incampus

From a refinery site to a center
for cutting-edge technology

Transformation history with role-model character

Preface

We have the joint task of protecting our environment in the best possible way. Together with our partners, we have therefore chosen a particularly sustainable approach to the construction of the incampus in Ingolstadt and implemented one of the largest soil remediation projects in Germany. In this way, a new technology park for the future of mobility could be built on a former refinery site.

In order to revitalize the former industrial wasteland for new utilization, 600,000 tons of earth were excavated and washed, over 220,000 square meters of land were cleaned and the groundwater was extensively treated.

The incampus offers space on 75 hectares for innovative companies in the field of mobility and digitalization – such as Audi and CARIAD. 15 hectares of the site will remain permanently undeveloped and will be designed to be close to nature. In addition, the incampus is certified as CO_2-neutral in its operation and will generate as much energy as it consumes in the future.

For its forward-looking approach, incampus has received an award from the German Sustainable Building Council (DGNB). The project also received the Gold Brownfield Award, which recognizes particularly sustainable reactivation of brownfield sites. The incampus is thus a role model for sustainable land recycling and a place for innovation.

Gerd Walker
Member of the Board of Management
of AUDI AG for Production and Logistics

History

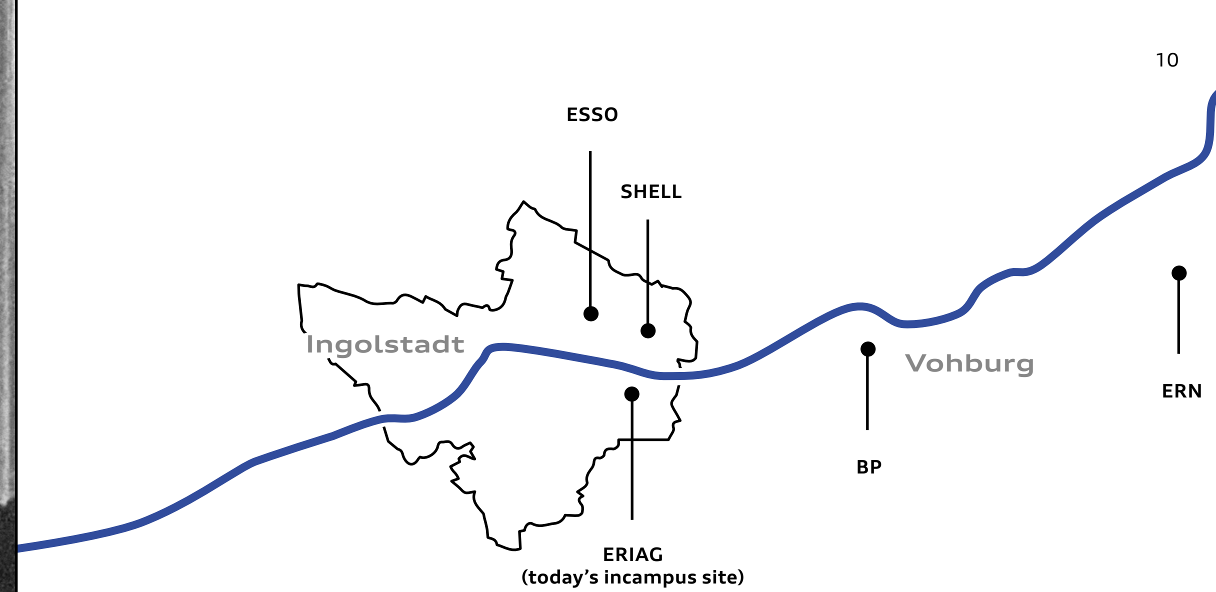
A site in Ingolstadt as a symbol of the emergence and development of the oil industry in Bavaria

Origin of the site

Origin of the site at the end of the Second World War

1945

The then Bavarian Minister for Economic Affairs Dr. Otto Schedl and Prime Minister of Bavaria Alfons Goppel



Decision to erect five refineries around Ingolstadt

1960

1959

Decision for the restructuring of Bavaria

Bavaria earmarked as an industrial location. 1959 was a pivotal year in terms of economic policy not only for the city and surrounding district of Ingolstadt, but also for the whole of Southern Germany.

World War II had ended more than a decade ago, and the currency reform and reconstruction phase were complete.

A spirit of optimism prevailed – and so the decision was made to map out a new future for Bavaria by transforming it from a purely agrarian state to one focused on a balance of agriculture and industry.

The challenge here: Industrial sites require a lot of energy. And Bavaria, an energy-poor state without large deposits of raw materials, was dependent on expensive coal imports from the Ruhr area at that time.

- The forest had long since ceased to play a role as an energy supplier
- Expansion and the use of hydropower had reached their limits
- The state's own coal reserves were exhausted

Dr. Otto Schedl, former Minister for Economic Affairs and Transport and from 1968 honorary citizen of Ingolstadt, therefore developed plans for a refinery site to create a better competitive outlook for Bavaria's domestic industry through less expensive sources of energy close to the site.

Construction of the process field with installation of the refining plant on the current incampus site

1965

The refinery in Ingolstadt commenced operations

Once the refinery had been commissioned, the main task in Ingolstadt was the production and refining of gasoline.

To the north of the site, crude oil and intermediate products were received and processed in the process field. The lower tank field was where the petroleum products were stored and refined according to customer requirements.

