

Project datasheet Dams

Decommissioning of BSS South Superior Tailings Dam

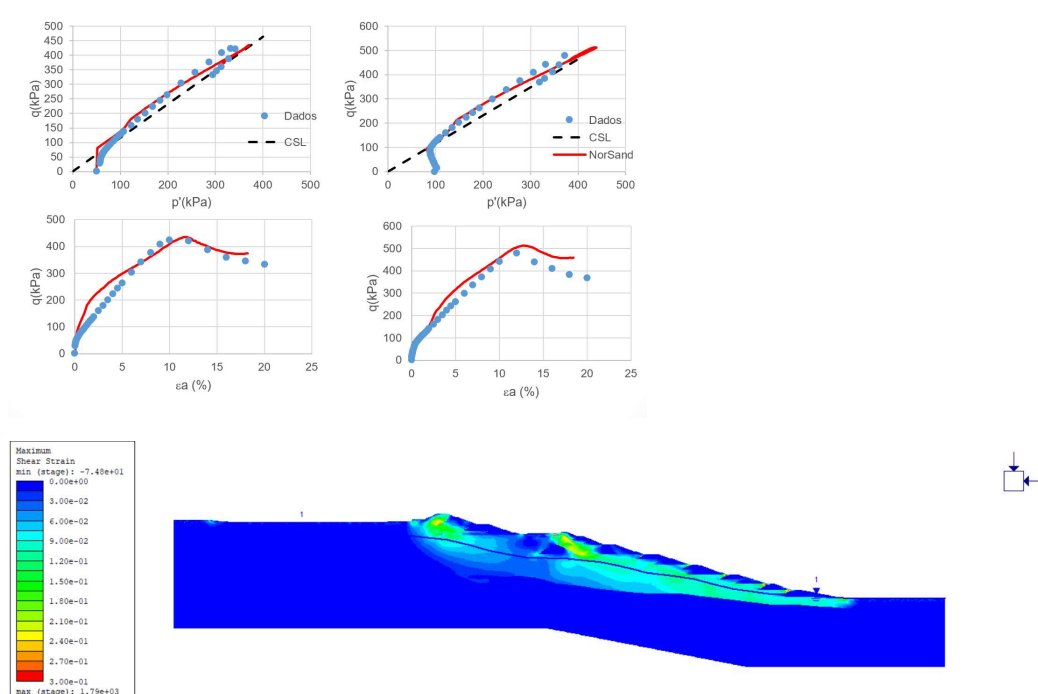
Location: Minas Gerais, Brazil

Client: Vale

Description: Terratek carried out in 2020 numerical finite element model to analyse the behaviour of the BSS dam, built by the upstream method and found to present a low factor of safety against static liquefaction. The numerical model using Plaxis employed a UDSM (user-defined soil model) developed by Terratek using the NorSand constitutive model. Therefore, the model is aimed at modelling the tailings behaviour of post-peak loss of strength, or strain-softening

Services provided by Terratek

- Analysis of existing site investigation;
- Obtaining NorSand geotechnical parameters from triaxial test results;
- Modelling the existing dam;
- Numerical modelling of tailings excavation and its effect on the dam behaviour.



Project datasheet Dams

Decommissioning of Mundo Mining Co Tailings Dams.

Location: Rio Acima, MG, Brazil

Client: MG State Public Works Dept

Description: Terratek carried out in 2017 and 2018 the decommissioning design for the abandoned gold mine. One tailings dam and the other is an arsenic-contaminated reservoir. These dams are located 2 km upstream of the water intake structure for the City of Belo Horizonte, and their failure would result in an enormous environmental disaster.

Services provided by Terratek

- Site investigation: drilling, sampling, lab testing, CPTU
- Geotechnical consultancy and design review;
- Contaminated water treatment design and plant;
- Drainage design;
- Geomembrane design over the existing tailings.



