

# **Geography 4411 – Water Resources Management**

## **COURSE PROJECT**

<b>A. Purpose of Project</b>	<b>2.</b>
<b>B. Project Evaluation</b>	<b>2.</b>
<b>C. Research Themes and Choosing A Topic</b>	<b>3.</b>
<b>D. Individual Research: Proposal Guidelines</b>	<b>6.</b>
<b>E. Individual Research: Report Guidelines</b>	<b>7.</b>
<b>F. Individual Research: Report Evaluation</b>	<b>8.</b>

## Geography 4411 – Water Resources Management

### COURSE PROJECT – Integrated Watershed Management

#### A. Purpose of Project

The context of your individual report should be *grounded* in academic theory pertaining to the principles of integrated watershed management. These principles should also be clearly *applied* to a specific case study(s) or water resources issue. Your research should not simply describe an existing resource problem, but must discuss how to apply integrated strategies to mitigate the problem, drawing on theory and case study(s) to support this strategy.

#### Learning Objectives

- Explore the complex and integrated nature of water resource issues
- Design and apply a watershed approach to existing management and decision-making
- Establish individual research skills specific to water resource management
- Critical thinking and innovation in the design of diverse and anticipatory strategies
- Research skills, communication
- Scheduling of deadlines, ‘plugging away’ and successfully completing tasks / objectives
- Self-education, empowerment and determination in professional activities

#### B. Project Evaluation (40% of Final Course Grade):

Proposal	=10%
Report	=30%

## **C. Research Themes and Choosing A Topic (Use as a general guide):**

**1. Protecting Watersheds and Ecosystems** - Conflicting demands for water use and the use and degradation of water quality in one sector has serious implications for other uses of the resource, resulting in a variety of economic and social conflicts and costs. There is a need to identify and implement innovative approaches for developing environmentally responsible stewardship and sharing of watershed resources. This includes recognition of the role of both groundwater and surface water in watersheds and the preservation and optimization of the maximum quality and quantity of these water resources. We must also identify policy mechanisms, research, and technological tools for watersheds that are at the leading edge of developing solutions to water management issues. The key research focus in watershed management is on developing methods to integrate land use with water quantity, water quality, demand, supply and equity for both human and environmental use and to mitigate adverse impacts from existing and past practices.

**Focus 1.1: *Develop Water Management Strategies For Local/Regional Watershed-Scale Applications*** focusing specifically on issues of water allocation decisions and the challenge of balancing competing water uses and resolving conflict. Such an investigation will involve attention to a number of questions, including the role of senior and local governments and non-government stakeholders, the transparency of decision-making processes, and the extent to which individuals understand both how they are linked to water resources and their watersheds.

**Focus 1.2: *Examine Integrated Water Resource Strategies That Help To Balance Human And Ecosystem Demands For Water Use And Conservation In Urban Areas.*** Urban water issues arise from competing demands for limited water resources from urban, industrial, and recreational users, as well as for preservation of surrounding coastlines or natural ecosystem components. Urban needs and demands in many regions are rapidly exceeding the available water in many rivers, lakes and aquifers during critical times of the year and new monitoring and treatment technologies are needed to ensure a sustainable water supply and to maintain sufficient water quantity and quality in streams and connected groundwater.

**Focus 1.3: *Improving Integrated Understanding of Factors Affecting Water Quality*** involves source control and pollutant retention and mitigation near the source as the first steps, and need to be put in place with a *multi-barrier* approach to water management. There are many areas relating to water quality for which we still have insufficient information to allow effective integration across issues and disciplines and there needs to be additional effort invested to identify the causes of impaired water quality, to delineate the relative importance of point and non-point sources of contamination, and to establish water quality linkages between surface and ground water compartments. There must be an increased realization that it is more cost-effective to prevent contamination, than clean it up.

