



Geospatial Technologies (or "Geomatics" as some prefer) is the progression of geography as it takes on the new capabilities of a high tech world. Geospatial applies to both the science and technology that drives areas of expertise such as land surveying, cartography, navigation, remote sensing, Geographic Information Systems (GIS) and Global Positioning Systems (GPS). Unlike the study of geography, Geomatics is a young term that has evolved quickly with advances in computing, satellite technology and a growing demand to understand our global environment.

Over the last 15 years, Golder professionals have led the way in the application of geospatial technologies to ground engineering and environmental services projects. In the earlier years, our geospatial services were provided in support of our core businesses by a handful of people based in a couple offices. Now we provide geospatial consulting services to a wide range of clients through the specialized skills of a global network of experts. Together we provide solutions that tie in your projects with geography and technology.

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VISUALIZING A WORK OF ART

BY CLARE DUNNING AND FRANK HARRISON, DENVER USA
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The large-scale artwork of Christo and Jeanne-Claude has amazed and perplexed many people over the years – temporary urban and rural creations such as a coastline in Australia wrapped with fabric, a curtain hung across a mountain valley in Colorado, and a nylon fence stretched across ranch land in California. What many art-lovers may not appreciate is the engineering work that goes into these flights of fancy.

The artists called on the skills of Golder's Denver, USA office for one of their upcoming works, "Over the River," which has been proposed for display during two weeks in the summer of 2010. Over the River will cover part of the Arkansas River in Colorado with over 900 panels of translucent silver fabric suspended from horizontal cables which will create shimmering waves above the running water. The river channel that will be covered twists through the valley with a multi-lane road on one side and a railway on the other. This creates an engineering challenge because there are a wide range of widths and heights along the 66 km (41 miles) of canyon, of which 11 km (seven miles) will be covered. In addition part of the river bank is solid rock, and some of the bank has loose rock that remains from road and railway-building.

All of this poses a challenge to Golder employees who are working on ways to anchor the cables. A three-dimensional spatial analysis has been devised to accurately determine the position for approximately 2,000 anchor points, while maintaining parabolic cables that are parallel in three dimensions. A virtual-reality fly-through of the canyon, indicating anchor, cable and panel locations, has greatly helped the planning process.

This sizeable work of art is expected to come together in 2010, when an estimated 250,000 people are expected to view the work of art. To learn more about the works of Christo and Jeanne-Claude, visit their web site at www.christojeanneclaude.net.



▲ Accurate planning is a big part of success in major outdoor artworks

MEGAPROJECTS CALL FOR A NEW ORDER OF INFORMATION

BY PAUL KEEFER, BRISBANE, AUSTRALIA
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Megaprojects in the mining sector are different from other projects – and it is not just because of the money involved. These projects, usually defined as having capital construction expenditure of US\$1 billion or more, have a whole different scale of needs around information management.

One of the reasons for this is rising global expectations about how mining companies manage the environmental and social impacts of their operations. Also, financial sources such as commercial lenders, development banks and institutional investors want to be sure that the projects they fund do not result in negative publicity.



As a result, huge volumes of information must be gathered, managed and stored in large geospatial databases, including all facets and phases of the mine's life – pre-feasibility, bankable feasibility, baseline environmental and social data capture, engineering design, and environmental factors such as surface water and groundwater management.

Gathering data is made easier by tools such as mobile GIS, which helps personnel navigate and become familiar with the area, gather geotechnical and environmental data, and map vegetation on land and in the water. At the output end of the process, three-dimensional visualizations help clients and stakeholders understand how the mine will develop and how environmental and other risks are being managed.

RESOLVING WATER SOURCE PROTECTION ISSUES

BY JOHN EASTON, BARRIE, CANADA
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Like an old-style American Western movie in which townspeople and ranchers struggle for rights to a well or stream, today's towns and cities may have conflicts with rural areas over protection of water sources. Farmers and other rural landowners sometimes feel that their property rights are being impaired by urban areas' need for water. Industrial land owners inside municipalities may also feel threatened by Municipal Source Water Protection strategies. A better understanding of underground water flow is helping to reduce this conflict.

