

*GUIDEBOOK: EXAMPLE MATERIAL FOR RESEARCH PAPERS**Prepared by Professor William Griffin**Revised 03/11/16**Dear Students,*

To help you develop your research projects, I have prepared examples of how your materials should look. The emphasis of these examples is content and writing style. If the materials that you submit look like these examples, then you should expect to earn a high grade. This package is based on a 2000-word Final Report. Your course may ask you to prepare something of different length.

This example material assumes that your university wants you to use APA format (6th Edition). APA is the American Psychological Association. I have tried to make my example papers comply with APA guidelines; however, I have probably made a couple of errors in regard to APA format. I apologize for any errors I have made with respect to APA format. You are required to review the APA materials provided by your university, become familiar with them, and comply with them. In other words, use the APA materials to familiarize yourself with APA guidelines; do not rely on my examples as authority on APA requirements.

APA places particular emphasis on citing of sources. This is done for two reasons:

- a. Give credit where credit is due. You need to differentiate between material that comes from you and material that comes from other sources. If you obtain information from another source, you are required to tell the reader what or who that source is. Likewise, if you take words (i.e., direct quotes) from a source, you are required to tell the reader what or who that source is. So, by following these citation rules, we avoid being accused of plagiarism (i.e., intellectual theft). If you take words or information from a source and you do not cite that source, you are indulging in plagiarism. Plagiarism is a serious violation of school rules, and it can earn a zero for you on your research paper. Conversely, if you take words or information from a source, and if you properly cite that source, you are not indulging in plagiarism. It should also be noted that, in some instances, plagiarism is illegal, and you can be sued.*
- b. Navigation. Remember that you are writing a research paper. That means you are a researcher. Your reader might also be a researcher, and they might find your paper to be of particular interest. In turn, they might want to follow up and read one of the sources that you have used. It is your responsibility to act as a navigator for your reader. That means it is your job to show the reader where you got all of your information and quotes so that the reader can find them. This navigation information*

typically includes things like the author, date, title of the article, title of the magazine or book in which the article appeared, publisher, volume number, page number and similar information. If you follow the APA guidelines for citations, it is assumed that you will be providing adequate navigation information for other researchers.

Aside from APA guidelines, here are some other guidelines that would be appropriate for a 2000-word research paper.

- a. You should use no less than five references in your research project.*
- b. There is a bias in favor of “scholarly” references (e.g., peer reviewed journal articles). Meanwhile, there is a bias against “common” references (e.g., articles in Time magazine, which have been written by professional reporters and have been subject to professional editing, but have not been subjected to a formal peer review process).*
- c. Most universities have a bias against using Wikipedia as a reference. The articles in Wikipedia are not peer reviewed (or, in some cases, edited). So scholars view Wikipedia as unreliable. You should not use Wikipedia as a reference in your research papers.*
- d. Some officials believe that the references that you select must be very current (i.e., less than two years old). It seems to me that this emphasis on currency should be interpreted in light of the subject matter of your project. If you are writing a paper on Thomas Jefferson, a person who lived two centuries ago, then a reference that is ten years old should not be regarded as stale (in my opinion); I would regard it as a current reference. Conversely, if you are writing a paper on the latest developments in gene therapy, this is a rapidly developing field, and you probably want all of your references to be no more than two years old.*

You will be building your research paper throughout the term (assumed to be an 8-week term). Think of it as an onion with five layers. You will be building an onion by starting in the center and adding a new layer every week or two during the term. You will not be allowed to “pull an all nighter” at the end of the quarter and write the Final Paper in a single-document sprint to the finish.

The following materials include five example documents. You will be required to prepare one of each of these for the research project that you will be conducting. These include:

- a. Topic Memo*
- b. Word Outline*
- c. Sentence Outline*

- d. *Draft Full Text*
- e. *Final Report*

You will provide each of these to your instructor on or before the assigned due dates (see the Course Syllabus for dates that your instructor wants you to use).

Everything must be double spaced, even quotes and your reference list. Use 12-point type font.

*In this Guidebook, you will see two types of type font. One is **Italic type font**. Those words are comments and instructions from me to you. They are not part of the example papers. You will also see words in **regular type font**. These are the example papers.*

With each of the example documents, I have provided a rubric. This will show you what I am looking for when I edit and grade papers. It will help you if you look at each rubric before you write the corresponding document. Your instructor may elect to use a different rubric.

Topic Memo

There are a couple of purposes of this Topic Memo.

- a. *You will propose the topic that you wish to use for your research paper. You will submit the Topic Memo to the instructor. The instructor will either approve your topic or suggest you pick another topic.*

- b. *In the process of writing this Topic Memo, you should be looking at sources of information. You need to answer to your own satisfaction the following question: “Will I be able to find adequate information and references to prepare the type of paper that is required for this course?” In this sense, your Topic Memo should become a **plan of study** for you. It should mention the types of sources that you intend to use. Note: It is a good idea to begin compiling references at this point, but providing a reference list is optional on the Topic Memo. If, in the process of preparing the Topic Memo, you find a source that appears valuable, you should cite it in the Topic Memo, and you should show it in a reference list.*

Rubric for Topic Memo

On this assignment you can score up to 10 points.

<i>Criterion</i>	<i>Points</i>
<i>Topic identification: Have you identified your topic in a clear manner? Why did you select this topic?</i>	5
<i>Research plan: Have you briefly outlined your plan to research the topic? Have you identified the type of references that you plan to use? Have you identified what libraries and sources you plan to use? If you plan to do interviews, have you identified the type of people that you want to talk to?</i>	5
<i>Total</i>	<i>10</i>

Topic Memo

To: Professor Griffin

From: Mary Sawtooth

Date: March 8, 2016

Subject: Topic Memo: Proposed research project on the benefits and impacts of hydroelectric dams

I propose to do my research paper on the subject of hydroelectric dams, their beneficial impacts and their negative impacts. Our nation faces many challenges in the realm of energy production. Many people believe we need to invest more resources in renewable energy. One source of renewable energy is hydroelectric power.

