The AquAeTerian

Quaerendum acutulibus modis – Searching for smarter methods   volume 17 | spring 2012

The President's Corner

AquAeTer turns 20 years old in August of this year. We began 2012 with some new and exciting projects, as well as, continuing on projects for clients who have worked with us since our beginning in 1992. We have added some new staff and are continuing to grow in size and capabilities. Paul Marotta in our Brentwood office has hired Kelley Spence, a regulatory specialist. Kelley has been thrown into the fire and is working with Chris Bolin, Chrisie Brown and Misty Huddleston on a fate and effects analysis of chemicals on humans, terrestrial plants and animals and on water species. Paul and Bob Stein are working on several wastewater projects to optimize performance of ASBs and prepare upgrade analyses to activated sludge replacement units to decrease capital and operating costs.

Chris Green and Mandy Alvis are working on Phase I, II and III projects for commercial real estate sites and for telecommunication towers. Chrisie Brown has been assigned as our litigation project director and has been assisting on several expert reports in the areas of toxic tort, air pollution, water quality and risk analyses with help from Natalie. Pam Hoover is working with her team on numerous permitting projects including NPDES, Air Permits, RCRA compliance and TRI reporting. John Michael has led his team of Miriam, Chris Sliger and Richard Rogers on dispersion and diffuser design projects on the Delaware River in New Jersey and the Mississippi River near Baton Rouge. His team came up with a unique design to maximize dispersion and prevent re-entrainment in the two-dimensional flow tidal Delaware River. Miriam Sielbeck and Misty Huddleston continue to work on a Use Attainability Analysis of a swampy, forested wetland system. The first of two each for fisheries and macrobenthos field collection events has been completed.

Annual Easter egg hunt at Beech Grove. Donkeys courtesy of Jeni's Pony Parties.

Chris Bolin and Steve Smith are finishing up their work on Life Cycle Assessments for treated wood products for the Treated Wood Council (TWC) and now have three "peer-reviewed" articles published. Steve continues to direct work on the Multi-State Trust on old Kerr-McGee/Tronox wood treating sites. Dan, Terra, Trey and Laura are spending many hours in the field collecting groundwater, soil samples and landfill gas samples.

In closing, we continue to have numerous challenging projects and look forward to assisting our many clients. We thank you for continuing to put your trust in us for assisting you on your most demanding projects.

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STREAM RESTORATION

Misty Huddleston, Ph.D.

Stream restoration describes a set of activities that are intended to assist in recovering or improving the overall chemical, physical, or biological health of a river or stream. Stream restoration is often undertaken in order to renew or restore streams that have been degraded, damaged, or destroyed to a point that requires human intervention or manipulation. Streams may be impaired in a variety of ways that include lowered water quality, impaired or degraded habitat, or altered structure and function of the stream channel itself. Stream impairment may be the result of a variety of factors. A few potential sources include logging, dam construction, agriculture, hurricanes, floods, adjacent human development, and other contributors of point source and non-point source pollution. Regardless of the source of impairment or the degree to which a system or stream has been altered, restoration ecology provides a set of definitions, analytical tools, and protocols to follow when undertaking an ecological restoration activity.

Restoration projects can be quite different in their objectives and in the methodology chosen to reach those goals. Restoration activities may be designed to replicate a pre-disturbance ecosystem or to create a new ecosystem where it had not previously occurred. A restoration project may aim to reestablish a natural channel design or to eliminate sources of erosion and sedimentation. Other potential project goals may include improved water quality, increased habitat quality, or augmenting or restoring populations of native, aquatic organisms. The primary goals of the project will help determine the specific restoration activities that will be conducted. Some examples of potential goals of restoration activities include the following:

- Establishing a streamside management zone- the re-vegetation of the stream banks to a width that will serve as a buffer for erosion control and help protect water quality from urban or agricultural runoff;
- Habitat enhancement- the process of increasing the suitability of a site as habitat for some desired species. Each species of fish, for example, has a specific habitat requirement. A restoration activity may aim to increase the quantity of a particular type of substrate in order to provide spawning habitat for a native species;
- Remediation - improving an existing ecosystem or creating a new one with the aim of replacing another that has deteriorated or that has been destroyed; and
- Mitigation - legally mandated remediation that is intended to offset an activity that is a known impact to existing or historic natural resources, such as streams, wetlands, endangered species, or archeological sites.

