A portion of the questions of the midterm will pertain to this case study. You do not need to memorize this case study since it will be reproduced on the midterm exam booklet. You are however strongly encouraged to prepare this case study before the midterm. Preparation includes reading the case study carefully, ensuring that you understand what it is saying, and attempt to demonstrate your knowledge of the course content using the case study.

Case Study - Preventing Terrestrial Wildlife Movement at Large Streams and Rivers

(Taken from Innocentive Challenge ID #9932952 with minor modifications)

Challenge Overview

Large fenced in areas are being considered for the protection of Caribou in the boreal forest of northern Alberta. Predators are kept out of the area by fences, but this becomes problematic when the fence line inevitably crosses rivers or streams.

The Oil Sands Leadership Initiative (OSLI; http://www.osli.ca/) is looking for creative and innovative ideas to prevent predators (Bears, wolves, coyotes) from crossing a line specific to a river or stream.

The Oil Sands Leadership Initiative (OSLI) is a collaborative network of companies operating in the Canadian oil sands. Each OSLI company develops its assets individually, but works collaboratively to achieve significant improvements in key performance areas: environmental sustainability, social well-being and economic viability. To formalize this approach, in April 2010 ConocoPhillips Canada, Nexen Inc., Statoil Canada, Suncor Energy Inc. and Total E&P Canada Ltd. signed the OSLI Charter, agreeing to work collaboratively on non-competitive issues, and share research and best practices. Shell Canada joined in 2011.

The initiative is founded on a common understanding among OSLI members of the need to work together to meet the challenges of responsible development.

Detailed Description & Requirements

Background

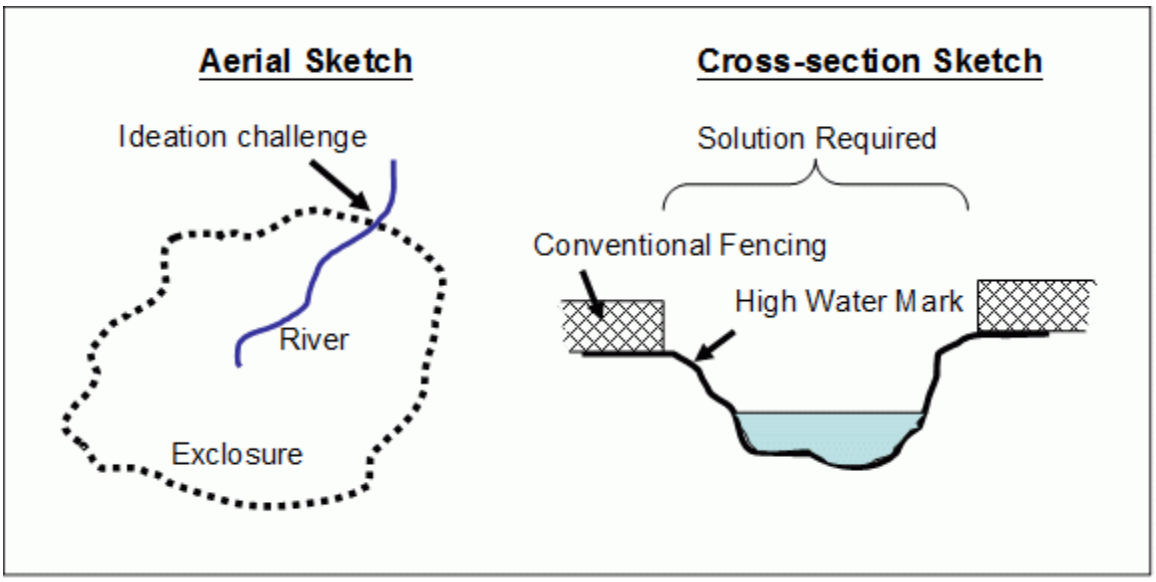
The Oil Sands Leadership Initiative (OSLI) is investigating the feasibility of a project to reduce predation risk to Woodland Caribou in the northeast boreal forest of Alberta. Caribou are classified as "threatened" under Alberta's Wildlife Act and Canada's Species at Risk Act. The federal and provincial governments define threatened as "a species likely to become endangered if limiting factors are not reversed."

