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CONSULTANT'S UPDATE

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FUNDING INFRASTRUCTURE PROJECTS DURING A RECESSION

By Ted R. Fylstra

In communities throughout Florida and across the country, drinking water and wastewater systems are straining under the weight of decades of federal government underinvestment. As the troubles with our water infrastructure mount, the country's economy slides deeper into recession. Investing now in drinking water and wastewater system improvement projects can help considerably to bring the economy out of the recession, while enhancing the quality and useful life of these critical components of our infrastructure.

But, how does a community do this when tax revenue is reduced, the lack of development or government waivers have reduced availability of funds from impact fees, and the money that is available is being stretched among competing needs? The answer is to make maximum use of remaining sources of grant funding. Sources of funding still available for critical infrastructure projects are described

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METROPOLITAN PLANNING ORGANIZATIONS

By William "Bill" E. Conerly, PE

Metropolitan Planning Organizations (MPOs) provide a mechanism to translate local transportation priorities into state and federal funds. The MPO is a federally-mandated and federally-funded transportation policy-making organization consisting of local government and governmental transportation authority representatives. In Florida, they are established under Florida Statue 339.175 and are intended to encourage and promote the safe and efficient management, operation and development of surface transportation systems that serve people and freight mobility needs. They are also meant to foster economic growth and development within urbanized areas of the State while minimizing transportation-related fuel consumption, air pollution, and greenhouse gas emissions. This is accomplished through an organized planning process led by the MPO.

MPOs develop transportation plans and programs in cooperation with state and public transit operators. The plans and programs are intended to provide for the development and integrated management and operation of transportation systems and facilities that include pedestrian walkways, bicycle transportation systems, and facilities that will function as an intermodal transportation system for the metropolitan area.

(MPOs—Continued on page 4)

EOH NEWS

EPA Risk Management Plan Auditing

- *EPA is emphasizing much more aggressive inspection and enforcement of facility Risk Management Plans (RMPs) under the Clean Air Act Section 112(r) and hazardous materials requirements under RCRA. Now the EPA is subjecting chemical plants, refineries, and other major industrial facilities to week-long audits in which every aspect of the facilities' processes are scrutinized and compared to the provisions of the RMP. Penalties have increased well into six figures.*

HUD and CPSC Issue Guidance on Identifying/Repairing Problem Drywall in Homes

- *The guidance takes into account visual signs of metal corrosion, evidence of drywall installation in the relevant time period, and the identification of other corroborating evidence or characteristics. http://www.cpsc.gov/info/drywall/hud10020.html*
- *This interim remediation guidance is based upon the most current scientific study and consensus, which recommends that consumers remove all possible problem drywall from the home/building, and replace electrical components and wiring, gas service piping, fire suppression sprinkler systems, smoke alarms and carbon monoxide alarms. Taking these steps should help eliminate both the source of the problem drywall and corrosion-damaged components that might cause a safety problem in the home/building. http://www.cpsc.gov/info/drywall/hud10068.html*

Inside this issue:

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below. Please read on to see which programs may be beneficial for your community.

Florida Department of Environmental Protection (FDEP) Small Community Wastewater Facilities Grants Program (SCWFGP)

The SCWFGP provides preconstruction and construction grants for eligible wastewater projects implemented by communities under 7,500 in population and with per capita income that is less than the State average. Grant amounts depend on the ultimate source of matching funds (State Revolving Fund (SRF) or community match), and the documented need for the project. Approximately $10 to $15 million is available on an annual basis.

Small Cities Community Development Block Grant Program (CDBG)

This program is available to communities with a population of 50,000 or less that opt out of their County's CDBG entitlement program. The Small Cities CDBG program is a competitive grant program that awards funds to eligible communities. Since 1983, funding has varied between $18 and $35 million on an annual basis. This program is a good source of funds for projects that the community cannot otherwise afford. Examples of eligible projects include:

- rehabilitation and preservation of housing;
- water and sewer improvements;
- street improvements;
- economic development activities;
- creating jobs for low and moderate income people;
- downtown revitalization;
- parks and recreation projects; and
- drainage improvements.

Based on its population, a community can apply for between $600,000 and $700,000 in grant funding for projects in any one application cycle.

Community Budget Issue Request (CBIR)

Although the Florida Legislature has not funded this program for the last three years, this program has, in the past, provided grant funds for completion of eligible projects that protect public health or the environment, and implement a state, local, or regional plan related to water quality improvement and restoration. As the economy improves, the State will likely reinstate funding of this program.

