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Water System Analysis

by Glenn D. Cooley, PE

Do your Fire Underwriter's reports show inadequate hydrant flows? Do you have flow or pressure problems in portions of your water system? We would like to take this opportunity to explain some services which we can provide for your water system. These include one or more of the following:

1. Create a computer model of your water system, permanently stored in computer memory.
2. Provide an analysis of proposed water main loops to determine their effectiveness.
3. Provide fire flow or other analysis at various locations within the water system.

There are several advantages to having the water system "computerized". First is the availability of future analysis. Once the system is stored on the computer many questions requiring complex calculations can be answered in a matter of a few hours, rather than a few days simply by recalling the system details from computer memory.

Second, the number of possible situations that can be considered are almost unlimited. Some of these theoretical cases could be:

- If a new industry wants to move into the area, can the system supply water at the flow and pressure the industry requires?
- Can the system supply the necessary fire flow to a proposed apartment complex?
- Where and what size water main do we need to correct the fire flow (or pressure) problems on "Any" Street?
- If there is a fire at the factory what will the water pressure be at the hospital?

Third, since the computer analysis is so fast, we can consider many different alternates to a flow or pressure problem. Thus we can compare the alternates for economy and select the one which gives the largest flow (or pressure) increase per construction dollar.

Complete water system maps are an important part of your infrastructure system. Often maps are outdated and do not show all the latest modifications or new construction. This makes analysis or planning difficult. With your existing maps, plans and assistance we can update your system maps. We also can restore old, non-printable maps to good-as-new condition using modern CAD technology.

Removal of Trace VOC's by Air Stripping

by Jeffrey C. Bahret, PE

It is becoming very common to suddenly find that your long standing groundwater supply is contaminated with Volatile Organic Compounds (VOC's). These trace quantities of toxic organic chemicals have a very low maximum contamination level (MCL), as determined by the New York State Department of Health (depending on compound; MCL's as low as 0.2 parts per billion). The VOC's become part of the groundwater aquifier by long term percolation of leachings from chemical industry waste, originating many times miles away from your public water supply well. Additionally frustrating, is that finding the point source of these contaminants has a needle-in-a haystack demeanor and, therefore, can be perpetually unknown.

The discovery of toxic effects of VOC's and the gradual revelation of the awesome scale of groundwater contamination has placed "air stripping" in a clear and urgent focus of attention during the past several years. The long, seemingly endless, debate in learned circles about relative carbon absorption, diffused oxygen aeration and other methods of removal of VOC's appears to be realistically resolved, placing air stripping clearly at the top of the list.

The mechanism of air stripping is that contaminated water is dispersed suitably on the surfaces of the packing as a thin film. Uncontaminated air is introduced at the bottom of the packed column. In accordance with defined physical laws, molecules of the dissolved "solute" (VOC's) are driven to cross the water/air interface in an attempt to reach a natural equilibrium of concentrations in air and water. It is evident from this visualization that the amount of air supplied (driving force) for a given amount of water is a key consideration in the stripper design.

"What compounds can be stripped?" is a pervasive question with very elusive answers. The key to the feasibility of air stripping a given organic chemical compound is in a physical parameter associated with that compound, called Henry's Law Constant ("H"). While leaving the proper definition of Henry's Law constant to the textbooks, we will attempt to relate it here in more popular terms. Henry's Law states that partial pressure of a chemical component in the air (evaporated from water) is directly proportionate to its concentration in water. The Constant "H" (the ratio of the partial pressure and the concentration) reflects the magnitude of such pressure. The "H" value can thus be seen as a measure of aggressivity with which molecule of the contaminant can cross the water surface to become airborne during air stripping. Therefore, the "H" value defines a predisposition of a compound for air stripping. A number of selected VOC's are ranked in the following chart in accordance to their Henry's Law Constants:

As indicated at the right of this chart, the lower the "H" Constant, the more difficult it is to remove these VOC's by the air stripping process. In these cases, it is normally necessary to employ some type of Absorption Treatment Process.

