**Geog 464 Learning Objective Outline**

**LOO 16 Project-level analysis for decision support**

16.1 What constitutes a workflow task model for project implementation-level analysis in terms of an environmental impact statement assessment, and how does it differ from the simpler process of environmental assessment?

16.2 What are the comparative differences in scope, design and build steps within an implementation-level analysis?

16.1 What constitutes a workflow task model for project implementation-level analysis in terms of an environmental impact statement assessment, and how does it differ from the simpler process of environmental assessment? *RUGIS* Chapter 11 Section 11.1

A generalized environmental impact assessment (EIA) process is as follows (Randolph 2004 p. 615):

1. Scoping: Design the process; draft work program; identify issues, impact variables, parties to be involved and methods to be used.
2. Baseline data studies: Collect initial information on baseline conditions and important impact variables, which might include socioeconomic as well as environmental parameters.
3. Identification of Impacts: Concurrent with baseline studies, identify and screen impacts of alternative actions in terms of variables, indicators and thresholds.
4. Prediction of impacts: Estimate the magnitude of change in important impact variables and indicators that would result from each alternative using "with and without project analysis". Use project outputs, simple algorithms, simulation models, and/or GIS as needed.
5. Evaluation of Impacts and Impact Mitigation. Compare indicator impacts to thresholds; determine relative importance of impacts to help guide decisions; evaluate strategies for mitigation of impacts.
6. Presentation of impacts: Present impacts of alternatives in concise and understandable format.

In King County Washington, an EIA was performed as part of a multi-step analysis process in siting a regional wastewater facility. A four phase process was used (From the SITING THE BRIGHTWATER TREATMENT FACILITIES PHASE 2 SUMMARY.PDF page 22 Table 4).

Phase 1 Prepare selection criteria and use to identify preliminary site list.
Phase 2 Study of the selected sites based on conceptual plant layout; six sites identified to move forward.
Phase 3 Prepare EIS to identify the impacts of the selected sites in phase 2, and suggest a preferred alternative.
Phase 4 Conduct permitting and further impact analysis as needed.

See Figure 11.1 to characterize difference in EIA and EIS process.

16.2 What are the comparative differences in scope, design and build steps within an implementation-level analysis? *RUGIS* Chapter 11 Section 11.2

GIS capabilities for project site investigation have been utilized in the construction industry, particularly in relation to construction management processes. There are GIS applications to support the scoping, design, and build phases of a project implementation, as well as applications that support an integrated approach.

**Scoping Process**

Site investigation is an important step in scoping a construction project. Existing data are often too coarse when it comes to design. Surface and subsurface conditions influence construction methods and choice of equipment to be used on a project and therefore affect the cost and scheduling of projects.

A rather large project called the Interstate 405 (I-405) corridor project was conducted from 2003 – 2015. In 2004, project-level designs and project-level environmental assessments were conducted concurrently. More and more infrastructure and facility projects are being programmed as *design-build* projects in order to expedite the construction schedule and deliver infrastructure solutions more quickly.

Two GIS applications that were particularly helpful were the watershed characterization program and early environmental investment program. The goal of watershed characterization is *"…to provide the project management team with information and alternative mitigation options which have potential to increase environmental benefits while reducing mitigation costs."* (Gersib 2004 et al. p. X)

Analysts use three steps to achieve the watershed characterization goal.

The **first step** is to gain understanding of the location and condition of natural resources at both the project site scale and a larger landscape scale. At the project site scale, analysts are after an understanding of the potential project impacts to existing natural resources. Analysts present a ranking of existing wetland sites within the project area to assist the project management team in their decision-making process to avoid and minimize impacts to wetland resources.

In a **second step**, this one at the landscape scale, analysts characterize the condition of key ecological processes (delivery of water, delivery and routing of sediment and large wood, aquatic integrity, and upland habitat connectivity) that the transportation project impacts. Analysts do this by interpreting existing land cover and natural resource data and by developing databases that identify the location and condition of wetland, riparian, and floodplain resources. Analysts then identify targeted landscape areas having the potential to restore key ecological processes – an ecosystem perspective.

In a **third step**, analysts identify candidate mitigation sites using the wetland, riparian, and floodplain data. In addition to these natural resource datasets, analysts developed a stormwater retrofit database to provide additional options for treating stormwater in urban areas where few viable natural resource options exist. Analysts established priority criteria and then ranked all candidate mitigation sites for stormwater flow control and natural resource mitigation. The stormwater flow control priority list was intended specifically for identifying potential wetland, riparian, and floodplain restoration sites as well as stormwater retrofit options that have potential to mitigate stormwater flow control impacts of the transportation project. The natural resource mitigation priority list provides a project management team with options for the mitigation of wetland, floodplain, and habitat mitigation needs of a project.

## Design Process

In an early description of GIS use for construction design, Oloufa, Eltahan, and Papacostas (1994) report how useful GIS databases can be for design-build organizations. They describe how organizations can benefit from a single database for building foundation analysis and design and the resulting design-construction integration. Unfortunately, their application for design is not as developed as it might have been, because other software developed specifically for those purposes can actually do a better job of analysis. Nonetheless, the data management and visualization component of the system was certainly beneficial in the design process.

Combining GIS with simulation has been an effective tool for the construction management process as shown in many successful case studies (Zhong, Li, Zhu, and Song 2004). A GIS-based visual simulation system (GVSS), composed of simulation and visualization techniques, was developed to improve transparency of complex processes. The GVSS proved to be a helpful and useful tool for the design and management of concrete dams. The GVSS offered planning, visualizing, and querying capabilities that facilitate the detection of logic errors in dam construction simulation models. The software also helps to understand the complex construction process, and is capable of organizing vast amounts of spatial and nonspatial data involved in simulation. A hydroelectric project, which took place on the Yellow River in the northwest of China, was used as an example. An optimum equipment set scheme is determined by simulating a variety of scenarios taking place under different construction conditions.

## Build Process

Construction jobs consist of many subcontractor jobs. Job activity scheduling is a critical aspect, making sure that work gets done in a coordinated manner. Although job scheduling is certainly possible without GIS (as project scheduling software exists), when using GIS people see more clearly what is being done when a visualization of the process puts it into a spatial context. In March of 1997, work began on Seattle's new baseball stadium, Safeco Field. At a cost of more than $485 million, and with an extremely tight construction schedule, this project required efficient and organized execution if it was to be completed on time. To help with Safeco Field's successful completion, Integral GIS, Inc. integrated the three-dimensional capability of GIS and the one-dimensional time management capability of Primavera Project Planner to characterize the construction process. This innovation led to the creation of what is now known as 4D GIS Construction Management (Integral GIS 2006).

Reaching out to the public about construction projects is a big deal in many jurisdictions. Among the GIS applications that have gained considerable attention is one from the Louisiana Department of Transportation and Development (Louisiana DOTD 2006). The Louisiana DOTD provides a state-wide on-line map for people to monitor all transportation proposed and active construction projects in the State by way of a GIS viewer (See Plate 11.1). A user can select among displayable and active layers. There are several tools to query and explore the data.