FDEP State Revolving Fund Loan Program (SRF)

The SRF program is similar in structure and process to the SCWFGP, but does not provide grant funding. The SRF program provides low-interest loans to communities for completion of utility infrastructure projects. Based on current bond rates of 4.35% and the census tracts associated with a particular project, a community could be eligible for an interest rate between 2% and 3%. Payments are normally amortized over 20 years, with a 30-year amortization available on request. Using this program, a community could leverage its utility revenue stream to complete projects while maintaining and building reserves.

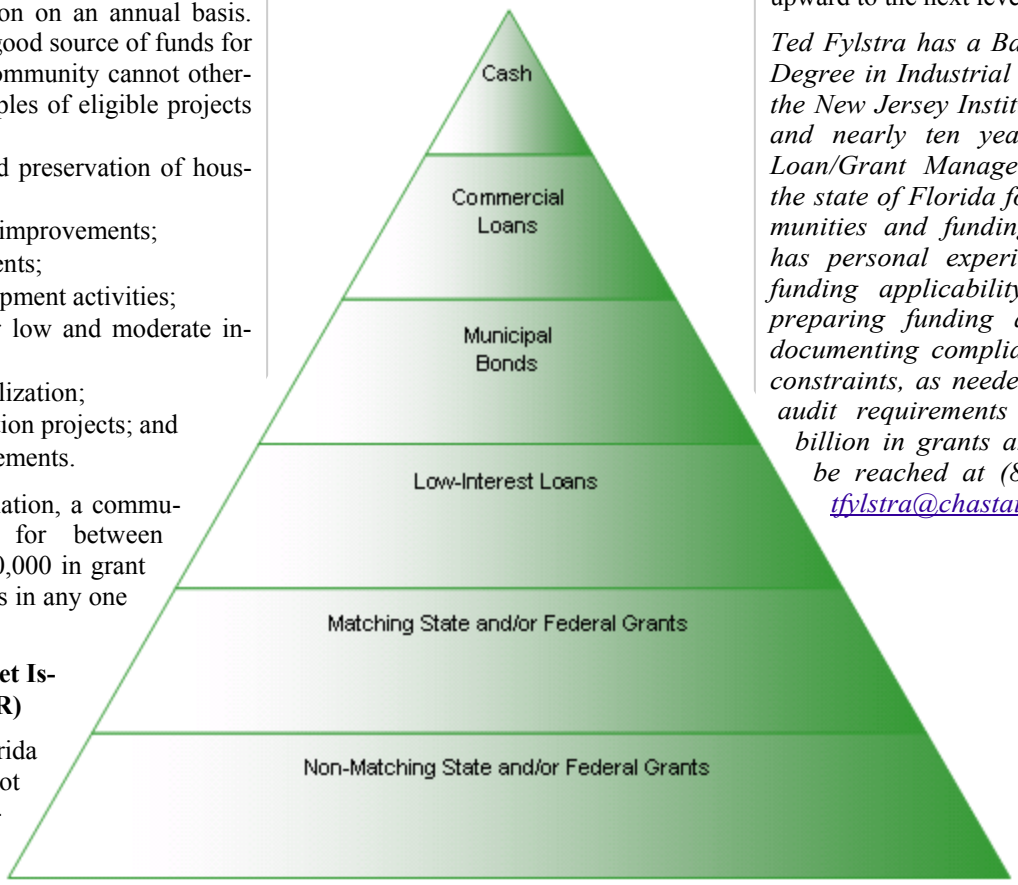
Municipal Bonds

One option that many communities use to fund infrastructure projects is bonds. However, in those instances where lower cost financing or grants are available, bonds are not the most advantageous financing method. For example, use of the SRF program referenced previously instead of bonds would involve 20 years of SRF repayments instead of 30 years of bond payments, and could save a community up to 70% on interest costs.

Cash

Any community with sufficient funds in reserve accounts could consider the use of those funds to construct infrastructure projects. While the use of cash eliminates the interest portion of bonds or loans, often the reserves can be invested at an interest rate approximating the low-interest rate provided by the SRF program, resulting in the equivalent of a 0% interest loan. This provides the community the advantage of being able to implement infrastructure projects while still holding on to their cash.

The diagram, at left, illustrates the overall preference of funding mechanisms, with the most desirable approach beginning at the bottom of the pyramid. Generally speaking, a community should exhaust options at each level before proceeding upward to the next level.



