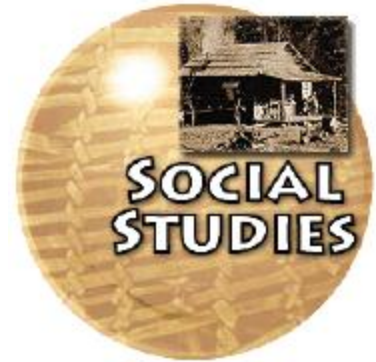


# A LONG AND DIFFICULT PROCESS



## ESSENTIAL QUESTION:

What combination of factors both natural and manmade is necessary for healthy river restoration and how does this enhance the sustainability of natural and human communities?

## GUIDING QUESTION:

It would be nice if a few sticks of dynamite could quickly remove a dam, but there are many big issues involved in dam removal, what are those issues and how do they relate to the Elwha River dam removal project?

## OVERVIEW:

In this lesson, students working in four groups will use *Exploring Dam Removal: A Decision Making Guide*, a web document published by American Rivers and Trout Unlimited, to research one of four issues involved in dam removal as it relates to the Elwha River. The students will synthesize their research for presentation to the class.

## TIME:

Two – three block class periods.

## MATERIALS:

- Computer/ internet access
- Pencil and paper
- Handouts

## PROCEDURE:

1. Review the Essential Question, introduce the Guiding Question.
2. Give the students a few minutes to respond to the Reflection Journal question then take a few minutes to discuss their responses. (Reflection Journal 1 handout)
3. Tell the students they will be using an online document titled *Exploring Dam Removal: A Decision Making Guide*, to examine the issue of dam removal.
4. Divide the class into four teams. Each team will look at one of the four issues: ecologic, economic, societal, and technical/mechanical that *Exploring Dam Removal: A Decision Making Guide* identifies as important.

5. Give the teams the student page so they know exactly what they are expected to do then send the teams to computers to answer some questions about the introduction to the guide all teams will answer these questions as background before adventuring into their issue. ( Student page & Handout 1)
6. After teams have completed the first set of questions, give them the handout that relates to their section of the *Guide* and have them begin their study. (Handouts 2).
7. When the teams have finished outlining their issue, tell them that they will relate the information they have gathered to the issue of the Elwha River Dam removals which they will expertly report on to the class. (Handouts 3)
8. Students will make an oral presentation on their issue. ( Oral Presentation Rubric)
9. Have students complete the final Reflection Journal page. (Reflection Journal 2)

### ASSESSMENTS:

- Reflection pages (see rubric)
- Completed handouts
- Final presentation (see rubric)

### WASHINGTON STATE STANDARDS:

#### READING:

1. **EALR 1:** The student understands and uses different skills and strategies to read.
  - a. **Component 1.3:** Build vocabulary through wide reading.
2. **EALR 2:** The student understands the meaning of what is read.
  - a. **Component 2.2:** Understand and apply knowledge of text components to comprehend text.
3. **EALR 3:** The student reads different materials for a variety of purposes.
  - a. **Component 3.1:** Read to learn new information.
  - b. **Component 3.2:** Read to perform a task

#### SOCIAL STUDIES

1. **EALR 3: GEOGRAPHY** The student uses a spatial perspective to make reasoned decisions by applying the concepts of location, region, and movement and demonstrating knowledge of how geographic features and human cultures impact environments.
  - a. **Component 3.2:** Understands human interaction with the environment
2. **EALR 5: SOCIAL STUDIES SKILLS** The student understands and applies reasoning skills to conduct research, deliberate, form, and evaluate positions through the processes of reading, writing, and communicating.
  - a. **Component 5.2:** Uses inquiry-based research

- b. **Component 5.4:** Creates a product that uses social studies content to support a thesis and presents the product in an appropriate manner to a meaningful audience.

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**WRITING:**

1. **EALR 1:** The student understands and uses a writing process.
  - a. **Component 1.6:** Adjusts writing process as necessary.
2. **EALR 2:** The student writes in a variety of forms for different audiences and purposes.
  - a. **Component 2.2:** Writes for different purposes.
3. **EALR 3:** The student writes clearly and effectively.
  - a. **Component 3.1:** Develops ideas and organizes writing.



Elwha River Restoration  
**Reflection Journal Page 1**

What do you think goes into the process of dam removal?