Regardless of the project goal, the restoration activities are usually designed to bring the stream to a point that resembles a reference stream condition. The reference stream is often an adjacent, undisturbed stream site that represents the pre-disturbance condition of the project stream. The reference stream will help provide insight into the ecosystem's historical species composition and functions. Once the final end point is been determined, the proper techniques to achieve that end point may be selected.

Restoration Techniques

Channel Modification. The next phase in a restoration project is to determine which techniques to use. The specific suite of techniques used will depend upon the goals of the project. Often the intended goal of a restoration project is to reestablish natural channel morphology to address issues with channel degradation and energy dissipation. Such changes will impact stream velocity, turbulence, scour, and sediment volume and bankfull depth. Channel modifications may include altering the channel shape by correcting stream sinuosity or meander characteristics, stream cross-section, or channel profile. Altering stream channels may also result in improved habitat for riparian plants and the wildlife that use those areas. However, special care must be taken to ensure that modifications are planned properly in order to avoid excessive erosion or other damages that may occur as a result of improper or poor planning.

Tagging the source population with Visible Implant Elastomer (VIE).

Addition of Structures. Channel modifications are one technique utilized to reduce velocity and dissipate energy, but other techniques include the introduction of cross-vanes, w-weirs, J-hook vanes, and engineered log jams. Cross-vanes are U-shaped structures composed of logs or large boulders that are installed across the stream channel. The size and placement of these structures assist in the reduction of bank erosion and stream velocity, and also provide benefits such as improved habitat for aquatic species like fish and crayfish. Engineered log jams, or large woody debris, are one other technique utilized to reduce velocity and dissipate energy. However, the introduction of large woody debris to the stream system has the added benefit of providing food for benthic macroinvertebrates and shelter and spawning habitat for fish.

Re-vegetation. Another major component of stream restoration projects is re-vegetation of the stream banks or riparian corridor. Stream riparian vegetation plays a crucial role in moderating stream temperature and dissolved oxygen levels, and serves as a food resource for benthic macroinvertebrates. Returning a stream to a more vegetated state will more closely mimic the natural condition of the stream channel and further assist in the recovery of the project stream. It is important to select and plant native plant species and to provide a buffer width sufficient to reduce the impacts of erosion and sedimentation. Certain species of plants and trees are selected for their ability to anchor the stream bank and provide an additional buffer against stream bank erosion, while other species are selected for their attractiveness to wildlife.

Species Reintroductions. Another important consideration in any stream restoration project is the recovery of the aquatic species within the project area.

Gilt Darter (Reintroduced Species)

Upon completion of a stream restoration project, many of the larger species of fish will move into the newly designed stream reach from areas upstream or downstream from the project area. However, research has shown that many smaller species of fish, such as minnows, darters, and sculpins, are limited in their ability to move large distances within a stream reach. The limited home range of these species often prevents them from moving up or downstream into the project area. Under these circumstances, it is often desirable to undertake a species recovery or restoration project.

The first step in such an undertaking involves examining the historical records of the stream and project watershed to determine which species should be present within the affected area. Species restoration or reintroductions are a complicated process that requires the cooperation and involvement of a variety of stakeholders including governmental and non-governmental organizations, state and federal biologists, and other interested parties or volunteers. The process may involve supplementing small populations that are already present, translocation specimens from an adjacent stream within the same watershed, or captive propagation to rear specimens in a quantity sufficient enough to reestablish natural, reproducing populations. Species reintroductions require annual monitoring and often result in adjustments to techniques or stocking effort.

The professional staff at **Aquaeter** is here to assist with your stream restoration, mitigation, and species recovery projects.

Misty Huddleston has over 7 years experience in fisheries and benthological sampling, identification and assessment. She holds a Ph.D. in Natural Resources, a M.S. in Wildlife and Fisheries Science, and a B.S. in Wildlife and Fisheries Science from the University of Tennessee. She is currently directing fisheries and benthological data collections and identification for a Use Attainability Analysis in Arkansas. Ms. Huddleston has significant experience in stream restoration and restoration ecology including experience translocating species into recovering water bodies.

