1

PROBLEM FRAMING

One of the first steps in any decision making process is to determine how to frame or structure the problem, the decision context, and the scope of the work. This initial stage will likely take place with the project team and the steering committee during one of the initial project meetings.

Below are some questions that may be helpful to clarify early on:

- What is the decision to be made?
- Does it make sense to look at a single dam, a segment of the river, or a whole river approach?
- What is the potential relationship of this decision to other decisions?
- Who will make the final decision? Is it a single individual or a group?
- When and how will the decision makers be engaged in the process?
- How will public input be factored into the final decision?
- What is the timeline within which the decision needs to be made?
- What deliverable will be needed from the decision process?

1.1

MAKING DECISION - PROBLEM FRAMING

ROLE PLAYING BOARD GAME

WHO:
Steering Committee

TIME:
2 hours

PURPOSE:
Roll playing can be a valuable way for people to understand an issues from another persons perspective.

MATERIALS:
Board game

OVERVIEW

The steering committee should include people representing the full range of concerns about a decision. Given that many dam decision are multi year projects, it is important to take time at the beginning of the process for the steering committee to get to know one another as the group starts to frame the problem. During this process it is good to also find ways for individuals within the group to understand the decision from other members of the groups perspectives.

One technique that is increasingly being used in diverse environmental public policy and natural resource management contexts is Role Playing Simulation. According to Song et al. (2021), "role playing simulation provides a forum to engage participants in a hypothetical, yet realistic policy decision making scenario in which they reconsider the usual way of making decisions and explore innovative solutions". Participants typically "assume a role different from their own, which is intended to interrupt behavior patterns, relieve anxieties related to concerns about revealing one's strategy, and provide insights into other stakeholders' perspectives, interests, and constraints" (Song et al. 2021; Crampton and Manwaring, 2014; Rumore et al., 2016).

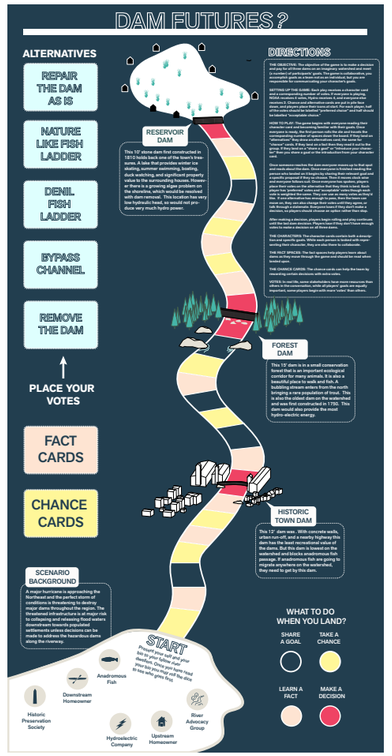
While there are good examples of integrating Role Playing Simulation with other more scientific models, we developed a Role Playing Board game that aims to achieve the same goals of helping members of the steering committee understand each others perspectives and interests.

THE OBJECTIVE: The objective of the game is to make a decision and pay for all three dams on an imaginary watershed and meet (x number) of participants' goals. The game is collaborative, you accomplish goals as a team not as an individual, but you are responsible for communicating your character's goals.

SETTING UP THE GAME: Each play receives a character card and a corresponding number of votes. If everyone is playing, NOAA receives 4 votes, Hydro receives 4, and everyone else receives 2. Chance and alternative cards are put in pile face down, and players place their icons at start. For each player, half of the votes should be labeled "preferred choice" and half should be labeled "acceptable choice."

HOW TO PLAY: The game begins with everyone reading their character card and becoming familiar with their goals. Once everyone is ready, the first person rolls the die and travels the corresponding number of spaces down the board. If they land on "alternatives" they draw an alternatives card, the same for "chance" cards. If they land on a fact then they read it out to the group. If they land on a "share a goal" or "introduce your character" then you share a goal or the introduction from your character card.

Once someone reaches the dam everyone moves up to that spot and reads about the dam. Once everyone is finished reading the person who landed on it begins by sharing their relevant goal and a specific proposal if they so choose. Then it moves clock wise and everyone follows suit. Once everyone has spoken, players place their votes on the alternative that they think is best. Each player has 'preferred' votes and 'acceptable' votes though each vote is weighted the same. They can use as many votes as they'd like. If one alternative has enough to pass, then the team can move on, they can also change their votes until they agree, or talk through a stalemate. Everyone loses if they don't make a decision, so players should choose an option rather than stop.