## Elwha River Restoration

### Student Page

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#### PART ONE

Your task:

There are many issues that must be considered before a dam is removed. You and your team will be using a web document published by American Rivers and Trout Unlimited titled *Exploring Dam Removal: A Decision Making Guide* as your text in order to explore a specific issue related to dam removal, then you will relate your findings to the removal of the Elwha Dams. Ultimately, you will make an oral presentation on your findings.

1. In order to build a little background, you and your team will read and answer some questions from the introduction to the text. (Handout 1)
2. Next you will read and summarize the section of the text that your group is exploring. (Handout 2) Have different members of your group take on different jobs so you can complete this in a reasonable amount of time. While you are reading make note of new vocabulary words. Chances are if you don't know a word then others don't know it either, write down and define those words for use in your final presentation. (Handout 3).

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#### PART TWO

Your next task:

1. Use the section headings of *Exploring Dam Removal: A Decision Making Guide* along with your pros, cons, summaries and vocabulary to explore reasons the decision was made to remove the Elwha Dams. Look at the "bottom line" questions to guide your search for answers. (Handouts 4) You and your team may not be able to answer every question but don't use this as an excuse for not trying there is a lot of information on the Elwha Dam removal project. Try these web sites:

[http://www.nps.gov/olym/naturescience/upload/All\\_Chapters.pdf](http://www.nps.gov/olym/naturescience/upload/All_Chapters.pdf) - This is a link to the *Final Supplement to the Final Environmental Impact Statement* for the Elwha, it should contain everything you need, however, it's over 300 pages long. Use your skimming skills to look for key words or sections that might contain useful information.

[http://www.americanrivers.org/site/PageServer?pagename=AMR\\_elwharestoration](http://www.americanrivers.org/site/PageServer?pagename=AMR_elwharestoration)

[http://www.americanrivers.org/site/PageServer?pagename=AMR\\_Elwha](http://www.americanrivers.org/site/PageServer?pagename=AMR_Elwha)

<http://www.elwhainfo.org/resource-management>

<http://www.drizzle.com/~rdpayne/opa-news-v4n1.html#3>

<http://www.nps.gov/olym/naturescience/upload/Economic%20analysis.pdf> iii, Executive Summary

<http://www.drizzle.com/~rdpayne/opa-news-v4n1.html#3>

<http://www.uvm.edu/~shali/elwha.pdf> pgs 12 & 13

[http://media.popularmechanics.com/documents/PMX0106SolarHouse\\_1stprfsb.pdf](http://media.popularmechanics.com/documents/PMX0106SolarHouse_1stprfsb.pdf)

If there isn't enough information in these links, type "Elwha Dam removal" into your browser. This is an important issue and there is a wealth of information on the web.

2. Use the information you have gathered in your research on the Elwha Dams to put together an oral presentation to your class on your particular issue. As experts on the topic, your presentation will provide an important piece to the puzzle of removing the Elwha Dams. Remember in your presentation you need to help your audience fully understand the issue. Ask your teacher for a grading rubric and a due date.

Have fun!



Elwha River Restoration  
**A Long and Difficult Process**  
**Handout 1**

Read the Introduction (pgs. 1-6) of *Exploring Dam Removal: A Decision Making Guide* and answer the questions. Access the Guide at

[http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641)

1. What are some of the benefits of dams?
2. What are some of the negative affects of dams?
3. What are some of the benefits of dam removal?
4. Are the outcomes of dam removal certain? Why or why not?
5. What factors are involved in making a final decision?



Elwha River Restoration  
**A Long and Difficult Process**  
**Ecological Issues**  
**Handout 2**

Read “Part III. Ecological Issues” of *Exploring Dam Removal: A Decision Making Guide* and identify the pros and cons of each ecological issue. If there are no identified pros and cons, write a short summary of the section. Access the guide at:

[http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641)

A. Upstream Flow and Habitat

B. Downstream Flow and Habitat

C. Fish and Wildlife

D. Passage and Movement of Fish and Other Species



E. Sediment Movement

F. Water Quality

G. Riparian Areas

H. Wetland Areas

I. Location of the Dam within the Watershed



Elwha River Restoration  
**A Long and Difficult Process**  
**Economic Issues**  
**Handout 2**

Read “Part IV. Economic Issues” of *Exploring Dam Removal: A Decision Making Guide* and identify the pros and cons of each ecological issue. If there are no identified pros and cons, write a short summary of the section. Access the guide at:

