Team Number: _____

2011 New Hampshire Envirothon Aquatics Exam
May 17, 2011

This exam was designed to be thought provoking and challenging. **Answer all questions** as completely and concisely as possible. Provide sound rationale for each of your answers. Answers that are not clearly explained will not receive full credit. Good Luck!

Question #1 (25 points)

A. Following is a list of tests that are frequently performed on New Hampshire's surface waters.

1. Describe the purpose of each test (2 pts ea.):

- **Conductivity**
- **Turbidity**
- **Total phosphorus**
- **Chlorophyll-a**
- **Dissolved oxygen**

2. There are benefits and drawbacks to using these water quality tests. Consider: New Hampshire has approximately 1,000 lakes and ponds and more than 9,500 miles of rivers and streams. Give one benefit and one drawback for relying on water quality testing (2 pts).

B. Does water become more or less dense when it freezes? How do you know this is true? Provide evidence of this phenomenon found in nature to illustrate your point (4 pts).

Question 1 continued on page 2 …

Score for this Question_____

C. Using Visual #1 (*map of Mt. Chocorua N.H.*) provided, find Great Hill Pond and identify the following (5 pts):

1. How many inlets does Great Hill Pond have? ___

3. How many outlets does Great Hill Pond have? ___

3. Name 3 features (roads, mountains, cemeteries, gravel pits, town centers, etc.) that may impact the water quality of Great Hill Pond.

a.

b.

c.

D. Using Visual #1 (*map of Mt. Chocorua N.H.*) provided, find Hemenway State Reservation to the South-east of Great Hill Pond. Is the pond in the state reservation part of the watershed of Great Hill Pond? Explain your reasoning (2 pts).

E. Non-native, invasive aquatic plant species can have major impacts on lakes, ponds, and rivers. Provide two impacts (negative or positive) (2 pts).

1.

2.

Question #2 (20 points)

Changes to New Hampshire's climate are occurring each day – some quite subtle and long-term, others more dramatic. New Hampshire's coastal waters are not immune to these changes. Changes may take the form of more frequent or intense storms, changing ecological composition of the Great Bay Estuary, or disrupting the land forms adjacent to the estuary and its watershed.

A. List four impacts of climate change over the coming years that could alter coastal waters as we know them today. (8 points)

1.

2.

3.

4.

B. What four measures or preparations can we take now to perhaps modify or reduce the negative effects to coastal waters? (8 points)

1.

2.

3.

4.

C. What could happen to the Great Bay Estuary and its aquatic life if the area witnessed a long dry spell, followed by a short but torrential rainstorm as a result of a change in climatic conditions? (4 points)

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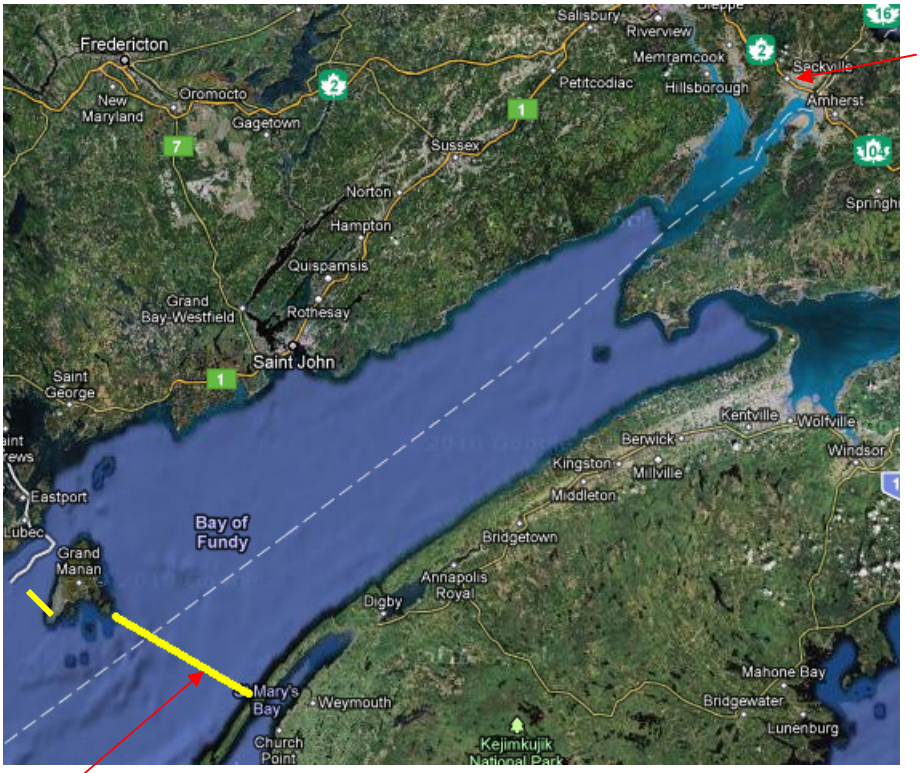
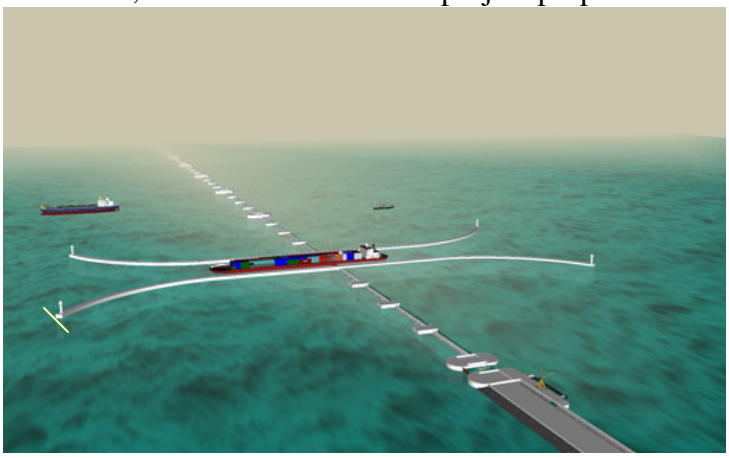
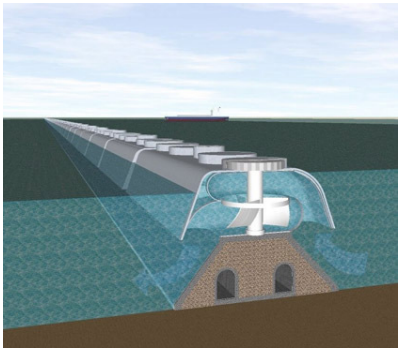
Question #3 (20 points). On the reverse side of this page, discuss the pros and cons of constructing the fictitious project described below. *Consider both the advantages and disadvantages of tidal power (in general and at this location), and the positive or negative impacts to* ***all aspects*** *of the environment.*



