ANGLE and LINE

A Quarterly Newsletter by COWAN ASSOCIATES, INC.
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STREAMSIDE BUFFERS

by Jeffrey L. Schroy, SET, CPESC

Streamside buffers are one feature that is often overlooked. Streamside buffers are also sometimes called riparian buffers. A buffer is a permanent area of trees and shrubs located adjacent to a stream. Continuous buffers provide better stream shading and water quality, protection, and corridors for the movement of wildlife. Streamside forests are the most beneficial type of buffer for they provide ecological and water quality benefits. When land is developed along a stream, the existing streamside buffer is often reduced in size or completely removed. Streamside buffers are important because they improve water quality by filtering pollutants, prevent erosion, stabilize stream banks, provide habitat, and provide nutrients to the stream.

Streamside buffers include the stream, its banks, the surrounding flood plain, low-lying meadows and any connected wetlands. Flood plains are flat, low-lying areas along streams or waterways that provide a place for rising water to go during floods. Meadows are fields without tree cover and, in low-lying areas, become part of the flood plain. Wetlands are areas of land that are saturated with water throughout most of the growing season.

Both the plants and soil alongside the stream make up the streamside buffer. Plants generally in a buffer are meadow grasses, shrubs, trees or any combination of these. The ideal buffer is 35 to 75 feet wide. The plants and soil nourish while they also protect the stream. Trees and plants growing here play a critical role in keeping the stream healthy. To improve or enhance a streamside buffer, plants that are native to Pennsylvania should be used. Shrubs will give the buffer a quick start because many reach full size in just a few years. Planting the right trees and shrubs can be quite inexpensive to establish and maintain. The area of the buffer directly adjacent to the stream should have native tree species and grasses or some type of groundcover to protect the streambank. The remainder of the buffer is usually planted with perennial grasses. Plants create habitats, providing food and shelter for wildlife. Wildlife can include butterflies, frogs, turtles and birds.

Streambank buffers provide greater resistance to runoff flow than maintained lawns, slowing the rate at which heavy rains enter streams and rivers. Runoff from a lawn can be almost as great as the runoff from asphalt. A healthy buffer slows surface runoff and retains water after a runoff event. This retained water then deposits nutrients and sediments into the ground and recharges the groundwater. Seeping runoff into the ground filters out toxins such as herbicides, pesticides and excess fertilizers that can contaminate the stream.

Roots of trees and shrubs form a network or physical barrier that holds solids and prevents the soil from being washed away during heavy rains. Grass roots are shallow and are not as effective at holding a stream bank or reducing flooding. Well-planted buffers with deep root systems hold the soil in place and control erosion. Erosion of the stream bank removes topsoil and essential nutrients. Washing of sediments into the stream destroys vital habitat. Plantings in the buffer slow and diffuse the energy of the floodwaters and reduce damage downstream. Shade from trees and shrubs reduces the growth of algae and keeps the water cooler. Cooler water is essential for water quality and local aquatic life.

Every stream carries fine particles of soil. Too much soil in the water can choke the life out of a stream. Sediments clog the streambed, covering rocks and gravel. Silt and sediment are generated from construction and farming activities. Stream pollution comes from manure, fertilizers, road salts, oil and other chemicals.

There are some potential threats to the long-term viability of plants in the buffer. These include overgrazing by deer and other animals, and plants that cannot survive frequent or prolonged flooding conditions. Farm animals cause the greatest damage to streambanks. Trees in the buffer must be species that can withstand high water table conditions.

One of the most important benefits of a streamside buffer is the creation of habitat. Plants along the banks of a stream contribute to the aquatic food chain, providing shelter for

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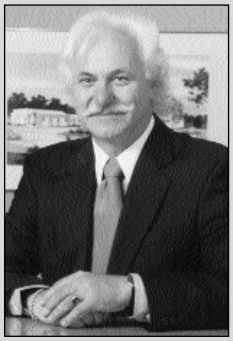
PRESIDENT'S CORNER



You may recall the news story from last December, covering the unfortunate event of a family with two small children getting lost on a mountain road in the Oregon wilderness. The father perished while hiking out to get help; the rest of the family was found and rescued almost two weeks after getting lost.

Making a shortcut through unmaintained mountain roads late in the year when freezing conditions and snow are predictable should be an unacceptable risk for most of us. However, a trained park ranger or rescuer familiar with and driving these same roads in a four wheel drive, equipped with satellite communication capability and survival gear, may constitute a totally acceptable risk.

Risk assessment is something that we all need to do for any of our activities if we wish to remain "relatively" safe. What I mean is that there is no absolute safety. We would like to believe that we can be totally safe, that we can lead our lives without risk, and that we can have a zero loss experience. We can, if we do nothing, produce nothing, operate nothing, and have no interaction with the environment.

