f.) system feasibility study or construction drawing

g.) system feasibility study or detailed design

h.) system feasibility study

i.) detailed design

j.) detailed design or construction drawing

k.) system feasibility study

Chapter 2.

1. The NSPE philosophy appears to be similar to the concept of environmental management. It approves of the use of natural resources after weighing the pros and cons; the needs of future generations must be taken into account. It is compatible with the design of infrastructure systems that have sustainability as a design goal.

2. "Economy of scale" means that the cost per unit of product or service delivered becomes lower as the magnitude or size of the system increases. In the context of civil engineering infrastructure systems, larger systems may require less land purchase or condemnation per unit of output; produce more output per unit of space or area; be able to take advantage of large scale manufacturing or more massive physical systems, etc. If sustainability goals require large scale systems to achieve low costs, there may be economies of scale that can be realized. For example, use of multiple solar cells that are interconnected by a grid and can share power might be more efficient than single isolated solar capture systems. Centralized heating and cooling systems that are shared by several buildings may be less costly to operate; core heating and cooling unit costs may become lower per BTU the larger the unit, and fewer total maintenance personnel may be needed. Certain sustainability technologies may be less expensive per unit of system as their size increases. For example, it will be less costly to construct 100 miles of seawall under one contract

than to construct ten separate seawalls each of 10 miles in length under ten separate contracts. Waste management and water treatment facilities may benefit from economies of scale.

3. Carbon foot-print associated with life style could be reduced by reducing any of the green items including transport and home energy consumption that comes from fossil fuel.

4. Community consumption of fossil fuel could be reduced in a number of ways indicated by both the yellow and green items in the figure. Use of solar arrays for power production combined with electric vehicles and transit, or use of bioreactors to convert waste into energy, represent several concepts. Green rooftops, wind farms, and energy efficient structures are several additional concepts.

5. The six phases in the life cycle of a concrete pavement can be deduced from Figure 2-3. They include resource extraction, manufacturing of the components (cement, steel), on-site construction, maintenance of the pavement, eventual demolition of the pavement, and recycling of the pavement materials.

6. Note: the table may appear on page 64 of the pdf file. “Data age” appears in the third row of the table. The table states this as an area of concern that might make the comparison of A and B inconsistent, which could limit the conclusions and recommendations of the study. However, judgment is required to determine if the comparison has merit and how the conclusions of the study might be limited.

7. Boston is located on the ocean and its elevations are close to sea level. Climate change associated with temperature increase could lead to a rise in sea level which might inundate low-lying areas of the city. One of the methods of coping with rising sea levels may need to be implemented. Since storm water is likely to be carried into the ocean, some means of storing it

also may be needed. It is likely that if the intensity and duration of the design storm increases, systems to carry off the may need to be able to accommodate larger amounts of runoff.

8. Water supplies for Las Vegas might diminish, which could lead to restricted use of water (increased need for water conservation), increased fees for water, or the need for new sources of water. Increased temperatures could lead to an increased need for water during summer.

9. The 2009 report *Global Climate Change Impacts in the United States* was prepared by the U.S. Global Change Research Program and was approved by its lead USGCRP Agency, the National Oceanic and Atmospheric Administration, other USGCRP agencies, and the Committee on the Environment and Natural Resources on behalf of the National Science and Technology Council. For the Southwest it projects that

***Water supplies [will] become increasingly scarce, calling for trade-offs among competing uses, and potentially leading to conflict.

***Increasing temperature, drought, wildfire, and invasive species will accelerate transformation of the landscape.

***Increased frequency and altered timing of flooding will increase risks to people, ecosystems, and infrastructure.

***Cities and agriculture face increasing risks from a changing climate.