Ted Fylstra has a Bachelor of Science Degree in Industrial Engineering from the New Jersey Institute of Technology and nearly ten years experience in Loan/Grant Management Services in the state of Florida for numerous communities and funding programs. Ted has personal experience determining funding applicability and eligibility, preparing funding applications, and documenting compliance with funding constraints, as needed, to comply with audit requirements for almost $1.6 billion in grants and loans. He can be reached at (813) 621-9229 or tfylstra@chastainskillman.com.

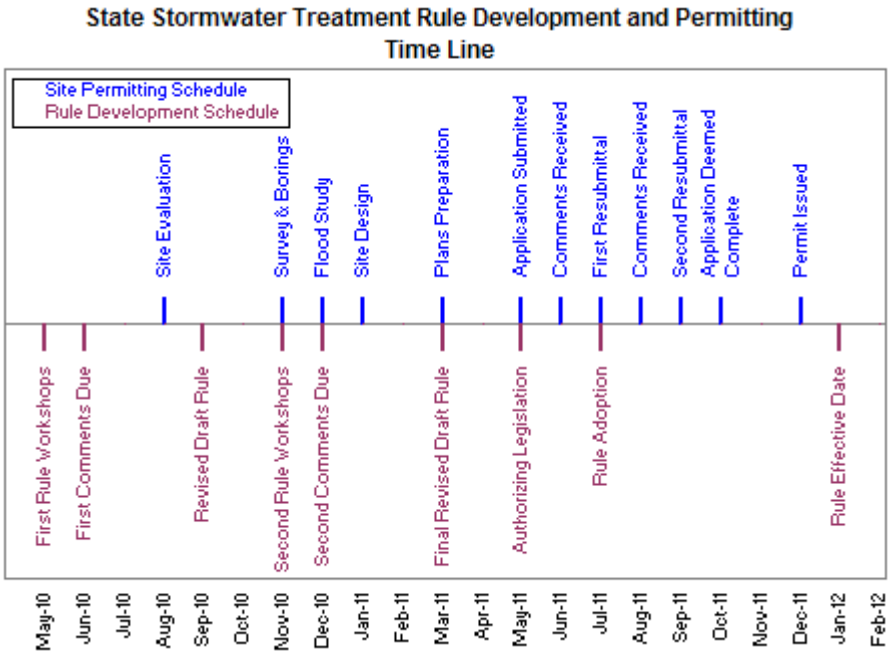
DEVELOPERS BEWARE: STORMWATER RULE CHANGES ARE COMING

By David J. Buyens, PE and Mark T. Livesay, EI

The new Statewide Stormwater Treatment Rule enacted by the Florida Department of Environmental Protection (FDEP) may begin to have a catastrophic effect on landowners and development as early as January 2012. As an example of the potential impacts, over 80% of the sites in Lakeland engineered by Chastain-Skillman, Inc. rely on wet detention or dry retention with underdrain/sidedrain to attain attenuation and water quality treatment goals. These options will no longer be solely adequate for all sites being developed. The new rule relies mostly on dry retention, which is not feasible on these sites. Simply stated, such sites may become uneconomical to develop. Therefore, owners and developers would benefit from immediately evaluating their sites to determine whether they should be designed and permitted before this new rule takes effect.

The FDEP presented the rulemaking schedule shown in the lower half of the graphic below. For planning purposes, the tasks to attain a permit are shown on the top half, working backwards from permit issuance prior to rule effect. This demonstrates that site candidates for grandfathering should be evaluated within the next couple of months.

The FDEP is currently seeking input to the new rule regarding performance standards, loading methodology, interim Best Management Practices (BMPs), verified BMPs, underdrain removal efficiencies, site data requirements, inspection and recertification criteria and frequency, and many additional items. In particular, additional data that clarifies some of the rule provisions was requested at the recent rulemaking workshop series held in May 2010. No input as to whether the rule should move forward was solicited because the FDEP is legally bound to implement some rule by laws passed ten years ago.



Background

In 1982, Florida was the first state in the country to adopt a rule requiring the treatment of stormwater to a specified level of pollutant load reduction. In 1990, the FDEP followed up with the State Water Implementation Rule, which requires "80% average annual load reduction of pollutants that cause or contribute to violations of water quality standards." Finally, in 1999, the Florida Watershed Restoration Act was enacted, leading to the implementation of Florida's water body restoration program and the establishment of Total Maximum Daily Load limitations (i.e., the maximum amount of a specific pollutant that can be discharged to a water body while maintaining water quality standards). These statutes contain new performance standards that were never implemented by regulatory agencies. Research has shown that current design and performance criteria do not adequately address nutrient loadings; therefore, there is a need to implement a statewide stormwater treatment rule.