However, since this is not reality, we must adjust our expectations to a concept of "relative" safety. What is safe to you may not be safe to me, and may be reckless to someone else. Our human nature makes us drive on the rush of adrenaline induced by risk. Consider how popular television shows are when depicting people risking life and limb in automobile racing, practicing what is known as "extreme sports," or animal shows where hosts take, in my view, irresponsible risk not only to themselves, but family members and coworkers as well, when they wrestle crocodiles or catch and provoke poisonous creatures for no other reason than to convey a risk rush to spectators. We may also enjoy a calculated risk rush by going to amusement parks or practicing some of the riskier sports ourselves.

However, in our ordinary lives, be it on the job, using public transportation or even driving our own cars, entering buildings or walking on sidewalks, we want to be "totally" safe. I am certainly not advocating that we have to accept accidents "as being part of our daily lives," I am only trying to illustrate that there are different levels of safety expectations that are appropriate to different situations.

From my forensic practice experience, which includes investigating and analyzing accidents, I learned the importance of understanding the concept of relative safety and incorporating that into our design and engineering work. But all of us need to be mindful that we have to make not only our environments and products as safe as possible, but also our conduct.

All of us are in certain ways designers, engineers, operators and maintainers of equipment and facilities. The safety engineering community has developed specific standards which can be summarized in the principle of a safety hierarchy.

This safety hierarchy consists of four basic actions we need to pursue to manage risk and remain relatively safe:

1. Design, build, fabricate, operate and maintain equipment and facilities for minimum hazard. Elimination of hazards or mitigation by appropriate fail-operational/fail-safe combinations like groundfault protectors or shatterproof glass should be our highest priority.

2. Install safety devices. Not all known hazards can be eliminated through design selection, but can be reduced to an acceptable level through the use of appropriate safety devices. Such devices are to keep people separated from hazardous zones, which includes guards and barriers to protect, for instance, people from falling and flying debris.

3. Provide warning devices. Where it is not possible to preclude the existence or occurrence of a known hazard, devices shall be employed for timely detection of the hazardous condition and generation of an adequate warning signal to warn of impending failure or hazardous conditions. This includes signs to warn of unanticipated steps in buildings, energized electrical lines, placement of traffic cones or provision of visual cues like painting the vertical gap of sidewalk slab separations, or audible cues like the back-up signal of trucks and construction equipment.

4. Special procedures and training. Where it is not possible to reduce the magnitude of existing or potential hazards through design, use of guards or warning signs, special operational procedures must be developed to counter hazardous conditions and enhance relative safety. This may include specific operational instructions, training and personal protection equipment such as safety goggles, shoes, rubber gloves, hearing protection, and similar devices.

Following this concept of a safety hierarchy is mandatory for us in the design and engineering community and will also manage your risk when you follow it to the extent you can. A safer you is a safer me.

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aquatic species by adding organic debris to the water. A buffer provides a stream with up to 90% of its nutrients in the form of fallen leaves. The food chain of a healthy stream starts with leaves falling into the stream. Buffers improve the habitat for stream-dwelling animals and woodland animals that require a nearby water source.

Taking care of streamside buffers should include management and maintenance guidelines. Buffers should be monitored to maximize wildlife habitat and water quality. The condition of the buffer should be monitored regularly and inspected after any severe storm for evidence of sediment deposit, and erosion or concentrated flow channels. Grass field areas should be mowed and the clippings removed. The use of fertilizers, pesticides, or other chemicals should be avoided.

Room Converted to Computer Lab for On-site ArcGIS Training

by Angelika B. Forndran, P.E.

Mr. William Chappell of PoconoGIS, an ESRI licensed instructor, is seen guiding the workshop participants through hands-on exercises with ArcGIS 9.2 February 22-23, 2007. The classroom participants were staff and clients of Cowan Associates. Cowan sponsored the costs of training for representatives from East Greenville Borough, Lansford Borough, and Lower Milford Township. Others were invited but were unable to attend. A room on the lower level was set up with 8 computer stations so the participants could work individually for the two days of training.

ArcGIS 9.2 is the 2006 version of ArcGIS, the evolving desktop computer program for using geographic information systems (GIS). "GIS" is a generic term for the management, analysis and display of geographic knowledge using series of information sets such as datasets, maps, and geoprocessing models. The unique feature of GIS is that all data is spatially-referenced and the database is linked to the mapping features. A variety of GIS products have been developed since the 1970's. The most common standard are the products produced by ESRI, which include the widely used products of ArcView, ArcEditor, and ArcInfo. The ArcGis desktop has updated the ease of using ArcView and expanded its capabilities; for example, communicating with other typical products such as computer aided drafting (AutoCAD) and spreadsheets (EXCEL).

Typical applications for GIS by engineering firms range from production of detailed utility maps which can show block by block features for water valves, sewer lateral connections, etc., to watershed maps showing planning features for watershed restoration and protection plans including areas of sensitive natural resources, flood plains, riparian buffers, land development projects, and potential sources of contamination. Municipalities have other typical applications such as using the tax map database to expedite billings or to identify the mailing list for specific public notifications, as well as enhancing their emergency response and police functions.

