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City of Salamanca - Titus Run Creek Stabilization
by: Sara Nuszkowski, I.E.

Residents of the City of Salamanca that live along Titus Run Creek have often had to deal with flooding of their yards and basements in the past. E&M Engineers and Surveyors, PC were recently hired to design stream improvements along the creek that will help prevent future flooding and to design the replacement of existing structures that have been damaged due to past flooding events.

Titus Run Creek begins in the hills of Allegheny State Park in Cattaraugus County. It flows into the City of Salamanca south of Interstate 86 and then on to the Allegheny River.

The project improvements will include the widening of Titus Run Creek. Critical areas along the creek will be reinforced with heavy stone riprap. Concrete and stone retaining walls will be constructed along areas of the creek where existing buildings are in close proximity to the creek. The proposed project will also include the demolition and replacement of the existing Frank Street Culvert.

Funding for the proposed project is also being investigated. Funding through the Federal Emergency Management Agency (FEMA) and the New York State Emergency Management Office (SEMO). FEMA and SEMO provide funding to help residents of the United States, Pennsylvania and New York recover from severe storms and flooding that has occurred in the past.

FEMA's Public Assistance Grant Program is one of the ways federal assistance flows to state, county and local government. It provides disaster grant assistance for the repair, replacement or restoration of disaster-damaged, public owned facilities and the facilities of private non-profit organizations. Federally declared disasters for 2004 include New York Severe Storms and Flooding and Tropical Depression Ivan.

These grants are aimed at helping restore funds spent on emergency services, debris removal and infrastructure restoration. The grants are also used to provide modifications that will prevent future flooding damage.

New Bridge Replacement Permit in PA
by: Christopher M. Ernst, PE

The Pennsylvania Department of Environmental Protection (PADEP) has issued a new General Permit (GP-11) that authorizes the testing, repair, rehabilitation or **replacement** of existing currently serviceable, water obstructions or encroachments, including bridges and culverts. The GP-11 became effective on August 10, 2004 and will remain in effect unless it is specifically modified, suspended or revoked by PADEP. The issuance of the GP-11 is significant because prior to its existence the only permit that was available for a bridge or culvert replacement was the Joint Permit Application (JPA). The JPA is a much more involved permit that results in higher engineering fees and longer review/approval times from PADEP. Also, there is a permit fee that is required for the JPA (waived for municipalities) and there is no permit fee required for the GP-11.

The use of the GP-11 for a bridge or culvert

replacement or repair is limited by the following:

1. No significant reduction in the existing opening is permitted.
2. There will be no significant changes to the grades of approach roadways or to overtopping characteristics.
3. Increases in bridge width or culvert length will be limited to a maximum of 12 feet perpendicular to the roadway on each side of the structure (including wingwalls, headwalls, riprap, and other appurtenant structures).
4. The removal of debris and accumulated sediment to ensure adequate hydraulic capacity for bridge or culverts is limited to 50 ft upstream or downstream of the bridge or culvert.
5. Bridges and culverts with paved bottoms shall provide for fish passage by constructing a low flow channel.
6. Bridge or culvert replacement projects may not increase water surface elevations for the 100-year flood event.
7. Backfill material may not be stored in the floodway or wetlands.

The use of the GP-11 is also limited by the area of wetlands that will be impacted by the proposed project. Wetland area which cannot be avoided and which will be permanently impacted are limited to a cumulative total of 0.05 acres (approximately 2, 180 ft^2) per project site.

Like the JPA, an Erosion and Sedimentation (E&S) Control Plan needs to be submitted to the PADEP for review and approval. Also, a Pennsylvania licensed engineer (P.E.) will need to prepare and certify the plans, specifications and reports that are submitted with the GP-11 if the bridge or culvert is used by the general public to access an industrial, commercial, residential development, etc.

Contact our office, your County Conservation District or your local PADEP office for more information on the GP-11. The GP-11 registration form and instructions are also available on the PADEP website (www.dep.state.pa.us).

"Green" Wind Power
by: Jeffrey C. Bahret, PE

The subject of windmills has recently become one of significant controversy. Often is the fact that individuals and groups which are all in favor of the trend away from fossil fuels to green power; are the same voices of objection when large wind generating farms are proposed within their back yards. This is understandable, as these massive uni-pedestal generation units with 100 foot rotors will change the view of the horizon. This article will stay away from this heated discussion as its purpose is to inform rather than influence.

Most people are unaware that the Engineering and technology advancements which over the past decade have enabled the construction of these large wind powered generators, has also trickled down to the much smaller residential units. The outcome has been the availability of 2 to 15 kw (kilo-watt) windmills which are not only more dependable that their earlier counterparts, but also more efficient and economical.