Products were transported both via the on-site loading terminal as well as by using tankers.

Ingolstadt in the early 1970s

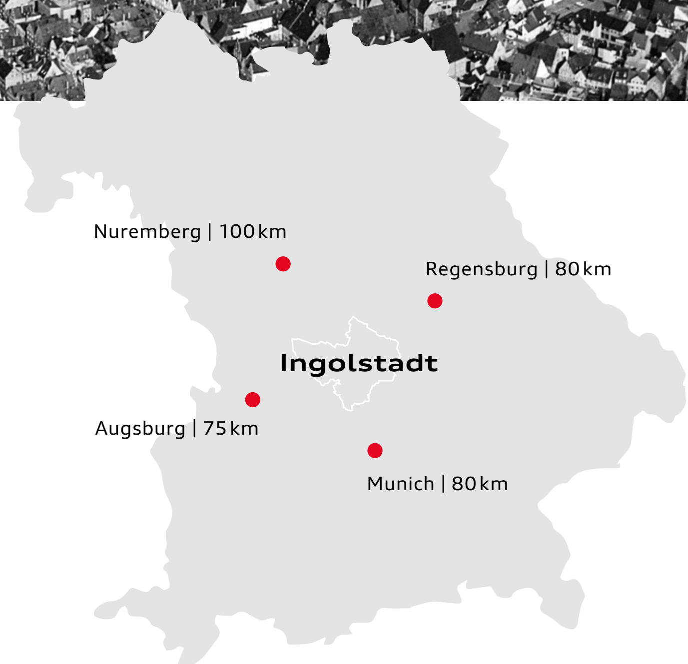
Location advantage

Ingolstadt: in the heart of Bavaria

Both geographical and economic factors played a major role in selecting the site for the Bavarian refinery.

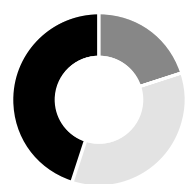
Ingolstadt is conveniently located between the four most important cities of Bavaria: Nuremberg, Regensburg, Munich and Augsburg. And Ingolstadt is in the geographical center of Bavaria and has excellent connections to the transport infrastructure: The city is currently a railroad hub and is situated on the A9 highway between the centers which at that time had the highest energy consumption (Munich with approx. 35% of total consumption in Bavaria, and Nuremberg with around 20%).

And Ingolstadt recognized the signs of the times and seized the opportunity to kick-start its economy by providing affordable land.



Shares of energy demand in Bavaria in the 1960s:

- 20 % Nuremberg
- 35 % Munich
- 45 % other

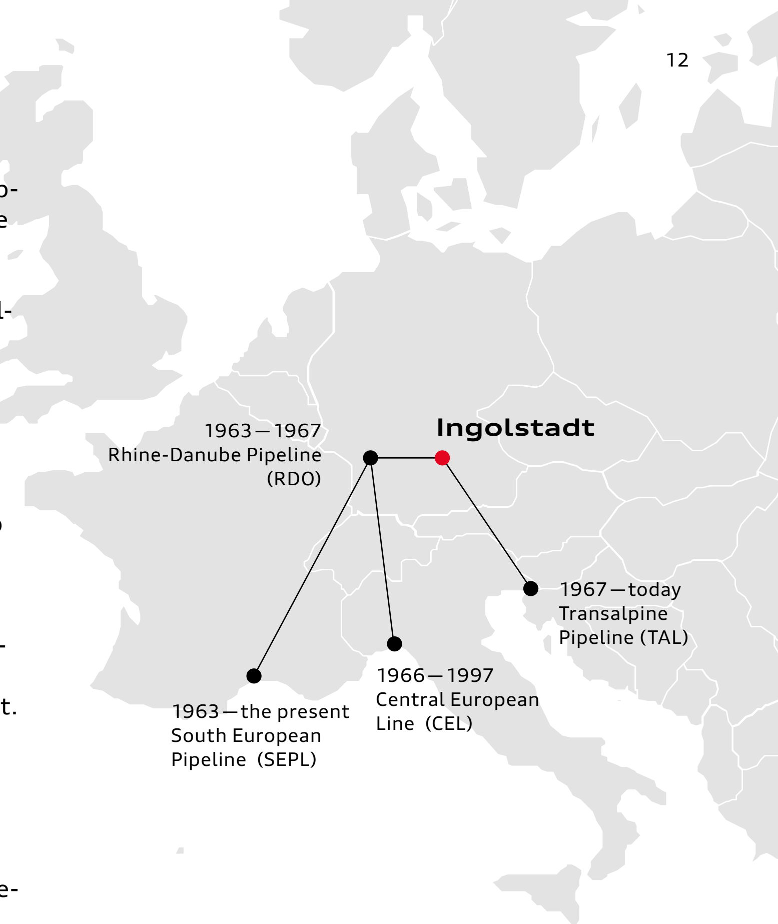


The new Bavarian Ruhr district

Multiple pipelines were built around Ingolstadt – dubbed the new Bavarian Ruhr district – to supply its five refineries with sufficient crude oil.

CEL: The Central European Line, from Genoa to Ingolstadt, should have been completed by 1963 but did not go operational until 1966 as a result of disputes surrounding its route through the Lake Constance region near Lindau.
TAL: The feasibility of another pipeline across the Alps was examined in 1963 over the space of four months. It then took another one-and-a-half years to obtain the rights of way of the more than 6,000 property owners to construct the Transalpine Line.
SEPL & RDO: The existing South European Pipeline from Marseilles to Karlsruhe from 1963 initially supplied the newly constructed refinery by means of an extension of the Rhine-Danube Pipeline to Ingolstadt. The direction of flow of the RDO was later reversed.