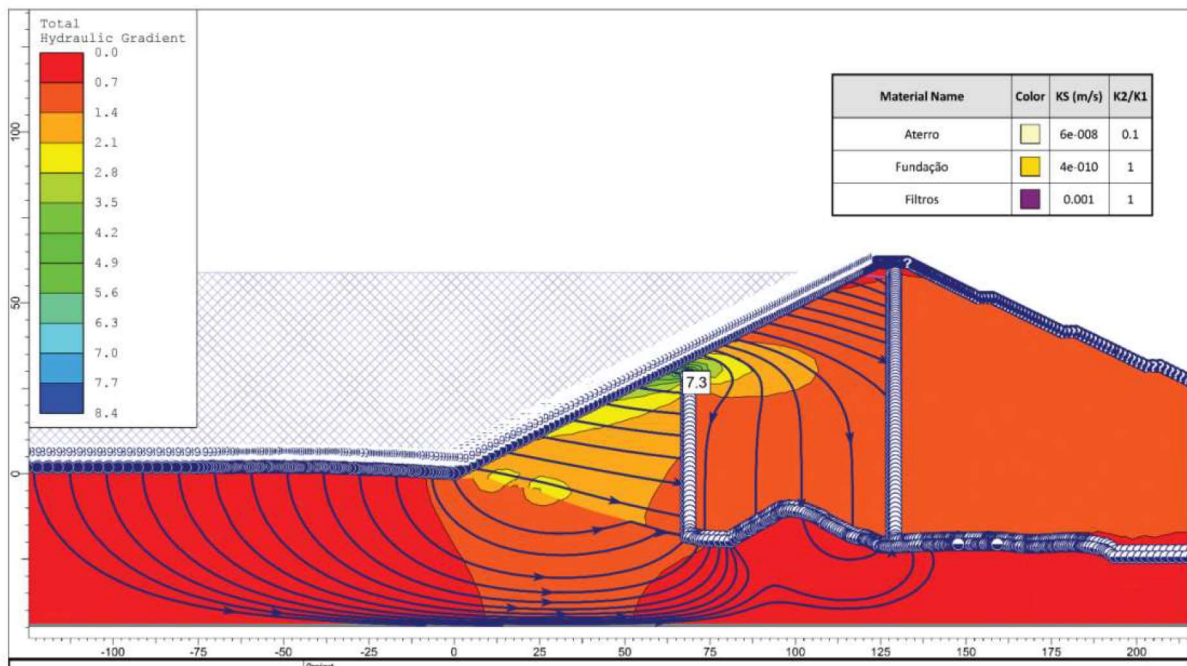
Project datasheet Dams

Design review of Maravilhas III Tailings Dam

Location: Nova Lima, MG, Brazil

Client: Construcap Contractors

Description: This is a tailings dam built by the downstream method and owned by Vale Mining. Construcap hired Terratek for the design review involving site visit and seepage, deformation and stability analyses. This work showed the need to redesign the rip-rap and high seepage gradients close to the top of the sand filter. Our recommendations also included improvement for the instrumentation programme.



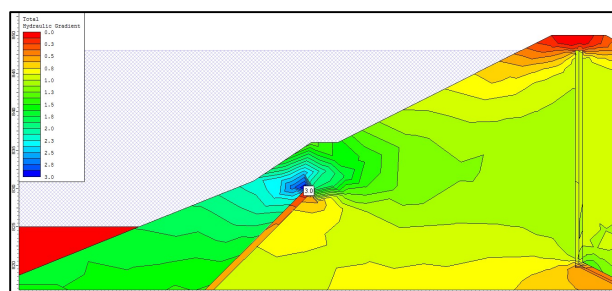
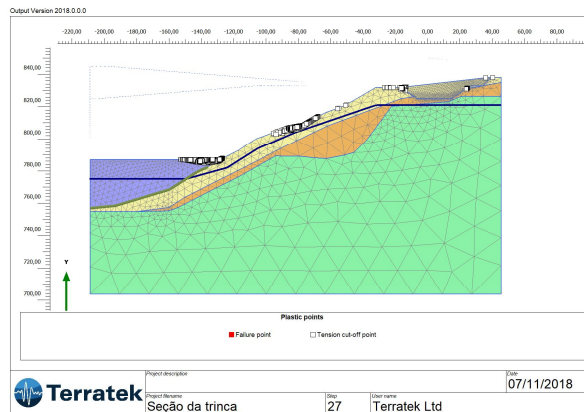
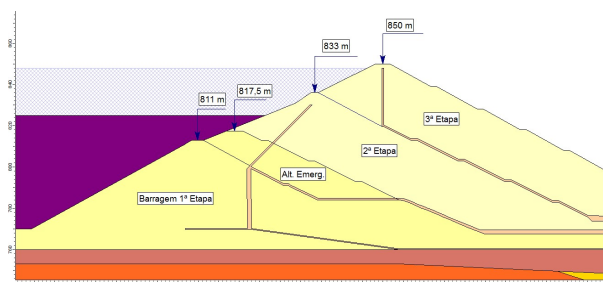
Project datasheet Dams

