Hydraulic Tunnels A and B - Hydroelectric project

Hydraulic tunnels for water transfer at Rrapuni

Librazhd, Albania

Project
Water transfer hydraulic tunnels for electric power production.

Construction Cost
Total project's cost: approx. € 7 m.

Project Schedule
Design: 2013 - 2014
Construction: 2013 - 2014

Project Description
Pressurized Hydraulic Tunnel A, for water transfer from Rrapunit river dam to the electric power production station.
Hydraulic Tunnel B, for the diversion of the Qarrishte river runoff to the dam basin.

Tunnel A total length: 2.310m
Tunnel B total length: 200m
Tunnels effective cross section: 21,00m²

Excavation Method
NATM – Drilling and blasting – mechanical means

Geology
Scree, Molasse, Ophiolites, Thrust zone of Ophiolites on the Molasse

Our Services
• Geological – geotechnical evaluation
• Detailed geotechnical and structural design

Construction details
• Skewed Entrance Portal of Tunnel A
• Formation of two (2) additional excavation faces for the main tunnel (Tunnel A) through an intermediate access tunnel

Client
AKTOR SHOQERI ANONIME TEKNIKE
Platanos & Trapeza Railway Tunnels and associated Hydraulic Drainage Tunnel
Athens - Patras High Speed Railway Line, Section Kiato - Egio
Central Greece

Project
- Platanos railway tunnel
- Trapeza railway tunnel
- Water drainage tunnel

Construction Cost
Total cost: approx. €100 m.

Project Schedule
Design: 2007 - 2009
Construction: 2007 -

Project Description
- **Section of Platanos Railway Tunnel**
  Tunnel’s length: 500m
  Excavation cross section: 140m²

- **Section of Trapeza Railway Tunnel**
  Tunnel’s length: 2,715m
  Excavation cross section: 140m²

- **Water Drainage Tunnel**
  Tunnel’s length: 200m
  Cross section: 7m²

Method of tunnel excavation
NATM – Use of mechanical means
TBM (Tunnel Boring Machine) for Trapeza tunnel pipe jacking

Final Lining
Reinforced concrete C30/37 and precast reinforced concrete segments

Geology
Marls, conglomerates, marine deposits
Maximum overburden of Platanos tunnel: 90m
Maximum overburden of Trapeza tunnel: 90m
Maximum overburden of water drainage Tunnel: 30m

Our Services
Detailed geotechnical & structural design

Construction Details
- Use of forepoles and spiles
- Excavation in two phases
- Pipe jacking technique

Client
AKTOR S.A.
Hydraulic Tunnel
Kostarakos Hydraulic Diversion Tunnel
Egnatia Highway, Section 3.3 – 3.5.1
Northern Greece

Project
Hydraulic tunnel

Construction cost
Total cost: approx. € 2,2 m.

Project Schedule
Design: 2006 - 2007
Construction: 2007

Project Description
Hydraulic diversion tunnel of Kostarakos stream
Length: 310m
Maximum overburden: 45m
Effective cross section: 19,8m²

Excavation Method
NATM – Drilling & blasting and mechanical means

Final Lining
Reinforced concrete C20/25 in tunnel’s sides
Gunite C25/30 in crown section

Geology
Peridotites, serpentinitized peridotites, serpentinites, tectonic melange

Our Services
• Detailed geological – geotechnical design
• Detailed geotechnical & structural design of tunnel and portals

Construction Details
• Use of forepoles and spiles
• Stiff temporary support by using steel sets of HEB type
• Support by use of anchors and shotcrete
• Closed ring solutions

Client
AKTOR S.A.
Hydraulic Tunnel

Hydraulic Drainage Tunnel for the stabilization of the landslide in the Big Cut area

Egnatia Highway, Section 3.3 – 3.5.1
Northern Greece

Project
Hydraulic tunnel

Construction cost
Total cost: approx. € 3 m.

Project Schedule
Design: 2008
Construction: 2008

Project Description
Hydraulic drainage tunnel for the stabilization of the landslide in the Big Cut area
Length: 520m
Maximum overburden: 100m
Effective cross section: 19.8m²

Excavation Method
NATM – Mechanical means

Final Lining
Reinforced concrete C20/25

Geology
Peridotites, serpentinized peridotites, serpentinites, tectonic melange

Our Services
Detailed geotechnical & structural of the tunnel and portals

Construction Details
- Use of steel sets of HEB type
- Use of anchors and shotcrete
- Micropiles for shotcrete shell’s foundation improvement
- Closed ring solutions

Client
AKTOR S.A.

