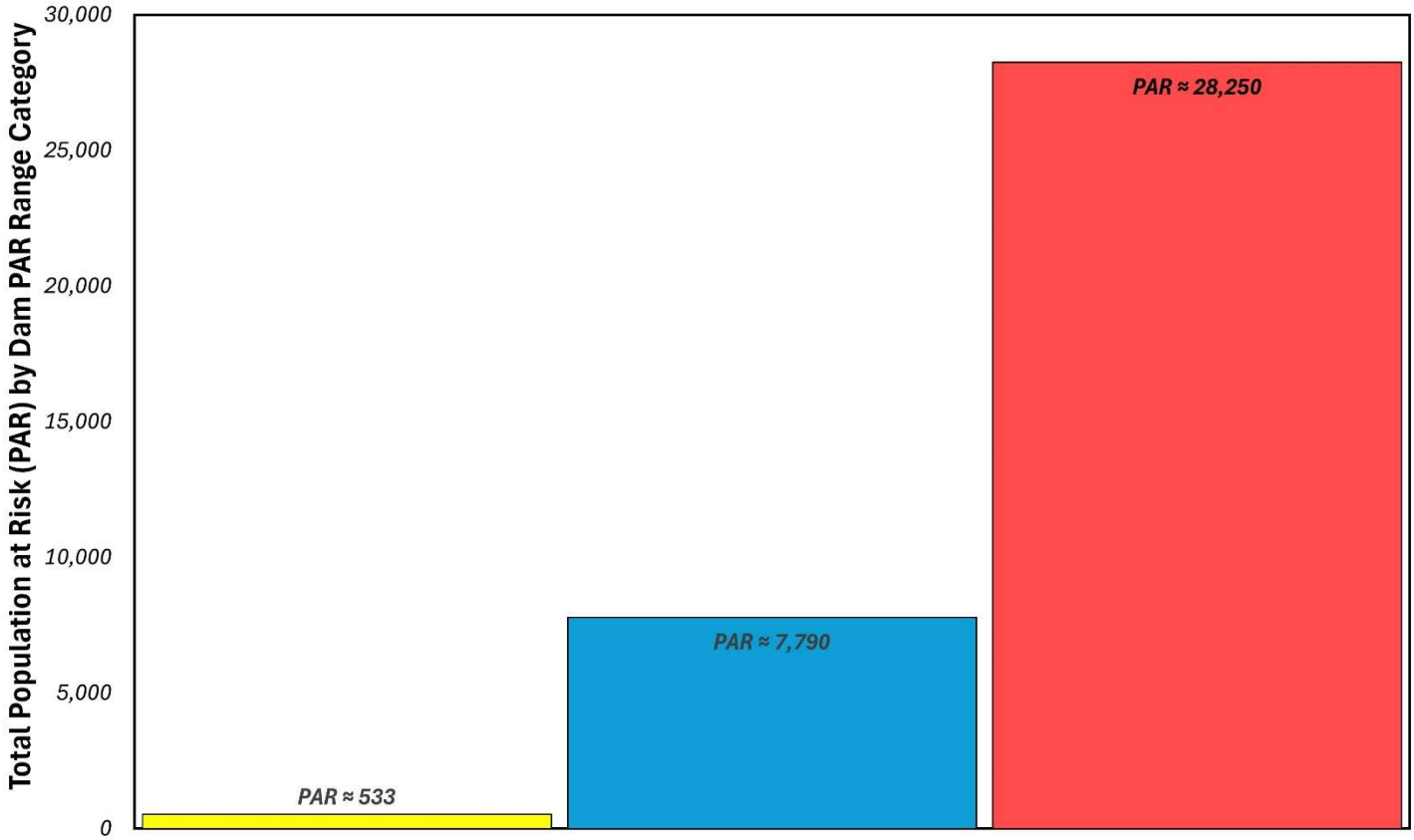
EAP vs. EOP - Minimum Requirements Table