Site of the 2011 Canon Envirothon
In Sackville, NB

Proposed 50 kilometer long (31.1 mile) tidal energy "reef" that is to be constructed in the Bay of Fundy, between New Brunswick and Nova Scotia. (Pictures below are from the website of Evans Engineering and Power, and illustrate a similar project proposed in Great Britain.)





At first glance this looks like a tidal barrage (analogous to a dam), but this design does not block the water movement as much, so it wouldn't affect the tides as severely and the environmental consequences would be much less. It could be built in sections, so power could start being generated at an earlier date than with a tidal barrage. Migratory fish could get through, mud flats could still be exposed at low tide, and it would be able to generate power for about 12 hours during the tidal cycle. Sections of it would open to allow shipping through.

Score for this Question_____

Question #4 (15 points)

Estuaries depend on salt water and fresh water for their health and function. They are sandwiched between the high salinity level of the ocean and the freshwater in the upland surrounding them. Activities in the watershed can impact the quality and quantity of freshwater that enters an estuarine system as runoff.

A. List three possible negative impacts on water quality as the water enters the estuary.

1.

2.

3.

B. Suggest one way that a freshwater wetland could minimize one of those negative impacts.

Score for this Question_____

Question #5 (10 Points)

Head of tide dams – Preserve or Remove

There are 19 head of tide dams in N.H of which only 7 of these dams have fish passage. These dams eliminate the transition zone between salt and freshwater ecosystems and therefore reduce the habitat diversity. These dams were originally built to support mills, generate power, control floods or provide drinking water. Many of these dams are in need of major repair and are no longer used for their original purpose. There are repercussions and costs to maintaining the dams as well as removing the dams.

From the choices below, pick two reasons to preserve the dam **and** two reasons to remove the dam giving a short supporting statement with each reason. This is not a comprehensive list of issues and therefore you may choose to elaborate on an item that has not been identified in this listing.

Preserve	**Remove**
Provides the towns drinking water	Dissolved oxygen will increase
Provides flood control	Removes a barrier to fish
Provides fire protection	Self sustainable healthy ecosystem
Historic landmark in town	Eliminates liability to dam owner
Possibly hydropower generation	Allows sediment to flush
Helps maintain groundwater levels	Home owners wells may be affected
Potential downstream contamination	Improvement of overall water quality

A. Preserve the Dam

1.

2.

B. Remove the Dam

1.

2.

Score for this Question_____

Question #6 (10 Points)

(See insect trays / laminated sheets of representative insects)

As part of your training as a NH DES field biologist, you are being tested on your knowledge of macroinvertebrates as indicators of water quality. As you know, stream macroinvertebrates refer to animals without a backbone, such as insects, aquatic worms and leaches that can be an effective means of assessing water quality. As with any assessment tool, limitations also exist when using macroinvertebrates to interpret water quality. Based on the biological (macroinvertebrate) data, you are tasked with answering the following questions:

A. List two possible advantages of using biological indicators to assess water quality

1.

2.

B. List one possible limitation of using biological data to assess water quality conditions

C. List one concept that is important when attempting to interpret biological (*i.e.*, macroinvertebrate) data. In other words, what features or conditions might be helpful in determining whether or not one macroinvertebrate sample is better or worse than another?

D. Review the two trays of macroinvertebrate data (laminated sheets of specimens may be substituted) and determine whether one site is more impaired than the other based on the macroinvertebrate data. You should provide justification for your answer to receive credit.

Score for this Question_____