

A scenic landscape photograph of a mountain valley. In the foreground, a calm lake reflects the surrounding greenery and a large, light-colored rock. The middle ground is filled with a dense forest of evergreen trees. In the background, rugged, rocky mountains rise against a clear blue sky with a few wispy clouds. The overall scene is peaceful and natural.

Bringing Reality into the Classroom

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Overview

- ◆ Purpose
- ◆ Background
- ◆ Practical Activities
- ◆ Implementation of Activities
- ◆ Results and Discussion
- ◆ Summary and Conclusions

Purpose

- ◆ Incorporate 6 activities into class
- ◆ Enhance student interest and learning using practical activities.

Active Learning Enhances Education

- ◆ Active learning in small groups promoted by Felder.
- ◆ Goff suggested using
 - hands-on design activities in class
 - problem solving activities that are relevant, fun, and exciting.
- ◆ Wyrick & Hilsen redefined Kolb's cycle:
 - doing, thinking, modeling, and checking.
Students may be brutal on evaluations however.

Student Retention by Learning Method

Stice, 1987

Learning Method	Retention by Learners
What they read	10%
What they hear	26%
What they see	30%
What they see and hear	50%
What they say	70%
What they say as they do something	90%

Vollaro promotes Field Trips

- ◆ See first hand the equipment, processes, etc. that is presented in the classroom.
- ◆ Stimulates discussion in the classroom.
- ◆ Schedule accordingly with appropriate topics covered in class.
- ◆ Have students prepare a formal report.
- ◆ Provide students with a list of questions to answer prior to the field trip.

Laboratory Experiments

- ◆ Incorporate lab experiments into class to promote hands on learning. *Pines & Roberts, and Motlagh et al.*
- ◆ Work on real projects obtained from consultants in the community in addition to having a laboratory experience with it. *Pines & Roberts*

Integrated Learning

- ◆ Microelectronics Teaching Factory
 - Students learn principles in the classroom.
 - Students then practice what they have learned in the laboratory with real tools.

Design & Analysis of Water Treatment Systems

- ◆ Senior level undergraduate course
- ◆ Discuss unit operations and processes used for producing potable drinking water
- ◆ Design course
- ◆ 7 environmental engineering students

Practical Activities

- ◆ Preliminary, individual design projects.
- ◆ Technical paper on current topic.
- ◆ Team design project.
- ◆ Field trip to water treatment plant (WTP).
- ◆ Two experiments incorporated into class.
- ◆ Played video showing unit operations and processes at a full-scale WTP.

Allocation of Points for Grade

Grade Category	Point Allocation
Preliminary Designs	100
Technical Paper	100
Summary Papers	100
Team Design Project	100
3-Tests (@ 100 pts. ea.)	300
Comprehensive Final Exam	300

Preliminary Designs

- ◆ Individual preliminary design projects assigned first day of class.
- ◆ Schematics with brief process descriptions due one week later.
- ◆ One design for a surface water plant.
- ◆ One design for reusing wastewater effluent as a drinking water source.
- ◆ Mean was 85.

Technical Paper

- ◆ 5 to 10-page technical paper required from each student on current topic.
- ◆ 10 references from refereed journals required.
- ◆ Assigned the first day of class and due by mid-October.
- ◆ Mean was 89.

Summary Papers

- ◆ Administered 3 or 4 times during semester.
- ◆ Summaries of the day's lecture or questions on areas in which they were unclear.
- ◆ Approximately 10 minutes of class time was used.
- ◆ Average on the summary paper was an 88.

Team Design Project

- ◆ Two-groups of 2 students and one-group of 3.
- ◆ Students prepared the preliminary design of a water treatment plant for Hillsborough County Florida.
- ◆ Intermediate and final deadlines established for Technical Memoranda.

Technical Memorandums

- ◆ Process Description
- ◆ Control Strategies
- ◆ Design Criteria
- ◆ Equipment Criteria
- ◆ Reliability/Redundancy
- ◆ Equipment cut sheets
- ◆ Equipment data sheets

SUBJECT: Seacoast Utilities PGA WWTP Expansion to 7 mgd -
Activated Sludge System

DATE: January 11, 1988

PREPARED BY: Rich Mines

PROJECT: SE24262.A1.05

INTRODUCTION

This technical memorandum (TM) summarizes design criteria, equipment requirements, and operational procedures for the activated sludge system at the Seacoast Utilities PGA WWTP. A discussion of the following components of the activated sludge system are presented in this TM:

- Aeration Basins
- Aeration-Basin Influent Splitter Structure
- Secondary Clarifier Flow Splitter Structure
- Secondary Clarification
- Return Activated Sludge (RAS) Pumping
- Waste Activated Sludge (WAS) Pumping Scum Pumping

DESIGN CRITERIA

Design criteria for the activated sludge process design are tabulated in Table 3-1. The aeration basins and secondary clarifiers are designed to treat a maximum month average day flow (MMADF) of 7.0 mgd and a maximum month BOD₅ and TSS load of 11,700 pounds per day. They will hydraulically pass a peak hourly flow (PHF) of 18.3 mgd with one basin out of service.