The shortest pipeline to Ingolstadt, the TAL, eventually supplied all five refineries with crude oil. The construction of this pipeline at a cost of around 800 million German marks was one of the biggest private-sector projects of that time.



TAL – from the Mediterranean to Ingolstadt

In the sea port of Triest, cargo is unloaded from the incoming oil tankers; and from the port facilities, the crude oil is sent through transfer pipelines on its journey to Germany. The TAL runs for 145 kilometers on Italian soil before crossing the border to Austria, where it traverses the Alps and the main ridge of the Alps beneath the Felbertauern tunnel, where the pipeline reaches an altitude of 1,572 meters above sea level.

Once it has arrived in Germany, the pipeline runs through the Inntal valley and then veers west past Rosenheim and Wasserburg. It then heads north toward the refineries in Vohburg and Ingolstadt.

The fuel depot in Lenting near Ingolstadt was used as as interim storage facility for the crude oil destined for the Bavarian oil refineries. It had seven tanks with a nominal capacity of 318,000 cubic meters.

Dismantling and remediation of the site

Decision to decommission the site

2005

The refinery shortly before decommissioning and the start of dismantling

2016—2019

Resolution on conversion and environmentally friendly remediation

In May 2016, the city of Ingolstadt, AUDI AG and the Bayernoil Raffineriegesellschaft mbH refinery signed a remediation agreement and took over the former refinery site as IN-Campus GmbH. From the very beginning, the overarching goal of this partnership was to create a showcase project for sustainable land recycling. The environmentally friendly revitalization of the industrial sector was intended to ensure reintegration into the economic and natural cycle and to enable mixed commercial and industrial use with healthy surrounding conditions for the people working on the site.

In May 2019, after intensive preliminary planning, the foundation stone was finally laid on the site in the presence of the Bavarian Prime Minister Dr. Markus Söder.

From left to right: Thomas Vogel (Managing Director of IN-Campus GmbH for AUDI AG), Dr. Christian Lösel (Mayor of Ingolstadt), Norbert Forster (Managing Director of IN-Campus GmbH for the City of Ingolstadt), Dr. Rupert Ebner (Environmental Officer Ingolstadt), Dr. Rüdiger Recknagel (Head of Audi Environmental Protection), Renate Preßlein-Lehle (City Planning Councillor Ingolstadt), Klaus Mittermaier (Managing Director of the General Works Council AUDI AG).

2008—2013

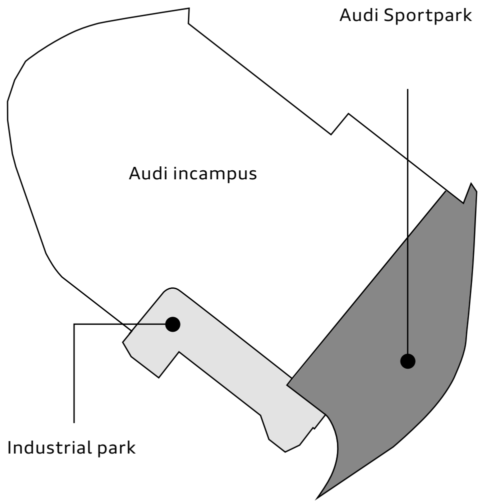
Dismantling of former refinery facilities

From 2008 onwards, dismantling began in 3 sections and new areas were created.

Audi Sportpark area: 2008 to 2009 saw the dismantling of the former loading terminal featuring a main line and turn-out track, fuel depot and loading. The land this freed up was sold in 2010 to FC Ingolstadt and the City of Ingolstadt to construct the Audi Sportpark.

Industrial park area: 2009 to 2010 saw the dismantling of the former truck loading area. The land is currently home to the industrial zone at the Sportpark. The Audi Sportpark was also opened in 2010.

Audi incampus area: From 2010 to 2013 the remaining fuel depots were dismantled, the processing plants were disassembled and the chimneys were demolished.



2023

Completion of remediation and official opening of the incampus

Bit by bit, parts of the remediated areas had already been built on over the years, so that the incampus could be officially opened in September 2023.

Remediation

A mammoth task with role-model character:
The comprehensive purification of soil and groundwater directly on the site to create a commercial area without tapping into renewed land consumption