Excavated tunnel

Hydraulic drainage tunnel entrance portal

Excavation and primary support
Cross section

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Waste treatment projects

Design and construction of a solid waste treatment plant at Sadinata Site, Sofia, Bulgaria

Project
Geotechnical interpretation and evaluation design of a waste Mechanical and Biological Treatment (MBT) plant for processing waste and producing Refuse Derived Fuel, at Sadinata site, Sofia, Bulgaria.

Construction Cost
Total cost: approx. € 80m.

Project Schedule
Design: 2013 - 2014
Construction: 2014 -

Project Description
Geotechnical interpretation and evaluation design for the foundation of the buildings and relevant facilities of the Sofia Municipality Waste Mechanical and Biological Treatment (MBT) plant, located in an area of approx. 107,000m² in Sadinata, Sofia.

Geology
Deluvial-proluvial Quaternary and Pliocene sediments consisting mainly of clay and gravel. Water table anticipated near the ground surface.

Our Services
- Preliminary geotechnical interpretation and evaluation
- Establishment of the geotechnical site investigation campaign
- Geological and geotechnical interpretation, hydrogeological assessment, evaluation of the geotechnical conditions and determination of the geotechnical units
- Elaboration of typical geotechnical cross sections
- Determination of the geotechnical profiles
- Identification of the critical areas with respect to the geotechnical characteristics of the prevailing formations
- Determination of the geotechnical parameters required for the foundation for the buildings and the relevant facilities of the MBT plant

Client
AKTOR S.A. – HELEKTOR S.A. Joint Venture

Design ground profiles application areas

Typical geotechnical cross-section

Geotechnical simulation model for temporary cuts
Mining – Hydraulic – Waste Disposal Project

Detailed Design for Kokkinolakkas Tailings Management Facility (TMF) in Kassandra Mines
Chalkidiki, Northern Greece

Project
Elaboration of detailed design of Kokkinolakkas Tailings Management Facility (TMF) in Kassandra Mines. Detailed design of two (2) dams (upstream & downstream embankments).
The project involves the construction of an integrated dry stacking area to store the tailings from ore processing at Mavres Petres and Olympias Mines.

Construction Cost
Total cost: approx. € 12.1 m.

Project Schedule
Design: 2013 – on going
Construction: 2013 – on going

Project Description
Upstream Embankment Dam
• Dam crest length: ≈ 242m
• Dam crest width: 10m
• Vertical dam height: max. ≈ 43m /in the dam axis ≈ 32m

Downstream Embankment Dam
• Dam crest length: ≈ 650m
• Dam crest width: 10m – 200m
• Vertical dam height: max. ≈ 92m /in the dam axis ≈ 76m

Kokkinolakkas Basin
• Tailings surface area: 393.090m²
• Tailings storage volume: ≈ 10.5 Mm³

Geology
Ground surface deposits from mining activities, amphibolites – amphibolitic gneisses, biotitic gneisses, groundwater
High seismicity area (Stratoni – Varvara fault)

Our Services
• Detailed design of one (1) rockfill upstream embankment dam, serving as cofferdam to Kokkinolakkas stream flow
• Detailed design of one (1) rockfill downstream embankment dam, serving as the southern boundary of the closed basin and as toe buttress to the existing Karakoli embankment
• Dams construction & deposition schedule
• Dams risk analysis and break-out study
• Basal liner system detailed design of Kokkinolakkas basin
• Detailed hydraulic design
• Detailed design of all required structures
• Water Management / Diversion Works / TMF Water Balance
• Dams & slopes stability analysis & assessment
• Internal road network design
• Geotechnical Investigation Program Planning and Supervision
• Geological – Hydrogeological – Geotechnical Interpretation and Evaluation
• Construction follow-up services / Technical expertise consulting
• Designer on site services
• Elaboration of closure & rehabilitation plans
• Tender documents for construction – BoQ’s
• Permitting design

Client
HELLAS GOLD S.A.
Mining – Hydraulic – Waste Disposal Project

Detailed Design for Two (2) Tailings Management Facilities (TMF) at Skouries Gold Project
Chalkidiki, Northern Greece

Project
Elaboration of detailed design of two (2) Tailings Management Facilities (TMF) at Skouries Gold project to store the tailings from ore processing mined from the open pit.