The following will present some simple estimating techniques that at most would require a pocket calculator. These techniques permit quick

approximation of the power in the wind and the potential energy available from modern wind machines.
The air about us has mass. Like any moving object, the moving air we know as the wind contains momentum. Momentum is related to Kinetic Energy, the energy of motion. The air's mass is a product of its density (p) and its volume. Since the air is constantly in motion, the volume can be found by multiplying the wind's velocity (V) times the area (A) through which it passes. The Kinetic Energy in the wind is thus: $KE = \frac{1}{2}\ p\ A\ V^3$

This derivation used to determine this formula (which has been omitted to keep you awake) reveals that the energy in the wind is a function of air density, the area intercepting the wind, and the wind's velocity.

As air density decreases, the energy in the wind decreases correspondingly. For example, at the same wind speed there is less energy in the wind at 5,000 feet than at sea level. The following table gives the percentage of energy available in the wind at various elevations compared with that at sea level.

Wind Energy Vs. Elevation

Sea Level	100%
1,000 feet	97%
2,000 feet	94%
5,000 feet	86%

Assuming the rotor intercept area is constant, the most important parameter governing energy in the wind is wind speed. Energy increases as the cube of the velocity. For example, if the wind speed increases from 5 to 10 mph, the wind energy available does not double; instead it increases eight times. Slight changes in wind speed has a considerable effect on the energy in the wind.

Wind power is usually described in the form of "power density" or power per unit area of the wind stream. Common practice is to describe power density in the form of Watts per square meter (W/m^2). Below are three equations for calculating power density (W/m^2) on air density at sea level:
$P/A=W/m^2 = 0.6125\ V^3$ (where V is in meters/sec)
$P/A=W/m^2 = 0.05472\ V^3$ (where V is in mph)
$P/A=W/m^2 = 0.8355\ V^3$ (where V is in knots)

As an example, we will examine the power density of a site with a 9 mph wind speed, and a site with a 10 mph wind speed. Both are set at an elevation of 1,500 feet above sea level:

$0.05472 \quad (9)^3\ 0.96 = 38.3\ W/m^2$
$0.05472\ (10)^3\ 0.96 = 52.5\ W/m^2$

Even though wind speed only differs one mph, 37 percent more power is available.

At this point an important question arises. What wind speed should one use in such calculations? Are average wind speeds good enough? The answer is no.

Using the average amount wind speed alone in the previous equation will product erroneous results. Your estimate could be off by a factor of two or more because the average of the cube of many different wind speeds is greater than the cube of the average wind speed. Luckily for us, researchers in this field have calculated statistical correction factors for estimating the power in the wind from the average wind speed. Because of greater uncertainty in the distribution, the statistical range of the correction factor (c) becomes greater at lower average wind speeds. The following table presents this data:

Average Wind Speed	Correction Factor(c)
8 mph	2.4 - 3.2
10 mph	2.1 - 2.7
12 mph	1.9 - 2.4
14 mph	1.8 - 2.1

Armed with this knowledge and information, it is relatively easy to estimate the potential "green" power production which could be claimed from the wind at any given site.

Your First Consultation is Free !
By: Al Vanderpoel, PE

I have been practicing engineering now for 33 years. There had been a lot of change over that time but there have also been some constants that do not change. One of the constants is the basic engineering that is provided. I have noticed over this time period that most of the projects that I am involved with incorporate one of the classic engineering principals - that is, analysis, design, construction, maintenance or a combination of these. But if I could point at the one aspect of engineering that is the key to any successful project, I would without question say that good analysis is essential. Without a firm foundation, the structure is shaky.

The need for this analysis is so important that we want to meet with you before we start any engineering, or put a single mark on paper. The first meeting with you, as our potential client, is a
session where we try to understand what you need, and see how we can accomplish that. If we design something for you that does not accomplish your end result, the project is going to be worthless. And even more important, if we hear you tell us to do something that is not going to be an efficient solution, then we are not doing you a service by constructing something that will not work. The first meeting is the chance to sort out what the most efficient solution will be.

The first meeting is also our change to look over what the service will cost. We will give you a proposal/agreement form that spells out exactly what we are going to do, how long it will take, and how much it will cost. The proposal/agreement may take some time to put together, since thought must go into the best method of work, or it may be a next day delivery. But, by writing out what we expect to do, and telling you the cost, the surprises are left out of the equation.

The good news is that this first consultation meeting is free! It is that important that we do the analysis on each project, that we must meet with you and talk. Therefore, if you have a project and need engineering assistance, give us a call. We will meet you on site and look things over. At no cost. Your time is all you will have invested.