Water resources management in the bottled water business

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Abstract

Nestlé Waters is the world's leader in the bottled water business. We operate 104 factories in more than 35 countries and produce different categories of bottled water: natural mineral water, natural spring water, drinking water. Our bottling activities depend mainly on the groundwater resources everywhere we operate.

With more than 500 water sources (wells or natural springs), Nestlé Waters has always considered their management as a strategic activity. This is the reason why a continuous monitoring system for each of those sources was put in place many years ago. The objective is to insure the sustainable water supply of our factories in terms of quantity and quality. Some technical procedures have been especially adapted to the bottled water business.

Moreover, to actively protect our water sources some specific activities have been implemented as the result of collaborative and open discussions with the communities. In particular Nestlé Waters is working alongside several local stakeholders (authorities, local communities, farmers) to put in place innovative and sustainable protection initiatives, which today cover thousands of hectares of aquifers recharge areas. Initiated in the early 1970s, the Agrivair programme in Vittel (France) is today considered a reference in groundwater resources preservation.

Keywords: water resources management, bottled water, water resources protection, Agrivair, Nestlé.

1 Introduction

Water is the source of all life, but while we tend to think of this as an abundant, inexhaustible resource, the fact is that less than 1% of all water on Earth is in a form usable by humankind. In dealing with the water challenge, it is clear that

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everyone must have a role. Governments have to take the lead, both as policy makers and through their fundamental duty to see that basic services are provided for their people. We need to look for ways and mechanisms, whether policy or market-based, that protect the world's water resources as well as access to water, but also to ensure each and everyone's responsibilities as water users.

Today, on a global scale, agriculture represents 70% of the world's withdrawal of freshwater; industry represents 20% and domestic use 10% (Shiklomanov [1]). Nestlé uses about 0.004% of the world's freshwater consumption (Figure 1). Our bottled water business uses 0.0009% (Nestlé [2]).

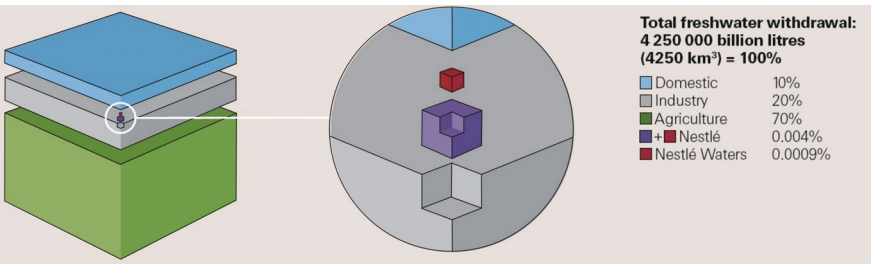

Figure 1: Total freshwater withdrawals worldwide 2006 [1, 2].

2 For a sustainable approach

The observation is simple and final: without water, life is impossible for plants, animals and human beings. As one of our essential natural riches, water is a right that is renewable, exhaustible and scarce – and each drop of it is precious. That is why Nestlé Waters always keeps environmental protection in mind as it continues to expand its activities. Every day, the company pursues an active policy in line with its flagship concerns: water resources, packaging and transport, health and wellness. Protecting our water sources (wells or natural springs) and their recharge areas has always been a priority for Nestlé Waters.

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The definition of sustainable development most currently referred to is that defined by the (United Nation's) Brundtland Commission in 1987 [3]: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". As such, the term covers not only the environmental aspects of development but an overall economic, social, and environmental thinking that takes into account the short and long-term as well as local and global dimensions.

Sustainable development is also a key concept in water management. According to Global Water Futures [4], "sustainable solutions" for the withdrawal of water resources generally exhibit three characteristics:

- First, they are strategic. Water is a strategic resource, meaning it is vitally important to human prosperity, economic development, environmental health, and political and geopolitical stability. The most effective solutions will recognize this importance and leverage the different roles water plays in each of these areas.
- Second, sustainable solutions are innovative. Innovation can stem from not only entirely new solutions, but also new applications and mixes of past solutions.
- Finally, sustainable solutions are effective over the long-term. Long-term solutions not only extend the lifespan of solutions implemented today, but also leverage the next generation of innovations and successes in an ever-rising upward spiral.

Strategic, innovative, long-term approaches will be necessary to solve the global water challenges of both today and tomorrow. Businesses can take many actions – individually, collectively, and in partnership with others – to address the evolving water challenges (WBCSD [5]).