CAI has used these tools for standard applications such as overlaying tax parcel boundaries onto a watershed map and obtaining recent owners for development of easements. Another application allows for generation of aerial and topo data with new developments to evaluate need for sewer extension.

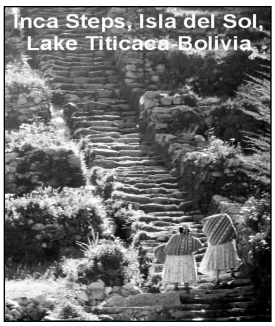
Most County planning departments are generating county-wide databases which are available to local governments and their consultants. Pennsylvania state-wide databases are also available from various sources. Staff at Cowan Associates have obtained many of the databases relevant to their clients. Working with GIS is a never-ending learning process. Tools and applications are always growing. Cowan Associates has invested in these tools and in this training to keep pace with the needs of its clients and keep improving its service capabilities. The class was fast-paced and laughter was abundant as the participants muddled through the learning process, but all the time and energies were well spent in bringing this fascinating and powerful tool to Cowan Associates.

If you have thoughts on GIS or have an application in mind that you would like to discuss, please contact Angelika Forndran, Director of Environmental Engineering, at 215-536-7075, extension 129.

STAIR CLIMBING

by Johann F. Szautner, P.E.

Samuel Johnson, the English poet and writer, quotes "The world is a great staircase, some are going up, some are going down." However, the National Safety Council reports that many are "falling" down. Deaths from staircase falls average about 12,000 a year. While some fall cases occur while ascending by tripping over the nosing or carrying a heavy load, most occur when descending and, most often, because of improper step geometry.



Caesar's architect, Marcus Vitruvius Pollio, was the first ergonomics expert by designing steps scientifically, basing geometry on the Pythagorean Theorem of $C^2 = a^2 + b^2$. The result is a 30 degree angle of incline for a normal step of about 12 inches. François Blondel, who headed the Royal Academy of Architecture of Paris, expanded on this step geometry formulation in 1672 by actually observing human step movement, and formulated this safe step geometry formula: $2R + T = 24$ to 25 inches, where R = riser height and T = tread depth. This work found its way into most of the architectural design and ergonomic texts, including codes and standards.

Today's International Building Code requires a maximum riser height not to exceed 7 inches, and a minimum tread depth to be not less than 11 inches. This requirement matches François Blondel's formula and results in $2R + T = 25$ inches.

Many of the world's important builders use stairs as a primary architectural feature. Think of the Capitol Building in Washington, D.C. or New York's Metropolitan Museum of Art.

Stairs are necessary and practical building elements, often used as architectural show pieces, which must be user friendly and safe.

From a user point of view, they require hard work against gravity and important safety features like consistent ergonomic geometry and railings.

WHAT IS 2 + 2?

Question: What is the sum of 2 + 2?

An accountant will say "What do you want the answer to be?"

A mathematician will say "I believe it is 4, but I will have to prove it."

A statistician will say "The population is too small to give an accurate answer, but on the basis of the data supplied the answer lies between 3 and 5."

An economist will say "Based on today's thinking, the answer is 4 but the answer may be different tomorrow."

An engineer will say "The answer is 4, but adding a safety factor we will call it 5."

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GIVING BACK TO THE COMMUNITY; HABITAT FOR HUMANITY

by Scott P. McMackin, P.E.

On April 14, 2007, nine (9) members of Cowan Associates had the fulfilling experience of spending time volunteering for a build day for Habitat for Humanity of Bucks County at their Emerald Hollow development in Trumbauersville.

The Emerald Hollow development consists of two phases, totaling 73 townhouse units, being entirely constructed by Habitat for Humanity. Habitat for Humanity notes that the development is considered to be one of the largest and most innovative projects in the northeast by providing affordable housing in a village concept with cluster housing and a large amount of open space.

The build day started at 8:30 a.m. and, after a short safety overview, we spent the day doing final cleaning and preparing a unit for closing, framing and erecting a second floor for a second townhouse, constructing a CMU foundation for a third townhouse, framing a garage entrance and preparing outdoor areas for landscaping. After a full day, Cowan Associates presented a contribution to Habitat and all went home for a good night's rest. Thanks to Dave Perry, Gene Marks, Rick Parker, Terry Tompkins, Jim Laubach, Katrina Laubach, Robert Whartenby, and Barry Tyson for volunteering their time. While it was the first day volunteering for many of us, I am sure it will not be the last.

Cowan Associates is proud to have been associated with Habitat for Humanity for many years, with William Kee serving on the Board of Directors of Habitat for Humanity of Bucks County. We thoroughly enjoyed our day and invite our readers to contact Habitat of Bucks County at 215-348-2204 or www.habitatbucks.org for information on volunteering.

ANGLE and LINE is published quarterly by Cowan Associates, Inc. For additional information on articles contained within contact:
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