[http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641)

A. Dam Owner’s Costs and Benefits

B. Societal Costs and Benefits

C. Recreational Costs and Benefits

D. Environmental Costs and Benefits

E. Property Values

F. Distribution of Costs and Benefits

G. Availability of Funding for Dam Repair or Removal



Elwha River Restoration  
**A Long and Difficult Process**  
**Societal Issues**  
**Handout 2**

Read “Part V. Societal Issues” of *Exploring Dam Removal: A Decision Making Guide* and identify the pros and cons of each ecological issue. If there are no identified pros and cons, write a short summary of the section. Access the guide at:

[http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641)

A. Community Understanding of the Dam, the River, and Dam Removal

B. Service(s) Provided by the Dam

C. Who Benefits From and Who Bears the Cost of the Dam

D. Community Sentiments Toward the Dam and the River

E. Historical Role of the Dam



**Elwha River Restoration  
A Long and Difficult Process  
Technical/Engineering Issues  
Handout 2**

Read “Part VI. Technical/Engineering Issues” of *Exploring Dam Removal: A Decision Making Guide* and identify the pros and cons of each ecological issue. If there are no identified pros and cons, write a short summary of the section. Access the guide at:

[http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641)

A. Feasibility of Repairing and Maintaining the Dam

A1. Safety Repairs or Upgrades

A2. Repairs or Upgrades to Continue Efficiently Providing the Dam’s Intended  
Uses

A3. Mitigation of the Dam’s Environmental Impacts

## **B. Feasibility and Design of Dam Removal**

### **B1. Obtaining Dam Removal Permits**

### **B2. Protecting Against Environmental Impacts**

### **B3. Managing Sediment**

### **B4. Removing Structures**

### **B5. Protecting Infrastructure**

### **B6. Restoring the Channel**

### **B7. Restoring Recovered Land**



Elwha River Restoration  
**A Long and Difficult Process**  
**Vocabulary**  
**Handout 3**

There should be some new vocabulary in the sections you are reading. Chances are that if you don't know or understand a word neither does your audience. Find at least six words that you don't know and define them for the illumination of your audience when you present what you have learned. There are probably more than six words you will need to define but you must at least show six.

1. Word
  - a. Definition

2. Word
  - a. Definition

3. Word
  - a. Definition

4. Word
  - a. Definition

5. Word

a. Definition

6. Word

a. Definition

Add more words (you know there are some) and definitions in the extra space below.





Elwha River Restoration  
**A Long and Difficult Process**  
**Ecological Issues**  
**Handout 4**

Using all the information you've gathered along with *Exploring Dam Removal: A Decision Making Guide* and the suggested web sites, answer the "bottom line" questions as regards the Elwha River Dams.

**A. Upstream Flow and Habitat:** Will the restored river and riparian habitat upstream outweigh the loss of impounded habitat?

**B. Downstream Flow and Habitat:** Is dam removal necessary to restore natural flows to the river? Do the benefits of restored flows outweigh the impacts on species that prefer unnatural flows?

**C. Fish and Wildlife:** Is the net impact of dam removal on fish and wildlife populations positive or negative?

**D. Passage and Movement of Fish and Other Species:** Will dam removal improve safe passage of migrating fish and movement of resident fish and wildlife? Is dam removal necessary to accomplish this? Can dam removal be done without enabling the spread of undesirable species?

**E. Sediment Movement:** What is the current net impact of the accumulated sediment on the impoundment and downstream habitats? How will sediments released during dam removal impact the riparian and riverine habitats in the short and long term?

**F. Water Quality:** Will dam removal have a net benefit on water quality, taking into account both short-term and long-term impacts and benefits?

**G. Riparian Areas:** Will there be a net gain in the amount and quality of riparian habitat as a result of dam removal?

**H. Wetland Areas:** How will the wetlands gained by dam removal compare in amount, type, and habitat value to the wetlands lost by dam removal?

**I. Location of the Dam within the Watershed:** Will dam removal significantly enhance the river's ecological values, given the location of the dam relative to other dams in the watershed?

Do you think the Elwha Dams should be removed? Justify your answer with evidence from your research.

<sup>1</sup> Questions from *Exploring Dam Removal: A Decision Making Guide*. American Rivers and Trout Unlimited, 2002, [http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641) Accessed March 2009.