AERATION BASINS EQUIPMENT REQUIREMENTS

Two new concrete aeration basins with the following dimensions will be constructed to meet the demands for the

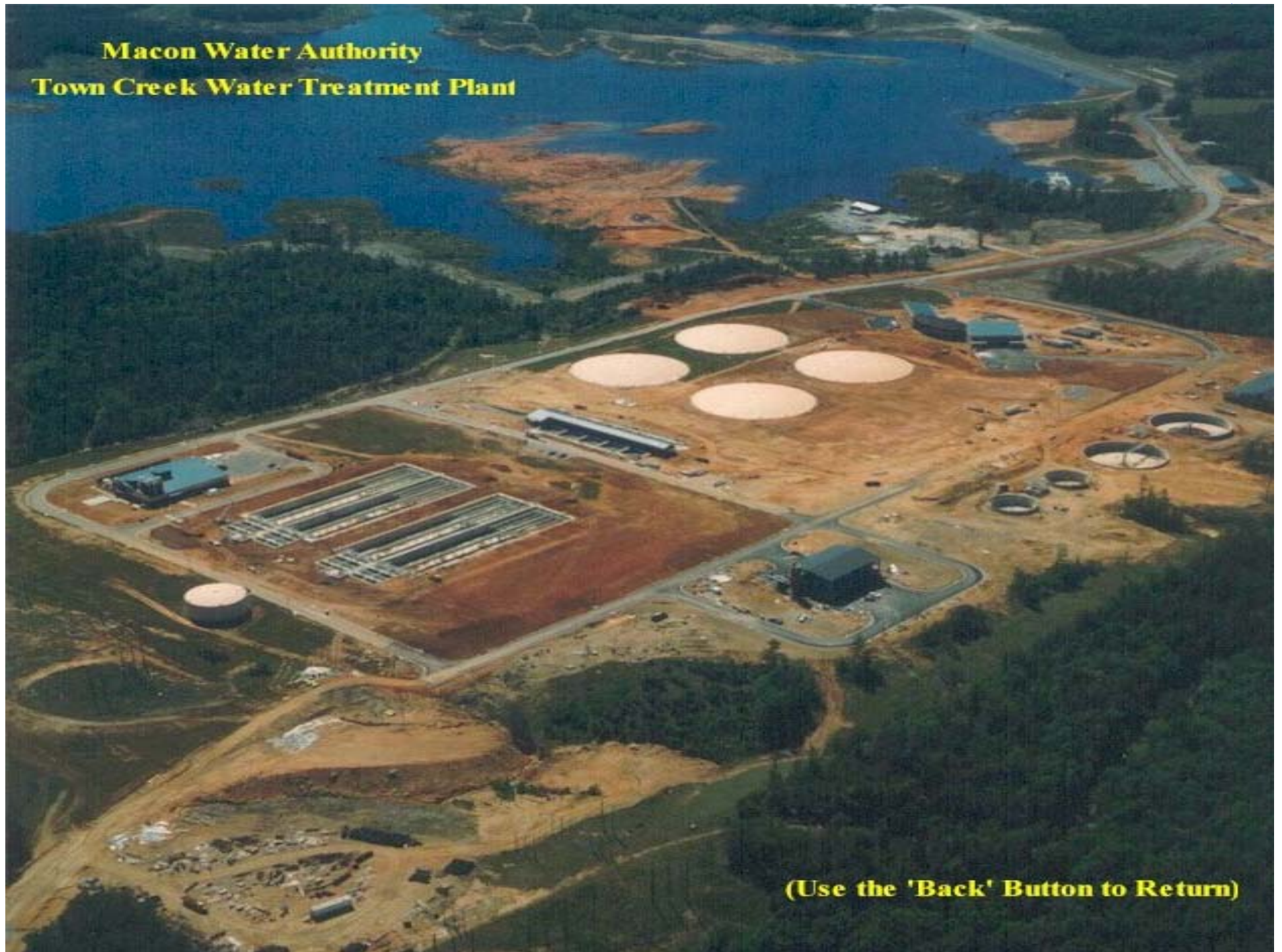
TMs- Scores

- ◆ Average for TM-1 was 87
- ◆ Average for TM-2 was 83
- ◆ Average for TM-3 was 88
- ◆ Two groups enjoyed working together.
- ◆ One group would have preferred to have done the project individually.

Field Trip

- ◆ 2- to 3-hour field trip taken to the Macon Water Authority's Town Creek WTP.
- ◆ Students wrote a 1- to 2-page report on the unit operations and processes.
- ◆ Average on field trip report was 88.
- ◆ A set of questions will be handed out prior to the field trip the next time the course is offered.

**Macon Water Authority
Town Creek Water Treatment Plant**



(Use the 'Back' Button to Return)

Lab Experiments

- ◆ Two laboratory experiments were conducted in the Environmental Engineering laboratory.
- ◆ Students ran the experiments but did not have to make up the reagents or set up the equipment.
- ◆ One experiment was on coagulation & flocculation and one on adsorption.



Video

- ◆ A video showing the unit operations and processes used for treating a surface water was shown early in the semester, and prior to field trip.
- ◆ The students gained a better perspective of the water treatment process.

Summary

- ◆ 6 activities integrated into course.
 - Preliminary design
 - Technical paper
 - Team design project
 - Field trip
 - 2 laboratory experiments incorporated into class
 - Video tape of WTP shown in class

Conclusions 1

- ◆ Students liked working on the open-ended design project but preferred to work individually.
- ◆ Students learned how to perform a literature review and the frustrations of using interlibrary loan.
- ◆ Students enjoyed going on the field trip to the water treatment plant.

Conclusions 2

- ◆ Incorporation of two laboratory experiments into the course was well received and stimulated interest in the course.
- ◆ Showing the video on the water treatment plant helped the students to understand the sequence of processes necessary for treating a surface water.

Conclusions 3

- ◆ Students were not accustomed to working in small groups during class time, however, their comments on the course evaluations suggest they learned from each other during these in-class exercises.

Happy Trails to You!!!

Dr. Mines