This technology can bring a number of benefits. If our nation could derive more of our energy from hydropower, we should be able to import less energy (oil). With hydroelectric dams, we can produce energy without creating products of combustion (e.g., sulfur dioxide, carbon dioxide, heavy metals). Aside from energy production, dams can bring other benefits such as flood control, water supply and recreation (Able, 2003).

Dams cannot be constructed or operated without negative impacts. Construction of dams can scar the environment. There can also be operational impacts. The natural flow of rivers is disrupted by dams, sometimes causing difficulties for flora and fauna. For example, migratory fish can experience difficulty if a dam is placed across the river along which the fish normally migrate. Dams can also act as sediment traps. That means their storage capacity can be diminished, and they can trap nutrients that would otherwise flow downstream (Baker, 2007).

During the week that I have had to work on this assignment, I have been prospecting for references. I may be able to use some of the following on my project.

- I visited the Savannah Public Library. I found two books on hydroelectric power.
- I made an electronic visit to the Saint Leo University library. I found three books on dams and seven books on hydroelectric power. There may be a professor at Saint Leo who is an expert on the subject and who I might be able to interview.
- I visited the library at Savannah Law School. I found two cases in the law library regarding hydroelectric power.
- I visited a local bookstore. I found several books on environmental impact of construction projects.
- I looked at Internet-based sources via Google search.
- Looking at electronic research tools (e.g., ProQuest), I did a search of article titles and abstracts. I found at least ten articles on hydroelectric power, its benefits and impacts.
- I looked at Amazon.com. It appears that they have several titles related to my topic. I might decide to purchase one of these books.
- I looked at the web site for American Society for Civil Engineers and *Civil Engineering Magazine*. It appears that they have published journal and magazine articles that might be useful on my project.
- I understand that the US Army Corps of Engineers builds and operates dams, and they might have an office in Savannah. If so, I will try to arrange an interview with one of their people.

Based on my prospecting effort, I believe I will be able to find adequate reference material on this topic. The federal government has built and operated many hydroelectric dams, and government agencies have published lots of material. Agencies in some states have

published material. Periodicals contain useful information (e.g., *Civil Engineering Magazine*).

There are general audience books in the library, as well as technical books and textbooks.

ProQuest and other electronic data bases should prove useful. The Internet should provide some reference material. I may try to find a local expert on dams and try to interview them.

I plan to devote 40 hours to my research on this topic during the first half of the term.

During the second half of the term, I will spend most of my time writing my paper and deciding which references should be used in it.

References

Able, J. (2003). *Benefits of Dams*. US Bureau of Reclamation. Washington, DC.

Baker, C. (2007). *Environmental Impact of Hydroelectric Dams*. New York. McGraw Hill.

Word Outline

After the instructor has reviewed and approved the Topic Memo, you will start work on the Word Outline. There are a couple of objectives of preparing a Word Outline.

- a. You want to begin visualizing the overall structure of the Final Report. In a sense, the Word Outline is a detailed Table of Contents for your Final Report.*
- b. You want to be identifying your data needs. Writing the Word Outline will help you identify the kinds of information that you will need to compile.*

One common structure for a research paper may be appropriate for your project. It includes four parts.

- You start with a research question.*
- Review references and sources.*
- Provide an analysis of the data and information that you have compiled.*
- State your conclusions.*

Note: At this point, you will have begun collecting information from references. So you should begin compiling a reference list. Therefore, your Word Outline should include some sort of a reference list.

Rubric for Word Outline

You can score up to 20 points on this assignment. The following rubric will be used to grade your Word Outline.

<i>Criterion</i>	<i>Points</i>
<i>Organization: Have you broken your topic down into an order that lends itself to discussion in a research paper? Have you left out any important issues that deserve to be discussed?</i>	<i>5</i>
<i>Clarity: Can the grader understand what you have written?</i>	<i>10</i>
<i>Spelling/ grammar: Is your paper free of spelling and grammatical errors?</i>	<i>5</i>
<i>Total</i>	<i>20</i>

Example Word Outline

Author's Name
March 15, 2015

Word Outline

Benefits and Impacts of Hydroelectric Dams

1. Information on Dams (Able, 2003)

Number of dams in the US *[Identify references and sources that you plan to use for this item.]*

Size range (What metrics are used to describe the size of dams?) *[Identify references and sources that you plan to use for this item.]*

Locations *[Identify references and sources that you plan to use for this item.]*

Ownership *[Identify references and sources that you plan to use for this item.]*

Regulation (Davis, 1998) *[Identify references and sources that you plan to use for this item.]*

2. Benefits of Dams

Electric power production (Charles, 2002) *[Identify references and sources that you plan to use for this item.]*

Water storage and supply *[Identify references and sources that you plan to use for this item.]*

Flood control *[Identify references and sources that you plan to use for this item.]*

Recreation (Fitzgerald, 2004) *[Identify references and sources that you plan to use for this item.]*

Wildlife habitat *[Identify references and sources that you plan to use for this item.]*

3. Impacts of Dams (Baker, 2007)

Construction impacts *[Identify references and sources that you plan to use for this item.]*

Disruption of natural flow of rivers (Ellis, 2006)

Disruption of fish migration *[Identify references and sources that you plan to use for this item.]*

Disruption of wetlands *[Identify references and sources that you plan to use for this item.]*

Sediment trapping *[Identify references and sources that you plan to use for this item.]*

Nutrient trapping *[Identify references and sources that you plan to use for this item.]*

References

- Able, J. (2003). *Benefits of Dams*. US Bureau of Reclamation. Washington, DC.
- Baker, C. (2007). *Environmental Impact of Hydroelectric Dams*. New York. McGraw Hill.
- Charles, E. (2002, May). *Hydroelectric Dams: How they Work*. Popular Science magazine. 209 (2), 26-31.
- Davis, M. (1998, March). *Federal, State and Local Government Roles in Regulation of Dams*. University of Washington Law Review.
- Ellis, M. (2006, May). *Hydroelectric Power can Create Significant Environmental Impacts* [Adobe Digital Editions version]. Smithsonian magazine. Retrieved from <http://www.smithsonian.gov>.
- Fitzgerald, P. (2004). *Recreational Opportunities Associated with Dams and Reservoirs* (pp. 59-63). In Sourcebook on Hydroelectric Dams, Johnson, A. (Ed). US Tennessee Valley Authority.