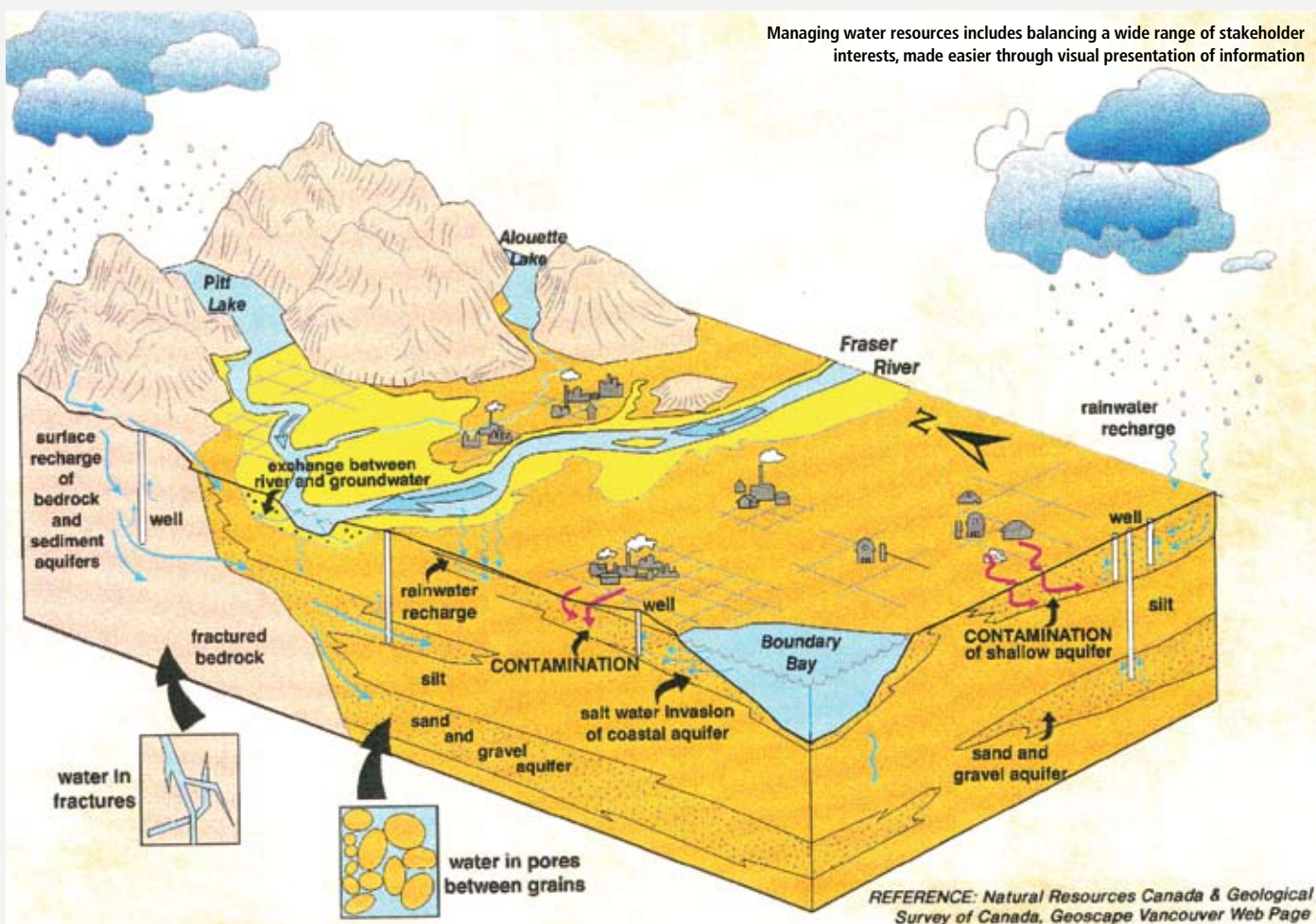
To help protect the area around a municipal water supply well, regulators designate a "capture zone" around municipal wells. Creation of a capture zone is intended to protect the public from activities that might contaminate the water, such as industrial operations or intensive farming. Some farmers and other rural landowners oftentimes feel that these zones are unrealistically large, thereby impacting their ability to use their properties for operations of their choice.