Construction Cost
Total cost: approx. € 29 m.

Project Schedule
Design: 2013 – on going
Construction: 2013 – on going

Project Description
Karatzas Lakkos TMF
- Dam crest length: 615m
- Dam crest width: 15m
- Vertical dam height: max. ≈ 190m / in the dam axis ≈ 160m
- Cumulative tailings surface area: 522,000 m²
- Cumulative tailings storage volume: 22.6 Mm³

Lotsaniko TMF
- Dam crest length: 455m
- Dam crest width: 15m
- Vertical dam height: max. ≈ 180m / in the dam axis ≈ 150m
- Cumulative tailings surface area: 308,000 m²
- Cumulative tailings storage volume: 13.4 Mm³

Geology
Porphyry intrusions, breccias, mica schists-gneisses, chloritic, biotitic, sericitic schists-gneisses, muscovitic, chloritic gneisses-schists, groundwater

Our Services
- Detailed design of Karatzas Lakkos TMF (including rockfill dam)
- Detailed design of Lotsaniko TMF (including rockfill dam)
- Dams construction & deposition schedule
- Dams risk analysis and break-out study
- Detailed hydraulic design
- Detailed design of all required structures
- Contaminant risk study
- Water Management / Diversion Works / TMF Water Balance
- Tailings transportation pipework
- Dams & slopes stability analysis & assessment
- Tailings liquefaction analysis & assessment
- Internal road network design
- Geotechnical Investigation Program Planning and Supervision
- Geological – Hydrogeological – Geotechnical Interpretation and Evaluation
- Construction follow-up services / Technical expertise consulting
- Designer on site services
- Tender documents for construction – BoQ’s
- Permitting design

(*) Designs jointly elaborated with Golder Associates (UK) Limited

Client
HELLAS GOLD S.A.
Solid Waste Landfill projects

Construction of Naxos Municipal Solid Waste Landfill
Naxos Island - Greece

Project
Geotechnical assessment and tender design for the construction of a Municipal Solid Waste Landfill, at Naxos Island.

Construction Budget
Total cost: approx. € 9.5 m.

Project Schedule
Design: 2012
Construction: 2013 –

Project Description
Geotechnical assessment and tender design of Naxos Municipal Solid Waste Landfill.

Geology
Weathered granodiorite with pillow-lavas

Our Services
• Geotechnical assessment of the available geotechnical designs & surveys
• Geotechnical investigations program
• Geotechnical design and slope stability analyses of the deposition basin slopes
• Design ground profiles
• Slope stability analysis of the waste tailings
• Geotechnical calculations for waste landfills waterproofing
• Geotechnical calculations for the waterproofing layers stability and for hydro-sealing adequacy

Client
HELEKTOR S.A.
Solid Waste Landfill projects

Construction of Chalkidiki Municipal Solid Waste Landfill
Chalkidiki – Northern Greece

Project
Geotechnical assessment and tender design for the construction of a Municipal Solid Waste Landfill at Chalkidiki.

Construction Budget
Total cost: approx. €11 m.

Project Schedule
Design: 2013
Construction: 2014 –

Project Description
Geotechnical assessment and tender design of the Municipal Solid Waste Landfill at Chalkidiki.

Geology
Biotitic granite

Our Services
- Geotechnical assessment of the available geotechnical designs & surveys
- Geotechnical investigations program
- Geotechnical design and slope stability analyses of the deposition basin slopes
- Design ground profiles
- Slope stability analysis of the waste tailings
- Geotechnical calculations for waste landfills waterproofing
- Geotechnical calculations for the waterproofing layers stability and for hydro-sealing adequacy
- Slope stability analysis of the access road

Client
HELEKTOR S.A.
Waste treatment projects

Construction and Operation of a household waste treatment plant at Levashovo area – St. Petersburg
PPP project
Russia

Project
Preliminary geotechnical assessment and design of a waste treatment plant at Levashovo area, St. Petersburg, Russia

Construction Cost
Total cost: approx. € 300m.