3 Water resources management

Protecting groundwater resources is critical to the ecosystems and communities where we live and work. In a given geographical area, Nestlé Waters seeks out and manages water sources in a sustainable way.

Therefore, we support legislation that protects groundwater for future generations. We always comply with local legislations and sometimes exceed them, if they are considered to be insufficient, by applying our own internal standards.

3.1 Water resources exploration

The water resources exploration phase is a crucial step in a new project. To assess the local water resources context some studies are performed by an external specialised company to collect all the key information on hydrogeology, quality, quantity and legislation. Based on this study, the location for the research area of a new water source is defined.

Afterwards some geophysical investigations are performed to optimize the drilling of an exploration well or the building of a natural spring catchment. In Figure 2 we can see the result of exploration conducted in Italy. By carrying out this investigation, we have been able to double the natural flow rate of the spring and protect the water quality by installing impermeable geotextiles around the catchment.

3.2 Water resources monitoring

Continuous interpretation of monitoring data allows us to rapidly detect any noticeable deviation in terms of quality or quantity. This then allows us to implement immediate actions to avoid additional degradations.

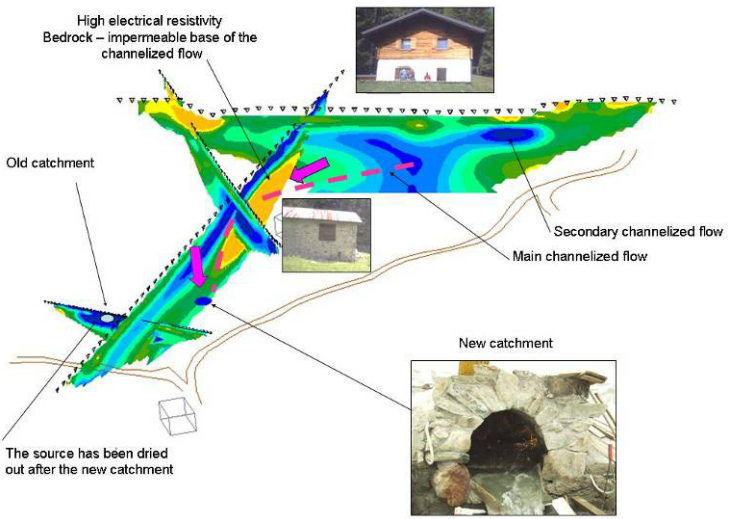

Figure 2: Application of electrical resistivity tomography method (Suena spring, Italy).

If no immediate reaction is taken, degradations may lead to a major intervention in the catchment, such as renovation or cleaning. It may also lead to a water shortage and then a temporary production stop or even the permanent loss of a source. Water resources management in the bottled water business has to be very reactive and well coordinated with the instantaneous production needs.

In Nestlé Waters, each of our water sources is monitored on a continuous basis (Figure 3). Different parameters are analysed and consolidated: water level, flow rates, conductivity, temperature, turbidity, rainfall. This list can be adjusted according to the site specifications. On top of that, a regular quality monitoring system (chemistry and microbiology) is implemented from the water sources to the filling machines including water transportation via pipes, water storage tanks and water treatment processes.

3.3 Water resources equipment

Based on the category of the finished products (natural mineral water, spring water, drinking water) and according to the legislation, some specific technical standards are applied. They depend mainly on the type of water treatment to be allowed.

In the bottled water business, it is possible to define water resources as our DNA. To ensure the water quality over the long term, the drilling operations are performed under strict hygiene conditions. All the equipment (rigs, pipes, cables, sensors) that will be in contact with the groundwater must be cleaned and disinfected carefully before any use.