Sentence Outline

After you have completed the Word Outline and received feedback from your instructor, you will produce the Sentence Outline. You will be building in more data and information, building in more references, and creating a document that has more words. When you are writing the Sentence Outline, you will be nearing the chronological midpoint of your project. The main purpose of the Sentence Outline is to provide you with an opportunity to build on your Word Outline and expand it to reflect the research you have been continuously conducting.

You can write this using sentence format, question format, or both. Either way, you need to use complete sentences. If you do a thorough job of preparing the Sentence Outline, you should find that each sentence from the Sentence Outline will become the topic sentence of a paragraph in your Draft Full Text and your Final Report.

At this point, you should be continuing to expand your data needs and reference list. It should be mostly complete when you finish the Sentence Outline, because you will have identified most of the references that you intend to use.

You will submit one paper copy of the Sentence Outline.

Rubric for Sentence Outline

You can score up to 30 points on this assignment. The following rubric will be used to grade your Sentence Outline.

<i>Criterion</i>	<i>Points</i>
<i>Organization: Have you broken your topic down into an order that lends itself to discussion in a research paper? Have you left out any important issues that deserve to be discussed?</i>	<i>5</i>
<i>Clarity: Can the grader understand what you have written?</i>	<i>20</i>
<i>Spelling/ grammar: Is your paper free of spelling and grammatical errors?</i>	<i>5</i>
<i>Total</i>	<i>30</i>

Example Sentence Outline

Author's Name

March 22, 2013

Sentence Outline

Benefits and Impacts of Hydroelectric Dams

1. Information on Dams (Able, 2003)

How many dams are there in the US? *[Identify references and sources that you plan to use for this item.]*

What proportion of the dams is used to generate electricity? *[Identify references and sources that you plan to use for this item.]*

What is the range of sizes of hydroelectric dams? Is there a minimum height and flow rate? Is there a minimum amount of electricity generated? *[Identify references and sources that you plan to use for this item.]*

Where are hydroelectric dams typically located? *[Identify references and sources that you plan to use for this item.]*

Who owns the hydroelectric dams in the US? How has the Federal Power Act influenced ownership? *[Identify references and sources that you plan to use for this item.]*

What agencies regulate construction and operation of hydroelectric dams (Davis, 1998)?

2. Benefits of Dams

How much of USA's electricity comes from hydro power (Charles, 2002)?

How are dams used to store water? *[Identify references and sources that you plan to use for this item.]*

How are dams used for flood control? *[Identify references and sources that you plan to use for this item.]*

What kinds of recreation opportunities are provided by hydroelectric dams (Fitzgerald, 2004)?

What kind of wildlife habitat can be created by hydroelectric dams? *[Identify references and sources that you plan to use for this item.]*

3. Impacts of Dams

What adverse impacts can arise during construction of a dam (Baker, 2007)?

How is land removed by construction of a dam and reservoir (Garrett, 1974)?

What adverse impacts can arise during construction of a dam? (Baker, 2007)

How do hydroelectric dams disrupt the natural flow of rivers (Ellis, 2006)?

How can hydroelectric dams disrupt the migration and reproduction of fish (McPhee, 1992)?

How can hydroelectric dams disrupt wetlands? *[Identify references and sources that you plan to use for this item.]*

How can dams trap sediment? *[Identify references and sources that you plan to use for this item.]*

How can dams trap nutrients (Leonard, 1990)? *[Identify references and sources that you plan to use for this item.]*

References

- Able, J. (2003). *Benefits of Dams*. US Bureau of Reclamation. Washington, DC.
- Baker, C. (2007). *Environmental Impact of Hydroelectric Dams*. New York. McGraw Hill.
- Charles, E. (2002, May). *Hydroelectric Dams: How they Work*. Popular Science magazine. 209 (2), 26-31.
- Davis, M. (1998, March). *Federal, State and Local Government Roles in Regulation of Dams*. University of Washington Law Review.
- Ellis, M. (2006, May). *Hydroelectric Power can Create Significant Environmental Impacts* [Adobe Digital Editions version]. Smithsonian magazine. Retrieved from <http://www.smithsonian.gov>.
- Fitzgerald, P. (2004). *Recreational Opportunities Associated with Dams and Reservoirs* (pp. 59-63). In Sourcebook on Hydroelectric Dams, Johnson, A. (Ed). US Tennessee Valley Authority.
- Garrett, M. (1974, February 11). *Construction of the proposed Dickey-Lincoln dam will flood 34,000 acres of Maine woodlands*. Boston Globe. pp A1, A6.
- Leonard, W. (1990, June 23). *Lake Powell and the Glen Canyon Dam are depriving Lake Mead fish of vital nutrients*. Las Vegas Times. Retrieved from <http://www.lvtimes.com>
- McPhee, J. (1992). *Shad*. New York. Harcourt Brace and Janovich.

Draft Full Text

After you have completed the Sentence Outline and received feedback from your instructor, you will produce the Draft Full Text. Essentially, you are building more detail into the paper until it is close to being complete.

The Draft Full Text is not a “rough draft.” In the Draft Full Text, you will be writing a draft report in full sentences and paragraphs. Do not write in shorthand or sentence fragments. You will include tables, figures and other materials that you plan to use in your Final Report. The sentences that you wrote in your Sentence Outline should evolve into topic sentences for paragraphs in the Draft Full Text.

The abstract is a short summary of your report, normally less than 200 words. Do not try to use the abstract as an introduction to your report. An introduction normally explains why the research is being done. If your report needs an introduction, write an introduction and put it at the front of the body of the report.

