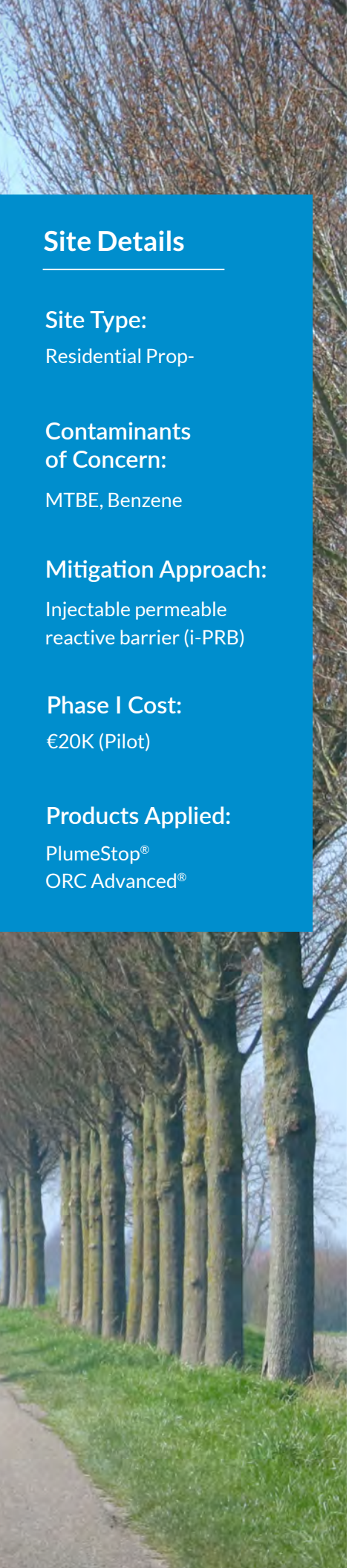
REGENESIS®

Injectable permeable reactive barrier stops MTBE and benzene plume

CASE STUDY

Pilot-scale application proves an effective solution to a long plume under a residential property



Site Details

Site Type:
Residential Prop-

Contaminants of Concern:
MTBE, Benzene

Mitigation Approach:
Injectable permeable reactive barrier (i-PRB)

Phase I Cost:
€20K (Pilot)

Products Applied:
PlumeStop®
ORC Advanced®

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Introduction

Fuel losses at a former petrol filling station in western Belgium, had resulted in the contamination of soil and groundwater with petroleum hydrocarbons and oxygenate additives. During the decommissioning of the site the source area was remediated, however a residual groundwater plume was left in place.

The groundwater flow is considered to be fairly slow on average (< 10m/year) however it is likely that groundwater velocity and contaminant flux is higher in heterogeneous but interconnected gravel lenses. Naturally anaerobic groundwater conditions combined with mobile and soluble contaminants has resulted in the development of long, stable plume of mostly **MTBE and some benzene** offsite.

With concentrations of 2,900µg/L MTBE up to 100m downgradient, this plume extends downgradient from the site under residential properties across the road and beyond this, beneath agricultural land.

Remedial Approach

Having taken over the site from the previous owner, **OVAM** determined that this plume represented a potential environmental and human health risk. OVAM required active remediation to take place and **Group Van Vooren** worked with **REGENESIS** to develop a suitable strategy.

It was decided that a pilot study would be completed to determine the effectiveness of a PlumeStop and ORC Advanced injectable permeable reactive barrier on this plume. The application of PlumeStop would coat the aquifer in a thin layer of activated carbon, creating a subsurface purifying filter. This would remove the contamination from the groundwater and sorb it onto the surface of the active carbon. The ORC Advanced would create a highly aerobic environment, stimulating the growth of benzene and MTBE degrading bacteria on the PlumeStop where the contamination had been concentrated. The microbes will then degrade the contamination, regenerating the sorption sites to allow further contamination influx and sorption, in order to provide an on-going long-term solution to the plume.