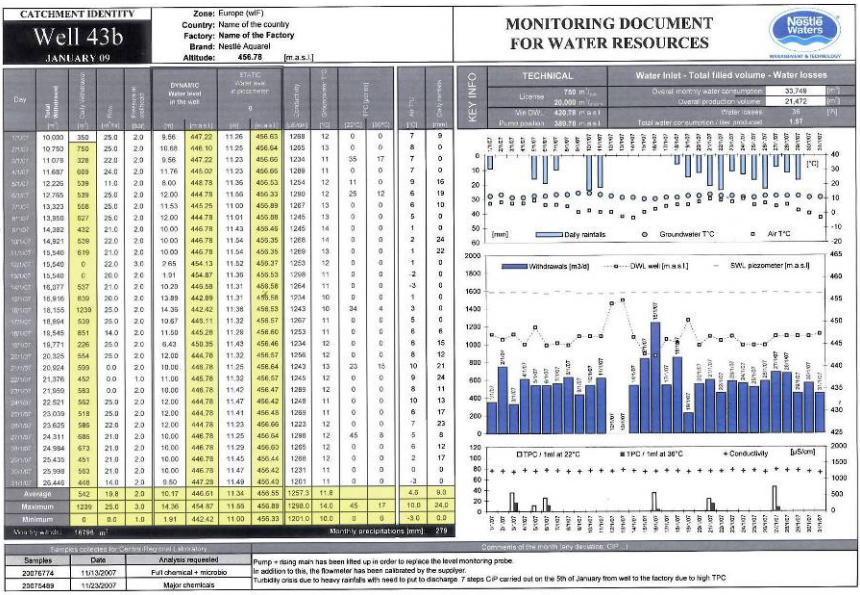

Figure 3: Water resources monitoring sheet.

The equipment that is installed in a well (casing, screens) or a natural spring is made of stainless steel (304L or 316L). The pipes that transport the water from the sources to the factory comply with the food grade standards (stainless steel or high density polyethylene).

The materials used for the surface equipment (wellhead) in the catchment building are also made of stainless steel (304L or 316L). Its design (connections, welding) minimizes the retention zones favourable to biofilm development. The equipment (flow meter, pressure, air microfiltration, sampling valve) minimizes the time needed in case of maintenance operations to avoid production stops and minimize the risk of microbiological cross-contamination during the operations. Our standard wellhead equipment gives us the possibility to perform a disinfection loop in case of microbiological contamination. This equipment is inspected before installation (Figure 4).

3.4 Water resources security

Water Resources are operated in a sustainable way as protection measures are implemented against all voluntary or accidental actions. It means the protection of the immediate environment and catchment equipment, and the protection of a wider area where human activities could impact the water resources (transportation, storage and treatment).

Security at the water sources (spring or well) is conducted using active measures. A motion sensor is installed in each catchment to detect the presence of any unauthorised person. It must cover all possible accesses (door, window,

trapdoor,…). This equipment must be connected to the factory (security guards house, production office,…). Written procedures are available in the case of an alert. This active system can be temporary disconnected during specific operations (sampling, maintenance) with a badge/code system.

Figure 4: Visual inspection of a wellhead equipment.

Additional measures can occasionally be put in place in case of alert:
- Automatic stopping of the pump (if any),
- Automatic diversion of the water flow to discharge.

The security of monitoring wells must be considered case by case from a hydro-geological perspective. Security measures have to be proportional to the potential negative impact caused by pollution occurring on a specific monitoring well with regard to the water sources used for bottling: the shorter the distance/travel time from monitoring wells to the sources in production, the greater the active measures to be adopted. For long distances/travel times from the used catchment, a routine inspection of monitoring wells locks integrity can be sufficient if performed regularly according to an agreed time frequency.

Concerning the monitoring wells in the aquifer system used for bottling activity, if they are located very close to a production well, they should be also secured with similar active measures (motion sensor). The risk for tampering and consequent groundwater contamination is as high as for the secured water sources used for production.

Pipes will convey raw water between catchment (well or spring), break-pressure tanks and loading stations (if any) to the raw water storage tank and/or water treatment room located at the bottling site. Security at break-pressure tanks buildings and loading stations must be similar to that adopted for catchment buildings (motion sensor and safety lock).

4 Water resources protection: Agrivair methodology

Nestlé Waters is working to protect and manage water resources around the world, especially in the Vosges region of France, which provides the natural mineral water for our products Vittel and Contrex (Figure 5).

Figure 5: Agrivair location.

Had the risk not been identified early, the development of intensive farming would have been a threat to the future quality of water resources. To this end, the company is engaged in a number of efforts throughout the area with the cooperation of government and local communities.

In the 1980s, a four-step methodology was especially developed and implemented (Perrot-Maître [6]):

- Understand the farming systems and why farmers do what they do;
- Analyze conditions of changing farmers practices and behaviour;
- Experiment, test, and validate in farmers fields the management practices necessary to reduce the nitrate threat;
- Research tools and indicators to support the change.

In 1992, a partnership was developed with INRA (National Institute for Agronomic Research) to investigate these opportunities in the form of a wide-scale, multidisciplinary research programme involving historians, sociologists, economists, agronomists and zoo technicians. The programme resulted in the creation of Agrivair, a subsidiary of Nestlé Waters, and a veritable "driving belt" in charge of implementing INRA proposals with local players.

