

Needs of the Consulting Engineering Sector and Strengths and Weaknesses of Today's Graduates

Kelly DiNatale, P.E., B.C.E.E.

Camp, Dresser, and McKee

A common concern of water managers in local governmental and consulting sectors is the challenge in finding, training, and retaining qualified, experienced water professionals capable of independently analyzing and directing work and managing projects. There has been a chronic shortage of employees with at least five years of experience that are prepared to advance to independent project management. This shortage appears to be slightly lessened with the recent economic downturn, but is expected to return once the economy recovers. Is this shortage of qualified candidates a perceived or real issue requiring discussion and action in both the academic and professional water communities? Has water engineering become a low valued profession such that many qualified students and young professionals with the skills and drive to excel are not considering this field of study or, if they have, leaving the profession after a few years for other more attractive professional opportunities? How is the consulting profession responding to this challenge?

The Challenge

Water resources and environmental engineering consulting is a difficult profession with high client expectations. Average salaries, while not low, have become less competitive over time compared to other areas of study and professions competing for today's students and young professionals. These other professions, particularly business, offer the opportunity for quick advancement, higher salaries and entrepreneurial opportunities. Government-sector water and environmental engineering employment presents even less opportunity than

consulting, but this is compensated by greater benefits and job security. A professional water or environmental engineer at a mid-level point in his or her career is likely to have expectations of significant increases in salary that are not supported by the market.

There is a need for more water professionals from all areas of expertise in both consulting and local government. In recent years, employers have been fortunate if there was a single qualified candidate for a project management position. Due to the current recession, there is likely to be more than one good candidate per position. However, the economy will rebound and we will be faced with shortages once again. Candidates frequently have strong geographical preferences with which employers must contend while consulting firms must hire to fill needs across the country or, indeed, across the world (i.e. they might hire a SWMM modeler in Florida to cover a need in the western U.S. or abroad). Firms currently are trying to draw from pools of candidates closer to where project need is located to avoid relocation costs and improve retention rates.

The Desired Skill Set for Graduates

A solid technical base is critical for new water resources or environmental graduates. There is also a need for a solid background in related fields that reflect the social and political framework within which engineering practices take place. The requisite skills include the following:

- Quantitative skills in modeling (water supply, hydrology & hydraulics, ground water, etc.) and advanced Excel spreadsheet analysis;

- Geographic Information Systems and Computer Aided Design for the design practices;
- Water supply and demand forecasting;
- Water quality management and its relationship to water supply and meeting future water needs;
- Basic understanding of environmental regulatory and policy issues. Too many students leave school without a basic understanding of existing environmental regulatory requirements;
- Decision-support analysis and other tools to analyze alternatives and reach common understanding on complex, contentious water issues;
- Good writing and communication skills, and including facilitation and presentation;
- Time and money management skills related to project management.

In recruiting college graduates into the water resources field, employers recognize that it takes many years to develop the knowledge base and experience to function as a water professional with high levels of independence and initiative. The ability to function at a policy analysis level will require extra-university experience and cannot be expected of new employees. Proper mentoring is vital to the development of strong policy analysis and project management skills.

Observations on College Graduates

The range of technical and analytical skills seems to vary widely among graduates with engineering degrees at both undergraduate and graduate levels. Graduates with a Bachelor of Science degree in engineering often have stronger analytical abilities and are better technically grounded than those who have entered a higher level engineering degree from another related water resources field. These technical and analytical skills acquired in undergraduate engineering may not be available for those with other undergraduate degrees entering graduate level engineering programs.

Writing and communication skills also vary widely among graduates and their importance cannot be overstated. It is often asserted, (but unproven) that technical and business writing

skills have deteriorated among graduates over time. All graduates have basic spreadsheet, word processing, and PowerPoint skills, but advanced quantitative abilities vary, with some graduates having strong modeling and programming abilities, while others struggle with anything more than an Excel spreadsheet.