One option being considered is to create “fenced safe zones” to protect caribou until sufficient functional habitat can be restored. The construction of a fence to exclude caribou predators such as wolves, bears and coyotes is being considered in the boreal forest of northern Alberta. This fence may run for hundreds of kilometers, enclose an area of thousands of kilometers-squared, and inevitably need to cross streams and rivers. These streams and rivers create several problems with respect to fencing such as:

- Water level depth and width vary over the summer months
- Streams may freeze solid over the winter
- Rivers continue to run under the ice during the winter
- Any structure rooted within the river will be impacted by ‘frost heave’ and movement of ice
- Rivers may have debris floating downstream, such as downed trees
- Streams may be in remote locations where regular maintenance will be difficult
- Conventional fencing is not feasible across larger waterways and may violate some provincial and federal regulations concerning restriction of water flow and fish populations.

A typical fence is shown below and is usually thick wire fencing, 2-3 meters high that is buried to some depth in the ground to prevent digging under it.

A major issue with fenced enclosures is controlling the movements of predator (wolves, bears and coyotes). These are smart animals and excellent climbers so they can easily find small gaps or ways around the fence. Rivers and streams provide natural travel corridors for these animals and the intersection of fence and waterway will be ‘tested’. Since the conventional fence will probably stop at the high water mark of a stream or river, they can easily walk around it, especially when the water level is low during the summer months. Hence, the need for ideas for some type of innovative “barrier” across rivers and streams. Please refer to the figure below.



There are also inherent challenges associated with working in the boreal forest. These can be very remote location to establish infrastructure (although monitoring of "fence" will be conducted once established). The diverse range of topography includes: bog, upland, riparian, fen, swamp with relatively poor drainage.

The Challenge

The Oil Sands Leadership Initiative (OSLI; http://www.osli.ca/) is looking for creative ideas for a "barrier" to prevent predators from breaching a protected, fenced area where the fence intersects with rivers and streams. Please note that the "barrier" does not necessarily mean a conventional fence or even a structure at all. It just has to prevent predators from entering the protected area along a line crossing a stream or river. Ideas should be as non-invasive as possible and avoid disturbing water flow, fish populations and even navigation (if the waterway is considered navigable).

For this Challenge, the design team can assume watercourses are at least 3 meters wide and 0.5 meters deep – up to 50 meters wide and 10 meters deep.

Any proposal should address as many of the following **Technical Guidelines** as possible.

1. The method (physical barrier or otherwise) will keep predators (bears, wolves, and coyotes) and ungulates (woodland caribou, moose, deer) from breaching an exclosure fence where the fence intersects with a river. Ideally the solution will not allow any breaches, although to be realistic, some breaches are acceptable. Generally speaking, a good solution will allow 1 to 5 breaches per year; a better solution will allow 1 or fewer breaches per year; the best solution will not allow any breaches.

2. The solution should cause the least amount of disturbance to the watercourse (as per the Canadian Department of Fisheries and Ocean's regulation regarding fish habitat disruption http://www.dfo-mpo.gc.ca/habitat/role/141/1415/14151-eng.htm and Transport Canada's navigable waters regulation http://www.tc.gc.ca/eng/marinesafety/tp-tp14838-3099.htm).

(Note: We do not expect the design team to interpret all regulations to determine what 100% "acceptable" is. Any solution will be subject to scrutiny by several governing bodies after the Challenge; however, the best solutions with the least amount of disturbance and infrastructure will be awarded, as determined by the OSLI, and brought up for consideration.)

3. The solution needs to 'link up' with conventional fencing for wildlife that will occur adjacent to the watercourse. If the solution is not a structure, there will be no physical "link", but the design team should show how continuous protection is maintained across the stream and beyond.
4. Woodland caribou must also not be able to cross this perimeter fence (in the other direction).
5. The solution must work year round, irrespective of seasonal conditions, including snow, ice, moving frost lines, changing water levels, and temperature ranging from -40 to 40 °C. The solution will be utilized (and maintained) for at least 40 years.
6. Any solution must not intentionally cause harm to any wildlife including an animal attempting a breach the barrier.