The Agrivair concept can be summarised as a 360° approach to protect groundwater resources (Nestlé Waters [7]):

1. Elimination of corn cultivation (nitrates and water consumption)
2. Composting manure

3. Maximum 1 cattle unit / hectare / year (i.e. 1 dairy cow)
4. No pesticide
5. Putting in place an alfalfa-based cultivation turnover
6. Balancing the animals intake
7. Put farms buildings in accordance with standards

For example, the use of pesticides is totally banned in the groundwater protection area. Agrivair keeps ladybugs (Figure 6), a natural enemy of crop-damaging insects, and releases them in farm fields when the harmful insects appear.

Figure 6: With Agrivair, ladybugs have replaced pesticides.

Figure 7: Agrivair area (9000 ha) around Vittel (France).

A thermal weed killing system was also implemented in the golf courses, public gardens and along the railways and roads. Through technical and economic support, Agrivair also encourages the use of organic fertilizers in place of chemical fertilizer.

Agrivair's forest management programme maintains a balance of trees that maximizes the nitrates the trees extract from the soil (Figure 7). In other words, Agrivair thins some trees so that young ones can grow.

By agreeing to adopt new, environmentally protective practices, the farmers concerned made a contractual commitment to following Agrivair specifications in the form of a notarised deed. This programme based on a strong scientific background created a win-win situation for both parties (Table 1).

Table 1: Costs and benefits of the Agrivair programme.

	Costs	Benefits
Farmers	- No direct financial cost but high transaction costs: cost of learning new practices and participating in identification and testing of practices and incentive system, and negotiations.	- Secured long term farming (30 years). - Cancelling of short-term and long-term debt. - Additional land.
Nestlé Waters	- Land acquisition - Farm equipment - Farm compensation - Agrivair operations (which is at least partially self financed).	- Eliminated business risk (1 billion bottles per year). - Sustainable water resources management

The question of whether or not the investment was economically justifiable was raised early in the process. The French National Agronomic Institute demonstrated that under the assumption that one hectare of well-managed pasture produced 3,000 m3 of mineral water every year; the scheme was economically feasible (INRA [8]).

Today, 92% of the farmland has been converted to the programme and respects every clause of the Agrivair contract. But the farmers are not the only people involved in the protection of the groundwater. Agrivair has widened the scope of its strategy to include in its project all the players present in the area.

The entire programme was essentially a "learning-by-doing" experiment. It was the ability to "think outside the box", brought by the multidisciplinary INRA team (and later Agrivair), and the active participation of farmers in identifying and testing alternative practices, that made the experience a success.

The successful long-term partnership with a public research institution was also a key element of success. Without it, Agrivair would not have been able to develop the programme and validate recommended practices scientifically. There was at the time a "strong political support to make the experience successful, to a certain extent regardless of the overall costs" (Déprés *et al.* [9]). Much was at stake not only for Nestlé Waters but also for the municipality, which benefited from the employment created by the business and the tax revenues on Natural Mineral Water.

The Vittel case study illustrates the difficulty in establishing "Payment for Ecosystem Service" (MEA [10]). Agrivair had to go negotiate a series of legal, regulatory, social, technical, political and administrative hurdles before a

successful partnership between Vittel and the farming community could be established.

It also illustrates the complexity of technical issues: how to calculate individual payments and estimate opportunity costs, as well as political issues such as the importance of other actors in influencing the bargaining process, and the rivalry within the farming community.

5 Conclusions

The growing stress on the world's water resources has further increased awareness about the importance of good water resources management and planning. Everyone, including policy makers, industry, agriculture and individual consumers, needs to take part in ensuring the sustainability of our world's water resources.

It is evident that there is no standard response for a global company like Nestlé Waters that has local operations in more than 35 countries and each factory set within its own specific context. Still, beyond the technical and hydrogeological considerations, being able to pose the right questions, and show willingness to also understand the wider socio-economic context should be a good step forward on the road of responsible water management.

All the scientific knowledge necessary to protect our resources in the long term is available. What is necessary above all is the maintenance of an open approach to the problem, with all the different players, that have a real determination to go all the way and to do it together involved. The Agrivair programme in Vittel has undertaken these challenges for the past decade, and now Nestlé Waters is starting to act similarly all around the world (Argentina, Switzerland, Spain, Turkey, Italy).

This approach respects the definition of "sustainable solutions" in water management being strategic, innovative and over the long term. It perfectly reflects our vision of sustainable development, which is based on a profitable business model that serves consumers while respecting humankind and the environment.

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