Sometimes, in the course of your research, you will collect or develop materials that are of interest, but do not fit well into the text. You may decide to include them in an appendix. If you plan to have some sort of an appendix in your Final Report, you should be including it here in the Draft Full Text. I suggest you use the following approach to developing your appendix.

- a. If you use materials developed by others (e.g., copies of research papers, pamphlets, photos), you may use them as is. They do not need to comply with APA format, but you need to cite them as references.*
- b. If you develop appendix materials on your own (e.g., new text), you should follow APA format for text and references.*

You will probably have gaps in your Draft Full Text, because you have not completed the project yet. That is acceptable. Here is how I recommend you handle these situations. You can include a note to yourself and the grader [in brackets] that reads like the following: [I want to include an interview of a government official who is an expert on environmental impact of dams. I have an appointment to interview Armstrong Professor Mary Quadrangle two days from now. If that interview proves useful, I plan to summarize it in a paragraph that would be located at this point in the research paper.] Likewise, you may also have data needs that have not yet been satisfied. If so, you might include a note like the following: [I have found some good reference material from the US Bureau of Reclamation. However, I know the US Army Corps of Engineers is active in building and operating large dams, but I have not found any good reference material on their work. So I am still looking and trying to fill in a gap here.] Later,

when you are preparing your Final Report, you will fill in the gaps and remove these bracketed notes.

The important requirement is that the Draft Full Text should be a report that is, say, 75 percent done, and it must be in a condition that is ready for the instructor to review. The following example Draft Full Text is about 1800 words in length. Note that it includes about 90 percent of the 2000 words required for your Final Report.

Rubric for Draft Full Text

You can score up to 40 points on this assignment. The following rubric will be used to grade your Draft Full Text.

<i>Criterion</i>	<i>Points</i>
<i>Organization: Have you broken your topic down into an order that lends itself to discussion in a research paper? Have you left out any important issues that deserve to be discussed?</i>	<i>5</i>
<i>Clarity and Content: Clarity: Can the grader understand what you have written? Are your sentences too long? Simple sentences are usually preferable to compound and complex sentences. Are your sentences free of ambiguity? Have you removed or repaired awkward sentences? Is each paragraph based on one idea or thought? Does each paragraph have a topic sentence? Does each paragraph have a concluding sentence (where appropriate)? Remember the goal: You want the reader to read from the first sentence of the paper to the last sentence without needing to stop to answer the question, "I don't understand what the writer is trying to say. I will need to read that sentence again." Content: Have you produced a paper that satisfies the requirement for word count or page number?</i>	<i>20</i>
<i>APA guidelines: Has the paper been compiled in conformance with APA guidelines?</i>	<i>5</i>
<i>Spelling, grammar, editing, proofreading: Is your paper free of spelling and grammatical errors? Have you run the Spell Check command on your word processor? Are you using the correct words? Have you done adequate editing and proofreading?</i>	<i>10</i>
<i>Total</i>	<i>40</i>

Example Draft Full Text

Draft Full Text

Benefits and Impacts of Hydroelectric Dams

Author: William Griffin

March 29, 2015

Author Note

Professor William Griffin is an environmental engineer and an attorney. He has taught at nine universities.

Correspondence concerning this article should be directed to Dr. Griffin at 1 Diamond Causeway, Suite 21, MB 335, Savannah, GA 31406. 912-349-7989.
billgriffin@theleadershipcente.com

Abstract

The increased emphasis on reducing imports of oil and other fuels, coupled with the desire to reduce emission of greenhouse gases from the burning of fossil fuels, is causing hydroelectric power to receive increased attention. The technology provides an opportunity to generate electricity from a domestic, renewable resource, and the process does not generate greenhouse gases. Meanwhile, construction and operation of hydroelectric dams can have adverse impacts on the environment.

Information on Dams

How many dams are there in the US? The number of dams in the US exceeds 10,000, and it may exceed 100,000. The US Bureau of Reclamation builds dams for purposes such as irrigation. Pactola Dam near Rapid City, SD is an example. Some of these dams are also used for generation of electricity (Able, 2003).

What proportion of the US dams is used to generate electricity? A minority of the US dams are used for hydroelectric power. The Bureau of Reclamation estimates that there are _____ hydroelectric dams in the US. In other words, ____ percent of the dams in the US are used for hydropower [I need to find a source and cite it]. Some of the larger dams and dam systems are operated by the US Army Corps of Engineers, Tennessee Valley Authority, and Bonneville Power Administration [I need to cite a source].

What is the range of sizes of hydroelectric dams? Is there a minimum height and flow rate? Hydroelectric dams are expensive to build. Consequently, they are not installed unless there is a minimum amount of water available to store behind the dam and run through the turbines. The tallest hydroelectric dam in the US is probably Hoover Dam, which is located on the Colorado River between Nevada and Arizona. It is about 800 feet high [I need to find a source and cite it]. The smallest hydroelectric dams are usually no taller than _____ feet [I need to find a source and cite it].

Where are hydroelectric dams typically located? As mentioned above, the site for a hydroelectric dam needs to be one where the flow in the river will make enough electricity to justify building the dam. Another factor in site selection is the shape of the valley. If the valley is narrow and deep, it should be possible to construct a dam at

reasonable cost that can impound a lake with a large storage volume. There is also a need to examine what areas will be submerged by construction of the lake. If the lake will fill in a desert or woodland where there are no human residents, then the disruption to people will be minimal. By contrast, if the lake will submerge a city of one million residents, then the disruption would probably be unacceptable and the dam site would be rejected (Johnson, 1997).

Who owns the hydroelectric dams in the US? Hydroelectric dams in the US are typically owned by government agencies. Federal agencies like Tennessee Valley Authority, Bureau of Reclamation, US Army Corps of Engineers, and Bonneville Power Administration are well known. State and local agencies sometimes own hydroelectric dams. An example is the City of Spearfish, SD, which recently purchased a hydroelectric system that had been built many years ago for Homestake Mine (Knox, 2007).