Rule Provisions

For many years, developers and their engineers have designed stormwater treatment ponds to both attenuate and provide treatment of stormwater runoff. Natural percolation ponds, filtration systems and wet detention systems utilize both physical and biological processes to improve the suspended solids concentrations from discharged water. Additionally, surface baffles remove greases, oils, and other floatable materials from the stormwater prior to discharge. Nonetheless, the stormwater management facilities developed and constructed under the current rule do not achieve the pollutant removal standards specified in the current statutes. The cumulative effect has been that development has contributed to the degradation of many Florida waters by the addition of dissolved nutrients such as nitrogen and phosphorus. Therefore, the new statewide treatment rule is being put in place to remove these nutrients. Specifically, the objectives of the rulemaking are as follows:

- increase removal of nutrients so that the post-development nutrient load will not exceed the nutrient load characteristic of the natural, undeveloped (native) condition;
- reinforce requirements for discharges to impaired waters;
- institute only one comprehensive rule for the FDEP and all five Water Management Districts (WMDs);
- update BMP design criteria;
- provide BMP Treatment Train credits where, in a manner similar to the use of wetland mitigation credits, owners of sites where it is difficult to meet the standards can instead purchase offsetting credits; and
- promote low impact design and retrofitting.

The new stormwater rule does not replace the current rules, but merely augments them to improve the quality of water discharged.

(Stormwater—Continued on page 5)

(MPOs—Continued from page 1)

The process for developing such plans and programs is designed to give consideration to all modes of transportation, and be continuing, cooperative and comprehensive, to the degree appropriate, based on the complexity of the transportation problems addressed. To ensure that the process is integrated with the statewide planning process, MPOs develop plans and programs that identify transportation facilities that should function as an integrated metropolitan transportation system, giving emphasis to facilities that serve important national, state and regional transportation functions.

Federal law requires the Governor and local governments to designate an MPO to serve each urbanized area with a population of more than 50,000. This does not, however, require that an individual MPO be designated for each such area. The Governor and local governments representing at least 75% of the population of an urbanized area can enact an interlocal agreement for an MPO to serve more than one urban area. Currently, in Florida, we have 26 MPOs. Each MPO is considered separate from the state or the governing body of a local government that is represented on the governing board. Each MPO's boundary includes the existing urbanized area it serves and the contiguous area expected to become urbanized in the next 20-year forecast period.

The five core functions of an MPO are:

1. Establish and manage a fair and impartial setting for effective regional decision-making in the metropolitan area.
2. Evaluate transportation alternatives, scaled to the size and complexity of the region, the nature of its transportation issues, and the realistically available options.
3. Develop and update a fiscally-constrained, Long-Range Transportation Plan (LRTP) for the metropolitan area addressing a planning horizon of at least twenty years that fosters:
   - mobility and access for people and goods;
   - efficient system performance and preservation; and
   - quality of life.
4. Develop a Transportation Improvement Program (TIP) that is a fiscally-constrained program based on the LRTP and designed to serve the area's goals while using spending, regulating, operating, management, and financial tools.
5. Involve the general public and all significantly affected subgroups in the four essential functions listed above.

When companies are considering new locations for job creation in major metropolitan areas, they eventually come to the question of what kind of transportation system a community has and how their employees will get to work. Whether it is maintaining and expanding our existing roadway network, or planning for the expansion of our rail systems to include both high-speed and light rail, Florida's MPOs are a critical component contributing to our quality of life.

Bill Conerly is a Senior Project Manager in Chastain-Skillman's Tampa Office. He has over twenty years of technical experience and thirteen years as a licensed engineer. Bill's work experiences include the design, permitting and construction management of residential, commercial and institutional projects. In addition, he serves as the District Engineer for several Community Development Districts and was recently appointed to the Sarasota Manatee MPO's Citizen's Action Committee (CAC). He can be reached at (813) 621-9229 or wconerly@chastainskillman.com.

