

Sea Spring Water delivers consultancy and geophysical services for groundwater exploration & production and water management. Our approach is based on the integration of cutting-edge knowledge and tools from the water and oil & gas industries and the scientific community.

About Us

Sea Spring Water is an independent exploration and consultancy firm from The Netherlands offering a full range of services to explore, develop and manage groundwater.

Industry focus traditionally lies on shallow, unconsolidated groundwater and surface water, and with increasing water demands on more costly or environmentally burdening solutions such as seawater desalination or extensive pipeline transports. We offer yet another solution.

Sea Spring Water focuses on characterizing conventional aquifers but also explores groundwater in unconventional hydrogeological settings, such as offshore coastal paleogroundwater and deep or fractured rock aquifers. Worldwide, this unconventional groundwater represents an underutilized and vast source of fresh to brackish groundwater.

Our team consists of experienced professionals from a variety of industrial E&P and scientific R&D backgrounds ranging from hydrology, chemistry and water management, to geology and geophysics, to engineering, (turn-key) project execution and environmental management. Experience comes from numerous domestic and international postings with Royal Dutch Shell, SGS Horizon, Royal Haskoning - IWACO, Wintershall and NASA, and from the Acacia Institute of the Vrije University Amsterdam. We supplement this by working with key scientific and industry specialists.

Sea Spring Water was the first company worldwide to focus on exploring and developing offshore paleogroundwater and our expertise here is unmatched. This is firstly due to a leading scientific understanding in offshore paleogroundwater genesis, characteristics and evolution, and secondly by knowledge on uniquely developed facilities for offshore production, that stay clear of oil & gas prices.

At the basis of our business lies a set of unique, proprietary and operational geophysical tools for the identification and delineation of fresh and brackish groundwater occurrences. Following complete groundwater assessment our in-house service includes the execution of front-end development studies for the assessment of technical and commercial viability and preparation of an outline plan for actual project execution.

We work together with a number of established industry players that allow us to offer a full project execution capability, including the design, construction and operation of facilities for production, treatment and delivery to the end users.

Services

Clients are offered a full range of services to determine local groundwater occurrences and to help define and develop this potential. Given the increasing problems associated with water withdrawal from onshore shallow aquifers and continuous depletion of these reservoirs, our specialty is to also look for water where others don't: in offshore coastal strata and in deep onshore strata.



Services

Exploration

- Hydrogeological Data Assessment & Modelling
- Geophysical Data Collection
- Hydrochemical and Soil Analysis

Development

- Front-end Field Development Studies
- Economic Assessment

Partnerships

SSW offers a total water supply solution by working with leading engineering firms in the fields of:

- Water and Oil & Gas Drilling and Production
- Geophysical Surveying
- Water Treatment

Hydrogeological & Geophysical Exploration Studies

- Subsurface definition, new data acquisition, reservoir & production modelling and forecasting.
- New data acquisition using electric and electromagnetic methods, including unique seaborne EM equipment, TDEM, FDEM, CVES, VES and Grounded Dipole TDEM. Seismic surveys are conducted with partners.
- In-house hydrochemical and soil analysis.

Front-end Field Development Studies & Economic Assessments

- Outline design of onshore and offshore water wells, and production, transport and treatment systems and water utilization scenarios.
- First pass assessment of cost and economics and initial plan for project execution.

News

Symposium "Groundwater Exploration: State of the Art and Beyond" (22 May 2008)

Fugro, the Dutch Association of Hydrologists (NHV) and Sea Spring Water will host a symposium on the analytical and applied geophysical methods in groundwater exploration. The symposium aims to present both current and near-future methods, to discuss how data collection and computational methods should work together, and what lessons can be learned from the past. Exploration experts from various private and public organisations will deliver lectures and in the evening various exploration and sounding methods will be presented in the field. The event is held on May 22 2008, and hosted at Landgoed De Horst in Driebergen. For further information or attendance please contact Sea Spring Water, Fugro Ingenieursbureau (www.fugro-nederland.nl), or visit the NHV website at www.nhv.nu/symposium.html

Sea Spring Water wins Herman Wijffels Innovation 2nd Prize (October 2007)

Out of a group of 227 innovative companies, SSW has been awarded the 2nd prize of the prestigious Herman Wijffels Innovation Prize 2007. The prize was awarded for the innovative concept and technologies used to explore and develop offshore groundwater worldwide. The Dutch Minister of Economic Affairs - Mrs. Maria van der Hoeven - and the CEO of Rabobank - Mr. Bert Heemskerk - presented the prize to Rogier van Opstal of Sea Spring Water.

Further details at www.rabobank.nl

Innovation nomination to Sea Spring Water (July 2007)

Sea Spring Water has been nominated for the Rabobank Herman Wijffels Innovation prize 2007. In October the winner will be announced out of 10 nominated companies.

For more details go to www.rabobank.nl

Innovation prize to Sea Spring Water (May 2006)

Rogier van Opstal, business developer at Sea Spring Water, has been awarded the KVWN ("Royal Association of Drinking Water Supply in the Netherlands") Junior Water Prize for his offshore groundwater business development work.