Itabiruçu Tailings Dam Design Review

Location: Itabira, MG, Brazil

Client: Empa Contractors

Description: This is a tailings dam built by the downstream method and owned by Vale. Empa was awarded the contract to carry out the second lift and hired Terratek for the design review. The work included a site visit when Terratek's team observed a cross and another longitudinal crack through the compacted embankment dam. Terratek carried out document review and seepage, deformation and stability analyses. The deformation analysis showed tensile stress zones where the observed cracks took place. This work showed high seepage gradients close to the top of the sand filter. Our recommendations also included the improvement of the instrumentation programme.



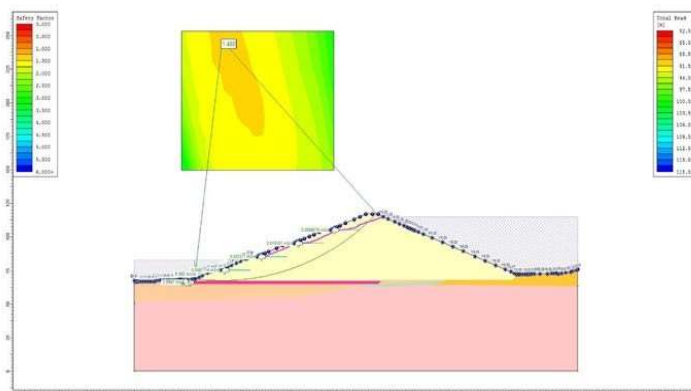
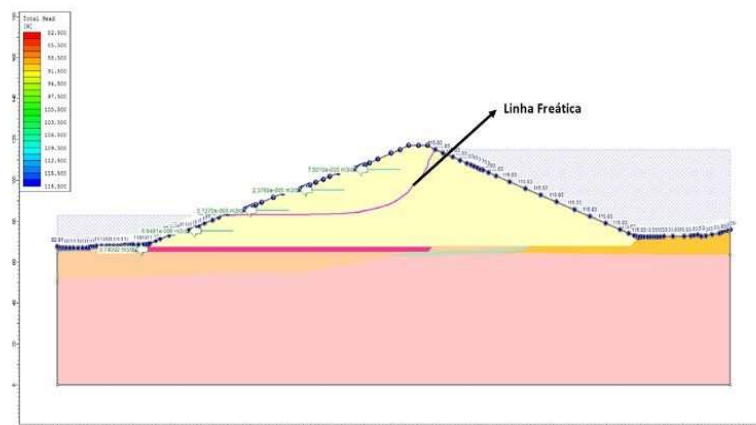
Project datasheet Dams

Sabão 1 & 2 Dams

Location: Serra do Salitre, MG

Client: Construcap Contractors

Description: These are water reservoir dams belonging to Norsk Yara Fertilizers Mining. Construcap is the contractor and hired Terratek for the design review. The work included a site visit, document review and seepage and stability analyses. Our analyses showed that the seepage analyses carried out by the designer was wrong due to a conceptual error for the selection of permeability values, taken equally in the vertical and horizontal direction. This misconception led to recommendations to change the dams drainage system to avoid the phreatic water level crossing the downstream slope of the dams.