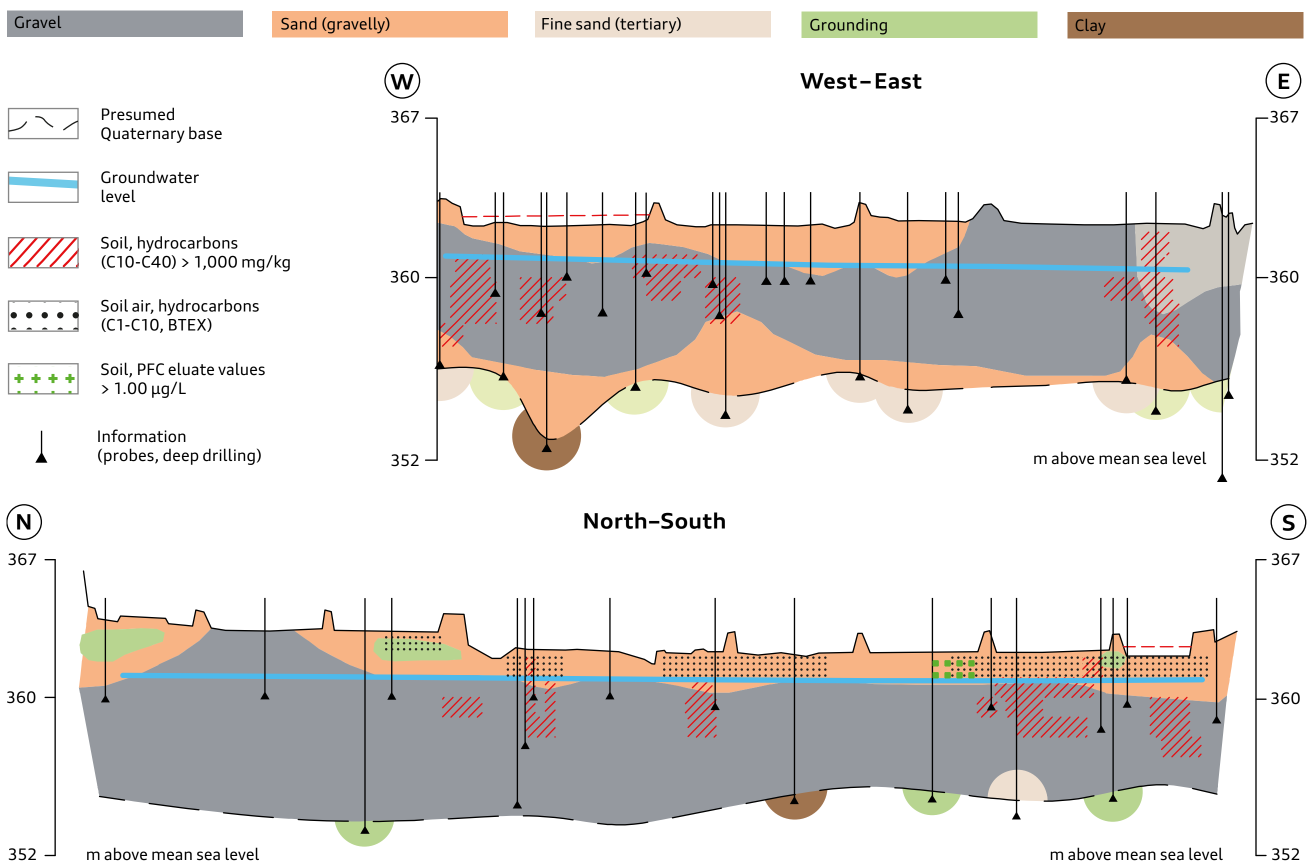
Investigation into contamination at the site

Focus on pollutants

The exact extent of contamination on today's incampus site was explored by extensive investigations after the acquisition of the area and an evaluation was made for later use. A total of over 1,200 exploratory drilling operations and structural digs were carried out down to a depth of max. 15 meters and tests conducted at over 250 groundwater control points over the years.

Via this close probing network, this involved conducting over 50,000 laboratory analyses on a wide range of refinery-typical pollutant parameters such as petroleum-derived hydrocarbons, aromatic and aliphatic hydrocarbons, as well as perfluorocarbons and polyfluorocarbons.

Geological sections



Pollutant dispersion on the site

The results of the contaminated site investigation enabled precise pollutant mapping, on the basis of which the optimal remediation methods could be selected.

One of the main decisions was to remove the pollutants from the soil and groundwater as directly as possible on the site. To this end, the most innovative cleaning processes were selected, further enhanced and implemented.