RECENT PROJECTS AND CONTRACTS OF INTEREST

- **School District of Hillsborough County (SDHC) Environmental Support -** CSI has been awarded a number of projects under an ongoing Professional Services Agreement for Environmental Consultant Services. These projects include a variety of engineering and scientific support activities directed at assisting the school district in complying with applicable environmental regulations and reducing the district's environmental risk exposure.
- **Process Safety Management (PSM) Audit, Midwestern US** – CSI will participate on the PSM Audit Team at a product distribution facility in the midwestern United States, owned and operated by one of the world's leading fertilizer manufacturing firms.
- **Habitat for Humanity Development Project -** This contract authorizes CSI to provide civil site construction plans and permitting services for a 20-acre commercial and residential neighborhood community in Sebring. This facility is expected to contain approximately 10,000 square feet of commercial space and approximately 60 single family lots.
- **Central Beef, Ind., LLC - Permit Compliance -** CSI has been requested to provide construction phase services in support of FDEP permit compliance, and hydrogeologic, drilling, and testing services related to the implementation of a groundwater monitoring plan.
- **Statewide SuperContract** - The Florida Department of Environmental Protection (FDEP) has selected our team, primed by Professional Services Industries (PSI), for negotiation of a contract to provide services to the FDEP's Bureau of Waste Cleanup. This contract will encompass four major program areas, including the Hazardous Waste Cleanup Section, Site Investigation Section, CERCLA (Superfund) Site Screening, and Brownfields. The base period of the contract is five years, with an option to be extended to a total of ten years.
- **Polk County Professional Surveying & Mapping Services** - CSI was one of six firms selected for award of a continuing services contract to provide surveying and mapping services throughout the County.
- **City of Lakeland Wastewater Collection System Evaluation -** Although still pending final approval through the RFP process, CSI has been selected by the City of Lakeland to provide data collection, flow calculations, and modeling for build-out of the City's proposed wastewater system located along U.S. Highway 98 South and S.R. 33 North.

ANNOUNCEMENTS

Paul Bizier, PE, has been selected to review a new manual of practice being developed jointly by the Water Environment Federation, American Water Works Association, and International Water Association. The manual will be titled Units of Expression for Water Systems (MOP 6). This book will create an internationally applicable and reliable reference that reflects an industry consensus for standardizing units across all documents for the same process. It is anticipated the manual will be developed within one year.

(Stormwater—Continued from page 3)

Together the rules will:

- change the treatment and design criteria associated with obtaining an Environmental Resource Permit;
- incorporate by reference the Stormwater Quality Applicant's Handbook;
- identify the rules of WMDs that are superseded (although each WMD will make the rules their own and be responsible for administering them);
- not affect agriculture or silviculture;
- not affect the current water quantity requirements.

Rule Impacts

Dry Sites

A dry site is one that has soils that percolate water quickly and easily. As with the current stormwater rule, the new rule allows most sites containing well drained soils and a low water table to utilize a dry retention stormwater treatment system, with percolation to groundwater as the disposal method. The treatment processes within a dry retention pond offers the greatest removal of nitrogen and phosphorus. The new rule also encourages the use of other water quality treatment components (a treatment train) including green roofs, pervious pavement, and bio-swales functioning as pre-treatment before the runoff enters the dry retention pond.

For these sites, the difference between pond designs under the current rule and the new rule varies with the site hydrology. Because the new rule essentially enhances the old rules, most dry sites will be engineered with either the same pond size or require a slight increase in pond size and the on-site stormwater conveyance system. The economic impact will be noticeable, yet likely viewed as manageable.

Wet Sites

The majority of sites in Florida contain either poor draining soils or a high groundwater table. Under the current rule, these sites are designed with a wet detention system or a dry retention system with underdrains or sidedrains to store and treat runoff. However, wet detention ponds fail to treat the stormwater runoff to the levels specified in the new rule, and underdrains and sidedrains are no longer allowed because their effect on nitrogen and phosphorus reduction is unknown. To achieve the required nutrient removal, stormwater management systems must under the new rule include a treatment train consisting of at least a dry retention pretreatment pond and a wet detention pond. Other BMPs such as green roofs, managed aquatic plant systems, bio-swales, and rainwater harvesting (stormwater reuse ponds) can also be included, yet they are sometimes costly and provide little reduction in nutrient loads. Other options for reducing the nutrient loads currently include source reduction via decreasing the impervious area proposed, using pervious pavement systems, implementing chemical treatment, prohibiting the use of onsite sanitary systems, limiting fertilizer use, and providing vegetated natural buffers (less land to develop), and Florida-friendly landscaping.