Technical training is the foundation for moving on to project management, water planning and policy analysis. An engineering career tends to have three phases:

- Phase 1 places an emphasis on acquiring and using technical and analytical expertise;
- Phase 2 is the development and effective use of project management skills; and
- Phase 3 places greater emphasis on developing and maintaining good client relationships.

Suggested Areas for Additional Emphasis in Water Resources and Environmental Education

1. *A strong technical and quantitative foundation* is needed during the first years of employment. Not all new employees have to be able to perform advanced modeling tasks, but there is a need for all new employees to be able to utilize complex spreadsheets and other tools to perform detailed analyses with minimal direction.
2. *The ability to analyze problems and develop solutions* using independent analysis must be developed. This can be partially learned by doing “real” projects as part of coursework in which students are required to analyze a problem, and prepare a professional quality report with all tables and figures, including using GIS. Water resources curricula should emphasize “real” project experiences requiring research and analysis throughout the program and not only during a senior design project.
3. *Development of report organization and writing skills* is critical. Attention to detail is an essential skill and a learned ability. Checking all calculations and results is important. Extensive writing should be required in the curriculum, followed by thorough critique and

editing until student skills meet professional standards.

4. *Project management skills* are essential. The ability to organize work and manage schedules and budgets is an essential part of consulting that is likely to be learned only on the job.

The Response of the Consulting Sector to These Needs and Requirements

As noted, the consulting sector will continue to be faced with a shortage of qualified graduates. The following realistic conditions will have to be faced by consulting firms as they try to hire and retain qualified personnel.

1. There will be continued development and applications of the “virtual workplace.” Firms that are regional, national or global will continue to hire candidates to fill disciplinary needs regardless of location.
2. Hiring will occur at the junior level to fill mid-level vacancies. There will be programs to accelerate the advancement of those recent graduates with the greatest potential.
3. It will be necessary to provide competitive benefits, especially benefits targeted toward mid- and junior-level staff. Flexible work options and reduced work weeks have proved popular among new hires.
4. It is likely to be necessary for the larger firms to fund and develop overseas engineering centers where labor is more abundant. This works well for repetitive engineering tasks such as digitizing and data input but can extend to skilled design and management tasks. This allows consulting firms to “stretch” the available engineering hours stateside. Camp Dresser and McKee (CDM) has production centers in Singapore and India.
3. Encourage membership in and involvement with professional societies. Provide incentives for staff to participate on committees.
4. Recognition that recent graduates are very socially conscious. Provide opportunities and programs in which staff can use their chosen profession to “change the world.” Examples can be as simple as riverfront cleanups or as complex as development of an in-house Engineers Without Borders Program.
5. Relocate staff to places of their choosing. For example CDM has increased its relocation budget significantly to accommodate relocations requested by staff members, including relocating overseas.
6. Implement internal or external development programs that address “English as a second language” issues. As the domestic resource pool dwindles, we are drawing on more and more foreign personnel to increase the candidate pool. CDM and major competitors have in-house staff that specialize in immigration issues, allowing us to hire foreign staff that have more complex immigration issues.
7. Recognize that any recent relief over hiring is a short-term phenomenon. Once the economy rebounds, the battle to hire qualified graduates will intensify. When the economy picks up, the qualifications of the candidates to be hired will have to be lower, even though advanced (masters) candidates are preferred to bachelor candidates.

CDM’s Approach to Staff Retention and Development

1. Provide financial support for continuing education and specialized training.
2. Continue to develop and deliver accredited coursework through CDMU, our in-house university.

Author Bio and Contact Information

KELLY DiNATALE is an Associate and Principal Water Resources Engineer at CDM, Inc. in Denver, Colorado. He has served as Technical Director for the Colorado Statewide Water Supply Initiative and the Colorado Inter Basin Compact and Basin Round Table processes. He is currently involved with water supply planning and system reliability, demand forecasting, water rights, agricultural water use and efficiency, water quality and treatment, optimization of infrastructure and trying to reach common ground on water issues. Prior to CDM he was Water Resources and Treatment Manager for the City of Westminster, Colorado. He can be contacted at (303) 383-2300 or dintalekn@cdm.com.