Article (Dutch) in the Volkskrant (leading Dutch newspaper, Dec 2004)

[Read](#) about Sea Spring Water's collaboration with the Vrije University Amsterdam in the design of a innovative seaborne TDEM (Time-Domain Electromagnetism) system for groundwater characterisation. This system has since been further modified and improved.

Publications

Related scientific publications of our core team may be found here: [Scientific Publications](#) (.pdf)

Unconventional Groundwater

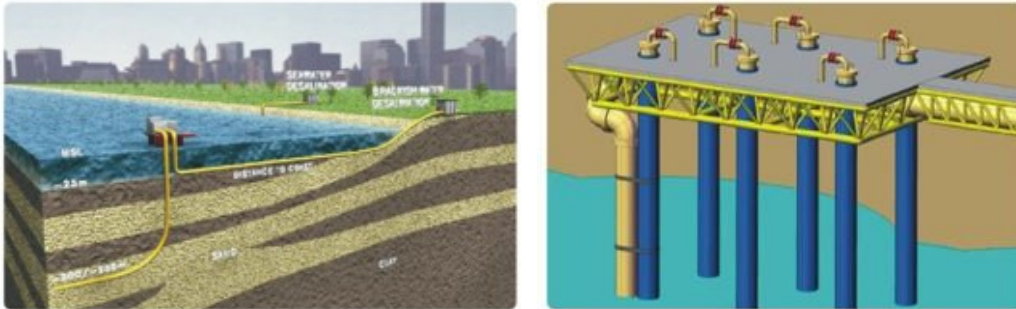
Background

Water scarcity is a sad fact of life to many regions worldwide, and it looms on the horizon of yet others. While a strong industry focus lies on water management practices or supply options such as seawater desalination and conventional groundwater development (i.e. groundwater development from unconsolidated, shallow aquifers), Sea Spring Water's focus lies on development of unconventional groundwater resources.

Incorporating leading industrial and scientific knowledge and tools, we explore and develop groundwater in locations where this is often deemed absent or unsustainable, such as offshore paleogroundwater or deep, onshore groundwater.

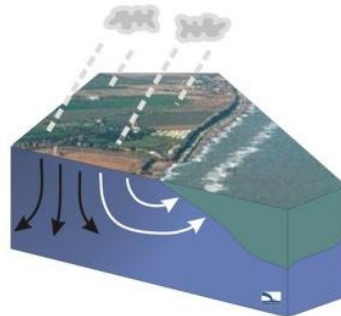
Offshore Paleogroundwater

Offshore paleogroundwater was formed during the low sea level stands of the last ice age. Imagine large parts of continental shelves worldwide where aquifers were formed and recharged. And where water quality has been protected up to current times. With a strong foundation in scientific research, Sea Spring Water is the first company worldwide to explore and develop this fresh to brackish resource.



Offshore Paleogroundwater concept and production rig

Innovative use of technology from the water and petroleum industries allows development for extended periods at a cost considerably lower than through any means of seawater desalination. And at volumes which make it an interesting option for either small demands or large municipal and industrial demands.



Groundwater recharged onshore may occasionally flow to submarine strata. A discharge to the sea ("springs") may also exist, but volumes are relatively small and would be best captured onshore. This active, offshore groundwater must not be confused with offshore paleogroundwater (above).

Onshore Unconventional Groundwater

Most groundwater worldwide is developed from unconsolidated, onshore sediments in the uppermost few hundred meters of the subsurface. Despite occurrences of groundwater in other settings, such as deep (500 - 2000 m+) groundwater or fractured and carbonate reservoirs, the water industry is largely unfamiliar with exploring this unconventional onshore groundwater. Actually, most existing unconventional groundwater developments are the result of coincidental discovery, for instance during petroleum exploration.

Sea Spring Water combines leading knowledge and tools from the scientific community and water and oil & gas industries to fundamentally understand genesis and evolution of unconventional groundwater and to systematically explore it.

Why

Groundwater development is generally part of a larger water management and supply strategy, in which other supply options, for instance from surface water, exist also. Groundwater does have significant advantages over other supply options:

Development of offshore groundwater becomes particularly interesting when cheap, shallow aquifers onshore have become unsustainable, polluted, or otherwise cause negative environmental effects. In many cases - in addition to exploring more unconventional onshore, groundwater occurrences - only expensive alternatives remain, such as elaborate pipeline & storage facilities or seawater desalination.

Depending on several key parameters, of which groundwater quality & depth, and distance offshore are the most important, one can develop offshore paleogroundwater and realize a significant cost-saving. In addition there are significant operational and environmental benefits too.