Three-dimensional groundwater modeling software is helping resolve this issue. In a groundwater supply well, water travels at variable rates within the capture zone, both horizontally and vertically. A better understanding of how long it takes for water to travel through horizontal layers of sediment helps hydrogeologists map out more appropriate sizes of capture zones. More accurate information on the geology and aquifer characteristics in each geological formation helps as well.

An understanding of the geology, the hydrogeology and the integration of this data by groundwater flow modelers is essential in the preparation of the highly accurate models that are now available.

The result is better protection of water sources, more defensible models, and greater harmony among land owners and regulators.

Managing water resources includes balancing a wide range of stakeholder interests, made easier through visual presentation of information



PACKAGING GEOGRAPHY FOR A GLOBAL ENERGY COMPANY

BY CHRIS JORDAN, CALGARY, CANADA
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A Canadian oil and gas company with operations around the world is better able to share information thanks to a solution that helps pull together and deliver data collected for a wide range of disciplines.

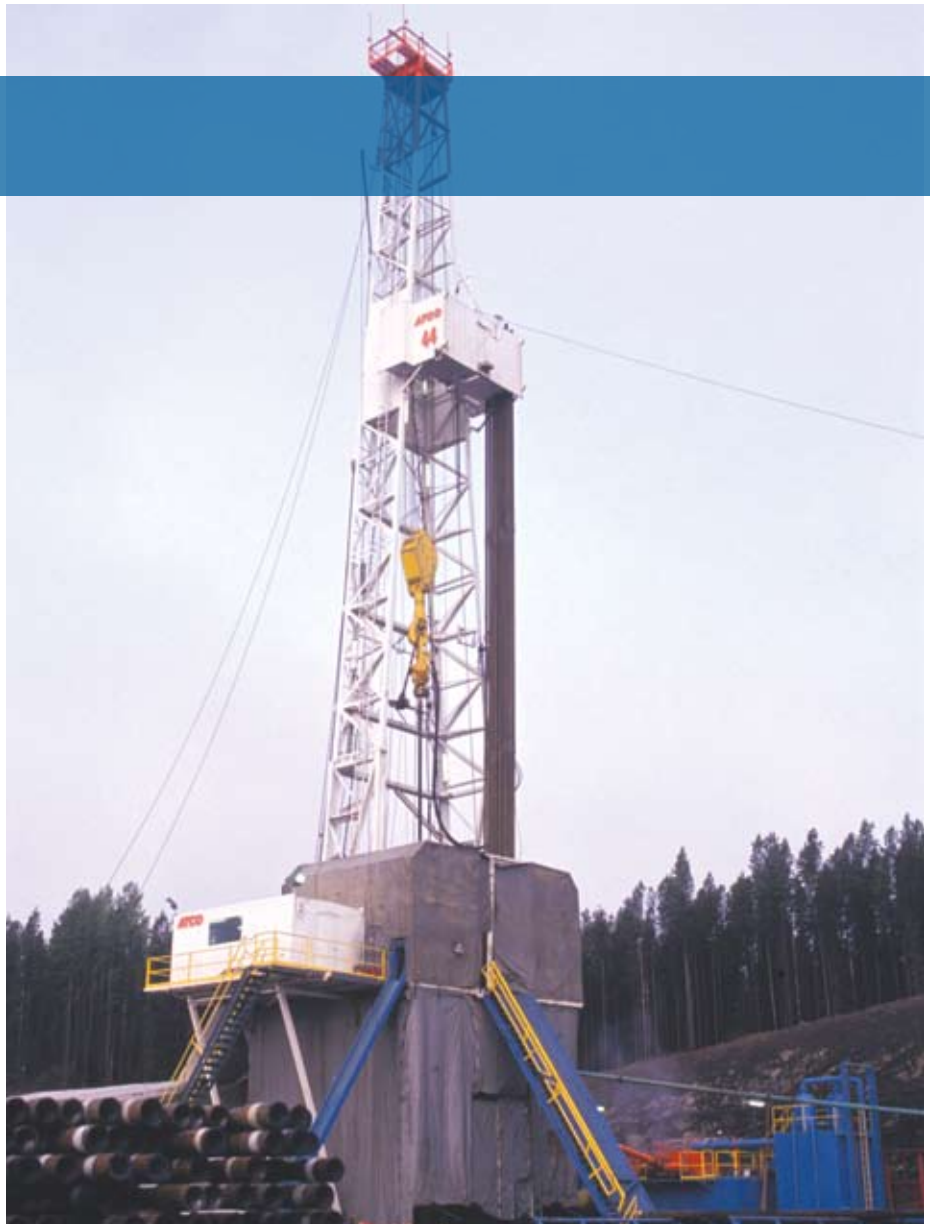
Talisman Energy, like many large energy companies, is challenged by vast quantities of geographic data. This includes information on seismic tests, environmental factors and land rights, among others.

