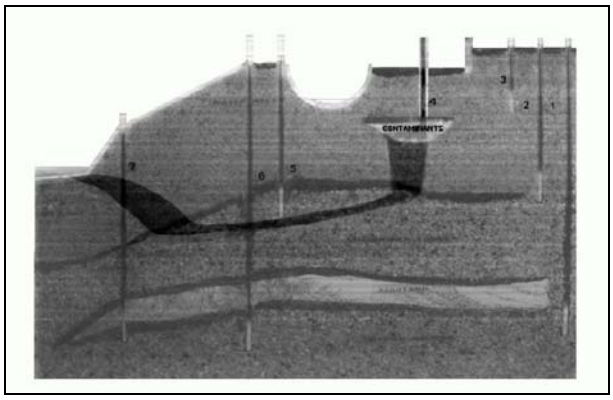
WDA CONSULTANTS INC.

WDA Consultants Inc. and its affiliates offer services in hydrogeology, contaminant hydrogeology, environmental studies, risk assessment, geophysics, remediation and decommissioning, hydrology, geology, and engineering geology, supported by extensive computer capabilities.

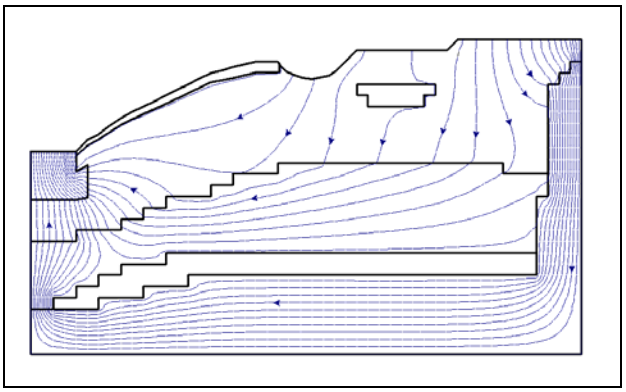
MISSION STATEMENT

WDA's aim is to provide solutions for sustainable development. This is achieved through efficient, quality fieldwork and data acquisition using methods suited for problem solving. Data evaluation and report preparation are aided by cost efficient computer support. Our reports provide both data **and detailed interpretation of results**.



Migration of contaminants in a sand model…

…and corresponding flow lines in a mathematical model



CONSULTING SERVICES

WDA specializes in the following services in geological and environmental investigations and remediation:

- quality field services
- monitoring of soil and water
- soil and water contaminant studies
- baseline geochemical investigations
- toxicological investigations
- pathway studies
- environmental isotopes
- assessment of groundwater flow systems
- large scale groundwater systems and CO_2 storage
- 2D/3D modelling of groundwater flow systems and migration of dissolved contaminants
- HYDRODYNAMIK – WDA's data system
- remediation and decommissioning
- computer services and program development
- support in litigation and hearings
- literature reviews/bibliographic searches

Our success is measured by the satisfaction of our clients

Using the above expertise, WDA also offers public consultation, expert testimony, environmental assessment, environmental approval assistance, and regulatory compliance.

OUR PEOPLE

WDA has the qualified staff to lead affiliates in providing a wide range of advanced services in environmental, hydrological and hydrogeological matters. We will work closely with the client to assess environmental and other industry concerns and provide tailored solutions.

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FIELD SERVICES

What *... are our field services?*

Well monitoring:

- to establish annual trends in water levels
- to monitor fluctuations in the groundwater table
- to monitor contamination
- to characterize the hydrodynamics of a groundwater system

Aquifer tests:

- to identify baseline data and the presence of specified chemicals
- to delineate the distribution of specified chemicals

Geochemical sampling:

- to determine permeabilities and transmissivities of aquifers
- to determine available water supply from an aquifer

Percolation tests:

- to determine suitability of an area for sewage disposal systems

Why *... do you need field services?*

Quality field services provide the base data for all evaluation and interpretation in any project. Quality field services are most important in contaminant identification and remediation. High quality field investigations are a precondition for meaningful analysis. They will allow remediation measures to be tailored to the cause, nature and extent of the undesired condition. They provide excellent return on your investment.

How *... can WDA help you with field services?*

We will:

- analyze your needs and goals
- evaluate existing data
- design and execute a field program in cooperation with you
- evaluate and interpret the data with appropriate methods to withstand the due diligence test.

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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MONITORING OF SOIL AND WATER

What

... does soil and water monitoring include?