How has the Federal Power Act influenced ownership? The Federal Power Act was enacted in the 1930s. It includes a concept called “municipal preference.” In the development of new hydroelectric facilities, it gives preference to government agencies. Therefore, most small hydroelectric dams serve the needs of government owned electric utilities. For example, the Washington Public Power Supply System was formed by the municipal electric agencies of over 100 cities and towns to generate, distribute and sell electricity. The municipal preference implicitly discourages investor owned utilities from developing hydroelectric power plants. Consequently, investor owned utilities generally generate electricity from coal, oil, natural gas, or nuclear power, not from water (Mulligan, 2001).

What agencies regulate construction and operation of hydroelectric dams? The principal agency regulating hydroelectric dams in the US is the US Department of Energy's Federal Power Administration. Their main regulatory role is in site licensing and the regulation of the sale of electricity on the wholesale market. To the extent that the Bureau of Reclamation, Corps of Engineers and other federal agencies are involved in hydro power, their rules and guidelines must be complied with. Some states also regulate dams. For example, some state governments have responsibility to inspect dams. As such, they would have standards against which their inspections would be conducted (Davis, 1998).

Benefits of Dams

How much of USA's electricity comes from hydro power? It has been estimated that about ___ percent of the US supply of electricity is provided by hydroelectric dams [I need to get the correct percentage] (Charles, 2002). These figures are based on the kilowatt hours produced during a typical year. Meanwhile, hydroelectric dams are also rated according to capacity. A dam may be equipped to generate 300 megawatts of electricity; however, the dam will make that much electricity only if the flow in the river and the storage capacity of the reservoir are adequate [I need to find a source and cite it].

How are dams used to store water? A dam is a structure that is built perpendicular to the flow of a river. Its purpose is to stop the flow of the river and store water behind the dam. By contrast, a levee is built parallel to a river, and its purpose is normally to prevent the river from flooding adjacent low lying areas of land. In the case of a huge dam like Hoover Dam, the reservoir may be built to store over a year of flow from the river. Dams with adequate storage capacity can be used to generate "peaking

power,” which is used during the times of highest use (e.g., daytime in cities in the summer season when businesses and air conditioners are in operation). Some hydroelectric dams have very little storage capacity, so they generate electricity whenever the river is flowing. Some of the dams on the Columbia River are of this run-of-river type [I need to cite a source].

How are hydroelectric dams used for flood control? In addition to creating storage capacity for generating power, most dams are also built with additional capacity to catch flood water. When rainfall or rapid snowmelt occurs upstream, the heavy river flow is captured in the reservoir behind the dam. Later, days after the flood event has occurred, the water can be released slowly from the reservoir. This process is intended to reduce flood damage downstream from the dam (Norton, 1998).

What kinds of recreation opportunities are provided by hydroelectric dams? When a dam is built, it can create a dramatic expansion in recreational opportunities. Examples include fishing, hunting, sailing, power boating, swimming and others. When these lakes are built, it is typical to see marinas, boat launching ramps, and other recreational facilities built (Fitzgerald, 2004). *[Note: This information is common knowledge, so it might not require a citation.]*

What kind of wildlife habitat can be created by hydroelectric dams? Because dams impound water, they create habitat for animals that require water. Aqueous fauna include fish, snakes, frogs, insects and the like. Water birds like ducks and wading birds are likely to find habitat in or along reservoirs. *[Note: This information is common knowledge, so it would not require a citation.]*

Impacts of Dams

What adverse impacts can arise during construction of a dam? When a large dam and reservoir are constructed, a number of impacts can occur. In some cases, towns must be moved, including demolition of buildings and movement of graveyards. It is common practice to remove all trees and large vegetation from the area of the reservoir.

Construction of dams can involve large earth moving activities, and this can create airborne dust pollution. Meanwhile, there may be a need to establish gravel mining operations to support the fabrication of concrete (Baker, 2007).

How is land removed by construction of a dam and reservoir? Let's assume that someone wants to build a 70,000-acre hydroelectric facility in upstate New York. They will need to take possession of 70,000 acres in the river valley upstream from the proposed dam site. This land will be "removed" from its current use (perhaps farming and forestry) and converted to a reservoir (Garrett, 1974).

How do hydroelectric dams disrupt the natural flow of rivers? A natural river does not flow at a constant rate. Its flow rate is based primarily on rainfall and snowmelt. Both of these vary in extent according to location and time of year. In general, flow rates of most rivers are higher in the springtime (Ellis, 2006). This provides opportunities for wetlands to recharge. It also provides opportunities for fish to migrate. After a large hydroelectric dam is installed, there tends to be a major change in the flow pattern of the river. For example, if it is desired to extract a constant amount of electricity from the dam (i.e., base load power), then a large reservoir is built in order to store lots of water and create a constant flow from the dam. The area downstream of the dam no longer sees variable flows. Instead, it may see constant flows. This constant flow rate may not be

suitable for migration of fish, and it may not allow wetlands to be recharged (Pepper, 2002).

How can hydroelectric dams disrupt the migration and reproduction of fish? Anadromous fish breed in fresh water. Their eggs hatch, and the young fish make their way to the ocean, where they grow to adulthood. Then they swim back upstream to breed in fresh water. Salmon and shad are well known examples of anadromous fish. If the stream is blocked by a dam, it may be impossible for the fish to move downstream or upstream. At some hydroelectric dams, fish ladders and fish elevators are used in an effort to help fish move around the dam. In some locations, these efforts are successful. However, in most rivers where dams have been installed, there has been a large reduction of anadromous fish population (McPhee, 1992).

How can hydroelectric dams disrupt wetlands? Wetlands behave like sponges. When a river's natural flow increases, adjacent wetlands absorb water. When the river's natural flow decreases, adjacent wetlands release water. Consequently, wetlands can have an important effect in moderating river flow and controlling floods. By contrast, if the river's flow is disrupted by a hydroelectric dam, the wetland may not receive enough water to recharge, and it will not be able to perform its flood control function (Oppur, 2003).