Often this information is held in different software packages and on different platforms. Also, it is gathered for different purposes and, as a result, might be unusable by other departments. The result of having to maintain various software licences and associated hardware is costly and efficiencies are lost.

Talisman needed an integrated solution that would facilitate storage and the dissemination of this information for easy access across the organization.

Talisman recently worked with Golder and other GIS experts in the development of an Enterprise GIS solution to let users query and view spatial data. Requirements included secure access, sophisticated tools for technical users and basic tools for casual users.

This Enterprise GIS solution is now being implemented and will continue to evolve over time as needs and opportunities are identified.



Combining information resources
supports company goals.

UNDERSTANDING LANDSLIDE RISKS

BY MATTHEW LANGLEY, BRISBANE, AUSTRALIA
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Residents of a hilly part of the Gold Coast, on the east coast of Australia, can sleep more soundly at night knowing there is now a better understanding of local landslide potential and improved management of the risks.

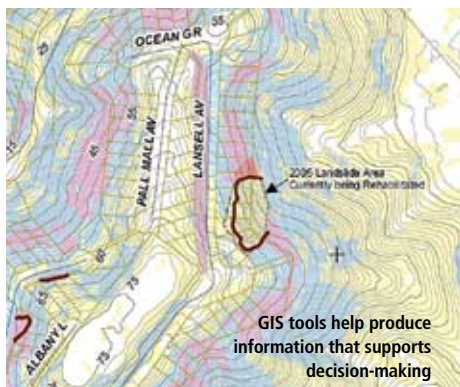
In June 2005, several landslides occurred on Currumbin Hill after a remarkable rainfall event. Nearby residents appealed to their local municipal Council to find out about whether more landslides could occur, where and when they might happen, and what could be done to prevent them.

To help the Gold Coast Council respond to the residents concerns, Golder developed a way to visually show the relative likelihood of landslides within the area, identify the most vulnerable properties and then assess those risks.

The process started with collecting existing data; conducting a landslide hazard assessment (which included a study of the geology, soil cover, groundwater flow and surface water drainage); gathering new subsurface data including borehole-drilling; and monitoring regional groundwater levels. It was also important to select the major factors causing landslides.

This involved collecting, managing and calculating a great deal of data that helped us assign weightings to each parameter affecting landslide potential. GIS-based applications helped manage this process, eventually producing a landslide hazard map which indicated the properties for which a landslide risk assessment was needed.

The result has been a tool that helps residents, political leaders and other community members understand where best to invest financial resources in risk-management measures.



KEEPING A SWEDISH TRAIN TUNNEL PROJECT ON TRACK

BY KIM FORCHHAMMER, STOCKHOLM, SWEDEN
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Building a railway tunnel under one of the oldest parts of Stockholm will run more smoothly and in a way that helps builders and other stakeholders stay informed on the progress, through the use of a data management tool developed by Golder.