The scope and objectives of soil and water monitoring programs will vary depending on your needs and goals. Monitoring may include:

- piezometer installation
- water level monitoring
- determining hydrodynamic base data for groundwater flow
- determining chemical base data for soil and water
- monitoring of chemical changes in wells and soil
- monitoring of soil air

Why

... would you want to use soil and water monitoring programs?

The development phase of industrial sites often requires that pre-existing groundwater levels, chemistry and hydrodynamic baseline conditions are known, as well as changes during the operation of the site.

Tracing and identification of chemical changes and determining their source will be required in situations of:

- well contamination
- site contamination (soil and water)
- migration of pollutants

How

... can WDA help you with soil and water monitoring programs?

We will:

- work closely with you to assess your needs and goals
- implement and execute the monitoring program
- provide evaluation and comprehensive and conclusive interpretation of the resulting data.

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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SOIL AND WATER CONTAMINANT STUDIES

What ... *are contaminant studies?*

Contamination is the degradation of soil and groundwater quality as a result of man's activities. A contaminant study strives to identify the nature, source and extent of the contamination in an area. It also prepares the foundation for risk analysis and eventual remediation.

A contaminant study involves the following:

- identify the contaminant
- delineate the groundwater flow system
- identify the source area
- delineate the migration path and mode of the contaminant

Why ... *would you require a contaminant study?*

Industrial sites often are sources of contamination. The contamination may have migrated on to neighbouring sites. Acquisition or sale of a property may require that any contamination on the site be identified, its risk factor determined, and the site possibly be remediated.

Contaminant studies are an important prerequisite for risk assessment.

How ... *can WDA help you with contaminant studies?*

We will:

- work with you, the client, to assess your needs and goals
- design an appropriate investigation program
- execute the contaminant study in accordance with your needs
- provide comprehensive and conclusive evaluation and interpretation of the findings
- determine the most cost effective remediation plan, if necessary

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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BASELINE GEOCHEMICAL INVESTIGATIONS

What *... do geochemical investigations include?*

A geochemical investigation includes:

- identification of suitable monitoring and sampling patterns
- collecting water, soil and soil-air samples for analysis
- determining the spatial distribution of the chemical species of interest
- determination of source and migration pattern

Why *... would you require a geochemical investigation?*

A geochemical investigation is used as a tool to determine the spatial and migration pattern of the chemical of interest, whether this be for baseline purposes or for contamination studies.

How *... can WDA help you with a geochemical investigation?*

We will:

- aid you in determining your needs and goals
- present you with the most cost-effective approach to meet your needs
- select sampling sites and collect samples
- oversee and coordinate the chemical analyses
- provide you with a comprehensive and conclusive evaluation and interpretation of the results

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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TOXICOLOGICAL INVESTIGATIONS

What

... are toxicological investigations?

Toxicity evaluation attempts to determine the effect of a toxin on the health of humans and farm animals by substitution tests on bacteria, fish and other test organisms. Toxicological investigations are often done in lieu of more time-consuming and expensive chemical studies.

Toxicological investigations involve:

- obtaining soil and water samples at a site
- determination of the toxicity of water and soil samples
- identifying the nature of the toxin and its source
- identifying the toxin using complementary chemical techniques

Why

... would you require a toxicological investigation?

Many chemical compounds are toxic to humans and animals, thus contamination of water or soil may have acute or chronic effects on people and animals in your area.

Identification of the toxin determines whether its removal from the site is necessary and what remediation technique is to be used.

How

... can WDA help you with toxicological investigations?

WDA is very experienced in conducting field sampling using proper techniques, in overseeing and coordinating the analyses, and in evaluating and interpreting the results.

We will:

- work closely with you to assess your toxicological need
- design and execute a field sampling program
- oversee and coordinate the toxicological analyses
- determine the necessary procedure for the identification of the toxins
- provide you with a comprehensive and conclusive interpretation of the findings

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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PATHWAY STUDIES

What

... are pathways studies?

A pathway study identifies the route followed by a chemical compound from source through the surface and the subsurface environment to the area under investigation. These studies encompass natural and man-made corridors for migration.

Why

... would you need a pathway study?

A pathway study aids in:

- identification of sources for contamination
- identifying changes that the contaminant may undergo during its migration
- risk analysis
- migration of pollution

How

... can WDA help you with a pathway study?

