DHI CASE STORY

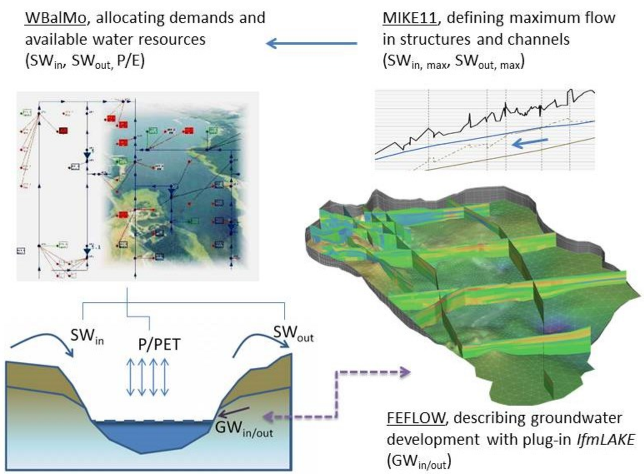
TRANSFORMING MINING PITS INTO A LAKE DISTRICT

Mine reclamation for pit lakes

It is no secret that the mining industry can have severe consequences for mining regions and the surrounding landscape. Vegetation and wildlife can be negatively impacted when mining production is abandoned. Rehabilitating old mining areas can be an immensely difficult challenge and few succeed at it. However, with the right strategies and tools, abandoned mining pits can be turned from lifeless landscapes into prosperous man-made lake districts. This is what has been done in Eastern Germany, where we provided accurate analyses and appropriate strategies for creating a new pit lake.

REHABILITATING EASTERN GERMANY MINING PITS

Large parts of Southern Brandenburg and Saxony in Eastern Germany are characterized by enormous industrial mining zones, where lignite has been mined and used for electricity generation. Although mining activities are still on-going and three large power stations continue to produce electricity, much of the industrial mining activities are planned to be phased out by 2015. A number of old pits left behind by the mining process have already been transformed into a new landscape, creating a massive new lake district never before seen in this region. In connection with the development of a new pit lake (Cottbus See) with a surface area of approximately 19 km^2 (7.3 mi^2), Vattenfall Europe Mining AG contacted us to optimize the mine closure plan through accelerated flooding of the pit lakes.



Model components system

SUMMARY

CLIENT

Vattenfall Europe Mining AG

CHALLENGE

- Need to develop a sustainable mine closure strategy for pit lakes
- Need to rapidly fill pit lakes using surface water, while maintaining appropriate river flows at the same time

SOLUTION

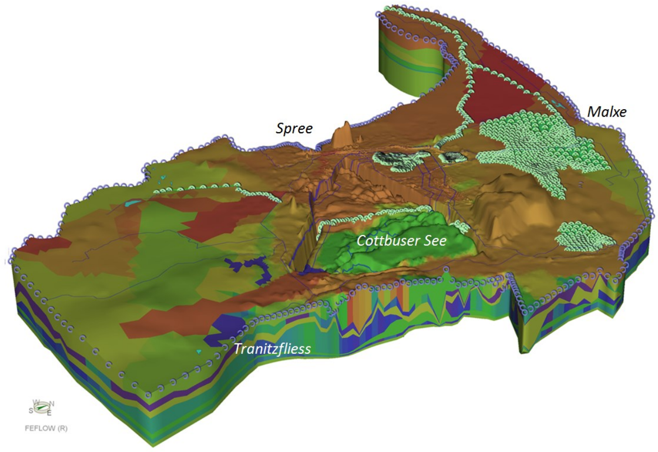
An integrated groundwater and surface water model capable of predicting a reliable strategy for rapid filling of the mine pits.