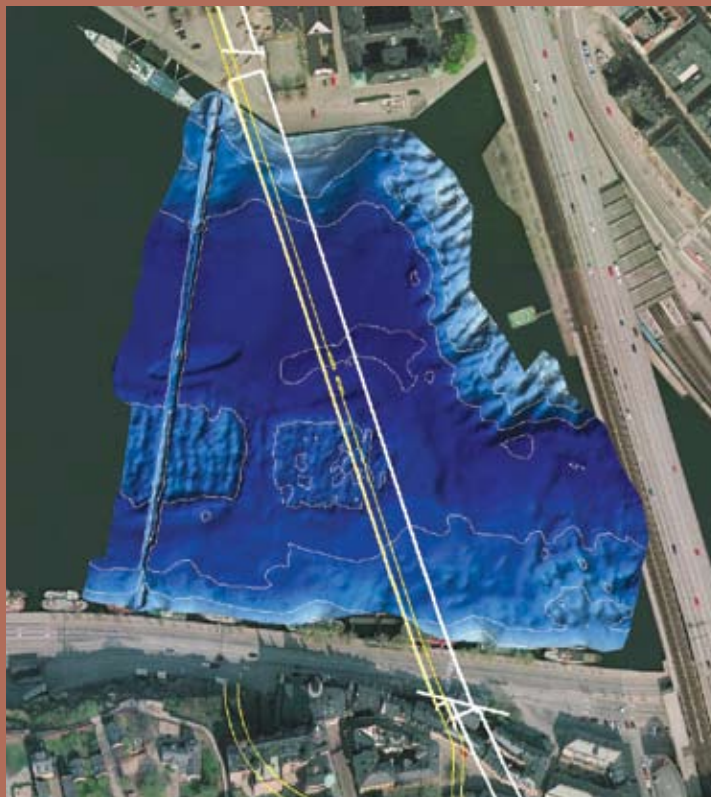
The Citybanan tunnel, which will extend six kilometres (3.7 miles) beneath downtown Stockholm, will ease train travel in and out of the capital. Planning the work requires coordination of a large number consulting firms including Golder, which is responsible for the geotechnical design of a particularly challenging section under a waterway. It is very important to be sure that the work of each firm supports, rather than conflicts with, the work of others.

During tunnel construction, which is expected to take from 2006 to 2013, large amounts of information must be made available efficiently to all companies involved.

A wide range of stakeholders also need real time information on tunnel construction, including operators of the city's subway system, environmental regulators, political leaders and owners of nearby buildings, some of whose buildings date back to mediaeval times.

Part of the solution comes from the Web-based interface developed by Golder. This system helps the construction team manage information on factors such as the status of nearby buildings and their foundations, water leakage and groundwater status.

Having this information available should allow the work to proceed efficiently and in a way that protects the interests of all stakeholders.



The tunnel will pass through lake Riddarfjärden in a submerged concrete tunnel. Depicted is a visualization of a sonar scan of the lake bottom, the planned concrete tunnel and access tunnels used during construction.

PREPARING AN INDUSTRIAL SITE FOR ITS NEXT USE

BY EVIE COSTER, MELBOURNE, AUSTRALIA
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Managing and conveying complex information associated with the remediation of a former industrial site in Coburg, Australia has been made easier thanks to GIS technology.

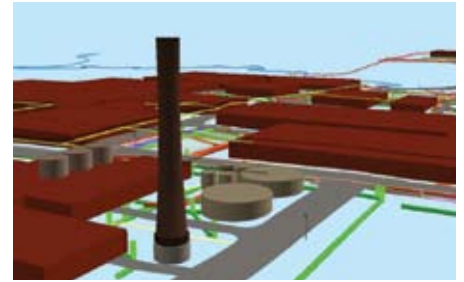
The former Kodak (Australasia) manufacturing and distribution site, where operations ceased in 2004, is being reborn as a part residential and part industrial property. To ready the 28-hectare (68 acres) site for its new owners, Golder worked with Kodak to remediate the soils and groundwater to meet Australian government requirements.

The study required incorporating information from previous site investigations and validation works with historical infrastructure plans, process diagrams and aerial photographs, to create a central information database resulting in better decision-making for the current remediation project.

To do this, Golder used GIS and geodatabase technology to build a common data management platform for cartographic display, modeling, statistical reporting, volume calculations and quality control. The goal was to provide a collective design framework for all layers of information thus providing useful data to all users.

This database was used to help prepare a “fly-through” model which included the buildings and the locations of contaminated soils, underground tanks, conduits and pipelines.

The result has been a tool that helps manage project data on a day-to-day basis, but is also a powerful way to convey progress and next steps to all parties including our client and the regulatory authorities.