Project datasheet Dams

Avanco Dam Design & Construction Method Review

Location: Carajás, Curionópolis, PA

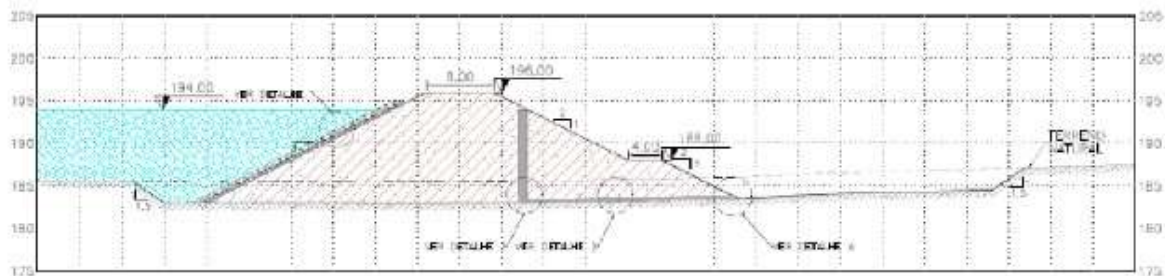
Client: Avanco Mining

Description: Avanco Copper Mining in the Amazon built during 2015 – 2016 a tailings dam, 11 m high, 320 m long embankment dam using the downstream lifting method. The drainage system consists of a horizontal sand blanket filter connected to the vertical chimney filter



Terratek provided the following services

- Site visit and safety inspection;
- Design review;
- Site resident engineering services;
- Final review & signoff report.



Project datasheet Dams

Germano Mining Dry Stockpile

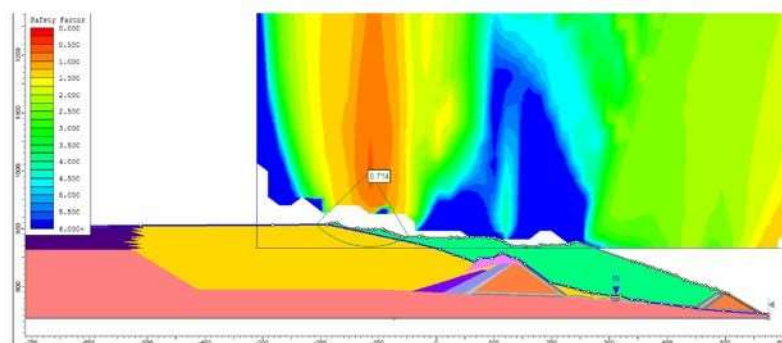
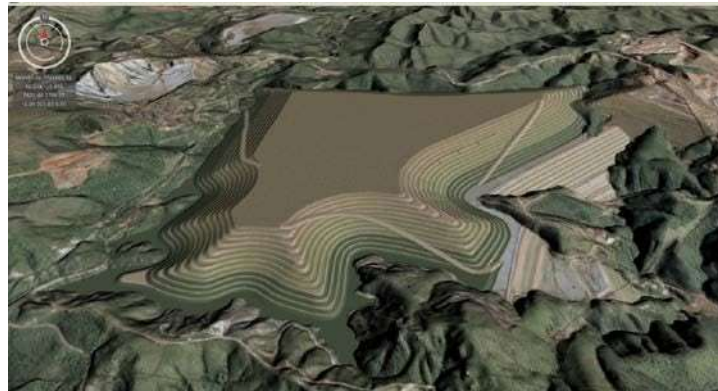
Location: Mariana, MG, Brazil

Client: Samarco Mining

Description: Samarco Mining awarded Terratek in 2013 a contract to carry out feasibility studies for a stockpile for the disposal of dry mine tailings.

Terratek provided the following services:

- In situ (CPTU, Seismic CPT, VST) and lab testing;
- Design and construction of a trial embankment on fine mine tailings;
- Probabilistic seismic hazard studies;
- Static and dynamic liquefaction susceptibility;
- Stability analyses.



Project datasheet Dams

Alemães Tailings Dam

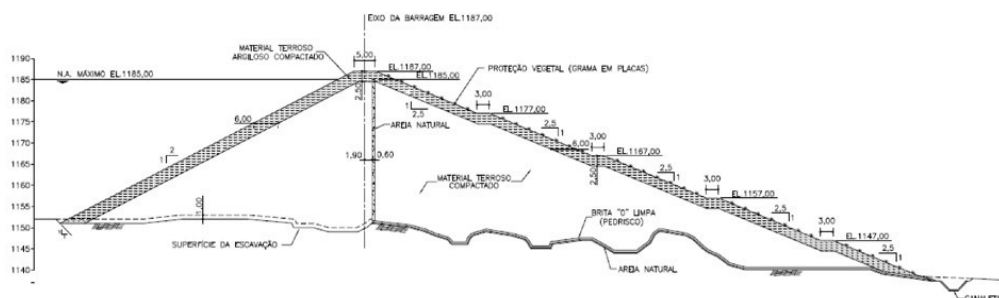
Location: Miguel Burnier Mine, MG, Brazil

Client: Gerdau Steel Co.