Project Schedule
Design: 2012 - 2014
Construction: 2013 -

Project Description
Preliminary geotechnical assessment and design of the various structural units of a waste treatment plant, located in an area of approx. 100,000m² in Levashovo, St. Petersburg

Geology
Mainly clays, loams and sandy loams. Water table anticipated near the ground surface, swamps presence in the broader area

Our Services
• Geotechnical evaluation and interpretation
• Geotechnical estimations for the foundation of the main facilities
• Geotechnical assessment for the required temporary excavations of the main facilities
• Geotechnical proposals for mitigating buoyancy issues
• Supplementary geotechnical campaign proposal
• Initial identification of issues that could overburden the projects budget (dewatering, soil frost heave, soil swelling, contamination etc.)

Client
Joint Partnership HELEKTOR S.A. – AKTOR CONCESSIONS S.A. – AKTOR S.A.
Waste treatment projects

Design - Construction - Maintenance - Operation of a waste treatment plant at Western Greece - PPP project

Greece

Project
Geotechnical assessment and tender design for the construction of a waste treatment plant and its waste landfill area, at Western Greece (PPP project).

Construction Budget
Total cost: approx. €100m.

Project Schedule
Design: 2012
Construction: 2013

Project Description
Geotechnical assessment and tender design of the various structural units and facilities of a waste treatment plant, a waste landfill area and a waste transfer station at Western Greece.

Geology
Neogene marls and lignites, waste deposits from lignite open pit mines, ash deposits from lignite combustion, alluvial sediments (clays and sands)

Our Services
• Geotechnical assessment of the available geotechnical designs & surveys
• Proposed geotechnical investigations program
• Geotechnical design and slope stability analyses of the deposition basin slopes
• Design ground profiles
• Subsoil improvement proposal and seismic hazard assessment of the subsoil foundation
• Slope stability analysis of the waste tailings
• Geotechnical calculations for waste landfills waterproofing
• Geotechnical calculations for the waterproofing layers stability and for hydro-sealing adequacy
• Foundation designs for various structural facilities of the plant (bearing capacity calculations, soil indicators, determination of the permissible settlements, subsoil bearing capacity improvement)
• Determination of the required excavations for finalization of the road layout and for the area where the construction of the waste treatment plant and the waste landfill area is foreseen

Client
Joint Partnership "AKTOR CONCESSIONS S.A. – HELEKTOR S.A."
Dams – Hydraulic Works

Recharge Dams and flood protection works
Northern Emirates, United Arab Emirates

Project
Update of studies and designs for new recharge dams and barriers, execution of safety audit of existing dams, design of new recharge structures and other flood protection works

Construction Cost
Total cost: approx. € 100 m.

Project Schedule
Design: 2011
Construction: 2012 - 2015

Project Description
- Design and review of approx. 120 recharge and energy dissipation structures, flood protection and water diversion works, in various locations
- Safety audit of existing Ham Dam upstream of Fujairah City and Bih Dam upstream Ras Al Khaimah City
- Dams’ catchment areas: 0.5km² – 105km²
- Dams’ reservoir volumes: 2,500m³ – 243,000m³
- Dams’ crest lengths: 10m – 2,800m
- Dams’ heights (wadi bed – dam crest): 2.5m – 18m
- Types of Dams: Concrete gravity dams
- Embankment dams
- Gabion drop structures
- Approximately 20km of flood protection channels
- Erosion and slope protection works in wadis
- Energy dissipation and sediment retention structures
- Other retaining works for the protection of farms and houses in the reservoir area of the recharge dams

Geology
Gravely alluvium, sandy-gravely old wadi and terrestrial terrace deposits, igneous rocks of ophiolitic complex (harzburgites, peridotites, gabbros), metamorphic schists, cherts, limestones, claystones, siltstones

Our Services
- Study, review and evaluation of existing studies and designs
- Assessment and evaluation of historic storms in the wider Arabic Peninsula region
- Extensive reconnaissance of each dam site to establish suitability
- Hydrologic and hydraulic assessment and evaluation of each site
- Geological, hydrogeological and geotechnical assessment of each dam site
- Design of the required technical solutions, including the relevant hydrologic, hydraulic, structural and geotechnical calculations
- Elaboration of tender documents (BoQ’s, technical specifications, construction cost overview)
- Execution of preliminary designs, final designs and construction drawings