Financial Advantages

- Lower overall capital & operational cost than seawater desalination
- Capacity increase of existing water sources through blending
- Possibility of direct use quality

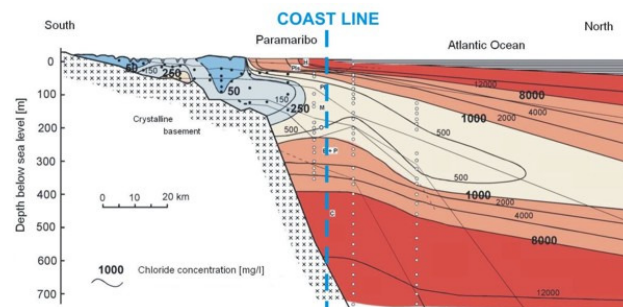
Environmental Advantages (compared to surface water and seawater)

- Protected from surface pollution
- Little solute load & chemically stable
- Constant temperature

Operational Advantages (compared to seawater desalination)

- Less brines disposal
- Less chemical usage
- Less energy required

The documented occurrences of offshore groundwater are enormous and not to be exploited rapidly, while environmental problems related to onshore overexploitation of shallow groundwater, notably land subsidence and coastal salinization, are avoided.



Offshore (Paleo)Groundwater extending to > 50 km offshore in Surinam

The water's origin can be both fossil and recent and qualities range from potable (< 500 mg/l TDS) to saline. Obviously the latter component is not of interest, but the associated volumes of fresh to lightly brackish groundwater are, especially offshore, still far greater than that of most conventional and shallower onshore aquifers.

Exploration

Exploration consists of the hydrological analysis of existing data supplemented by newly acquired data, and the development of static and dynamic reservoir models to predict production behavior and yield.

Our approach is highly systematic, fundamental and multidisciplinary in nature and it incorporates the know-how, methodology and tools of both industrial and academic experts. It relies heavily on our know-how in areas of fresh-salt hydrology, coastal hydrology, paleohydrology & - geomorphology, structural geology, tectonics, GIS and in geological and reservoir modeling.



Exploring Offshore Groundwater with Electromagnetics (EM)

New data acquisition relies on understanding the capabilities and limitations of exploration tools to locate and define unconventional groundwater. Together with several key industry and academic parties, we are therefore continuously researching and developing new exploration equipment, most notably offshore EM (electromagnetic) exploration equipment.

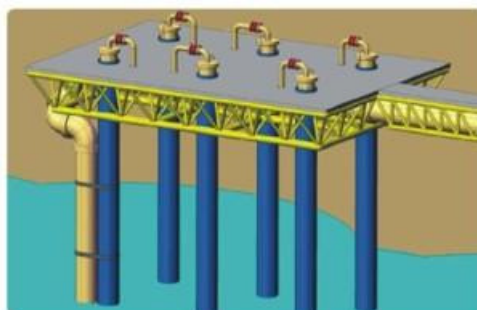


Exploring Groundwater the more conventional way

Production

Because production comes from offshore aquifers or from deep onshore aquifers, conventional water drilling and production practices and techniques are not fully suited. To some degree they must be combined with technologies from mainly the petroleum industry, while maintaining their low - non oil & gas - cost.

Our team's background in the water and hydrocarbon Exploration & Production field, together with strategic alliances with several main industry players, has resulted in a variety of drilling, production and transportation concepts.



Offshore Groundwater production facility.

Although vertical wells are traditionally the preferred option, the ongoing development of cost effective deviated and horizontal drilling techniques is increasing the production alternatives.

Treatment

Groundwater may be fresh to brackish and require anything from basic filtration and disinfection to desalination. Sea Spring Water works together with established water treatment engineering partners to offer the optimal solution.

Brackish Groundwater Utilization

However, it may be smart, if possible, to use the water directly with minimal additional treatment and cost. Although this potential is often undervalued, brackish water has ample utilizations to make it interesting. For instance, it maybe used in biosaline agriculture, landscaping, watering of livestock, or in industry and construction.

An interesting utilization is also as blending water in post-treatment of distilled water, for blending with other water supplies, or in front-end blending in desalination plants. This improves the feed water quality and desalination efficiency, and thus the product water yield.

In conclusion, straightforward desalination, as is done in many seawater desalination plants worldwide, remains possible, and still offers a cost effective water supply solution.

After treatment the water is ready for distribution to the end user.

Oil & Gas - Science

Sea Spring Water is founded on the principle that where technical matters are concerned, only the best human resources and technology should be adopted. We therefore look further than just the water industry.

Oil & Gas

Huge budgets have allowed the oil industry to developed sophisticated knowledge and tools for hydrocarbon exploration and development and certain of these skill sets realise significant added value if applied to groundwater scenarios. For instance, the much tighter grip on lithological and diagenetic factors that control reservoir performance are beneficial for deeper paleogroundwater. Other qualities lie in basin analysis, drainage basin analysis, and well assessment and interpretation beyond the well bore.

Similarly, for complex strata and extensive data sets the industry's static and dynamic modelling tools become very worthwhile. In addition to specifically hydrological software we therefore also use software packages such Eclips, Petrel and Kingdom.

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Science

Science plays a crucial role in groundwater exploration. On one hand it develops knowledge and technology that may be adopted for commercial use, while on the other hand it represents a quality control on commercial results. For example, science has driven the discovery of offshore paleogroundwater, which was unknown in the water industry up to several years ago. Our team has an extensive scientific track record, an overview of groundwater publications may be viewed here.

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