A three-dimensional visualization (above) helps project managers keep track of the buildings and underground installations on the site, shown below in a pre-demolition aerial photo.



Aerial image courtesy of Kodak

PREDICTING THE NOISE FROM WIND TURBINES

BY TERESA DREW, CALGARY, CANADA
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Wind power is often thought of as environmentally benign, but there are still environmental considerations to be made, including noise impacts. Windfarm developers need to be able to demonstrate to environmental regulators, local municipal authorities, nearby landowners and other stakeholders that the noise from wind turbines will be well managed.

Why, given the low noise levels of today's turbines, does this issue raise so much controversy? One reason is that humans are visually cued in what they notice. Wind turbines are large, out in the open, often on high ground, and they move – all factors that attract attention. Any sound they make is likely to be noticed.

Part of the solution comes through demonstrating to regulators and other stakeholders that noise levels from turbines will be managed in a way that stays within appropriate limits. This includes determining noise levels at the planning stage, so that turbines can be placed in optimal locations.

To do this, windfarm developers can use an increasingly accurate box of tools to help them determine noise levels for variables such as topography, prevailing wind directions and wind speed. High accuracy weather models, coupled with GIS solutions that overlay this data with topographic maps, help build an accurate picture of wind turbine noise impacts prior to construction.

The results are better informed stakeholders and less complicated development of a power resource that is an increasingly important source of alternative energy.



Isopleth diagrams help indicate noise levels from a projected wind turbine location

News from Golder

ACCREDITATIONS/ PROFESSIONAL ACTIVITIES

Our Italian operating company has recently been accredited under OSHAS 18001 for Health & Safety. This is particularly important in Italy as we work for a number of Oil & Gas companies and the accreditation underlines our commitment to continuous improvement and the highest standards of Health & Safety.

Jas Singh from our Kamuela, Hawaii office has been named Vice President of the Academy of Industrial Hygiene (AIH).



A new book by Mike Jefferies and Ken Been, senior Golder specialists, delves into the mysteries of liquefaction: its causes, the math behind the modeling and the state-of-the-art contributions Golder is making to further our understanding of this phenomenon. Not just for engineers, this book is also about the pioneering spirit and a piece of Golder history. Hoping for an autographed copy? Call us; we would be happy to introduce you to the authors.

CE News recently published an article by Gregg Hudock (Golder Atlanta) called: "A Race Against Time." The article discusses the more than 11,000 dams constructed by the USDA NRCS over the last 50 years and the NRCS Watershed Rehabilitation Program that is now evaluating these structures to determine if the structures



require rehabilitation to extend their design life. Many of the structures are now high hazard dams and necessitate rehabilitation because of the probability of the loss of life in the event of a dam breach. For more information, contact Gregg at: ghudock@golder.com.

ACCOLADES

Golder Associates has been voted as one of the Top 10 Best Companies to Work for in South Africa in the Deloitte/Financial Mail Best Company To Work For Survey.

For the fifth year in a row, CE News Magazine recently ranked Golder Associates Inc. as #7 in its 2006 Best CE Firms to Work For competition in the large company category. We also ranked 26th in the top 50 chart for all engineering companies in the U.S.



The Western Australia Engineering Excellence Award winners were announced recently and Golder won the International Projects and Exports category for our work on reclamation of the waste dumps at Batu Hijau. We entered jointly with PT Newmont Nusa Tenggara.



Golder Associates has been selected as one of the TOP 100 Employers in Canada. We were selected out of the 60,000 companies that were invited and the over 1,500 companies that applied. Top 100 Employers are assessed in eight categories including: physical workplace; social atmosphere; health and benefits; vacation time; employee communications; performance management; training and skills; development and community involvement. In addition to the TOP 100 Employers in Canada designation, the British Columbia office has been selected as one of BC's TOP 30 Employers.

EVENTS

At the official inauguration of our Turkish company, held at the Canadian Embassy in Ankara, rather than give our guests a souvenir to take home with them, we decided to plant a tree for each person who attended. Feedback from our guests indicated that they very much appreciated this approach and respected our practical commitment to sustainability. As a more permanent reminder, we have posted an individual certificate confirming that a tree has been planted on their behalf to each of our 100 guests.