After making a decision, players begin rolling and play continues until the last dam decision. Players lose if they don't have enough votes to make a decision on all three dams.

THE CHARACTERS:
The character cards contain both a description and specific goals. While each person is tasked with representing their character, they are also there to collaborate.

THE FACT SPACES: The fact spaces help players learn about dams as they move through the game and should be read when landed upon.

THE CHANCE CARDS:
The chance cards can help the team by rewarding certain decisions with extra votes.

VOTES: In real life, some stakeholders have more resources than others in the conversation, while all players' goals are equally important, some players begin with more 'votes' than others.

REFERENCES and ADDITIONAL RESOURCES

Song, Cuihong, Natallia Leuchanka Diessner, Catherine M. Ashcraft, and Weiwei Mo. 2021. "Can Science-Informed, Consensus-Based Stakeholder Negotiations Achieve Optimal Dam Decision Outcomes?" Environmental Development 37 (March): 100602. https://doi.org/10.1016/j.envdev.2020.100602.

1.2

MAKING DECISION - PROBLEM FRAMING

DATA COLLECTION

WHO:
Project Team with support of Steering Committee

TIME:
May take weeks to gather all the relevant data and make it into a clear presentation.

PURPOSE:
Compile everything that is know about the dam

MATERIALS:
Historic documents, studies, planning documents, town records, etc.

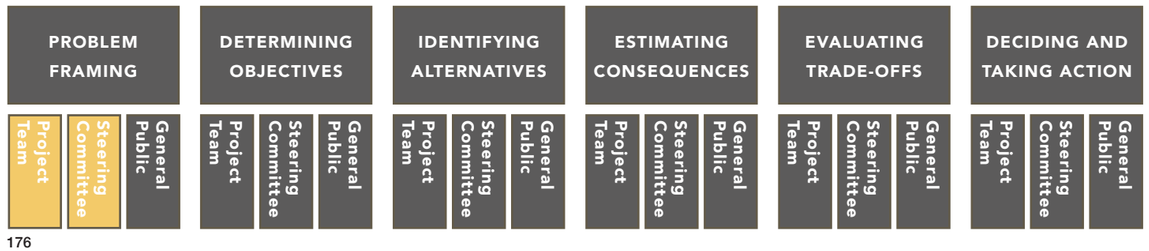
OVERVIEW

One of the initial steps for the project team is to collect and synthesize all available existing data on the dam, the river, and the surrounding landscape. These could include archival records of local, state, and federal agencies for existing maps and plans, past dam inspection reports, FEMA flood mapping, air photos, historic maps and photographs, fisheries data, planning department reports, and utilities mapping. The initial reconnaissance phase is intended to determine the overall breadth of the project and the likely project challenges. The materials are best compiled into a presentation or document that can be shared with the public and steering committee and kept for future reference.

Dam and Land Ownership: Determine the date of construction and history of repairs and modifications of the dam through research and consultation with a civil engineer, expert consultants and historical engineering drawings. If the dam owner is not the project proponent, determine the dam owner and, if necessary, a point of contact for the dam owner. It may also be helpful early on to do a preliminarily assessment of land ownership around the impoundment and the dam structure.

Dam Uses: Determine if the dam and impoundment are currently serving any purpose that will necessitate replacement of the use. Most dams in Massachusetts no longer serve the purpose for which they were designed, but many do provide important functions. Dams that provide water supply, hydropower, flood control, road, rail, or other utility crossing, are much less viable dam removal projects than those structures that do not provide these services. In some cases, these purposes can be replaced by other means.

Infrastructure: Identify any potential infrastructure that could be impacted by dam removal. For example, if bridges cross any portion of the impoundment or downstream of the dam, an assessment will need to be made of potential scour during the feasibility study. In some places, water and sewer pipes or telecommunication cables cross through dams or through the impoundment and alternatives will need to be assessed for protecting or moving them. Some dams are attached to mill buildings or retaining walls, requiring a stability assessment during the feasibility phase.



Rare Species: Determine if the dam, impoundment, or adjacent land are in priority or estimated habitat for state listed species, based on maps published by the Natural Heritage & Endangered Species Program. If these habitats are present, projects can only proceed through close consultation with state and federal biologists.