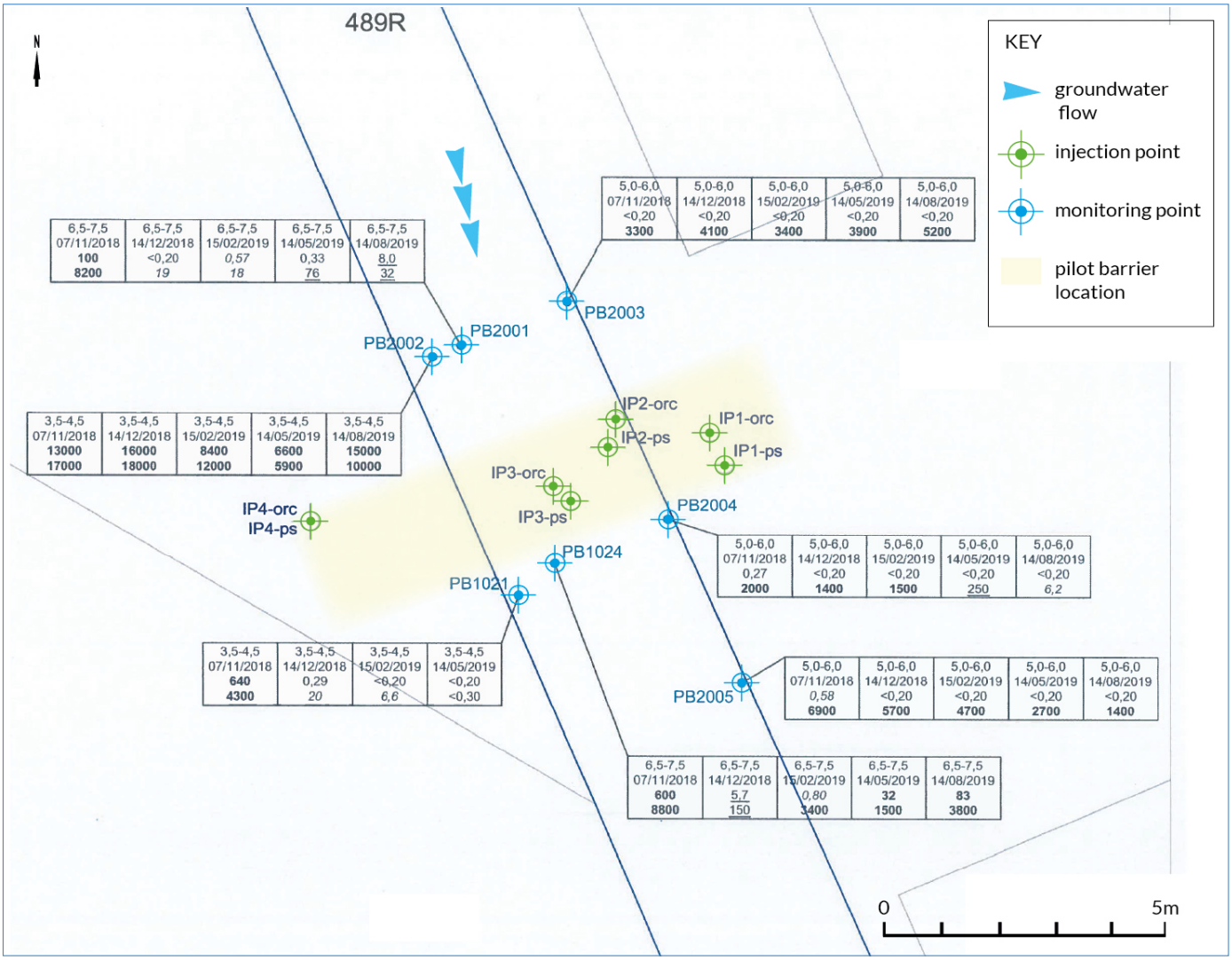
Remediation Technologies

PlumeStop® Liquid Activated Carbon™ is a breakthrough groundwater remediation technology that reduces dissolved phase contaminant plumes in days. The key innovation with PlumeStop is that it is composed of extremely fine particles of activated carbon (1-2µm) suspended in water through a proprietary dispersion chemistry developed by the REGENESIS Research and Development department. This allows the technology to flow into the subsurface at low pressure and achieve consistent, reliable distribution – a capability unlike any other form of activated carbon used for groundwater remediation today. PlumeStop is often applied with enhanced aerobic biodegradation or enhanced anaerobic biodegradation remediation technologies to ensure rapid and complete contaminant destruction.