VALUE

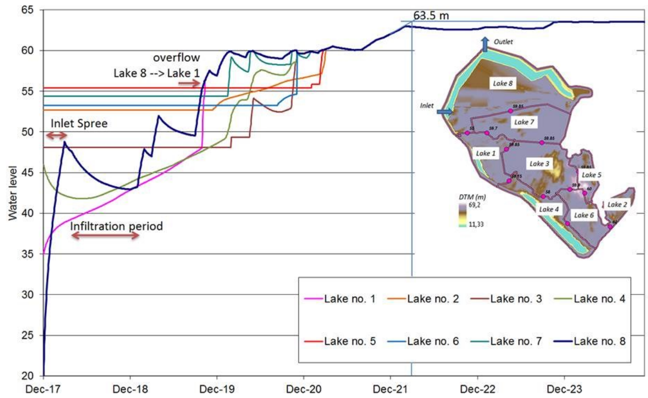
- Reliable prediction of the river flows that could be sustainably diverted into the pit
- Reduction of pit flooding time frame by seven years from the original mine closure plan

LOCATION / COUNTRY

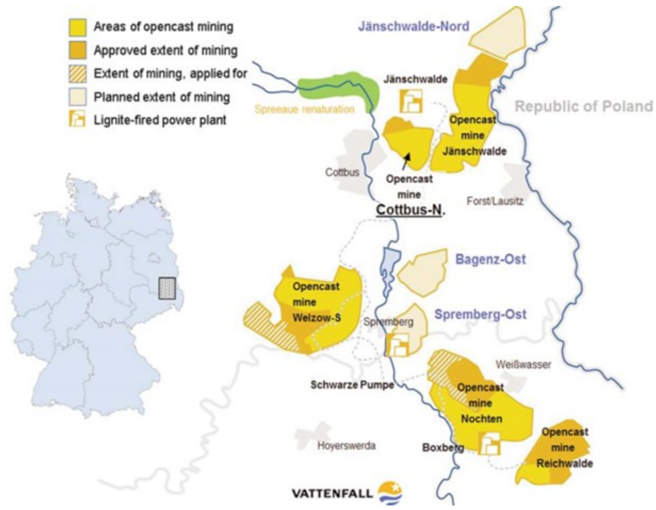
Cottbus See, Saxony in Eastern Germany



Overview of FEFLOW 3D groundwater model with applied conductivities and boundary conditions



Water level development within single lake basins with additional surface water inlet



Location of Cottbus See and the surrounding mining pits (Source: Vattenfall Europe Mining AG)

REDUCING FLOODING PERIOD

The challenge was to provide the right strategy for filling up the lake in a reasonably short period of time. This had to be done while maintaining acceptable environmental flows within the river system used to source the additional surface water required. We concluded that the time required to complete the filling of Cottbus See could be reduced significantly by using a strategy that included additional surface water inflow. The results showed that it will take approximately five years to fill up the lake to a level of +63.5 m (208 ft) Above Mean Sea Level
(AMSL) by using additional surface water inflow from the river Spree. This means that the lake filling will be finished by around 2023. This period is more than 10 years shorter than the flooding period without additional surface water inflow and about seven years shorter than previous mine closure plans estimated.

PRECISE, INTEGRATED AND RELIABLE MODELLING PROVES ESSENTIAL

In order to achieve these results, it was essential to use integrated groundwater and surface water modeling. We used the following modeling components:

- a 3D FEFLOW groundwater model
- a MIKE 11 surface water model to describe different options for the outflow to the river Spree
- a WBalMo water and allocation model to identify long-term and optimal water allocations

By using FEFLOW and MIKE11, we were able to describe the water level development of the lake. This was done with detailed information about the inflow into the lake (groundwater inflow, surface water inflow, as well as rainfall and evaporation at the surface).

In addition to the inflow into the lake, it was important to obtain detailed information about the long-term water needs as well as the water availability of the Spree River. For this purpose, we extended and updated the water management and allocation software – WBalMo – to provide a strong basis for long-term management analyses of the Cottbus See lake. Optimization analyses of the WBalMo model had to be restricted with respect to the maximum possible outflow discharge towards the Spree. For this reason, we first conducted hydrodynamic analyses using a MIKE 11 1D model for routes along the existing branch Schwarzer Graben, as well as for alternative routes directly towards the Spree. By applying the MIKE 11 model component, we were able to analyze the maximum outflow rate of the planned diversion system.

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