Emergency Action Plan (EAP)	Emergency Operations Plan (EOP)
Dam Failure Inundation Map – Stormy Day Failure	Public information and media communications plan
Dam Failure Inundation Maps – Other scenario if applicable, such as high flow event, flood gate operation event, etc.	Positions that have the authority to issue an evacuation
Emergency Notification Charts from Dam Owner to local and state emergency personnel and others	Methods of evacuation communication/warning, including communication procedures, templates, and/or scripts
EAP Process – Roles and Responsibilities list for the following: dam owner/operator, incident commanders, emergency management directors, dam owner technical representatives, VEM, and the State's Dam Safety Program	Evacuation areas, addresses, and facilities
Discussion on how an event is detected	Facilities that may need additional assistance evacuating
Emergency Level Determination Section	Evacuation routes and traffic control requirements
EAP Termination Discussion	Road closure locations and supplies needed
EAP Review and Update Discussion	Local or regional shelter location(s)
EAP Periodic Testing Discussion	Shelter staffing and facility plan
Record of Revisions to EAP Document	EOP maintenance plan/schedule - To include review of plan for current EAP information, contact information, mutual aid plans, equipment inventory, etc.
Listing of parties who were provided the EAP	EOP training plan - To include a list of all positions that should be trained on the plan, certifications or training needed for specific positions, and a training/exercise schedule
A template for an Unusual or Emergency Event Log and Report	Emergency Management planners
	Schedule and requirements for EOP maintenance

Appendix D:

Population at Risk Chart for DEC-Regulated HIGH Hazard Potential Dams

Population at Risk (PAR) for Vermont DEC Regulated HIGH Hazard Potential Dams



High Hazard Dams with PAR < 100
Estimated Population at Risk = 533
Number of Dams = 17

*Lowell Lake Dam**
Star Lake Dam
Ryder Pond Dam
*Lake Sadawga Dam**
St. Albans South Reservoir Dam
*Sweet Pond Dam**
*Lake Sadawga West Dike**
West Hill Pond Dam
*Silver Lake Dam**
Wright Reservoir Dam
Crescent Lake Dam
St. Albans North Reservoir Dam
Keyser Dam
Snow Lake Dam
Stiles Pond Dam
Institute Pond Dam
Blodgett Dam

High Hazard Dams with PAR 100-999
Estimated Population at Risk = 7,790
Number of Dams = 22

Indian Brook Reservoir Dam
Nichols Pond Dam
Mackville Dam
*Johnson State Lower Dam**
Windsor Upper Dam
Okemo Snow Pond Dam
Wantastiquet Lake Dam
Mahoney Dam
Woodward Dam
Rutland City Reservoir Dam
South Pond Dam
Iroquois Lake Dam
*Lake Paran Dam**
Elizabeth Mine TP-1 Dam
Warren Lake Dam
Chestnut Hill Reservoir Dam
Lower Pond Dam
Snowshed Pond Dam
Lake Clara Dam
Jacksonville Pond Dam
East Long Pond Dam
Lake Mansfield Dam

High Hazard Dams with PAR ≥ 1,000
Estimated Population at Risk = 28,250
Number of Dams = 11

*Wrightsville Dam**
*Waterbury Dam**
Jewell Brook Site No. 1 Dam
Jewell Brook Site No. 2 Dam
Jewell Brook Site No. 5 Dam
Jewell Brook Site No. 3 Dam
Thurman Dix Reservoir Dam
Pleasent Valley Reservoir Dam
*East Barre Dam**
Stowe Upper Golf Course Dam
West Lake Dam

* - State of Vermont-Owned Dam

Notes:

1) PAR is defined as the approximate number of people likely present in areas downstream of a dam that could be affected by a dam failure such as potential for loss of life or property damage. It is an estimate of the number of people within a dam failure flood inundation zone regardless of level of impact.

2) It is estimated that the total PAR located downstream of the 50 DEC-regulated HIGH hazard potential dams is over 35,000 people. PAR estimates for FERC and PUC regulated dams were not available.

3) PAR estimates should be considered approximate. The quality of study used to generate PAR estimates varies from sophisticated and detailed computer aided analysis to more rudimentary methods. PAR can vary based on a variety of factors including but not limited to differences between actual dam failures and simulated failures, modeling methods and limitations, changes in downstream development, and baseline flood conditions.

Appendix E:

EOP Production and Implementation Cost Comparison Table

Emergency Operation Plan Development and Implementation Costs Worksheet

Developed by: BTG Date: 27-Jul-25

Notes:

The estimated costs of Emergency Operation Plan (EOP) development and implementation, below, are to provide "order of magnitude" values, only. In the EOP Committee's work, there were relatively few examples of mature and viable EOPs and the individual municipality approach to EOPs were varying/not standardized. Accordingly, these costs should not be used for direct funding purposes. The EOP Committee recommends that a detailed study be performed to refine these costs prior to undertaking legislation or funding. The assumptions and estimates are provided. Readers should carefully review this work to determine if estimates are reasonable for their specific case.