ORC Advanced is specifically designed and used for the accelerated, in situ aerobic biodegradation of a wide-range of aerobically degradable substances. Enhanced aerobic biodegradation is the well-understood and widely studied practice of adding oxygen (an electron acceptor) to groundwater and/or soil to increase the number and vitality of indigenous microorganisms able to perform biodegradation. ORC Advanced products are typically injected into groundwater or applied into open excavations where upon hydration they provide a controlled-release source of oxygen for periods of upto 12 months, on a single application.

Application

Ghent Dredging employed **Injectis** to complete the application in the driveway of a residential property. The PlumeStop and ORC Advanced were injected separately into a total of eight locations. Live underground services meant that some injection locations needed to be moved west of their planned location. Injection proved difficult due to the low permeability of the soils, with daylighting occurring at the upgradient well. By injecting more slowly, with lower pressure, the daylighting was stopped and the injections completed without further incident. The works took three days to complete.

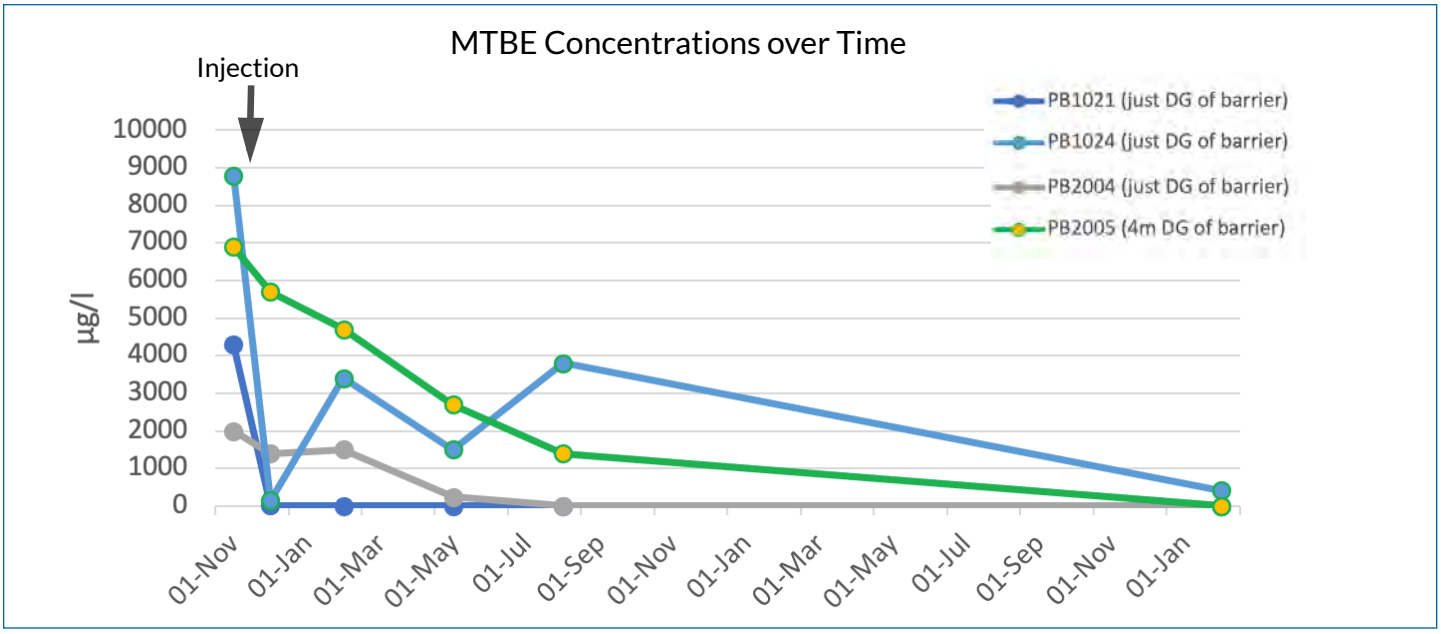


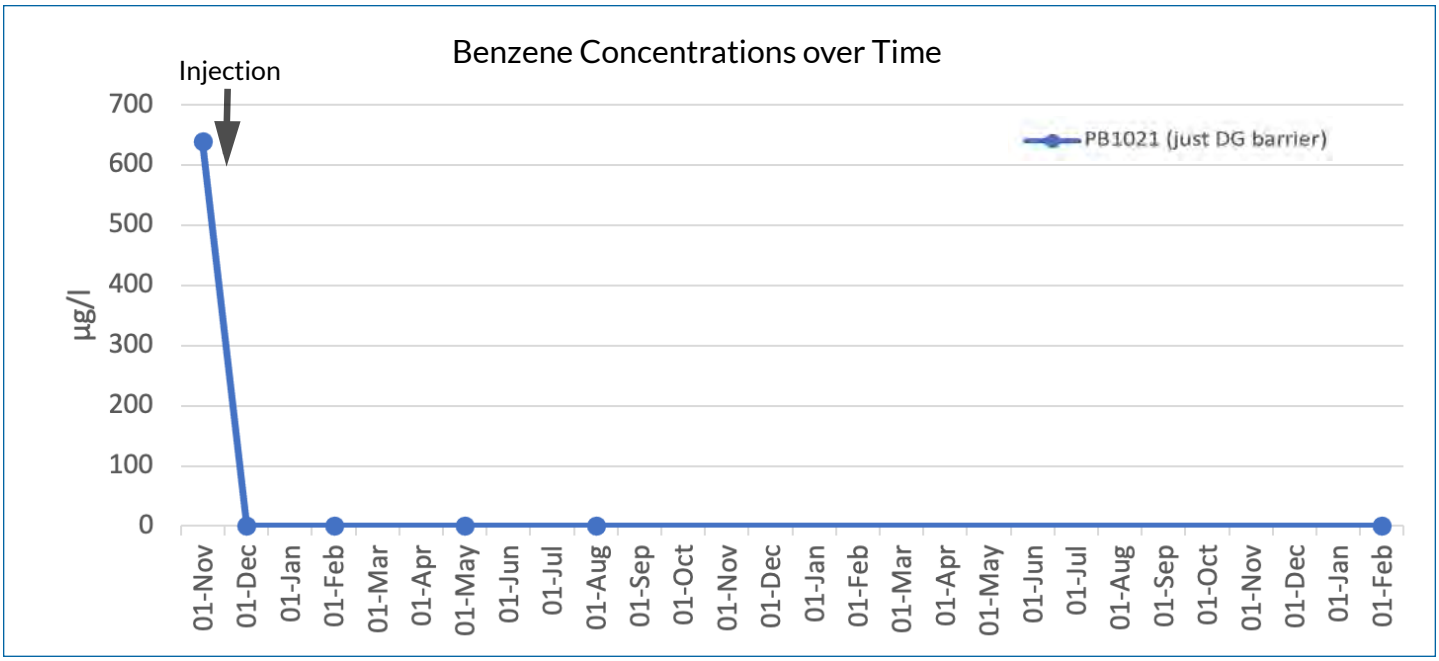
Results

The application resulted in rapid reductions in MTBE and benzene in the monitoring wells immediately downgradient of the barrier. The concentrations remained low in two of the wells, but more variable data was seen in the third. This may have been due to a local limited secondary source of contamination, however the concentrations were observed

to reduce further over time. The concentrations in the monitoring well 4m downgradient of the barrier reduced more gradually. This was due to a combination of the effect of clean water passing out of the barrier versus back-diffusion of the contamination moving from the low permeability clays between the barrier and the downgradient well into the mobile groundwater. As the back-diffusing mass reduced, the concentration in the downgradient well reduced to low concentrations and was maintained there by ongoing upgradient treatment.

Validation was halted for logistical reasons after 10 months, however a further sample was taken 27 months after application. The results show that the barrier is still operational with a mean 99.9% reduction in benzene and mean 98% reduction in MTBE (with 3 out of 4 wells at 99.9% reduction).





Conclusion

A combined sorption and enhanced biological degradation injectable permeable reactive barrier was quickly, safely and easily installed in the subsurface beneath a residential property. The application resulted in rapid reductions in MTBE and benzene concentrations.

This pilot treatment was on-going and long-term, with very low concentrations maintained after 27 months. The application was deemed to be highly cost-effective with a small cost, short time onsite and no ongoing operating costs.

Full-scale remediation is now planned using a series of five barriers along the length of the plume to ensure treatment of all of the contamination.

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