Sediment Quality
Preliminarily assess the potential for contaminants trapped behind the dam by considering current and past upstream land uses such as industrial activity and road density. Information on water and sediment quality in the river may also be available from past environmental studies. Analyzing a sediment sample may even be useful at this reconnaissance phase, to understand the breadth of the project if other assessments are insufficient to determine the probability of contamination. The sample should be taken from the fine-grained portion of the impounded sediment and analyzed at a lab for heavy metals and organic constituents. Sediment screening standards are available from the Department of Environmental Protection. The need for contaminant cleanup can significantly increase project complexity and cost.

Community Concerns
Preliminarily assess potential community interests and concerns. Is the impoundment currently used for recreation? Is there an opportunity for a park or canoe access following dam removal? Is the dam structure an important historic resource for the site, neighborhood, or town? Have other parties expressed an interest in contributing to the long-term maintenance and liability of the dam structure?

Funding Possibilities
Determine potential "hooks" for funding possibilities. Foundations and agencies that provide grants for river restoration and dam removal have different interests. Some provide funds for projects that help anadromous fish such as herring or salmon or for other sport fish such as trout. Others will provide funds for private landowners working to improve habitat on their land. Based on these "hooks" some projects can be almost entirely funded by outside sources, while others will receive very little outside funding. With overall project costs typically in the hundred thousands, this is a critical first step.

Site Survey: As part of this process of early data collection, it is recommended that a professional site survey is done. The site survey will create a scaled topographic base map showing existing conditions to provide information necessary to assess engineering conditions and deficiencies, hydraulics and sediment management. In order to completely survey the site, the surveying team must get in the water! The surveying should include:

1. Topographic plans and cross section drawings of the river and adjacent land, cultural (the dam, roadways, buildings, utilities, etc.) and geographic features in the impoundment, downstream and upstream,

2.. A survey of the deepest part of the stream through the impoundment, downstream, and upstream (longitudinal profile),

3. A survey of the impoundment bottom and the depth of soft sediment throughout the impoundment (bathymetry and depth to refusal),

4. A delineation and survey of the resource areas that will be affected as required in the Wetlands Protection Act and Army Corps of Engineers regulations, including: Land Under Water, Bordering Vegetated Wetland, Riverfront Area, Mean Annual High Water Line (or Ordinary High Water Line), and Bordering Land Subject to Flooding.

REFERENCES and ADDITIONAL RESOURCES

Executive Office of Energy and Environmental Affairs (2007). *DAM REMOVAL in MASSACHUSETTS: A Basic Guide for Project Proponents.*

Historical Topographic Maps available here: https://www.usgs.gov/faqs/how-do-i-find-download-or-order-topographic-maps

1.3

MAKING DECISION - PROBLEM FRAMING

PROBLEM SKETCH

WHO:
Project Team and Steering Committee

TIME:
2-5 hours

PURPOSE:
Build understanding of key elements of the decision and get group familiar with SDM process.

MATERIALS:
Printed blank SKETCH decision matrix and a chalkboard or flip chart and writing materials.

OVERVIEW

During this early problem framing, it may be helpful to do a quick problem sketch with the group. The problem sketch walks quickly through the first steps of the SDM process- framing the decision, identifying preliminary objectives, and identifying a range of possible alternatives. This problem sketch immediately helps everyone understand the SDM process, helps build a shared understanding of the key elements of the decision, and may help clarify what studies or data will be needed to evaluate the alternatives.

During this problem sketch, the group can develop a draft of a preliminary consequence table that links objectives, performance measures and alternatives. This process can provide insight early on into key information gaps, potential trade-offs and uncertainties. This will help the team determine what additional expertise, studies, or consultation may be needed to help evaluate the alternatives.

It is important to remember at this stage that Structured Decision Making and the creation of the consequence table is an iterative process. The goal of this early problem sketch is just to get a better sense of the decision and to test the possible objectives and alternatives. The consequence table will change and evolve as the public is engaged and the decision is better understood- objectives or alternatives may be added or removed and the language used to describe them can be refined further down the process.

PRE-WORKSHOP PREPARATION:

Ensure that the room you are working in has a large chalk board , blackboard, projector, or other way to draw the consequence table. It is best that it is visible to the whole group as you are filling it in. You may also print out the draft consequence table to the right so that each participant has one to take notes and brainstorm with.

