

## EXTENDED ABSTRACT

**Closure of an open pit and landfill for excavated earth**

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**Abstract** The project site in Tyrol/Austria in quaternary sediments produced since 1967 by 2006 gravel for the construction industry. A total output of 400.000 m<sup>3</sup> gravel is reported. In depth there was no continuation of the deposit because there was mainly fine grain gravel and argillic gravel. Therefore it was necessary to prepare the final closure of the opencast mine. A new utilization for the former open pit is now a landfill for excavated earth. In general there are two strategies to shut down an open pit:

Case 1: To stabilize the former open pit operation with excavated earth.

Case 2: Start-up of a long-life landfill with excavated earth. After the closure a newly utilization of the area for farming is again possible.

In compliance with the regulations applicable to mining, the licensing procedure for the authorization of the operation is implemented according to:

- Mineral Law, Forest Law, Tyrolean Nature Preservation Law etc.
- conservation of water in general
- potable water in the vicinity of the location

**Key Words** Austria, land fill, mining

**Introduction**

A conservation project of water management was authorized to prepare the licensing procedure. Test pits, pumping tests and water analysis were carried out and the water bearing bed was explored. There is no interrelationship between surface and/or groundwater and potable water.

By the local government of the federal state of Tyrol was authorized a lifetime of the landfill of ten years. During the lifetime of the project is required a (hydro)geological and ecological su-



*Location of the project in Austria*



*Figure 1 All-round view of the former open-pit mine*



*Figure 2 Scrap view of the open-pit mine before refilling*

pervision of the landfill with control of the surface water, the groundwater and hydrochemical analysis. After the closure of the landfill greening and plantation is finished and the location is again adapted for agricultural use.

### **Initial situation**

Quaternary loose sediments are used in the Eastern Alps often as industrial rocks. In Itter in Tyrol/Austria from 1967 to 2006 400,000 m<sup>3</sup> gravel was recovered and used in the construction industry (Figure 1 and 2). Some embankments were not stable any more. After the exhaustion of the economically winnable gravel reserves the closure of the open pit was to be intended.

### **Case 1**

To stabilize the former open pit operation with at least 150,000 – 200,000 m<sup>3</sup> excavated earth (Mineral Law).

### **Case 2**

Start-up of a long-life landfill with 400,000 m<sup>3</sup> excavated earth (Waste Economy Law). After the closure a newly utilization of the area for farming is again possible. Tourism in the region is very important for the country and the landscape is protected by carrying out this project. In the closer surrounding an allowed ground excavation dump was absent up to now. For this reasons this case was favoured.

In compliance with the laws and regulations applicable to landfill and mining, the licensing procedure for the authorization of the operation is implemented according to:

Mineral Law, Forest Law, Tyrolean Nature Preservation Law etc. In addition there are also Water Regulations and their standards inevitable:



*Figure 3 Investigation of the subsoil by trenching* *Figure 4 Sampling of the groundwater to the perpetuation of evidence*

- conservation of surface and groundwater in general
- potable water in the vicinity of the location. Some wells and one gallery are to protect.

#### Hydrogeological investigation and assessment of the location

A geological ground survey with the water outlets in the opencast mine was carried out. A conservation project of water management was authorized to prepare the licensing procedure. Test pits, pumping tests and water analysis were carried out and the water bearing bed was explored (Figure 3). A hydrologic triangle was put on. Water samples and hydrogeochemical analysis (conductivity, water hardness, sulphate, pH value, water level) improved that there is no pollution of



*Figure 5 Whole view of trenching (hydrologic triangle)*

the surface and the groundwater and no hazard for potable water (Figure 4). There is no interrelationship between surface and / or groundwater and potable water (Figure 5).

#### Lay out of the ground excavation dump

A new entrance had to be put on to avoid the nearness of settlement areas.

- lifetime of the landfill of ten years
- training and order of the supervision staff
- ban of the storage of hazardous to water materials on the dump area
- the future dump area was fenced in
- installation of truck scales
- removing and temporary storage of the topsoil
- furnish of temporary storage facilities for the delivered ground excavation
- sequential restoration of the pastureland

#### Implementation of the project

From the task of the gravel production up to introduction of the ground excavation dump three-year project development was necessary.

Year	Measures taken
2007	Topographical survey  Exploration (trial pits) and water analytics
2008 – 2009	New entrance (civil law arrangement)  Licensing procedure(s):  Mineral Law, Waste Economy Law, Forest Law, Tyrolean Nature Preservation Law etc. In addition there are also Water Regulations and their standards inevitable
2010	Beginning of filling and (hydro)geological and ecological supervision  Settlement of a ground water probe during the lifetime of the project.