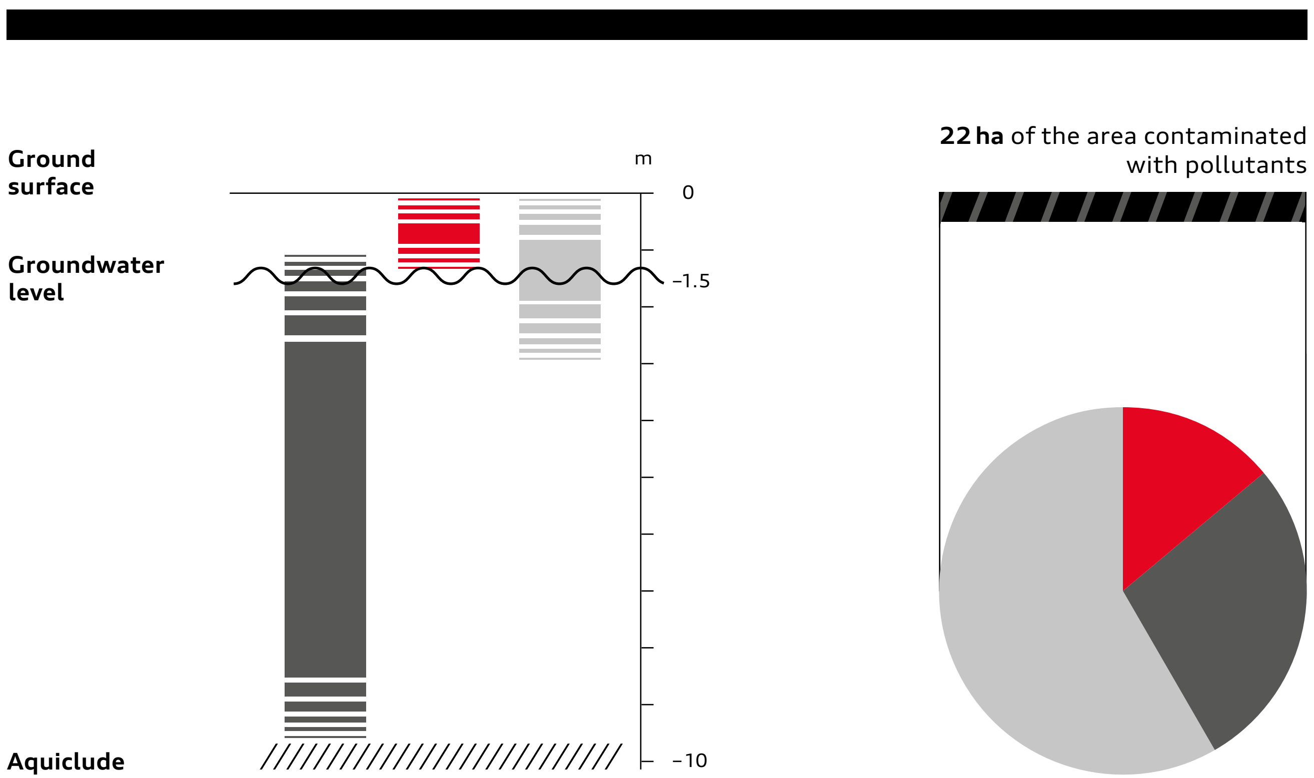
126,000 m² volatile aliphatic and aromatic hydrocarbons

60,000 m² petroleum hydrocarbons

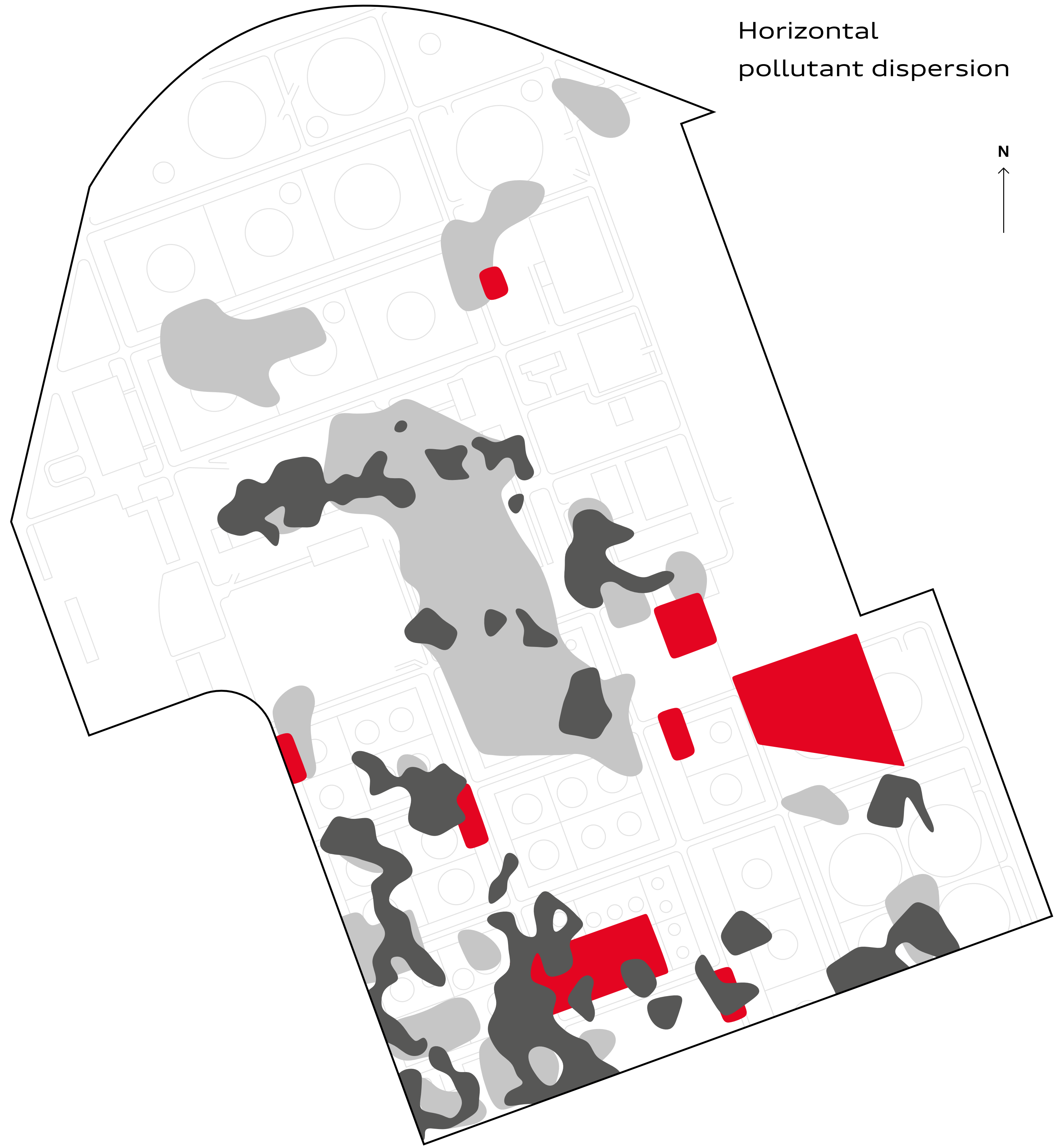
30,000 m² perfluorinated and polyfluorinated chemicals (PFAS)