How can dams trap sediment? It is normal for rivers to transport sediment from upstream areas to downstream areas. Normally, these sediments reach the ocean. Beach sand, for example, normally has its source in nearby rivers. When a dam is built on a river, it creates a reservoir full of still water. This encourages the sand and dirt to settle out within the reservoir instead of flowing toward the ocean. In some cases, dams have

substantially filled in with sediment. This limits their capacity to perform water storage, hydroelectric generation, and flood control functions (Quibble, 2004).

How can dams trap nutrients? The sediments carried by rivers include chemicals that are beneficial to plants and animals. If the dam and reservoir trap sediments, they can also capture nutrients. This is what occurred when the Glen Canyon Dam and Lake Powell were constructed. Before the dam was constructed, there was large population of healthy striped bass living in Lake Meade, downstream from Glen Canyon. Some years after Glen Canyon Dam and Lake Powell were constructed, it was noticed that the striped bass in Lake Mead were thinner (and to some eyes, strange looking). It is believed that this happened because the normal flow of chemical nutrients into Lake Mead had been disrupted. Growth of plants such as algae was reduced. This had an adverse impact on the food supply for the whole food chain, including the striped bass at the top of the food chain. The managers of the Glen Canyon Dam have experimented with an annual “flushing” process which is intended to remove sediment from Lake Powell and get more nutrients flowing into Lake Mead (Leonard, 1990).

Note: At this point, you should be nearly done compiling your reference list. Adding more references in the Final Report should be done only to fill in gaps.

References

- Able, J. (2003). *Benefits of Dams*. US Bureau of Reclamation. Washington, DC.
- Baker, C. (2007). *Environmental Impact of Hydroelectric Dams*. New York. McGraw Hill.
- Charles, E. (2002, May). *Hydroelectric Dams: How they Work*. Popular Science magazine. 209 (2), 26-31.
- Davis, M. (1998, March). *Federal, State and Local Government Roles in Regulation of Dams*. University of Washington Law Review.
- Ellis, M. (2006, May). *Hydroelectric Power can Create Significant Environmental Impacts* [Adobe Digital Editions version]. Smithsonian magazine. Retrieved from <http://www.smithsonian.gov>.
- Fitzgerald, P. (2004). *Recreational Opportunities Associated with Dams and Reservoirs* (pp. 59-63). In Sourcebook on Hydroelectric Dams, Rassel, W (Ed.). US Army Corps of Engineers.
- Garrett, M. (1974, February 11). *Construction of the proposed Dickey-Lincoln dam will flood 34,000 acres of Maine woodlands*. Boston Globe. pp A1, A6.
- Leonard, W. (1990, June 23). *Lake Powell and the Glen Canyon Dam are depriving Lake Mead fish of vital nutrients*. Las Vegas Times. Retrieved from <http://www.lvtimes.com>
- McPhee, J. (1992). *Shad*. New York. Harcourt Brace and Janovich.
- Mulligan, S. (2001, June-July). *Municipal preference rule continues to discourage investor owned utilities from building hydro dams*. Energy Law Review; Law review of the Federal

Energy Bar Association. Edited by the University of Kansas Law School Law Review team.
Volume 13.

Norton, E. (1998, June). *A simple calculation method for sizing flood control reservoirs*. Water Resources magazine.

Oppur, L. (2003, June). *Disruption of wetlands by development of large dams and reservoirs*. Science Magazine.

Pepper, C. (2002, December). *Modification of natural stream flow by hydroelectric dam operation*. Nature magazine.

Quibble, M. (2004, May). *Large dams can trap giant amounts of sediment*. Nature magazine.

Final Report

After you have completed the Draft Full Text and received feedback from your instructor, you will produce the Final Report.

Final Report is not a “Final Draft.” In the Final Report, you will produce a professional quality report. It will include no spelling or grammar errors. It will be clearly written and easy for the reader to understand. It will include no loose ends. It may include tables, figures and/or an appendix. The partially complete text that you prepared for your Draft Full Text will now become final copy.

Rubric for Final Report

You can score up to 50 points on this assignment. The following rubric will be used to grade your Final Report.

<i>Criterion</i>	<i>Points Available</i>
<i>Organization: Have you broken your topic down into an order that lends itself to discussion in a research paper? Have you left out any important issues that deserve to be discussed?</i>	5
<i>Clarity and content: Clarity: Can the grader understand what you have written? Are your sentences too long? Simple sentences are usually preferable to compound and complex sentences. Are your sentences free of ambiguity? Have you removed or repaired awkward sentences? Is each paragraph based on one idea or thought? Does each paragraph have a topic sentence? Does each paragraph have a concluding sentence (where appropriate)? Remember the goal: You want the reader to read from the first sentence of the paper to the last sentence without needing to stop to answer the question, “I don’t understand what the writer is trying to say. I will need to read that sentence again.” Content: Have you produced a paper that satisfies the requirement for word count or page number?</i>	30
<i>APA guidelines: Has the paper been compiled in conformance with APA guidelines?</i>	5
<i>Spelling, grammar, editing, proofreading: Is your paper free of spelling and grammatical errors? Have you run Spell Check? Are you using the correct words? Have you done adequate editing and proofreading?</i>	10
<i>Total</i>	50

Example Final Report

Final Report

Benefits and Impacts of Hydroelectric Dams

Author: William Griffin

April 5, 2015

Author Note

Professor William Griffin is an environmental engineer and an attorney. He has taught at nine universities.

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Abstract

The increased emphasis on reducing imports of oil and other fuels, coupled with the desire to reduce emission of greenhouse gases from the burning of fossil fuels, is causing hydroelectric power to receive increased attention. The technology provides an opportunity to generate electricity from a domestic, renewable resource, and the process does not generate greenhouse gases. Meanwhile, construction and operation of hydroelectric dams can have adverse impacts on the environment.

Information on Dams

How many dams are there in the US? The number of dams in the US exceeds 10,000, and it may exceed 100,000. The US Bureau of Reclamation builds dams for purposes such as irrigation. Pactola Dam near Rapid City, SD is an example. Some of these dams are also used for generation of electricity (Able, 2003).