**2. Protecting Public Health:** Clean, safe water, along with clean air, adequate, safe food and housing comprise the most vital physical human needs. Meeting these needs helps to achieve a remarkable standard of living in affluent nations like Canada. In contrast, the World Health Organization estimates that 3.4 million people, mostly children, die annually from water-related diseases (including diarrheal diseases spread by contaminated drinking water and infectious diseases with a waterborne element like malaria). By comparison, Canadians are remarkably safe. Yet, tragedies like Walkerton demonstrate that a failing to invest in up to date technologies and training of personnel can compromise safe water, resulting in eventual disaster. The depressing circumstances facing most of the globe should provide a continual reminder of the powerful capability of water to spread disease and misery. For a developed country such as Canada, safe water should be among our most highly valued services, reflecting our comparatively high standard of living. But failure to respond to growing needs for infrastructure investment is likely to cause waterborne disease outbreaks. The contamination of safe drinking water by sewage or animal fecal intrusion during distribution has proven to be a major cause of the otherwise relatively rare waterborne outbreaks in affluent countries.

**Focus 2.1: *Setting Priorities For Safe Water Among Competing Risks Based On Evidence.*** At a time when drinking water supplied to the majority of Canadians (i.e. in large urban municipalities) is of the highest quality and safety it has ever been, a growing number of consumers are willing to invest funds in additional home water treatment devices. This reflects a lack of public confidence in the safety of public water supplies, despite their generally high quality. Meanwhile, the list of trace contaminants in drinking water guidelines requiring monitoring and reporting continues to grow. Focusing increasing resources and public concern on trace contaminants, which are generally of much lower risk, can dilute the focus on the proven risks to public health, principally pathogens. It is possible that some risks to drinking water such as trace chemical contaminants may emerge as an important public health issue, but we clearly need more rigorous grounds for identifying such risk. An improved understanding and communication of the evidence and uncertainty for risks of trace contaminants is needed to provide a basis for improved decisions given the inevitable risk tradeoffs arising when investing resources.

**Focus 2.2: *Improving the Capability of Small, Rural and Remote Communities to Assure Clean, Safe Drinking Water and Adequate Sanitation.*** The greatest threats to drinking water safety occur in smaller Canadian communities (often northern, remote and rural, and more recent examples... First Nation Reserves) with limited technical and/or financial resources. These communities may also have to deal with difficult source water supplies and limited capacity or jurisdiction to protect source waters. Technologies and systems that function adequately in large urban areas or with sophisticated technical supervision function poorly or fail in small or remote communities. The greatest assets for assuring safety in drinking water systems (well-trained, supported and dedicated operators) are usually the most difficult to attract and retain in small or remote communities.

**Focus 2.3: *Preparing for Rapid Recognition and Effective Response to Recognized or Emerging Waterborne Disease Threats.*** The potential for water to spread disease because of naturally occurring, accidental or intentional contamination with disease causing agents (microbial or chemical) makes it essential for drinking water providers and public health officials to have the means of recognizing and dealing effectively with contamination and disease risks in water.

**3. Ensuring Sustainable Water Infrastructure:** Canada has a large supply of fresh water, which can be protected through stewardship of our natural resources. But the long-term supply is threatened in some regions, particularly as a result of climate change, which is likely to have a large impact on our water resources, with differing regional and local impacts. How this changing supply of water is treated for conveyance to populations centres, how it is used and in what state it is returned to the environment will determine its long-term sustainability. Flood protection, water and wastewater delivery, for example, requires an expensive network of structures, floodways, pipes, pumping stations, and an array of drinking water and wastewater treatment technologies. All this investment is called "water infrastructure." In many communities this infrastructure is coming to the end of its design life and in some cases its operational life, leading to an "infrastructure deficit" of over \$50 billion. Such a large-scale investment will require new and innovative technology and methods of management.

**Focus 3.1: *Water Quality Master Planning For The Integration Of New Infrastructure. Regulatory Requirements For The Water And Wastewater Industry*** are anticipated to expand even further over the next 10-20 years in Canada and worldwide. Many urban centres will balance retrofitting their existing infrastructure, which is meeting today's needs, with entirely new infrastructure to comply with these anticipated regulations. New regulations are likely to include new drinking water standards and regulations affecting the treatment of wastewater. Hence new drinking water technology will need to be developed, researched and evaluated. Future investment expenditures on treatment plants will have to be optimized by incorporating conservation and demand management, which will reduce the pressure on capacity expansion, and incorporate climate change impacts. All decisions designed to meet the new regulatory environment will have substantial economic implications for the water industry.