Construction Details
- Concrete gravity dams with upstream and downstream slope of 1:1 (V:H) in order to sustain the greater than hydrostatic force applied in the dams’ body
- Ogee and stair shaped spilling section for concrete dams
- Embankment dams with upstream slope of 1:2 (V:H) and downstream slope of 1:4 (V:H)
- Rock armor protection in the downstream slope of embankment dams
- Geomembrane in the upstream slope of embankment dams and gabion drop structures to prevent piping
- Bottom outlets provided in all recharge structures

Client
Consultant HSS – United Arab Emirates

OMIKRON KAPPA Consulting
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Fax: + 30 210 6837499, e-mail: info@omikronkappa.gr, www.omikronkappa.gr
Dam, Hydraulic Work
Setta Manikia Dam, Evoia
Central Greece

Project
Water supply – Spillover – Discharge tunnel of dam and relevant works
Dam inundation basin
Dam road works

Construction Cost
Total cost: approx. € 5 m.

Project Schedule
Design: 2005 - 2006
Construction: 2005 - today

Project Description
• Water supply – Spillover – Discharge tunnel
  Length: 1,180m
  Effective cross section: 14,3m²
• Works of entrance and exit water supply tunnel and design of water supply tower
• Dam basin water flush
  - Reservoir length in the upper flood level: ~ 1,900m
  - Reservoir width in the upper flood level: ~ 120m
  - Reservoir capacity in the upper flood level: ~ 2,9m³
  - Reservoir capacity in the upper storage level: ~ 2,6m³

Geology
Intercalations of schists and sandstones
Thick – bedded sandstones
Surface failures and creep
Max. overburden of water supply tunnel: 126m

Our Services
• Execution and evaluation of geotechnical investigation program
• Design of water supply – Spillover – Discharge tunnel
• Relevant tunnel works:
  - Water supply tower with valves in 4 different levels
  - Technical tunnel inflow
  - Tunnel gates placed in vertical shaft approx. 90m before the exit portal
  - Vertical wall after the tunnel exit portal, for the energy diffusion
  - Technical basin of calmness
  - Non-controlled spillover for the water outflow from the technical basin to the natural canal
  - Drinking water shaft in trench underneath the tunnel
  - Water supply outflow downstream the tunnel towards the control valves house
• Flood wave study downstream the water supply – spillover – discharge tunnel, along the new receiver
• Specific techno-geological study of slope’s stability of inundation basin

Client
AKTOR S.A.
Dam Works, S1, S2, Vrachasi Hydraulic Tunnels

Aposelemi Water Dam
Crete, Southern Greece

Project
Hydraulic tunnels for water transfer

Construction Cost
Total Cost: approx. € 15 m.

Project Schedule
Design: 2007 - 2010
Construction: 2008 - 2012

Project Description
Hydraulic tunnels for the transfer of water (S1 & S2 tunnels) from Aposelemi dam at the refineries and from there at Saint Nikolaos (Vrachasi tunnel)

- S1 hydraulic tunnel length: 1,590m
- S2 hydraulic tunnel length: 2,050m
- Vrachasi hydraulic tunnel length: 680m

Tunnels effective cross section: 8.50m²

Excavation Method
NATM – Drilling and blasting – mechanical means

Geology
Phyllites, schists, limestones

Our Services
- Geological – geotechnical evaluation
- Detailed geotechnical and structural design

Construction details
- Use of spiles
- Final lining from shotcrete at tunnel’s top heading and reinforced concrete at tunnels sidewalls

Client
AKTOR S.A.
Dam, Hydraulic Works

Aposelemi Water Dam – Water intake structure
Crete, Southern Greece

Project
Water intake structure final design

Construction Cost
Total construction cost: approx.€ 2 m.

Project Schedule
Design: 2008
Construction: 2008

Project Description
Water intake structure of horse-shoe shape cross section and connection with the swerve culvert

Cross section: 4.50m
Max. height: 4.00m
Length: 150m

Geology
Weathered phyllites, phyllites

Our Services
• Design and dimensioning of water intake structure
• Design and dimensioning of the connection between water intake structure and diversion culvert
• Design and dimensioning of water intake chamber
• Detailed geotechnical and structural design

Client
J/V TOMI S.A. – AKTOR S.A.
Hydraulic Tunnel

Yacambu – Quibor Tunnel
Venezuela

Project
Hydraulic tunnel

Project Schedule
Design: 2003
Construction: 2003-2004

Project Description
Hydraulic tunnel passing through the Andes
Length: 25000m
Cross section: 30m²