What proportion of the US dams is used to generate electricity? A minority of the US dams are used for hydroelectric power. The Bureau of Reclamation estimates that there are 3,400 hydroelectric dams in the US. In other words, perhaps ten percent of the dams in the US are used for hydropower (Rassle, 2009). Some of the larger dams and dam systems are operated by the US Army Corps of Engineers, Tennessee Valley Authority, and Bonneville Power Administration.

What is the range of sizes of hydroelectric dams? Is there a minimum height and flow rate? Hydroelectric dams are expensive to build. Consequently, they are not installed unless there is a minimum amount of water available to store behind the dam and run through the turbines. It is desirable to build the dam high, because the taller water column will store more potential energy that can be extracted by the turbines. The tallest hydroelectric dam in the US is probably Hoover Dam, which is located on the Colorado River between Nevada and Arizona. It is about 800 feet high (Taylor, 2004). The smallest hydroelectric dams are usually no taller than ten feet high (Rassle, 2009). The other variable of interest is flow rate. If more water flows in the river, more water can flow through the turbines. Therefore, hydroelectric dams located on large rivers can usually generate more electricity than dams located on small rivers with a lower flow rate.

Where are hydroelectric dams typically located? As mentioned above, the site for a hydroelectric dam needs to be one where the flow in the river will make enough electricity to justify building the dam. Another factor in site selection is the shape of the valley. If the valley is narrow and deep, it should be possible to construct a dam at reasonable cost that can impound a lake with a large storage volume. There is also a need to examine what upstream areas will be submerged by construction of the dam and lake. If the lake will fill in a desert or woodland where there are no human residents, then the disruption to people will be minimal. By contrast, if the lake will submerge a city of one million residents, then the disruption would probably be unacceptable and the dam site would be rejected. Likewise, if the new reservoir would destroy the habitat of a threatened or endangered species, it might be appropriate to reject the proposed site (Johnson, 1997).

Who owns the hydroelectric dams in the US? Hydroelectric dams in the US are typically owned by government agencies. Federal agencies like Tennessee Valley Authority, Bureau of Reclamation, US Army Corps of Engineers, and Bonneville Power Administration are well known. State and local agencies sometimes own hydroelectric dams. An example is the City of Spearfish, SD, which recently purchased a hydroelectric system that had been built many years ago for a private company, Homestake Mine (Knox, 2007).

How has the Federal Power Act influenced ownership? The Federal Power Act was passed in the 1930s. It includes a concept called “municipal preference.” In the development of new hydroelectric facilities, it gives preference to government agencies. Therefore, most small hydroelectric dams serve the needs of government owned electric

utilities. For example, the Washington Public Power Supply System was formed by the municipal electric agencies of over 100 cities and towns to generate, distribute and sell electricity. The municipal preference implicitly discourages investor owned utilities from developing hydroelectric power plants. Consequently, investor owned utilities generally generate electricity from coal, oil, natural gas, or nuclear power, not from water power (Mulligan, 2001).

What agencies regulate construction and operation of hydroelectric dams? The principal agency regulating hydroelectric dams in the US is the US Department of Energy's Federal Power Administration. Their main regulatory role is in site licensing and the regulation of the sale of electricity on the wholesale market. To the extent that the Bureau of Reclamation, Corps of Engineers and other federal agencies are involved in hydroelectric power, their rules and guidelines must be complied with. Some states also regulate dams. For example, some state governments have responsibility to inspect dams. As such, they would have standards against which their inspections would be conducted (Davis, 1998).

Benefits of Dams

How much of USA's electricity comes from hydro power? It has been estimated that about 20 percent of the US supply of electricity is provided by hydroelectric dams. Nuclear energy provides a similar amount of electricity (Charles, 2002). These figures are based on the kilowatt hours produced during a typical year. Meanwhile, hydroelectric dams are also rated according to capacity. A dam may be equipped to generate 300 megawatts of electricity; however, the dam will only make that much electricity if the flow in the river and the reservoir capacity are adequate (Underwood, 2001).

How are dams used to store water? A dam is a structure that is built perpendicular to the flow of a river. Its purpose is to stop the flow of the river and store water behind the dam. By contrast, a levee is built parallel to a river, and its purpose is normally to prevent the river from flooding adjacent low lying areas. In the case of a huge dam like Hoover Dam, the reservoir may be built to store over a year of flow from the river. Dams with adequate storage capacity can be used to generate “peaking power,” which is used during the times of highest use (e.g., daytime in cities in the summer season when businesses and air conditioners are in operation). Some hydroelectric dams have very little storage capacity, so they generate electricity whenever the river is flowing. Some of the dams on the Columbia River are of this “run-of-river” type (Spencer, 2008).

How are hydro dams used for flood control? In addition to creating storage capacity for generating power, most dams are also built with additional capacity to catch flood water. When rainfall or rapid snowmelt occurs upstream, the heavy river flow is captured in the reservoir behind the dam. Later, days after the flood event has subsided, the water can be released slowly from the reservoir. This process is intended to reduce flood damage downstream from the dam (Norton, 1998).

What kinds of recreation opportunities are provided by hydroelectric dams? When a dam is built, it can create a dramatic expansion in recreational opportunities. Examples include fishing, hunting, sailing, power boating, swimming and others. When these dams are built, it is typical to see marinas, boat launching ramps, and other recreational facilities built (Fitzgerald, 2004).

What kind of wildlife habitat can be created by hydroelectric dams? Because dams impound water, they create habitat for animals that require water. Aqueous fauna include fish, snakes, frogs, insects and the like. Water birds like ducks and wading birds are likely to find habitat in or along reservoirs. If the reservoir is created in a location that would otherwise be dry (e.g., a desert), the expanded availability of water may result in new types of plants growing near the reservoir. That, in turn, can create habitat for additional types of fauna.

Impacts of Dams

What adverse impacts can arise during construction of a dam? When a large dam and reservoir are constructed, a number of impacts can occur. In some cases, towns must be moved, including demolition of buildings and movement of graveyards. It is common practice to remove all trees and large vegetation from the area of the reservoir. Construction of dams can involve large earth moving activities, and this can create dust pollution. Meanwhile, there may be a need to establish gravel mining operations to support the fabrication of concrete for the dam (Baker, 2007).