100 Vinyl Choride 10 (O_2) (CO_2) Tetrachloromenthane (CTC) Tetrachloroethene (PCE) Trichloroethene (TCE) 1	"Easy to Strip"
1,1,1 Trichloroethane (TC) Toluene Benzene 1,2 Dichloroethane 0.1 1,2 Dibromoethane (EDB) Methyltert-butylether (MTBE) 1,1,2,2 Tetrachlorethane Naphthalene Phenanthrene 0.01	Perceived as "difficult to Strip"
1.2 Dibromo-3 Chloropropane (DBCP) Di isopropylmethyl phosphonate (NH_3) Pentachlorophenol 0.001 0.0001 Endrin Dieldrin 0.00001	Generally labeled as "Not strippable" or "Not feasible to Strip"

Project Inspection – A Valuable Investment

by Christopher M. Ernst

Having a qualified person to inspect a construction project is very important. The project inspector is responsible for assuring that the project is constructed correctly, serving as a liaison between the contractor and the design engineer and the owner and for recording all events that take place at the construction site. The inspector will keep the contractor honest and will be able to provide the contractor with assistance in interpreting the design plans and specifications. The inspector can also provide valuable information for as-built plans and will be able to record the location of existing utilities and other facilities within the project site. This service can be provided by someone that

works for the individual or agency that owns the project facility, the agency that is funding the project, a firm that specializes in construction management/inspection or by the engineering firm that designed the project.

The choice that is often made by the owner or the funding agency is to provide their own inspection as a means of saving money, especially on smaller projects or when the project funding is limited. The question then becomes is this truly the most cost-effective and efficient decision that could be made? The answer to this question will most likely vary depending on the individual situation. The factors to consider when deciding whether or not to use your own workforce to inspect a project are the qualifications of the proposed inspector(s), the complexity of the project, the ability of the proposed inspector(s) to provide thorough inspection while maintaining their daily responsibilities, or the effect of removing the proposed inspector(s) from their daily responsibilities in order to provide full-time inspection.

An alternative source of inspection is the use of a firm that specializes in construction management/inspection. The positive aspect of using this type of firm is the fact that you will have a qualified person on the job site. The downside is that the inspector will most likely have no knowledge of the project prior to construction. The progress of the project may be slowed due to the inspector having to check with the design engineer on every issue as opposed to having the authorization to make field decisions.

Using a qualified inspector from the engineering firm that designed the project is the best choice if the funding is available. The inspector will be able to communicate directly with the engineer that designed the project. There is also a possibility that the inspector may have been involved with the design, therefore enhancing his or her knowledge of the project prior to construction. Changes in the design during the construction phase due to field conditions will be more efficient due to the direct relationship of the inspector to the design engineer. The cost of paying for a full-time inspector has been found in some cases to be less than the cost for making corrections for errors or oversights that were not caught during the construction because of a lack of inspection. Periodic or part-time inspection may be one way of reducing the cost, but this can also be as dangerous as having no inspection at all. An error may occur between inspections that can result in the project not being completed correctly or on budget.

Inspection is a topic that should be considered early by an individual or an agency looking to complete a construction project. The owner must remember that having a full-time inspector on the job is like having an insurance policy. No one likes to pay the premiums for the policy, but having a project done correctly and on budget will be worth the investment.

Mapping Assistance

by Al Vanderpoel

We are fast becoming a country with more and more restrictions placed in front of us before we can buy land or construct a project. Mapping is one of those areas that government agencies want to know more about, including everything from flood plains to wetlands to tax parcels, and everything imaginable in between.

The list of information required to be included with a parcel intended for development can be mind boggling. But, the resources to assist with the mapping are here. As an example, I will list the maps available for my home area, McKean County.

- Detailed maps with ground elevations are available on the USGS topographic maps.
- Tax parcels are shown on the municipal tax maps which are prepared by McKean County.
- Soil types are plotted in the “Soil Survey of McKean County”, by the USDA Soil Conservation Service.
- Wetland delineations are shown on “National Wetland Inventory” by the Department of Interior and plotted on USGS topographic maps.

- Floodplains and floodways are delineated on maps prepared by the Federal Emergency Management Agency.
- Water supply lines are shown on the construction and as-built drawings for the municipalities and the Bradford Water Authority.
- Sewer lines are shown on the construction and as-built drawings for the municipalities and the Bradford Sanitary Authority.
- Storm water management runoff release rates are plotted for the Tunungwant Creek watershed by McKean County.
- Oil and gas wells are shown on the Pennsylvania Geological Survey Maps, and Warrant Maps of McKean County.
- Historical data for the municipal areas is found in the Sanborn Fire Maps of the early 1900's.
- Boundary surveys for literally thousands of parcels are on file in the office of E&M Engineers and Surveyors.
- Maps of the old railroad lines, state and municipal road construction, and land development are also on file.

These resources are invaluable in the land development projects that we are involved in and all these maps are available to E&M Engineers and Surveyors. There can be major setbacks to a project if the up front research is not done properly. For instance, the discovery that a portion of a parcel of land is a floodway is information that a developer needs to know before they plan for the use of that parcel.

At E&M Engineers and Surveyors, we can assist with all these mapping needs. Whether you are planning a major subdivision, or a simple parking lot expansion, the old addage that an ounce of prevention is worth a pound of cure is more true than ever.

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