**Focus 3.2: *Rebuilding Rural and Small-Scale Infrastructure.*** In Canada 20% of the population lives in small communities (less than 10,000 people) but approximately 80% of the treatment works in Canada service these rural populations. Many of these communities have little or no treatment robustness for their water and wastewater services and their water remains untreated, with inadequate monitoring of water quality. All this compromises both public health and economic development. There is an urgent need to research small-scale treatment plants and problems of rural communities.

**Focus 3.3: *Developing Innovative Techniques for Reducing the Physical Impacts and/or the Vulnerability of Communities to Riverine and/or Surface Flooding.*** As a result of climate and land use changes there has been a loss of traditional wetlands, ponds, and streams, and an increase in artificial flood impacts from development and flood protection schemes. Management of flood control structures and requires new approaches such as structural and non-structural flood-proofing, and involvement of a range local and regional stakeholders within the watershed scale of management.

**D. Individual Research: Proposal Guidelines**

**Name:** \_\_\_\_\_

**10% of final grade:** A research **proposal** must have the following components:

1. Introduction: Problem statement (what is it that you want to research about the management of water resources, what case study(s) will you focus on to develop an example of this research, and how will an IWRM approach help you to provide recommendations for this particular case study(s)?)
2. Report Structure / design: How will you structure your report? How will theory and case studies be used to prove your overall argument or achieve your objectives
3. References (NO MORE THAN 20% non-academic sources)
4. Detailed/ descriptive headings of the proposed research paper

## **E. Individual Research: Report Guidelines**

No more than 2000 words

The report should be well research and re-researched to ensure that you have chosen only those articles that directly inform your chosen topic and achieve your objectives. The report should be properly structured using a recognized academic format, with clear headings and an outline, title page and proper referencing, and the concise use of appropriate research information that supports your ideas and strategies. The report should provide primarily academic information and sources, although 20% of your resources can be from elsewhere provided that these sources are directly relevant to your case study.

Your report should help you to communicate information about:

1. The overall Water Resource Management theme or context that your case study is placed within. (Place your case study and ideas within a general resource theory or approach).
2. Your theoretical approach and recommendations to the case study required to enhance Integrated watershed management (Context to support your approach and how such an approach can benefit the water resource issues in your given case study and watershed unit).
3. The justification for why your approach is a good example for the adoption of strategies and management ideas. Here you should discuss the intention of your argument, and the goals, plans, policies and procedures that would be necessary for the practical implementation of your management ideas.

## F. Individual Research: Report Evaluation

Student Name:

Final Mark:

This form is used to assess your report. It is derived from Hay's (1997) "Communicating in Geography and the Environmental Sciences." You can use it to establish areas for improvement in your written communication. After each line item there are spaces for four tics [ ]. The further a tic appears to the right, the better your work was for this item. No tic for an item means that that particular item did not apply to the assignment being marked.

Note that all line items are not equivalent; thus, a simple addition of tics will not lead to your overall mark. Line items are of different importance depending on the nature and level of the assignment being marked.

QUALITY OF ARGUMENT	POOR			GOOD
Does the argument fully address the topic?				
Does the argument demonstrate internal coherence?				
Is the argument well structured throughout the paper?				
Is the material presented relevant to the topic?				
Is the topic dealt with at sufficient length?				
QUALITY OF EVIDENCE				
Is the argument well supported by evidence and examples?				
Is there an accurate presentation of evidence and examples?				
Is there an effective use of figures and tables?				
Are illustrations effectively presented and correctly cited?				
WRITTEN EXPRESSION AND PRESENTATION				
Is the writing fluent and succinct?				
Is the writing grammatically correct?				
What is the quality of punctuation?				
What is the quality of spelling?				
Is the writing and presentation legible?				
Is the assignment of reasonable length?				
SOURCES AND REFERENCING				
Are there an adequate number and type of sources?				
Are the sources acknowledged?				
Is the referencing style consistent and correct?				
Is the reference list correctly presented?				
OVERALL DEMONSTRATED ACADEMIC ABILITY				