Therefore, the solutions available for these wetter sites are limited and will likely be significantly more expensive, to the extent that cost could prohibit economical development. For example, the modifications required to change a wet site in such a manner as to enable a dry retention pretreatment pond to function and provide the required treatment level, the poor draining soil must be replaced or filled by substantial amounts of well-draining material. Since balancing cut and fill is key to the economical development of most sites compliance with the new rule may render many sites undevelopable from the perspective of economic feasibility.

Recommendation

Owners and developers would be wise to evaluate their existing or potential land holdings to assess the impact of the statewide stormwater treatment rule. If the rule's requirements have the potential to adversely impact the economics of developing a site, then it may be beneficial for the owner to obtain the Environmental Resource Permit prior to the effective date of the rule (currently projected to be January 1, 2012) so that the site is grandfathered for the duration of permit, usually five years, and then additionally extended for as long as possible past that time.

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CRITTER WATCH

By Arthur "Art" D. Wade III, PWS

The sandhill crane (*Grus canadensis*) is a large, gray-colored bird, with long legs and neck, that can be readily identified by the red patch on top of its head. These birds generally operate at a relaxed pace and are frequently seen foraging in small groups for insects, seeds, and earthworms in pastures, roadside ditches, wetlands, and even residential neighborhoods, where it's possible to interact with them once they feel comfortable with their surroundings.

Two sub-species are found in Florida: the Florida sandhill crane (*Grus canadensis pratensis*), which is a permanent resident of the State; and the migratory greater sandhill crane (*Grus canadensis tabida*), which visits during the winter until about April. Both sub-species look alike, but the migratory bird is larger in size.

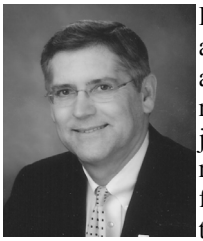
Sandhill cranes mate for life, which can be up to 20 years, and nest during the winter and spring in nests constructed with vegetation in shallow wetlands. Two to three eggs are normally laid and both male and female share the incubation responsibilities. Within one month, the chicks emerge and are able to fly in approximately 70 to 75 days. As with all cranes, sandhill cranes participate in dancing (bowing, jumping, wing flapping, etc.) during courtship, but this activity also regularly occurs during non-mating periods. The "call" of the sandhill crane is a "chatter" that can be heard for long distances.

Reference:

International Crane Foundation and the Florida Fish and Wildlife Conservation Commission

DECISION-MAKING, RISK AND THE UTILITY FUNCTION

By James R. Chastain, Jr., PhD, PE, MPH



Have you ever tried to analyze a problem and after much effort you reach a conclusion that just doesn't seem correct…so you reject it in favor of another choice that "felt better" to you? Does this mean that it is a waste of time to arrive at a decision by analytical means? If this sounds familiar, then it might be beneficial to become acquainted with the concepts developed in Utility Theory.

Our daily lives consist of a continuous stream of decision events. Many of these decisions tend to be of little consequence and have to do more with personal preference or convenience than substance. In fact, typically these decisions are made without even consciously thinking about making a decision. However, occasionally decisions must be made that carry significance that can have far-reaching impact and implications. When faced with such situations in your business or personal life, it would be helpful to have a basis for making those decisions other than intuition or chance. In other words, especially in these uncertain times, is there a systematic way of improving decision-making especially when there is incomplete or conflicting information?

In fact, there are techniques for addressing this problem. Decision Analysis and Management Science has evolved substantially over the last 25 years. Much of this has been driven by the development of the personal computer, but it has also been required by the increasing complexity of our society. While it isn't possible for this article to even survey the theory and practice of the field, it might be helpful to highlight one or two techniques that can be used to sort out decision factors.

When faced with an important decision, there is a mix of at least four factors. First, there is some degree of uncertainty surrounding the question under consideration. Usually, this is related to the fact that there is incomplete information upon which to base the decision. Generally, the objective is to achieve or maximize some type of gain. At the same time, there may also be a need to avoid or minimize an associated loss. Associated with these factors, there exists a degree of risk that the desired gain may not be achieved. In difficult situations not only is the gain not achieved, but also the loss that was feared could occur. With the economic situation that has developed over the past year or two, many people who have money invested in a 401k or other investment fund can relate to this problem description.

One technique frequently used in an attempt to balance these factors is the Utility Function. While a fully developed explanation of utility theory can get somewhat complicated, with a little practice, its routine use can be quite straightforward. Before proceeding with the explanation of the utility function process there are three points that need to be emphasized.