Description: This earth structure is a tailings dam constructed by the downstream method. The starting dam is a 50 m high, 180 m long embankment founded on phyllite rock.

Terratek provided the following services:

- Site visit,
- Stability analyses,
- Instrumentation analysis;
- Design review and sign-off report



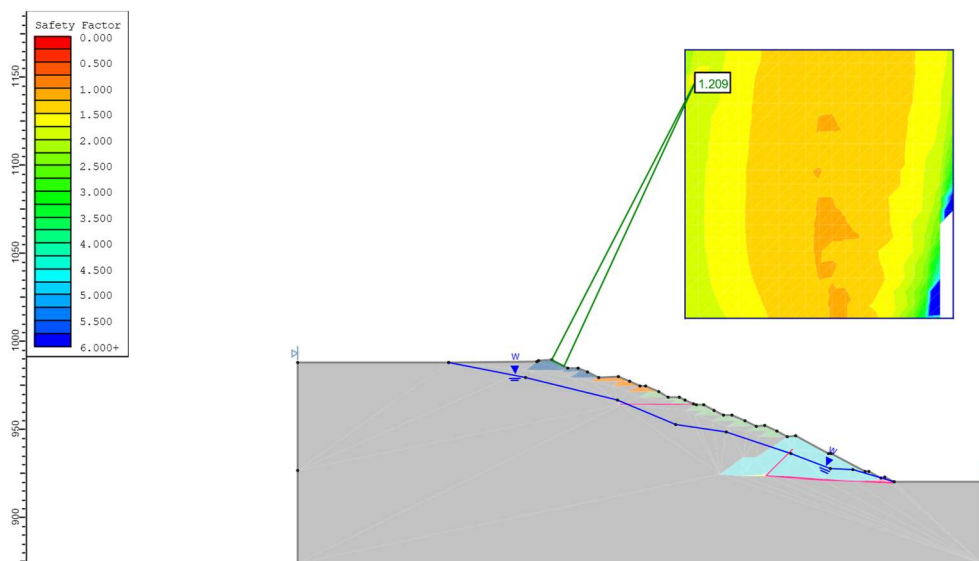
Project datasheet Dams

Itatiaiuçu Tailings Dam Review

Location, Itatiaiuçu, MG, Brazil

Client: Arcelor Mittal

Description: In 2009 Terratek was hired to investigate the stability of the tailings dam, about 100 m high and built by the upstream construction method. The work involved site investigation including in situ and lab testing and analyses. This work showed loose silty sandy tailings and a very high water level in the dam, close to the dam slope. Undrained laboratory testing showed liquefiable tailings with a cohesionless behaviour and a drained friction angle of 26 degrees. Stability analyses yielded a very low factor of safety $FS = 1.25$. Terratek's final report did not ensure dam stability.



Project datasheet Dams

Project name: Morro do Ouro Tailings Dam

Location: Paracatu, MG, Brazil

Client: Kinross Mining

Description: Morro do Ouro tailings dam is 4 km long and 120 m high, is among the world's largest dams of its type. Terratek provided geotechnical services from 2002 to 2008. It involves the dam and other structures such as the SAG mill foundation, slope stability of the pit,



Services provided by Terratek

- Safety inspection;
- Geotechnical consultancy and design
- In situ testing, seismic piezocone
- Geophysical testing
- Flume tests to simulate tailings beach
- Safety review and sign-off reports
- Design and construction of a trial embankment over tailings
- Stability and liquefaction assessment
- Instrumentation and monitoring