We will:

- work closely with you to assess the importance of possible sources
- apply environmental isotope studies for identification of sources and their relative importance
- implement and execute a pathway analysis program
- provide detailed interpretation of the findings

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ENVIRONMENTAL ISOTOPES

What

... are environmental isotopes?

Environmental isotopes of an element are part of the natural environment and are non-radioactive. They are ideal for use as fingerprinting tracers. Since they are already present in the system they are not added to the environment.

Why

... would you use environmental isotopes?

The identification of fluid sources and pathways is often aided by the use of environmental isotopes. For example, waters from different areas may contain different isotopic fingerprints allowing the identification of the source.

Sulphur isotopes are particularly useful for fingerprinting of sulphur-containing contaminants.

How

... can WDA help you with the application of environmental isotopes?

We will:

- design an investigative program in consultation with you, the client
- collect the samples in the field
- oversee and coordinate the isotopic analyses
- evaluate and interpret the results of the isotopic analyses

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ASSESSMENT OF GROUNDWATER FLOW SYSTEMS

What

... do groundwater flow studies include?

Groundwater flow studies include:

- determining the hydrogeology of an area using existing data
- determining location of the water table
- inexpensive computer modelling of the vertical flow regime in the area
- identifying general groundwater flow directions (recharge and discharge)

These studies may occur in conjunction with monitoring, pathway and geochemical studies.

Why

... would you want a groundwater flow study done?

Assessment of groundwater flow directions will help you to design a cost-effective monitoring system tailored to your needs.

Groundwater flow studies help to delineate:

- recharge and discharge areas
- potential areas for contaminant migration
- potential contaminant pathways

How

... can WDA help you with a groundwater flow study?

WDA is experienced in the assessment of local and regional groundwater flow worldwide.

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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LARGE SCALE GROUNDWATER FLOW SYSTEMS AND CO_2 STORAGE

What

... need is there for the investigation of large scale groundwater flow systems with respect to CO_2 storage?

Carbon Capture and Storage (CCS) is seen as the means to facilitate the shift from petroleum and coal-based energy to systems with no or greatly reduced CO_2 output. The Intergovernmental Panel on Climate Change (IPCC, 2005) made CCS the apparent method of choice to help reduce the rate of climate change while shifting to alternate energy sources. Presently there is a need to improve significantly on the concepts and physics used by IPCC (2005) for the planned injection and storage of CO_2. Of particular importance is knowledge with respect to the extent and depth of groundwater flow systems. WDA's work has shown that the direction of CO_2 migration (as gas, supercritical fluid, or dissolved in saline aquifers) is determined in dependence upon force fields in groundwater flow systems. These and other conceptual and calculation changes for CO_2 storage are summarized in www.wda-consultants.com/co2-main.htm.

Why

... are such investigations required?

The new knowledge requires the understanding of groundwater flow systems, particularly the recharge and movements of deeper circulating groundwater on a regional scale. Skills and experience needed are geophysical interpretation and tectonic analysis, drilling and completion of deep wells, as well as field studies, remotely sensed data interpretation with respect to the distribution of recharge and discharge areas and computer modeling of regional groundwater flow.

How

... can WDA help in these investigations?

Personnel of WDA have been involved in regional groundwater flow studies in the semi-arid Canadian sub-Arctic, and in regions of North Africa, France and Germany. As early as 1972, Dr. Weyer studied the regional distribution of recharge and discharge areas in India using satellite imagery. We are experienced with groundwater recharge in desert regions (Kuwait and Oman). We have installed monitoring wells for deep groundwater flow at several locations.

WDA will:

- Execute holistic investigations of both regional surface and groundwater systems within catchment basins through use of available data, remote sensing imagery and field installation of monitoring networks
- build-up data banks for existing and new data, applying modern GIS-techniques
- determine recharge mechanisms and amount in desert countries with so-called 'fossil' groundwater
- oversee and coordinate all baseline studies for climate, soil, surface water and groundwater
- prepare comprehensive and conclusive reports about all findings

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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MODELLING GROUNDWATER FLOW SYSTEMS

What *... is groundwater flow modelling?*

Modelling of groundwater flow is a tool to provide better understanding of groundwater flow systems. Given the known hydrodynamic and geologic parameters defining an area, groundwater flow modelling will provide you with a model describing general spatial flow directions and transport in an area.

The results may be used to identify recharge and discharge areas and provide guidelines for further analyses..

Why *... do you need groundwater flow modelling?*

Groundwater flow modelling offers a rapid and inexpensive method of identifying possible source areas for contamination in an area. Model results may be used to design sampling and remediation methods.

