Unit Ops: Guidance for Final Design Project

This supplements the guidelines I posted for you earlier. For each component of the final project, I am listing some additional specific things you should consider including that were not with in the scope of the corresponding Design Assignment (homework). You are certainly free to think up or research additional things, and I will give extra credit accordingly.

Note that in most cases listed I want you to present several design alternatives and then select one and justify the selection. This is a crucial part of real-world design process. You don’t have to spend endless hours on this; just dig up a few alternatives (can even be straight from the textbook, or else do some web surfing) and then provide a reasonable basis for your choice. Keep in mind that simplicity and low cost are always components in your justification, especially for a small system.

Water Flow Forecasting, Headworks, Pretreatment Water storage:
Work up flows (peaking?) and make them available this week to bother project teams via email to Susan Wacaster. Look at several types of available screening and pre-treatment devices, specific to water treatment. Get chemical and temperature data at the following DEQ website:

http://www.deq.state.or.us/wq/lasar/StationLocatorCriteria.htm

Search for Elk Creek and then look for “Elk Creek at Hayhurst Road (Drain)”. Use your judgement about coming up with some average values as guidance, within the limitations of the posted data. (E.g., seasonal variation?)

Water Clarifier
Consider improved design using lamellar or tube clarifiers. A lot of product info is available on the web. Here are two good sites to get you started:


http://www.enviroaccess.ca/fiches_3/F3-06-96a.html

Also, provide total solids flow and estimates of solids content, specific gravity of the sludge.

Water Softening
Basic softening will follow the approach and conditions used in DA-5. In addition, please consider a more practical recarbonation system that uses pure carbon dioxide instead of aeration. Calculate the CO2 demand and estimate the cost of providing the CO2. Also calculate a value of the calcium carbonate saturation index for your finished water, using a method such as that proposed by Langelier. I can provide info on the Langelier index.

Water Filtration/Backwashing
Specify all filter-bed materials with details of characteristics. Look at several types of available proprietary underdrain systems. Consider all the main operational regimes (e.g., constant flow, constant head, declining flow) and choose among them with justification. Specify anticipated backwash schedule with justification. Provide a simple hydraulic analysis that shows you will
provide adequate head at all time to drive the system. Account for the backwash water when designing for overall throughput.

**WW Flow Forecasting, Headworks, Pretreatment;**
Work up flows and make them available this week to other project teams. Look at several types of available screening and pre-treatment devices, specific to waste-water. Consider comminutors and grit removal systems for wastewater. Analyze expected amounts of waste products to dispose of. Allow for adequate storage of water and propose a structure. Communicate with Sharzad dey on odor control.

**WW Primary clarifier/Odor Control**
Consider the relative merits of square/rectangular versus circular basins. Look at several types of available sludge collection systems and don’t forget scum removal systems for waste water clarifiers. Provide estimates of solids content of the sludge. Discuss odor control technologies and “good neighbor” plans. Coordinate odor control for primaries with odor control of headworks.

**Activated sludge/aeration basin & secondary clarifier**
Look at several types of available aeration systems and choose one; provide basis for your decision. Consider the basic variations on conventional activated sludge process such as plug-flow versus fully mixed; step aeration or tapered aeration. Make a decision as to which to use and justify it. The shape and layout of the aeration basins should reflect the type of process chosen. Calculate the amount of air that must be supplied.

**Nitrification/Denitrification**
Look at several types of nitrification/denitrification schemes, such as those outlined in the supplemental notes or as found on the web. Analyze and discuss advantages of the different approaches and then justify your design. In discussing systems that add carbon (as in methanol) estimate the cost of the methanol as a factor in the treatment costs.

**Sludge Digestion & Dewatering**
Look at several types of available dewatering systems; choose and justify. Discuss the sludge handling systems needed for each type of sludge. For WW, identify and justify a digestion regime, along with expected yields of gas by-products.

**Water Disinfection, WW Chlorination/Dechlorination**
Look at several types of available chlorinator systems. Illustrate the system chosen and how it works (basic schematics). Identify safety features of the system. Incorporate safety features into the area or structure in which the chlorination system is located (ventilation, detectors, alarms, windsocks, etc). Identify issues surrounding chlorination and dechlorination of waste water. Identify the dechlorinating chemical and justify. Include all chemical costs.

**Water Coagulation/Flocculation**
Look at several types of available chemical mixers, flocculation systems including circular combination units. Account for the revised flow estimates. Provide sludge volume and characteristics so that the sludge handling team can use your data. Provide all chemical costs. Consider tracking down some info on chemical handling systems.
Project Manager: Make sure you get water and wastewater flow data as soon as possible and send that to all so that everyone is using a consistent design flow. Look over the characteristic layouts shown in the text, and make sure that various people are communicating about the amount of flow or solids that pass from one unit op to another.