Vertical pollutant dispersion

75 ha total area



Horizontal pollutant dispersion



Soil exchange in combination with soil washing

Honeycomb excavation enables precise access to contaminated material

In the so-called honeycomb excavation method, the contaminated soil was removed piece by piece with hexagonal steel honeycombs, about 1.5 meters wide and 10 meters long. By placing honeycombs next to each other, precise excavation and targeted pollutant re-moval were achieved – even at groundwater levels near the surface.

In order to avoid transporting the contaminated soil to landfills, the soil was reprocessed directly on the site.

Remediation using the honeycomb excavation method

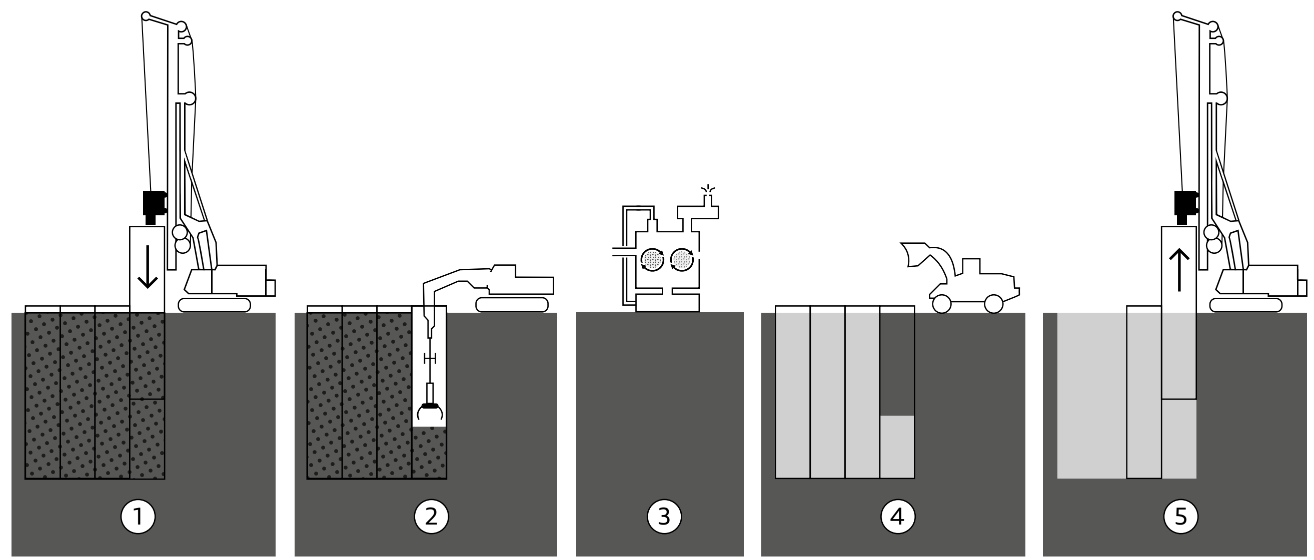
1. Insertion of the honeycombs
The steel honeycombs are inserted into the ground with a leader-guided vibratory device.

2. Excavation of honeycomb
Excavation of honeycomb sections with a crawler excavator and a grabber extension with clamshell gripper.

3. Cleaning the contaminated material
Directly in the soil washing plant on the premises.

4. Filling of honeycomb
Filling of excavated honeycomb with a wheel loader.

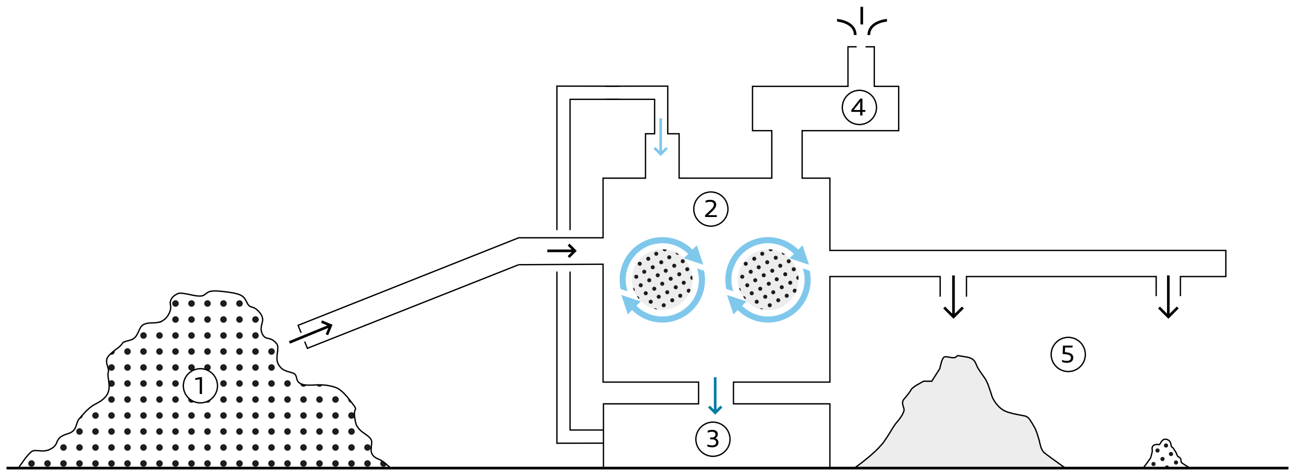
5. Removal of honeycomb
Extraction of honeycomb with a leader-mounted vibratory device.