How *... can WDA help you with groundwater flow modelling?*

We will use groundwater flow modelling to:

- model existing hydrodynamic and hydrogeologic data to identify general patterns of groundwater flow in your area as a guide in setting up a monitoring program
- at the end of the project use the obtained data to provide a more accurate model of groundwater flow in the area as an aid in remediation

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REMEDIATION AND DECOMMISSIONING

What *... are remediation and decommissioning?*

Remediation is the process of cleaning up a contaminated site. It follows from a systematic definition of the character and extent of contaminants and is an important component of the broader decommissioning process to restore sites to an environmentally acceptable condition.

Why *... would you need a remediation action plan or decommissioning?*

During the operational phase, an industrial site may have been contaminated. A remediation action plan defines the goals, objectives, priorities, methodology and procedures for cleanup. A well prepared plan allows for an economical and timely cleanup consistent with regulatory requirements.

How *... can WDA help you with remediation action plans and decommissioning?*

We will:

- identify and understand contaminant issues at your facilities,
- develop site specific plans to deal with cleanup concerns, and
- manage and implement site remediation and related decommissioning activities

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COMPUTER SERVICES
PROGRAM DEVELOPMENT

What

... are our computer capabilities?

- groundwater modelling
- data collection, storage, and processing
- software development (Visual BASIC, AutoLisp, C, Lotus macros)
- CAD applications and digitization of maps and digital elevation models
- Internet connection for efficient data transfer between office and clients

We can accept data in any format for use in data evaluation and interpretation.

Why

... would you want to make use of our computer capabilities?

Our proven knowledge of computers, data processing and analysis, ensures timely and cost effective storage, retrieval and processing of all project data.

How

... can WDA help you with our computer services?

Computer analyses are done in-house and thus do not rely on outside sub-contracting. This means a more rapid turn-around from project inception to finished report.

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SUPPORT IN LITIGATION AND HEARINGS

What *... does support in litigation and at public hearings include?*

Support in litigation and hearings includes:

- identification of case needs
- evaluation of available data
- selection of suitable methods to collect and document technical evidence
- evaluation and interpretation of technical data from both parties
- preparation of a comprehensive and conclusive report
- technical support for the litigating attorney
- provision of expert testimony which stands up under cross-examination

Why *... would you require support for litigation and hearings?*

Strong technical support and expert testimony is essential for successful litigation.

How *... can WDA support you in litigation and hearings?*

WDA applies refined scientific investigation and interpretation methodology. WDA maintains its own scientific bibliography containing more than 65,000 titles. WDA personnel have been successfully involved in major federal and provincial agency hearings, including ERCB (now AEUB) and FEARO.

We will:

- identify the case needs and the most promising technical approach to its solution
- evaluate all available data
- devise an investigation plan in co-operation with the litigating party
- evaluate and interpret all technical data from both parties
- prepare a comprehensive and conclusive report regarding all points of view
- provide technical input into the selection of tactics and strategy for case presentation
- provide expert testimony which stands up to cross-examination

WDA has experienced personnel to assist your company in instituting these measures in a quality oriented, timely and cost effective manner.

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LITERATURE REVIEW
BIBLIOGRAPHIC SERVICES

What

... do literature review and bibliographic services include?

Literature review and bibliographic services include:

- comprehensive collection of relevant scientific and unpublished technical literature on a well defined topic
- evaluation, summary and critical reporting of results, scientific developments of the subject under consideration
- identification of future development needs

Why

... would you require literature reviews and bibliographic services?

Bibliographic services by professionals provide a balanced and weighted collection of relevant literature and reports. The value of this approach far exceeds the flood of citations often received from electronic searches by library personnel.

Literature review, evaluation and critical reporting by outside agencies can provide an independent point of view.

How

... can WDA help you with literature reviews and bibliographic services?

WDA personnel have conducted major literature reviews in water, soil, air, plant and bacterial systems. Review topics have also dealt with drilling, corrosion, toxicity, chemistry, groundwater dynamics and related subjects. At present WDA maintains a selected bibliography of 65,000 titles.

We will:

- collect relevant literature through electronic searches and most importantly, through interviews with various experts and agencies working on all aspects of the subject matter
- read and extract all relevant publications and reports
- test reported data for plausibility and contradictions
- summarize the findings in a clear, concise, comprehensive and conclusive report with deductions, conclusions and recommendations

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