Elwha River Restoration  
**A Long and Difficult Process**  
**Economic Issues**  
**Handout 4**

Using all the information you've gathered along with *Exploring Dam Removal: A Decision Making Guide* and the suggested web sites, answer the "bottom line" questions as regards the Elwha River Dams.

**A. Dam Owner's Costs and Benefits:** Are the long-term costs of operating and maintaining the dam less or more than the costs of removing the dam? Do any benefits of the dam need to be replaced, and if so, by whom?

**B. Societal Costs and Benefits:** Are others in the community responsible for any additional costs and benefits of maintaining or removing the dam?

**C. Recreational Costs and Benefits:** Will dam removal positively or negatively influence community revenues from recreation?

C. **Environmental Costs and Benefits:** Do the net environmental costs (or benefits) of keeping the dam outweigh the net environmental costs (or benefits) of removing the dam?

D. **Property Values:** Will dam removal positively or negatively affect property values adjacent to the stream? Will these effects, if any, be short or long term?

E. **Distribution of Costs and Benefits:** Who benefits the most from retaining/removing the dam? Who bears the costs for retaining/removing the dam?

F. **Availability of Funding for Dam Repair or Removal:** What funds are available to pay for dam maintenance/repair or removal?

Do you think the Elwha Dams should be removed? Justify your answer with evidence from your research.

<sup>1</sup> Questions from *Exploring Dam Removal: A Decision Making Guide*. American Rivers and Trout Unlimited, 2002, [http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641) Accessed March 2009.



Elwha River Restoration  
**A Long and Difficult Process**  
**Societal Issues -**  
**Handout 4**

Using all the information you've gathered along with *Exploring Dam Removal: A Decision Making Guide* and the suggested web sites, answer the "bottom line" questions as regards the Elwha River Dams.

- A. Community Understanding of the Dam, the River, and Dam Removal:** Do the decision makers and other concerned parties have sufficient information to make an informed decision about dam removal? Or dam retention?
- B. Service(s) Provided by the Dam:** Does the dam provide any services? Are these services as valuable as the services provided by a free-flowing river? If yes, can these services be provided through alternative means?
- C. Who Benefits From and Who Bears the Costs of the Dam:** Who benefits from and who bears the costs of the dam? Who will benefit from and who will bear the cost of a restored river?



**D. Community Sentiments Toward the Dam and River:** How do community members feel about the dam? About the river? About dam removal?

**E. Historical Role of the Dam:** Does the dam have true historical value, and are there ways to commemorate the historical value without keeping the dam?

Do you think the Elwha Dams should be removed? Justify your answer with evidence from your research.

<sup>1</sup> Questions from *Exploring Dam Removal: A Decision Making Guide*. American Rivers and Trout Unlimited, 2002.

[http://www.americanrivers.org/site/DocServer/Exploring\\_Dam\\_Removal-A\\_Decision-Making\\_Guide.pdf?docID=3641](http://www.americanrivers.org/site/DocServer/Exploring_Dam_Removal-A_Decision-Making_Guide.pdf?docID=3641) Accessed March 2009.



Elwha River Restoration  
**A Long and Difficult Process**  
**Technical/Engineering Issues -**  
**Handout 4**

Using all the information you've gathered along with *Exploring Dam Removal: A Decision Making Guide* and the suggested web sites, answer the "bottom line" questions as regards the Elwha River Dams.

**A1. Safety Repairs or Upgrades:** If the dam is unsafe, will dam removal cost less than repairs and ongoing maintenance? Are repairs to the dam prohibitively expensive?

**A2. Repairs or Upgrades to Continue Efficiently Providing the Dam's Intended Uses:** If expensive upgrades are needed to maintain the dam's services, is it more cost effective to remove the dam and find alternatives to replace those services?

**A3. Mitigation of the Dam's Environmental Impacts:** If environmental mitigation measures are needed, is it more cost effective to keep the dam and mitigate for its environmental impacts or remove the dam?

**B1. Obtaining Dam Removal Permits:** Will permitting requirements affect the design, cost or feasibility of the removal? Are there permitting requirements for dam repair, reconstruction, or related to any of the services provided by the dam that will affect the feasibility or cost of keeping the dam?<sup>1</sup>

**B2. Protecting Against Environmental Impacts:** What steps must be taken to eliminate or minimize the environmental impacts of the dam removal?