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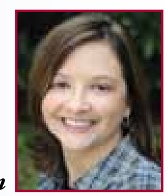

AquAeTer NEWS

In searching for smarter methods…

AquAeTer now uses Geotech's EnviroData® database software to streamline the process of data management. Analytical data or electronically generated data from the field are imported directly into the software database and in many cases include geospatial referencing. The software allows us to analyze, query and report the data more efficiently than in the past. In addition, the software communicates well with ArcGIS® for a more fluid process when creating comprehensive maps and figures to help our clients better understand complex data.

James H. Clarke, Ph.D. was just approved as a Board Certified Environmental Scientist (BCES) by the American Academy of Environmental Engineers and Scientists.

Misty Huddleston, Ph.D. received certification in Wetlands Delineation, Restoration, and Repair in Tennessee. She also attended Erosion and Sediment Control Level I in Tennessee.

Pam Hoover and Mandy Alvis attended the TDEC Hazardous Waste Annual Report Workshop Writing Seminar.

Miriam Sielbeck participated in the Aquatic Science Risk Assessment Model Workshop given by WWPI.

Chris Green attended Applications of Groundwater Geochemistry seminar given by the National Groundwater Association.

Chrisie Brown and John Michael Corn attended the DRI Toxic Tort Seminar this year.

Passive Groundwater Sampling

Dan Gezon, EI

Groundwater sampling can require a "truck-load" of equipment to prepare for sampling, and requires removal of water (sometime large volumes) before sampling, obtaining samples, and then cleaning sampling equipment before using it at the next well. But, depending on the type of data that are needed, the process can be much less complex and require much less equipment.

Traditional groundwater sampling methods use pumps or bailers to remove "stagnant" purge water from the well, with the volume removed based on the well size or stabilization of field parameters (like temperature or pH), and then the collection of samples using pumps or bailers. Meant to represent natural conditions of the surrounding water-bearing zone, these methods are widely accepted as the correct ways to collect representative groundwater samples, but properly dealing with purge water, particularly when contaminated, can add to the complexity and cost of sampling. Even when very carefully employed, purge sampling methods result in some amount of disturbance of the water in the well. Within the past decade, a more passive form of sampling has gained acceptance as a viable alternative.

Passive Sampling works on the principle that water within the screened interval of a properly constructed well represents natural groundwater conditions. Each type of passive sampling relies on placing a sampler inside the well for an equilibration period so that the sample collected represents natural conditions. After equilibration, the sampler is removed and the sample is collected. Passive samplers come in three types including diffusion samplers, equilibrated grab samplers, and accumulation samplers.

There are several advantages to using passive sampling vs. purge sampling. First, they can provide samples representative of "natural conditions" because they remain in the well for an extended period without agitating the water column. This eliminates human introduced sample turbidity and the possibility that a non-soluble or non-mobile contaminant will be introduced into the sample. Passive sampling does not result in purge water that must be disposed. Using passive samplers can reduce field time and cost.

This quarter, we'll focus on diffusion samplers. The diffusion sampler can be placed in a discrete location within the water column, where it represents the condition of groundwater at that depth. Based on this principle, multiple samplers can be placed at desired intervals through the water column to determine if and/or where there is contaminant stratification.

Diffusion samplers follow Pick's Law of Diffusion where dissolved chemicals move from areas of high concentration to areas of low concentration. In diffusion sampling, the movement occurs through a membrane, until both sides of the membrane have equal constituent concentrations. The time to achieve equilibrium can vary, but most constituents equilibrate within two weeks. Since the analytes must travel through the membrane to be included in the sample, only certain analytical results can be obtained from these methods. Generally this method is used for Volatile Organic Constituents (VOC) sample collection; although some other analytes do pass through certain types of diffusion membranes including explosive compounds, soluble SVOCs, and some trace metals.

This method is particularly advantageous for one-time or multiple-time monitoring for VOCs in groundwater, and is accepted by most Federal and State agencies.

We'd be happy to talk to you about the applicability of passive sampling at your project location!

Dan Gezon, EI has almost 3 years experience with ***AquAeTer*** *in environmental and civil engineering related projects. He holds a dual B.S. in Civil Engineering and Environmental Engineering from Michigan Technological University. Mr. Gezon has experience in groundwater monitoring, environmental permitting, solid and hazardous waste management facilities, water quality studies, hydrogeology studies, water and wastewater treatment and conveyance, air quality engineering, and water resource engineering. He has participated in preparation of landfill design documents, including design drawings and specifications, and has overseen landfill cell construction and CQA for landfill liner installation and repair.*

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