Method of tunnel excavation
NATM – Mechanical excavation, drilling and blasting

Final Lining
Reinforced shotcrete

Geology
Sandstones, phyllites and limestones
Squeezing conditions
Max. overburden: 1200m

Our Services
• Detailed design of final lining, in specific sections of the tunnel
• Designs jointly elaborated with Dr Evert Hoek

Construction Details
Steel sets with sliding joints in order to confront severe squeezing problems

Client
SISTEMA HIDRAULICO YACAMBU – QUIBOR S.A.
Hydraulic Tunnel
Olympic Village Tunnel
Athens, Greece

Project
Hydraulic tunnel

Construction Cost
Total cost: approx. € 4 m.

Project Schedule
Design: 2003
Construction: 2003-2004

Project Description
Hydraulic tunnel for the flood protection of the Olympic Village,
application of pipe jacking technique
Total length: 320m
Cross section: 20m²

Method of tunnel excavation
Pipe Jacking

Geology
Marls, clays, gravels

Our Services
• Detailed geotechnical & structural design of the tunnel with
  pipe jacking technique
• Detailed design of construction shafts

Client
AKTOR S.A.
Financing Procedures of E.U.
Flood Protection Measures, Slovakia
Central Europe

Project
Services and Technical Assistance for the financing of high priority flood protection measures from the Cohesion Fund of the European Union

Construction Cost
Estimated total cost: approx. €100 m.

Project Schedule
Design: 2004 - 2005
Construction: The works are under tender evaluation

Project Description
Design of flood protection measures in the urban areas of Bratislava, Banska, Bystrica & Presov, in the frame of financing procedures from E.U.

Bratislava: Design of levees and movable elements
Banska Bystrica: Design of hydraulic flood diversion tunnel and a diversion weir
Presov: Design of levees and riverbed modulation

Our Services
• Feasibility studies
• Environmental impact assessment studies
• Elaboration of the applications for financing from the Cohesion Fund of the EU
• Tender documents
• Land permit studies
• Services jointly provided by OMIKRON KAPPA CONSULTING & EDR GmbH, Munich

Client
Slovak Water Management Enterprise (SVP)
Special Geotechnical Applications

Jet Grouting Diaphragm Wall
Egnatia Highway, Section 2.4 – 3.1
Northern Greece

Project
Jet grouting diaphragm wall, for the reduction of water inflows in order to construct the foundations of M2 to M6 piers of T10 bridge at Metsovitikos River

Construction Cost
Total cost: approx. €6 m.

Project Schedule
Design: 2007
Construction: 2007-2008

Project Description
• Jet grouting diaphragmatic wall with secant ground piles
• Central diaphragm wall, with 3 rows ground piles
• 4 additional diaphragm walls at the foundation areas of the piers
• Diameter: Ø 80, Length 10m-20m
• Total walls length: 365m

Geology
• Riverbed deposits (sands, breccia argillaceous materials)
• Conglomerates with high permeability
• High river flood discharge
• High groundwater table

Our Services
Detailed geotechnical design

Construction Details
• Dam construction for the arrangement of the riverbed
• Rip - rap construction for the protection of the main diaphragm wall

Client
AKTOR S.A.
Culvert
Culvert OA3
PATHE Highway, Kakia Skala Section
Central Greece

Project
Highway hydraulic work

Construction Cost
Total cost: approx. € 0.4 m.

Project Schedule
Design: 2003
Construction: 2003 - 2004

Project Description
Rectangular culvert
Upstream section:
Length: 221m (closed cross section)
        11m (open cross section)
Height: 2.5m
Width: 2.0m

Downstream section:
Length: 30m (closed cross section)
        45m (open cross section)
Height: 2.5m-7.6m
Width: 2.0m

Geology
Limestones
Seismically active area

Our Services
Detailed geotechnical & structural design

Client
AKTOR S.A.
Culvert

Culvert OA9

PATHE Highway, Kakia Skala Section

Central Greece

Project
Highway hydraulic work

Construction Cost
Total cost: approx. € 0,21 m.

Project Schedule
Design: 2003
Construction: 2003 - 2004

Project Description
Rectangular culvert
Length: 79m (closed cross section)
       37m (open cross section)
Height: 2,0m
Width: 2,5m

Geology
Limestones
Seismically active area

Our Services
Detailed geotechnical & structural design

Client
AKTOR S.A.