SETTING UP THE EXERCISE:

Start to get the group brainstorming about the problem by asking them what matters most to them with regard to issue or decision. This can help begin to establish the objectives that can be filled in on the left hand side of the table.

During the process, do not let the group get too caught up in the wording of the objectives- that will come later. At this stage the goal is to get the main factors that will be impartation to understand.

Once the group has completed the Sketch consequence table, ask them to look over it- If it was filled in, would it summarize all the essential information to make a decision?

SKETCH Consequence Table	Performance Measure	SCENARIO 1	SCENARIO 2	SCENARIO 3
OBJECTIVE 1				
OBJECTIVE 2				
OBJECTIVE 3				
OBJECTIVE 4				
OBJECTIVE 5				
OBJECTIVE 6				
OBJECTIVE 7				
OBJECTIVE 8				
OBJECTIVE 9				
OBJECTIVE 10				

REFERENCES and ADDITIONAL RESOURCES

Gregory, R., Failing, L., Harstone, M., Long, G., McDaniels, T.L., & Ohlson, D.W. 2012. *Structured Decision Making: A Practical Guide to Environmental Management Choices*. Wiley-Blackwell, Chichester, U.K.

See exercises:
2.1 for guidance on brainstorming objectives
2.3 for guidance on brainstorming performance measures
3.2 for guidance on brainstorming alternatives.

1.4

MAKING DECISION - PROBLEM FRAMING

PADDLE THE RIVER!

WHO:
Steering Committee and General Public

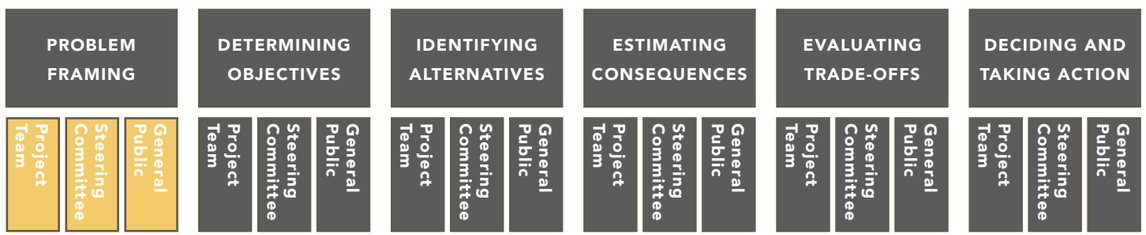
TIME:
3-5 hours

PURPOSE:
Familiarize the Project Team, Steering Committee and public with the river and the dam site

MATERIALS:
Canoes/kayaks, maps, life jackets, insurance, water, snacks

OVERVIEW

Early on in the process, it is helpful to get the steering committee, the project team and members of the public out on the river. Sometimes when talking about a river or a dam in a meeting, it is easy to forget the physical realities. By getting out on boats and exploring the river both upstream and downstream of a dam, everyone can gain a better understanding of the dam within its context and get clarity on some of the key issues are on the river. Being on the water, is the best way to get to know a river. Participants can observe the wildlife and plants, and experience the recreational opportunities first hand.



PREPARATION:

Determine a route for the group that is reasonable given the time and the skill level of the group. Ideally you will want to put the boats in above the dam or series of dams that is under discussion and paddle downstream. If canoes are available they are ideal since there can be an experienced paddler in the stern and two inexperienced people in the front.

Take all necessary safety precautions to ensure the group is safe or hire a kayak/ canoe rental company that can help with safety and logistics. Require all paddlers to wear life jackets.

DAY OF PADDLE

Prior to getting in the boats, use an aerial and/or topographic map to orient the group to the area that will be explored. The maps should be brought on the trip and depending on the length of the paddle, they can be taken out multiple times to help the group make the connection between what they are seeing on the ground in the landscape and what is on the map.

Ideally, there should be someone on the paddle that can discuss the ecological conditions that are observed on the paddle including plant and animal species, invasive species, flow conditions, etc. From the water, the participants may be able to observe the adjacent upstream properties that might be affected by dam removal. They can observe any recreation on the impoundments and experience portaging the dam.

REFERENCES and ADDITIONAL RESOURCES

To Access Topographic Maps: https://www.usgs.gov/faqs/how-do-i-find-download-or-order-topographic-maps

For information on insurance contact the American Canoe Association Insurance: https://americancanoe.org/insurance/for-event-organizers/