Preliminary considerations

Although it may seem obvious, it is first necessary to carefully define the problem statement. It is not unusual for people to quickly form the question to be solved, but how one defines or frames the problem can profoundly influence the outcome. Thus, make sure that you are trying to answer the right question. Helpful thoughts along this line are to note:

- What triggered the need for a decision?
- What are the known constraints?
- What are the essential elements of the problem?

Closely related to the problem definition is the clarification of objectives that you wish to achieve through the decision. This is important because the objectives form the basis by which the alternatives will be evaluated.

Second, when risk/reward evaluations and tradeoffs are made, they by nature involve a level of subjectivity. One person may be risk-averse while another may be risk-tolerant or risk-seeking. Accordingly, the "right" decision may be dependent on the person asking the question or evaluating the options. This can be an important point to remember if several people are involved in making the final decision.

Finally, it should be noted that a good decision may not equal a good outcome and, conversely, a good outcome may result from a poor decision. The process of good decision-making increases the probability of achieving a good outcome, but it does not guarantee it. Uncertainty and risk have real effects and can influence the outcome outside of the control of the analyst. Using a structured decision-making process can also highlight the important success factors which can improve asset allocation as well as determine "stopping rules" to minimize loss if an outcome is not achieving the desired results.

Why use Utility Functions?

One of the primary reasons for the development of Utility Theory is that sometimes common alternatives analysis techniques don't adequately capture the risk associated with a decision, relative to the decision-makers risk tolerance. Common deterministic methods of comparing alternatives such as net present value, internal rate of return, and cost-benefit analysis generally are not set up to consider risk and uncertainty in their analysis. Accordingly, if the decision-maker is aware that risk exists and it has not been adequately factored into the analysis, then his confidence in the validity of the final decision may be weakened.

As an example, suppose that a manager must decide on a process improvement, and two solutions may exist. After doing a net present value (NPV) analysis, Alternative A has an NPV of $400,000 and Alternative B has a NPV of $200,000. However, the decision-maker knows that if a major client cancels its order, the NPV of Alternative A is -$100,000 while Alternative B is $75,000. In this situation, Alternative A clearly is the best solution so long as the major client remains stable. However, Alternative B has much less risk in that it will not result in a loss regardless of the client action. In other words the appropriate investment decision will be strongly influenced by the amount of risk that the decision-maker deems appropriate and how sensitive the company is to operating at a loss with respect to the investment horizon.

It is for this type of situation that stochastic or probabilistic methods have been developed. While many of these approaches can become mathematically intensive, the application of Utility Theory can be fairly straightforward. An interesting characteristic is that it describes how individuals should make decisions as well as predicting how they do make decisions.

How is a Utility Function developed?

In formal settings, the basic data that will be used for decision-making will most likely be developed by using Expected Monetary Value (EMV), with or without a decision tree. This process can also be used on non-monetary decisions that are common to daily life. However, in order to develop a utility function, the alternatives must be defined and clarified in an orderly fashion. A convenient

(Decision—Continued on page 7)

(Decision—Continued from page 6)

means of doing this is through the use of a decision tree, which identifies the different options under consideration and assigns a probability of occurrence to each. From this information, a Utility Function is developed that translates each of the possible results into a non-monetary measure known as a "utility." The "utility" of this result represents the total value or desirability of a decision alternative to the decision-maker. Although not required, a convenient way to do this is to assign a utility value between 0 and 1 to represent the desirability of the alternative, where 0 is least desirable and 1 is most desirable. A simple means of developing a utility function is as follows:

- carefully consider each alternative and the desirability of it coming to pass. Then, assign to it a utility (or desirability) value (between 0 and 1);
- estimate the probability of the alternative coming to pass;
- using the EMV or other ranking result for each alternative, multiply by the utility value and the probability of occurrence to obtain an overall utility; then
- compare alternatives to select the alternative with the highest utility.