Project datasheet Dams

Project name: Soledade Dam

Location: Ouro Branco, MG, Brazil

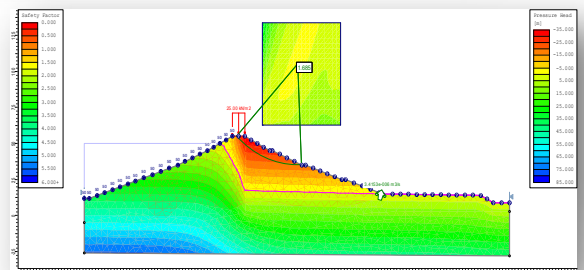
Client: Gerdau Steel Manufacturing



Description: Soledade Dam and its water reservoir is a large structure and part of the Gerdau Steel Manufacturing Plant. Soledade Dam was built in the 70s and is a large 70 m high compacted earth dam. Terratek is in charge of the dam safety analyses and since 2006.

Services provided by Terratek

- Yearly safety inspection;
- Geotechnical consultancy and design
- Safety review and sign-off reports
- Stability assessment
- Instrumentation and monitoring



Project datasheet Dams

Project name: Germano Tailings Dam

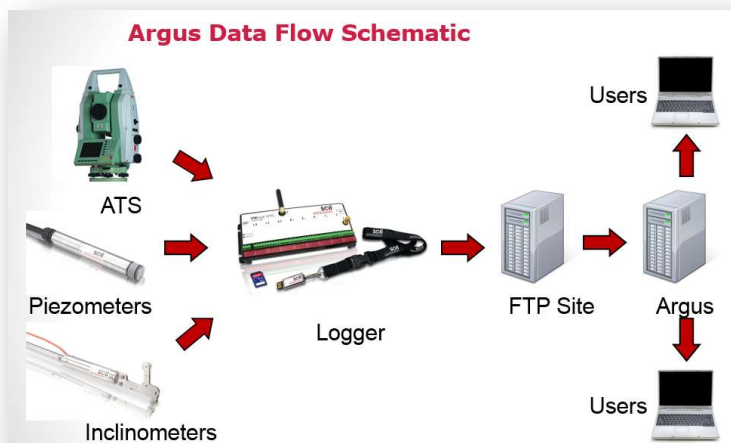
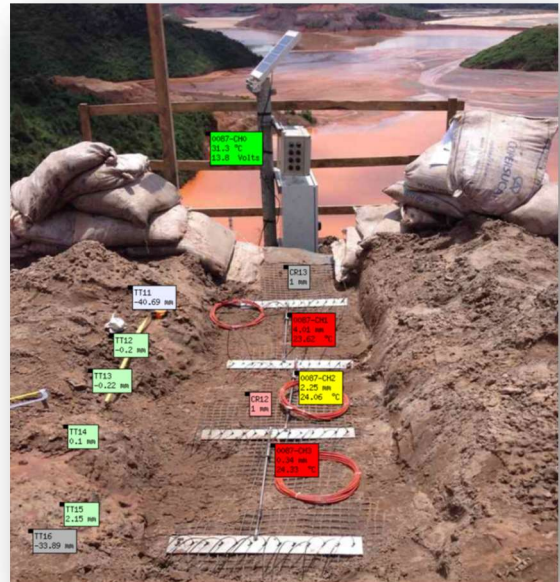
Location: Mariana, MG, Brazil

Client: Samarco Mining

Description: Germano tailings dam is 110 m high and, by the time of its completion in 2020 will be 140 m high. Terratek installed an automated monitoring system

Services provided by Terratek

- Supply of instruments; piezometers, hydraulic settlement cells, inclinometers, flowmeters, dataloggers
- Installation
- Datalogging
- Argus web-based monitoring system for all electrical instruments



Project datasheet Dams

Project name: Areal concrete dam

Location: Rio de Janeiro, Brazil

Client: Ampla Energy

Description: Areal dam is an old concrete structure built in the late 40s and its height is 30 m. An inspection carried out by Terratek showed severe concrete damage and cracking.



Services provided by Terratek

- Concrete inspection;
- Dynamic monitoring of the structure using vibration measurements on selected points on the dam crest;
- Spectrum analysis to identify structural modes
- Mathematical modelling of the structure;
- Model validation through vibration measurements
- Design of rehabilitation works
- Geotechnical monitoring

