This assignment placed the student in the shoes of a watershed manager for an area in upstate New York. It used a computer simulation program that emulated the waters of a local lake in response to four defined values that were user controlled in quantity. These included population, quality of agricultural practices, the percent of land available for agricultural use, and the efficiency of the wastewater treatment plant that serves the area. These variables are through some undefined means used to calculate three dependent values of algal density, Secchi depth, and the concentration of dissolved oxygen at the bottom. The premise of this activity is that a student will discover through ‘play’ the effect of changing the values of the ‘independent’ variables upon the three dependent variables. This assumes that the student has the basic biological knowledge that these four ‘independents’ would change the sustainable population of algae within the lake. It also assumes the student have the foresight to see that as algae population increases the Secchi depth would decrease (inversely proportionate) as light is reflected/refracted differently. In addition, it presumes that the student understand that the reason for a decrease in dissolved oxygen is proportionate to the number of creatures consuming the gas within the water, thereby the algal density. It also requires an understanding of limiting reagents in biological scenarios as the algal density must remain below a critical maximum or it would kill all of the algae and other inhabitants of the lake by suffocation. Beyond all of this it also requires certain deficiencies in knowledge or foresight to accept that the four ‘independent’ variables actually are. In example, ‘Wastewater Plant Efficiency’ (PE) is going to be a function of the local population, the greater the population becomes the more inefficient the plant will be as it nears its max capacity. This would be due to the increasing need for haste in processing, and also due to the error in filtration; even if the filter were to remain exactly as effective as prescribed, if less than one hundred percent, the greater the volume of waste processed the greater the volume of waste missed. The second may be addressed in the program, the first however is human nature and almost absolutely overlooked.

This introduces the tradeoffs that are addressed in 3.8.10A. As almost a rule if we can make more money that is first priority and as a second will attempt to give back so long as it doesn’t reduce profit to or below its previous level. In example, the timber industry, we clear-cut forests in order to sell the lumber to other industry; this increases the CO₂ (through processing
both of this lumber (burning), or just running the facility) in the atmosphere and reduces the total quantity of CO₂ that the system is able to sequester. Then, in ‘recompense’ the selfsame industry plants an equal or lesser number of trees, that are so immature often many die of exposure, in an area that is equal or lesser to that from which the previous were removed, and as such more are lost to competition over limiting resource. Not to mention the fact that this area of planting is far too frequently somewhere else entirely to allow agricultural development in the newly deforested area, which in its own turn redistributes the buffering and cleansing resource of the forest to an area that few to none benefit from except in the most indirect manners. These practices, not limited to this industry, have thankfully begun to come under harsh criticism in the recent society’s eye. These changing societal values further address this same standard but the third and fourth bullets in turn. This activity addresses all three of these same with the first being in the fiscal activity portion where one cannot achieve the ideal as the population and farmland are fixed and improving the AP and PE costs too much to attain perfection. The third and fourth bullets are captured also simply by the introductions description of your job, you must act as a society after a goal counter to that which the agricultural industry may most enjoy. Many of our favorite and most used technological innovations of history have been the greatest of boons to our current society in many economic and convenience fashions, such as the automobile. This has provided means to transport goods over vast distances and to peoples’ that otherwise may have been unable to exist there. However, ever silver lining has a dark cloud around it; these same automobiles have increased our consumption of Earth’s natural resources to a nearly unmentionable extreme and in addition have produced various toxins and gasses that affect the climate of the entire planet.

These cause and effect relationships are much illustrated by this activity in that every time a practice or technology is implemented, in our watershed, it bears consequences, which are themselves interdependent, upon the lake in question. This addresses standard 3.8.10C, bullet one, directly. The application’s use of economic limitation to force a best possible solution with limited resource in the fiscal crisis scenario illustrates 3.8.10Cs’ second bullet in that, you must
attempt to minimize the impact upon the lake while still maintaining an equal population and also satisfying a strict budget and set differential costs of improvement.

This activity would complicate a teacher’s life, I expect, unless some previously trained aides were present to help the teacher familiarize students with the controls while completing the game. I know that the controls were counterintuitive to me at least, on many occasions and finding the exact values, after an iteration, was a challenge. The number of crossing dependencies also would provide some challenge to explain in full, and to short the description may actually lead to problems of its own as you have then created a student-body that was told a, in absolute sense, wrong answer deliberately by the teacher, this could lead to trust issues unless dealt with well.

3.8.10. GRADE 10

A. Analyze the relationship between societal demands and scientific and technological enterprises.
   • Identify past and current tradeoffs between increased production, environmental harm and social values (e.g., increased energy needs, power plants, automobiles).
   • Compare technologies that are applied and accepted differently in various cultures (e.g., factory farming, nuclear power).
   • Describe and evaluate social change as a result of technological developments.
   • Assess the social impacts of a specific international environmental problem by designing a solution that applies the appropriate technologies and resources.

B. Analyze how human ingenuity and technological resources satisfy specific human needs and improve the quality of life.
   • Identify several problems and opportunities that exist in your community, apply various problem-solving methods to design and evaluate possible solutions.
   • Analyze a recently invented item, describing the human need that prompted its invention and the current and potential social impacts of the specific invention.
   • Apply knowledge of oceanography, meteorology, geology and human anatomy to explain important considerations that need to be made for construction of homes, buildings and businesses in the United States.
   • Assess the impacts that agricultural science has had on meeting human needs and improving the quality of life.

C. Evaluate possibilities, consequences and impacts of scientific and technological solutions.
   • Relate scientific and technological advancements in terms of cause and effect.
   • Describe and evaluate the impacts that financial considerations have had on specific scientific and technological applications.
   • Compare and contrast potential solutions to technological, social, economic and environmental problems.
   • Analyze the impacts on society of accepting or rejecting scientific and technological advances.