The key in this process is to find the "point of indifference" between the competing alternatives and states of nature. At its core, this is an intuitive balancing of the characteristics of the options. This is sometimes difficult, but it forces the decision-maker to quantify his viewpoint. In its simplest form, a rudimentary spreadsheet can be used as follows:

Alternative	Condition	Occurrence Probability	Desirability	Utility
A	1	0.7	0.5	0.35
	2	0.3	0.4	0.12
			Overall desirability (sum):	0.47
B	1	0.8	0.7	0.56
	2	0.2	0.2	0.04
			Overall desirability (sum):	0.60

In this simple case, two options have two different outcomes with different probabilities of occurrence. The decision-maker has a different sense of the desirability of each outcome. By structuring the problem in this way, one can see that Alternative B has the greatest overall opportunity of a desirable outcome, even though outcome B.2 has the lowest desirability. Looking at the problem in this way, if the decision-maker "doesn't like" the result, they can adjust the desirability estimates to be more in line with actual perceptions. Also, by looking at the table one may be able to adjust the occurrence probability by seeing the importance of various components and exerting more effort to improve the possibility of that action coming to pass. Note that this particular example didn't include a monetary (quantitative) component. Thus, the technique can be used on qualitative decision-making.

This process can be extended to decisions using quantitative characteristics (e.g., money) without a great deal of difficulty. The primary difference is that the EMV of each alternative and outcome is multiplied by the probability of occurrence and utility (desirability) estimate. Because by convention the worst projected outcome is assigned "0" and the best outcome is assigned "1," the other options must be scaled between them.

To illustrate using the example above, the pertinent values can be estimated as follows:

Most desirable outcome U($400,000) = 1

Least desirable outcome U(-$100,000) = 0

Comparing to Alternative B (Outcome 1 = $200,000), the decision-maker believes that relative to making $400,000 or losing $100,000, he would rate being given the $200,000 at 0.7 desirable. That is, it's not as desirable as getting $400,000, but it's much more desirable than losing $100,000. Thus, point of indifference, or utility, is 0.7. Likewise, when considering Alternative B (Outcome 2 = $75,000) the decision-maker rates that option at 0.4, because it's not nearly as good as making $400,000, but it's still much better than losing $100,000.

In basic mathematical terms this is expressed as:

U(Option) = U(Best Outcome)p* + U(Worst Outcome)(1-p*)

where: U(Base) = Utility of base case under consideration

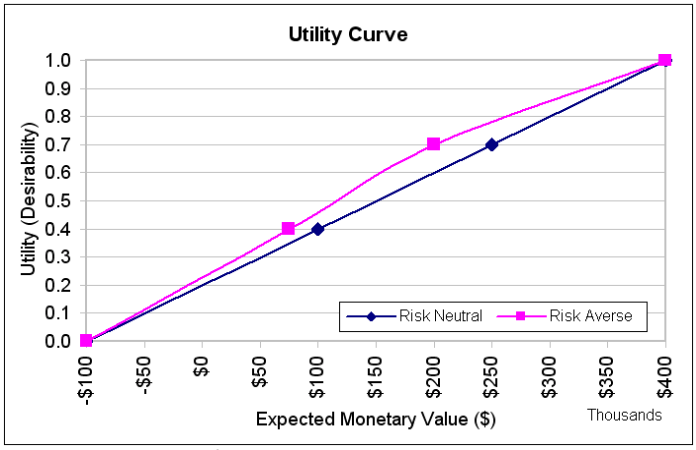
p* = point of indifference between the alternatives (between 0 and 1)

U($200,000) = $400,000 * 0.7 + (-$100,000) * 0.3 = $250,000

U($75,000) = $400,000 * 0.4 + (-$100,000) * 0.6 = $100,000

Examination of these results indicates that the decision-maker is risk-averse, which can be seen by noting that the he is willing to accept $200,000 for option B, when the EMV for Option A is $250,000. Likewise, he is willing to accept $75,000 for the less desirable case of Option B, rather than Option A which had an EMV of $100,000. Another way of expressing the result is that the decision-maker was willing to pay a risk premium of $50,000 or $25,000 for the two conditions.

This can be shown graphically by plotting the individual points in what is referred to as a Utility Curve. By entering the chart at a particular utility value, one is able to see how the decision-maker values a particular risk for the defined problem. If the curve lies above the straight line (risk-neutral), the decision-maker tends to be risk-averse; if below the straight line the tendency is to be risk-seeking.



While this process can become more involved for more complicated decisions, the real value is that it forces one to examine the potential outcomes in relation to the risk involved. Without a doubt, much of this is subjective, but that is the whole point. As much as we may believe that we are completely objective in our decision-making, the fact of the matter is that there is always a subjective element to it, especially if uncertainty and risk are factors in the decision. As an example, the recent volatility in the stock market will likely have many people reevaluating their risk profile. This is one tool that can help explore their perceptions of risk.

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