Soil washing directly on the premises

In a soil washing plant, the excavated soil was cleaned and sorted by grain size. In this way, more than 90 percent of the excavated soil material could be recycled and returned to the terrain.

The path of contaminated soil material through the soil washing plant



1. Contaminated material
The contaminated soil material, excavated using the honeycomb method, was sent into the soil washing plant.

2. Soil washing
In a multi-stage washing process, the soil was extensively purified and pollutants were removed from the soil grain and dissolved in the washing water

3. Wastewater treatment
The contaminated washing water was then purified and added back to the soil washing process in a closed cycle.

4. Exhaust air purification
All exhaust air was centrally recorded before leaving the plant and freed from harmful pollutants.

5. Purified soil
The soil washing resulted in clean material, more than 90 percent of which could be backfilled on the site.
Only less than 10 percent of the soil had to be disposed of externally as waste.

Air sparging: air against pollutants

8 facilities
run simultaneously on a fully automated basis

›120,000 m²
total area purified

400,000 m³
purified soil volume

A gigantic “straw” blows pollutants out of the soil

The air-sparging process is like blowing air into a glass of lemonade with a drinking straw. Just as the carbonic acid contained in the drink is expelled, air sparging is used to transfer volatile pollutants, which easily change into a gaseous state, from the groundwater and the soil into the air.

The air blown in and loaded with pollutants is then sucked out of the underground and cleaned in filter systems.

On the incampus site, an area of over 120,000 square meters was freed from pollutants using this process – one of the largest air-sparging measures in Germany.

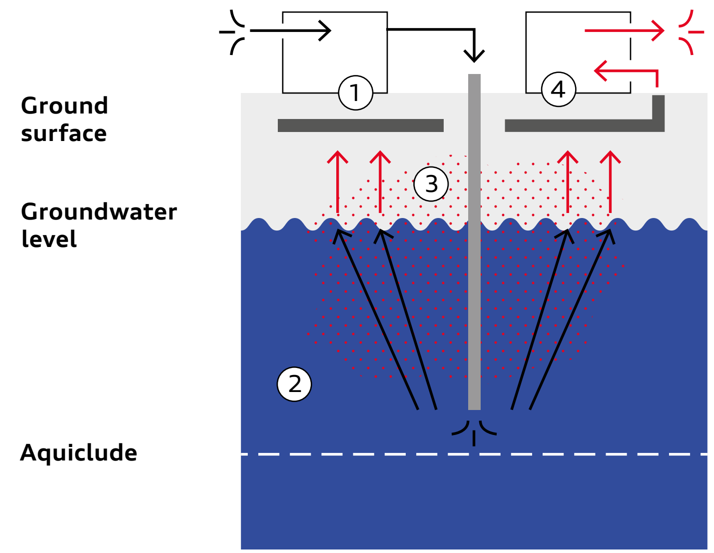
How air sparging works

1. Air injection into groundwater.

2. The air injected flows through the contaminated area and picks up the pollutants dissolved in the groundwater.

3. Siphoning of contaminated air into siphon drainages.

4. The air contaminated with pollutants which is extracted from the soil is purified before it is discharged into the environment.

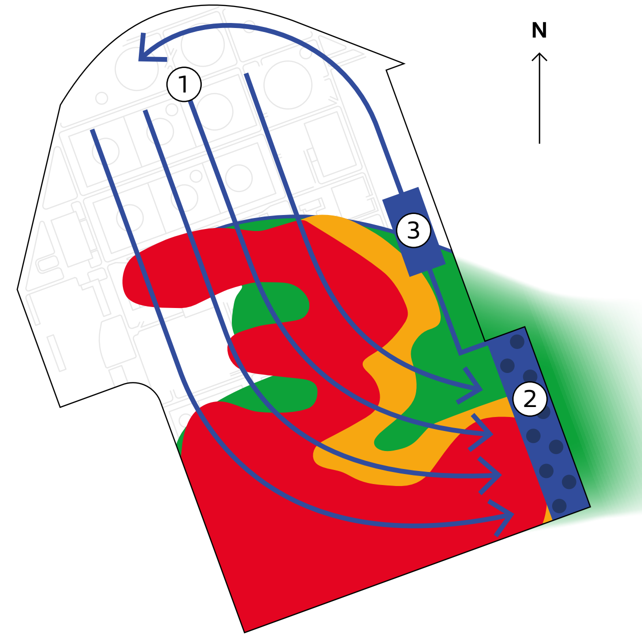


Intelligent water management as an integral part of utilization

Hydraulic contamination protection and groundwater treatment

50 percent of the areas adjacent to the incampus site are nature reserves, such as the Danube wetlands. To prevent contaminated groundwater from the site running off into the adjacent Danube wetlands, a series of wells protects the entire site. The groundwater from the wells is treated and then fed back into the aquifer through percolation.