**B3. Managing Sediment:** Is there a feasible method of managing the sediment behind the dam?

**B4. Removing Structures:** What is the most cost effective and environmentally sound dam removal method?

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<sup>1</sup> Questions from *Exploring Dam Removal: A Decision Making Guide*. American Rivers and Trout Unlimited, 2002. Accessed March 2009.

**B5. Protecting Infrastructure:** Are there structures that will have to be stabilized, retrofitted, or relocated if the dam is removed?

**B6. Restoring the Channel:** Does the new river channel need to be actively designed or can the river naturally find its own channel?

**B7. Restoring Recovered Land:** Will the recovered land need to be actively revegetated?

Do you think the Elwha Dams should be removed? Justify your answer with evidence from your research.



Elwha River Restoration  
**Reflection Journal Page 2**

After all you've read and heard, do you think some dams and the Elwha Dams in particular should be removed?

### Elwha River Dam Removal Oral Presentation Rubric

CATEGORY	4	3	2	1
Content	Shows a full understanding of the topic.	Shows a good understanding of the topic.	Shows a good understanding of parts of the topic.	Does not seem to understand the topic very well.
Stays on Topic	Stays on topic all (100%) of the time.	Stays on topic most (99-90%) of the time.	Stays on topic some (89%-75%) of the time.	It was hard to tell what the topic was.
Comprehension	Students are able to accurately answer almost all questions posed by classmates about the topic. Students have fully answered the questions on the handout.	Students are able to accurately answer most questions posed by classmates about the topic. Students have mostly answered the questions on the handout.	Students are i able to accurately answer a few questions posed by classmates about the topic. Students have answered a few questions on the handout.	Students are unable to accurately answer questions posed by classmates about the topic. Students have answered less than three questions on the handout.
Preparedness	Students are completely prepared and have obviously rehearsed.	Students seem pretty prepared but might have needed a couple more rehearsals.	Students are somewhat prepared, but it is clear that rehearsal was lacking.	Students do not seem at all prepared to present.
Vocabulary	Uses vocabulary appropriate for the audience. Extends audience vocabulary by defining words that might be new to most of the audience.	Uses vocabulary appropriate for the audience. Includes 1-2 words that might be new to most of the audience, but does not define them.	Uses vocabulary appropriate for the audience. Does not include any vocabulary that might be new to the audience.	Uses several (5 or more) words or phrases that are not understood by the audience.



Speaks Clearly	Speaks clearly and distinctly all (100-95%) the time, and mispronounces no words.	Speaks clearly and distinctly all (100-95%) the time, but mispronounces one word.	Speaks clearly and distinctly most (94-85%) of the time. Mispronounces no more than one word.	Often mumbles or can not be understood OR mispronounces more than one word.
Collaboration with Peers	Almost always listens to, shares with, and supports the efforts of others in the group. Tries to keep people working well together.	Usually listens to, shares with, and supports the efforts of others in the group. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others in the group but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others in the group. Often is not a good team member.

## **Reflection Journal Rubric**

### **Outstanding response (4)**

An outstanding reflection journal response is an original, thought-provoking response to the questions raised in the prompt. It contains specific examples from both the student's experiences as well as the classroom material whenever possible. It asks original, provocative, relevant questions. It is also virtually free of grammatical errors.

### **Above-average response (3)**

An above-average journal thoroughly addresses the questions raised in the prompt. It contains specific examples from both personal experiences as well as the classroom material whenever possible. It asks provocative, relevant questions. It may contain some minor grammatical errors.

### **Average response (2)**

An average journal competently addresses the issue raised in the prompt. It contains some examples from both personal experiences as well as the classroom material whenever possible. It asks relevant questions. Grammatical errors may be present, but they will not impede the reader from understanding the context of the sentences.

### **Below-average response (1)**

A below-average journal does not competently address the issue raised in the prompt. It contains few examples from personal experiences or the classroom material. It asks easy questions. Grammatical errors are so rampant that they impede the reader from understanding the context of the sentences.

### **Failure to respond to the assigned prompt (0)**

A failing journal does not address the issue raised in the prompt at a middle school level. It contains very few examples of personal experiences as well as classroom material, or the student fails to respond at all. Grammatical errors are so rampant that they impede the reader from understanding the context of the sentences.