From left to right: Nural Kuyacak, Pietro Jarre, Selbin Dincturk Rossetti, Bryan Leach and Susan Tully.

Golder was a Gold Sponsor at the Canadian Brownfields 2006 Conference titled "Developing a New Real Estate Frontier" which was held on October 26 & 27 in Toronto by the Canadian Brownfield Network and the Canadian Real Estate Association. A Golder client won a brownfield award at the conference for Golder's work at Three Sisters Mountain Village. Dr. Mike Patterson (mpatterson@golder.com) chaired the International Keynote presentation at which the King of Sweden was present. For more information contact Jeanette Southwood (jsouthwood@golder.com).

JOINT-VENTURE NEWS

An alliance agreement has been signed between Golder and OSD, a specialist pipeline service company headquartered in Brisbane, Australia. OSD and Golder will exchange personnel to help solidify the relationship in Australia and North America. OSD provides pipeline services for mining clients and water resource projects as well as for oil & gas companies.

NOTEWORTHY PROJECT AWARDS

Golder Associates is part of a team led by Ecofys and Royal Haskoning to undertake a general study on the environmental impact of CO2 Capture and Storage (CCS) in onshore oil and gas reservoirs in the Netherlands on behalf of NAM, a major Dutch oil and gas operating company owned by Royal Dutch Shell and Exxon.

The Manchester, USA office has been awarded a three-year on-call contract for geotechnical services from VTrans (Vermont Agency of Transportation). Golder was awarded the highest technical score of all firms who submitted. The contract has a maximum value of US\$ 1M.

Bruce Power of Ontario retained Golder to start a 30 month environmental assessment of its New Build project, which could see the construction of four new, next-generation nuclear reactors with a combined capacity of 4,000 MW (these would be the first new reactors for Ontario in 25 years).

Golder was recently successful in providing multiple services to support the development of the regional water infrastructure "Water Grid" project in Queensland, Australia. We are providing environmental, project management, hydrogeology, geotechnical investigation, design review, and construction inspection services for two new dams, existing dam upgrades, and hundreds of kilometers of water pipelines.

FACILITATING FAST RESPONSE TO PETROLEUM SPILLS

BY SARA MARXEN, SEATTLE, USA
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Whenever there is a spill of petroleum products or other contaminants into inland surface waters, a big part of a successful response comes from effective communication of spill characteristics and response sites to responders in the field – before the liquid has been dispersed by winds and currents.

A pilot project using a Geographic Response Plan (GRP) in the western United States will help the State of Washington better manage the data related to surface water spill response and also help emergency response teams arrive more quickly at the places where their actions can do the most good.

Previously, much of the necessary spill response information was held in multiple databases and a hard copy report was difficult to keep current. Golder's GRP is a dynamic product which allows for easy data updates, "one-click" output of updated data, a standardized database for entering new response areas and a dynamic tool to estimate how quickly a spill is moving.

The GRP will include maps of spill response sites, the method of response, sensitive resources to protect and other geographic information necessary to understand and access the area – all factors that contribute to good emergency planning.

In developing the GRP, Golder used Geographic Information System (ESRI) software to develop a data structure that can quickly receive input of data for other watersheds in the State and produce the necessary maps and reports.

The availability of high-speed computers and advanced databases means it is possible to provide more effective spill containment services at the right time and place.



Good planning helps emergency workers, shown here in a practice drill, get to the scene quickly



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TECHNICALLY SPEAKING

Technically Speaking is published for valued clients and employees of Golder Associates. This quarterly newsletter includes articles showcasing innovative and technically challenging projects that Golder professionals have worked on throughout the world.

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GOLDER ASSOCIATES

At Golder Associates, we strive to be the most respected global group specializing in ground engineering and environmental services. Employee-owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Our professionals take the time to build an understanding of our clients' needs and of the specific environments in which they operate. Golder has experienced steady growth in the number of people we employ and our technical capabilities. We now employ over 5,000 people who operate from more than 140 offices across Africa, Asia, Australia, Europe, North America and South America.