In the meantime, the groundwater brought into a water cycle in this way is used to cool the newly built Data Center on the campus. The waste heat obtained in this process can be used elsewhere for heating. In this way, the remediation process has developed into an intelligent multiple use of the water cycle on the site.



1. Direction of flow of groundwater
2. Series of wells
3. Purification plant

Effective groundwater purification

In the well gallery itself, ten groundwater wells work with fully automatic control of the feed pumps. The pumped water is treated in a multi-stage groundwater purification plant. In this way, pollutants dissolved in the groundwater can be removed with a purification performance of over 99.9 percent. To this day, the groundwater is regularly tested for any new contamination that may occur.

The purified water is filtered into the aquifer via an approximately 6,000-square-meter seepage ditch, which was created as part of the biotope facility.

Utilization

The sustainable revitalization of the formerly heavily contaminated refinery site transforms the area into a forward-looking technology park – without sealing new areas

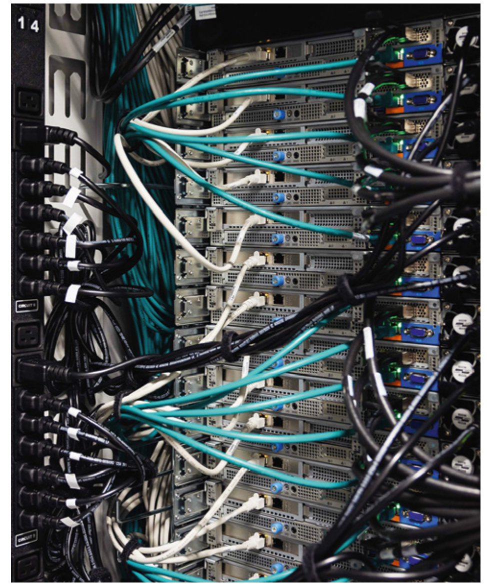
Data instead of oil

Space for the automotive future

Where petroleum products were still being manufactured until 2008, work is now being carried out on the automotive future. Successfully remediated and without sealing new areas, the incampus is a role model for sustainable land recycling and offers space for innovative companies and their partners in the field of mobility, digitalization and sustainability (ESG) – such as Audi, CARIAD and the Technical University of Ingolstadt.

The incampus is designed to be open and an integral part of the City of Ingolstadt. An example of this is the approximately 50-meter-wide campus artery – an avenue about one kilometer long with green spaces that create communication and meeting spaces for employees and visitors in the middle of the area. The entire technology park is already working today as certified CO_2-neutral and is to become a zero-energy campus. While the park currently still uses green electricity from outside, the area itself is to generate as much renewable energy as it needs in the future. Measures for this include waste heat utilization, energy storage and intelligent control systems.

The incampus has already received an award from the German Sustainable Building Council (DGNB) for its forward-looking approach. In 2024, the project also achieved a gold award for “Best Commercial and Industrial Project” at the Brownfield Awards which honor particularly sustainable reactivations of industrial wastelands.



Shaping the future together

The incampus creates the conditions for strengthening regional value creation and working together with high-tech partners on concrete solutions for the future of mobility. Currently, the incampus is home to Audi’s new Vehicle Safety Center and a Data Center, as well as the largest tech hub of CARIAD, the software company in the Volkswagen Group.

The Vehicle Safety Center
Audi’s new Vehicle Safety Center is the company’s most important development facility in the field of passive safety: It offers opportunities for state-of-the-art crash tests. During the design phase, care was taken to ensure that tests can be carried out that go well beyond the current requirements in the various markets. This allows the system to be flexibly adapted to future developments.

The Data Center
A new Data Center has been built by Audi in the vicinity of the Vehicle Safety Center. It supports the company’s future projects with state-of-the-art hardware and software. In the technical concept of the Data Center, maximum availability, maximum failure safety and energy efficiency are the top priorities. Thanks to a new concept, the waste heat from the servers flows into the overall energy supply network of the incampus site and can be called up elsewhere on the area for heating. This turns the Data Center from a consumer into an energy producer.

Software Competence and Digitalization
The incampus is also home to CARIAD’s largest tech hub: More than 2,000 employees work there on tech stacks for all Volkswagen Group brands, including the development of the digital driving experience, automated driving and tech platforms as well as cloud services.

In the northeast of the site, the Technical University of Ingolstadt also operates its control center for the IN2Lab project, a digital test field for automated and connected driving, in which Audi is participating as a project partner.

Biodiversity by natural landscaping

15 hectares of the extensively prepared site are reserved for the environment and are designed in close coordination with local NGOs. Among other things, an alluvial forest with nutrient-poor grassland is being created here, thus forming an ecologically high-quality transition between the high-tech area and nature.

From various bodies of water and deadwood areas to sand lenses and cairns to the planting of adapted tree and shrub varieties, such as bird cherry, black cherry, hornbeam, sea buckthorn and blackthorn – the declared goal is to create a diverse ecosystem with different biotope types in order to increase biodiversity on the site in the long term.

Targeted local measures secure habitats. For example, cairns serve as sand lizard habitats.

The functional building with fire station is directly adjacent to the newly created biodiversity areas.

An open space for ideas and innovations, shaping the future

Publishing details

Audi Environmental Program
Dr. Rüdiger Recknagel, ruediger.recknagel@audi.de

Concept and realization:
Mathias Ziegler, mathias.ziegler@audi.de

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