Variables:

The following are examples of variables impacting costs of EOP development/implementation:

- Potential extents/impacts of dam failure/incident flooding on a municipality
- Level of critical infrastructure in dam failure inundation area
- Distance municipality is downstream from dam
- Ability for emergency warning and notification
- Town size
- Status of local emergency services (contracted, subcontracted, or municipal)
- Engagement of volunteer staff to assist with some tasks.
- Experience of professional emergency staff.
- Capability and available funding of local emergency services
- Presence or absence of dams in series.
- Quality of dam Emergency Action Plan (EAP) and dam failure inundation maps
- Quality of partnership with Dam Owner.

Assumptions:

- These estimates were derived with simplified assumptions, subcosts, and approach. Use cautiously.
- Estimated costs are for the development/implementation of one EOP for one municipality. Dams failures that would impact multiple municipalities will require multiple EOPs.
- For this example, it is assumed that the EAP is up to date and of good quality.
- It is assumed that various personnel that would be needed to successfully develop and implement an EOP will have the availability to remain engaged, and seek timely resolutions on issues. All entities will have the time and resources to be collaborative.
- Cost per hour per person, assume ***$150*** . Could range from $75 to $150 or more depending on what entity is performing the majority of the work (local staff, Regional Planning Commission, consultant, VEM staff, or others).
- This estimate is for a dam with an "average" inundation area/impact zone. Dams with few properties/ resources impacted could be less and properties with a large number could be substantially more.

EOP Development/Implementation Costs Worksheet, continued

Estimate the cost of production of dam failure EOPs for HIGH hazard potential dams.

Milestone 1: EAP Review by Municipality **EST. TOTAL** **$1,800**

Task: Receive and review EAP from dam owner.

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Police Chief
Emergency Medial Services
Department of Public Works Supervisor/Road Foreman

Each personnel reviews EAP on own and prepares for meeting

Hrs. each	No.	Cost/hr	Est. Total
2	6	$150	$1,800

Milestone 2: Kickoff Meeting **EST. TOTAL** **$2,550**

Task: Local Emergency services group meets with Dam Owner to discuss EAP and develop relationship.

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Police Chief
Emergency Medial Services
Department of Public Works Supervisor/Road Foreman
Dam Owner

Each personnel attends meeting

Hrs. each	No.	Cost/hr	Est. Total
2	7	$150	$2,100

Meeting Notes are developed and distributed

Hrs.	No.	Cost/hr	Est. Total
3	1	$150	$450

EOP Development/Implementation Costs Worksheet, continued

Milestone 3: Standing Meetings **EST. TOTAL $14,800**

Task: Emergency services group meets regularly to develop an EOP.

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Police Chief
Emergency Medial Services
Department of Public Works Supervisor/Road Foreman
VEM Representative

Assume 6 meetings (1 per month) needed to develop a draft EOP, plus some out of meeting time.

Each local emergency personnel attends meeting

Hrs. each	No. staff	No. mtg	Cost/hr	Est. Total
2	6	6	$150	$10,800

VEM Staff attends 2 meetings

Hrs. each	No. staff	No. mtg	Cost/hr	Est. Total
2	1	2	$150	$600

Out of Meeting Drafting development

Hrs. each	No. staff	Cost/hr	Est. Total
40	1	$85	$3,400

Milestone 4: Finalize EOP **EST. TOTAL $5,100**

Task: Finalize EOP, submit to VEM and attach to Local Emergency Management Plan

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Police Chief
Emergency Medial Services
Department of Public Works Supervisor/Road Foreman
VEM Representative

EOP Development/Implementation Costs Worksheet, continued

Each personnel reviews final EOP and provides comments

Hrs. each	No.	Cost/hr	Est. Total
2	7	$150	$2,100

Out of Meeting Drafting to Final

Hrs. each	No. staff	Cost/hr	Est. Total
16	1	$150	$2,400

Submit Final EOP to VEM and attach to LEMP

Hrs. each	No. staff	Cost/hr	Est. Total
4	1	$150	$600

GRAND TOTAL EST. $24,250

$75/hour $150/hour
$14,000 $25,000

Order of Magnitude Range of $10,000 to $30,000 per EOP per Town to Develop

Estimate the cost of implementation of dam failure EOPs for HIGH hazard potential dams.