How is land removed by construction of a dam and reservoir? Let's assume that someone wants to build a 70,000-acre hydroelectric facility in upstate New York. They will need to take possession of 70,000 acres in the river valley upstream from the proposed dam site. This land will be "removed" from its current use (perhaps farming and forestry) and converted to a reservoir (Garrett, 1974).

How do hydroelectric dams disrupt the natural flow of rivers? A natural river does not flow at a constant rate. Its flow rate is based primarily on rainfall and snowmelt. Both of these vary in extent according to location and time of year. In general, flow rates

of most rivers are higher in the springtime (Ellis, 2006). This provides opportunities for wetlands to recharge. It also provides opportunities for fish to migrate. After a hydroelectric dam is installed, there tends to be a major change in the flow pattern of the river. For example, if it is desired to be able to extract a constant amount of electricity from the dam (i.e., base load power), then a large reservoir is built in order to store lots of water and create a constant flow from the dam. The area downstream of the dam no longer sees variable flows. Instead, it may see constant flows. This constant flow rate may not be suitable for migration of fish, and it may not allow wetlands to be recharged (Pepper, 2002).

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Anadromous fish breed in fresh water. Their eggs hatch, and the young fish make their way to the ocean, where they grow to adulthood. Then they swim back upstream to breed in fresh water. Salmon and shad are well known examples of anadromous fish. If the stream is blocked by a dam, it may be impossible for the fish to move downstream or upstream. At some hydroelectric dams, fish ladders and fish elevators are used in an effort to help fish move around the dam. In some locations, these efforts are successful. However, in most rivers where dams have been installed, there has been a large reduction of anadromous fish population (McPhee, 1992).

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When a river's natural flow increases, wetlands absorb water. When the river's natural flow decreases, wetlands release water. Consequently, wetlands can have an important effect in controlling floods. By contrast, if the river's flow is disrupted by a hydro dam,

the wetland may not receive enough water to recharge, and it will not be able to perform its flood control function (Oppur, 2003).

How can dams trap sediment? On rivers without dams, it is normal for the rivers to transport sediment from upstream areas to downstream areas. Normally, these sediments reach the ocean. Beach sand, for example, usually has its source in nearby rivers. When a dam is built on a river, it creates a reservoir full of still water. This encourages the sand and dirt to settle out in the reservoir instead of flowing toward the ocean. In some cases, dams have substantially filled in with sediment. This limits their capacity to perform water storage, hydroelectric generation, and flood control functions. Furthermore, downstream of some dams, some beach areas have experienced “erosion” caused by a reduction in the replenishing flow of sand from rivers (Quibble, 2004).

How can dams trap nutrients? The sediments carried by rivers include chemicals that are beneficial to plants and animals. If the dam and reservoir capture sediments, they can also capture nutrients. This is what occurred when the Glen Canyon Dam and Lake Powell were constructed. Before the Glen Canyon Dam was constructed, there was a large population of healthy striped bass living in Lake Meade, downstream from Glen Canyon. Some years after Glen Canyon Dam and Lake Powell were constructed, it was noticed that the striped bass in Lake Mead were thinner (and to some observers, strange looking). It is believed that this happened because the normal flow of chemical nutrients into Lake Mead had been disrupted. Growth of plants such as algae was reduced. This had an adverse impact on the food supply for the whole food chain, including the striped bass at the top of the food chain. The managers of the Glen Canyon Dam have

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References

- Able, J. (2003). *Benefits of dams*. US Bureau of Reclamation. Washington, DC.
- Baker, C. (2007). *Environmental impact of hydroelectric dams*. New York. McGraw Hill.
- Charles, E. (2002, May). *Hydroelectric dams: how they work*. Popular Science magazine. 209 (2), 26-31.
- Davis, M. (1998, March). *Federal, state and local government roles in regulation of dams*. University of Washington Law Review.
- Ellis, M. (2006, May). *Hydroelectric power can create significant environmental impacts* [Adobe Digital Editions version]. Smithsonian magazine. Retrieved from <http://www.smithsonian.gov>.
- Fitzgerald, P. (2004). *Recreational opportunities associated with dams and reservoirs* (pp. 59-63). In Sourcebook on Hydroelectric Dams, Rassel, Wanda (Ed). US Army Corps of Engineers.
- Garrett, M. (1974, February 11). *Construction of the proposed Dickey-Lincoln dam will flood 34,000 acres of Maine woodlands*. Boston Globe. pp A1, A6.
- Leonard, W. (1990, June 23). *Lake Powell and the Glen Canyon Dam are depriving Lake Mead fish of vital nutrients*. Las Vegas Times. Retrieved from <http://www.lvtimes.com>
- McPhee, J. (1992). *Shad*. New York. Harcourt Brace and Janovich.
- Mulligan, S. (2001, June-July). *Municipal preference rule continues to discourage investor owned utilities from building hydro dams*. Energy Law Review; Law review of the Federal Energy Bar Association. Edited by the University of Kansas Law School Law Review team. Volume 13.

- Norton, E. (1998, June). *A simple calculation method for sizing flood control reservoirs*. Water Resources magazine.
- Oppur, L. (2003, June). *Disruption of wetlands by development of large dams and reservoirs*. Science Magazine.
- Pepper, C. (2002, December). *Modification of natural stream flow by hydroelectric dam operation*. Nature magazine.
- Quibble, M. (2004, May). *Large dams can trap giant amounts of sediment*. Nature magazine.
- Rassle, W. (Ed.) (2009). *Sourcebook on hydroelectric dams*. US Army Corps of Engineers
- Spencer, M. (2008). *Survey of US Government agencies managing hydroelectric dams*. US Department of Energy's Energy Information Agency
- Taylor, M. (2004). *Visitor information guide for Hoover Dam*. US Department of the Interior.
- Underwood, P. (2001, May). *Tradeoff studies in sizing of hydroelectric dams*. Civil Engineering magazine