Milestone 1: Plan EOP Implementation Trainings — **EST. TOTAL * $2,400**

Task: Review EOP and determine training needs

Personnel:

Municipal Manager/Selectboard Chair

Local Emergency Management Director

Each personnel reviews EAP on own and prepares for meeting

Hrs. each	No.	Cost/hr	Est. Total
8	2	$150	$2,400

Milestone 2: Purchase and Install Warning Devices or Systems (if applicable) — **EST. TOTAL * $0**

Est. Total $0 to $35,000 — **to $35,000**

Varies widely based on preferred system

EOP Development/Implementation Costs Worksheet, continued

Milestone 3: Train first responders **EST. TOTAL * $25,200**

Task: Review EOP and determine training needs

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Fire Department (Assume 5 staff)
Local Police Chief
Local Police Chief (assume 5 staff)
Emergency Medical Services (Assume 3 staff)
Department of Public Works (DPW) Supervisor/Road Foreman
DPW Staff (assume 3 staff)

Each individual reviews EOP and attends Training meeting

Hrs. each	No.	Cost/hr	Est. Total
8	21	$150	$25,200

Milestone 4: First (and ongoing) Tabletop Exercises **EST. TOTAL * ** $23,700**

Task: Perform EOP exercise including debriefing or "hotwash"

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Fire Department (Assume 5 staff)
Local Police Chief
Local Police Chief (assume 5 staff)
Emergency Medical Services (Assume 3 staff)
Department of Public Works (DPW) Supervisor/Road Foreman
DPW Staff (assume 3 staff)

Each individual reviews EOP and attends Training meeting

Hrs. each	No.	Cost/hr	Est. Total
6	21	$150	$18,900

Consultant or assistant to design/run Tabletop, (review EAP, EOP, design tabletop, run, debrief)

Hrs. each	No.	Cost/hr*	Est. Total
32	1	$150	$4,800

*Fixed cost

EOP Development/Implementation Costs Worksheet, continued

Milestone 5: Post EOP Adoption Standing Meetings **EST. TOTAL **** **$8,400**

Task: Meet at least twice annually for testing, updating, and discussions about EOP. **Annual**

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Police Chief
Emergency Medical Services
Department of Public Works (DPW) Supervisor/Road Foreman
DPW Staff (assume 3 staff)

Attend two meetings annually

Hrs. for 2	No.	Cost/hr	Est. Total
8	7	$150	$8,400

Milestone 6: Update EOP & Public Engagement **EST. TOTAL **** **$5,700**

Task: To align with EAP updates, assume once every two years an update is made **Annual**

Personnel:

Municipal Manager/Selectboard Chair
Local Emergency Management Director
Local Fire Chief
Local Police Chief
Emergency Medical Services
Department of Public Works (DPW) Supervisor/Road Foreman
DPW Staff (assume 3 staff)

Attend one meeting to review and discuss updates

Hrs. each	No.	Cost/hr	Est. Total
4	7	$150	$4,200

Out of Meeting Drafting of updates to Final

Hrs. each	No. staff	Cost/hr	Est. Total
16	1	$150	$2,400

Public Engagement

Hrs. each	No. staff	Cost/hr	Est. Total
16	2	$150	$4,800

*** Costs generally thought to be "one time" in the implementation process.**

**** Costs generally considered to be re-occurring. For purposes of these estimates, these costs have been converted to an annual frequency.**

EOP Development/Implementation Costs Worksheet, continued

"ONE TIME" GRAND TOTAL EST.	$51,300
ANNUAL/ONGOING GRAND TOTAL EST.	$25,950

	$75/hour	$150/hour
"ONE TIME" GRAND TOTAL EST.	$25,000	$55,000
ANNUAL/ONGOING GRAND TOTAL EST.	$10,000	$30,000

"One Time" Order of Magnitude Range of $25,000 to $55,000
Annual/Ongoing Order of Magnitude Range of $10,000 to $30,000
per EOP per Town to Implement (assuming no warning devices/systems)

Summary:

Order of Magnitude Ranges			
Develop EOP, per EOP/Municipality (ONE TIME)	$10,000	to	$30,000
Implement EOP, per EOP/Municipality (ONE TIME)	$25,000	to	$55,000
Develop and Implement EOP (ONE TIME)	$35,000	to	$85,000
Implement EOP, per EOP/Municipality (ANNUAL)	$10,000	to	$30,000