ACACIA MINE OPERATIONS
GÖKIRMAK COPPER MINE
Erosion Sediment Control Plan 2017

Document Number	**ACACIA-2017-E&S-AECOM-PLN-192**
Disclosure Date	**29.09.2017**
Prepared By	**Environment & Social Department, AECOM Consultant**

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LIST OF ABBREVIATIONS

AMI	Acacia Maden İşletmeleri A.Ş.
EBRD	European Bank for Reconstruction and Development
EC	Erosion Control
GCP	Gökırmak Copper Project
GIIP	Good International Industry Practices
HSE	Health Safety Environment
IFC	International Finance Corporation
LR	Landscape and Reinstatement
SC	Sediment Control

1. PURPOSE AND SCOPE

This Erosion and Sediment Control, Landscape and Reinstatement Plan (the Plan) is prepared for the Gökırmak Copper Project (GCP or "the Project") and is developed to provide the practices and measures to prevent or reduce erosion at the Project Area, minimize the impacts of sediment and provide measures for landscape and reinstatement in compliance with national legislation, requirements of international financing institutions (e.g. IFC Performance Standards, EBRD Performance Requirements) and other applicable Good International Industry Practices (GIIPs). The plan will be applied systematically during construction, operation and rehabilitation phases of the Project.

Measures regarding mine closure and rehabilitation phase of the Project are detailed in the Mine Closure and Rehabilitation Plan prepared specific to the Project. This Plan should be considered together with the Mine Closure and Rehabilitation Plan.

This Plan is prepared specific to the Project Area with the following two key objectives:

To determine and design site specific measures for controlling erosion and sediment and ensuring medium and long-term reinstatement of the GCP site.

To develop long-term landscape plans for the site to mitigate visual impact and enhance the ecological and landscape character of GCP for the operation phase.

Due to the nature of the Project Area and the degree of excavation works, the area is considerably modified and there exists shorter and longer term erosion, slope integrity and sedimentation risks. Therefore, site specific designs for erosion and sedimentation control as well as medium/long-term reinstatement/landscaping measures are required. In the scope of this Plan, desktop studies and site visit was conducted. The details of these studies are given in the subsequent sections of this Plan.

This Plan is a living document and the responsibilities, procedures and compliance actions should be updated as appropriate. It is the responsibility of the site HSE Manager to be fully aware of its contents, to provide relevant training to staff and to ensure that procedures are being implemented to achieve compliance with this Plan.

2. LEGISLATIVE FRAMEWORK

In this section, the legislative framework that is related to erosion and sediment control, landscape and reinstatement is summarized.

2.1 National Requirements

The Environmental Law (No. 2872), which was published in Turkish Official Gazette No. 18132 dated August 11, 1983 and revised in Turkish Official Gazette dated May 29, 2013 (Law No. 6486) provides the legislative framework for the regulation of industries and their potential impact on the environment. Industrial projects are subject to varying levels of review that begin while projects are in the development phase. Additional regulations apply to facilities once they are in operation.

The Environmental Law authorized the promulgation of a number of regulations.

Those that pertain to the management of soil quality, water quality and waste will have direct and/or indirect impacts on the erosion and sediment control, landscape and reinstatement features at the Project Area. Major pieces of environmental legislation that will potentially impact management of these features include, but not limited to, the following:

<u>General</u>

- Regulation on Environmental Impact Assessment, Official Gazette No. 29186 dated November 25, 2014
- Regulation on Environmental Permits and Licenses, Official Gazette No. 29115 dated September 10, 2014
- Regulation on Environmental Audit, Official Gazette No. 27061 dated November 21, 2008

- Regulation on Permission to Mining Activities, Official Gazette No. 25852 dated June 21, 2005
- Regulation on Implementation of Mining Activities, Official Gazette No. 27751 dated November 06, 2010

Soil

- Regulation on Reclamation of Land Deteriorated by Mining Activities, Official Gazette No. 27471 dated January 23, 2010
- Regulation on Soil Pollution Control and Contaminated Sites by Point Source, Official Gazette No. 27967 dated June 17, 2011
- Water
- Water Pollution Control Regulation, Official Gazette No. 25687 dated December 31, 2004
- Regulation on Quality of Surface Water, Official Gazette No. 28483 dated November 30, 2012
- Regulation on Monitoring of Surface Water and Groundwater, Official Gazette No. 28910 dated February 11, 2014
- Regulation on Protection of Groundwater against Pollution and Deterioration, Official Gazette No: 28257 dated April 07, 2012
- Regulation on Control of Pollution Caused by Hazardous Substances in the Aquatic Environment and Its Surroundings, Official Gazette No. 26005 dated November 26, 2005

Waste

- Regulation on Control of Excavation, Construction and Demolition Waste, Official Gazette No. 25406 dated March 18, 2004
- Regulation on Waste Management, Official Gazette No: 29314 dated April 2, 2015
- Regulation on Mining Wastes, Official Gazette No. 29417 dated July 15, 2015 (will be in force as of July 15, 2016)

2.2 International Conventions

Turkey is a party to the European Landscape Convention (enforced in 2000 and ratified by Turkey in 2003).

2.3 Requirements of International Financing Institutions

EBRD Performance Requirement (PR) 3 on Resource Efficiency and Pollution Prevention and Control and EBRD PR 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources are relevant requirements of the EBRD applicable to the scope of this Plan.

EBRD PR3 recognizes that increased economic activity and urbanization can generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Therefore, resource efficiency and pollution prevention and control are essential elements of environmental and social sustainability and projects must meet good international practice (GIP) in this regard. The objectives of this PR are:

- To identify project-related opportunities for energy, water and resource efficiency improvements and waste minimization.
- To adopt the mitigation hierarchy approach to addressing adverse impacts on human health and the environment arising from the resource use and pollution released from the project.
- To promote the reduction of project-related greenhouse gas emissions.

EBRD PR6 recognizes that the conservation of biodiversity and sustainable management of living natural resources are fundamental to environmental and social sustainability. This PR recognizes the importance of maintaining core ecological functions of ecosystems and the biodiversity they support. All ecosystems support a complexity of living organisms and vary in terms richness, abundance and importance of species. The objectives of this PR are:

- To protect and conserve biodiversity using a precautionary approach.
- To adopt the mitigation hierarchy approach, with the aim of achieving no net loss of biodiversity, and where appropriate, a net gain of biodiversity.
- To promote good international practice (GIP) in the sustainable management and use of living natural resources.

3. ROLES AND RESPONSIBILITIES

The following sets out the roles and responsibilities of AMI staff on site for the management of erosion and sediment control generated by the Project.

Project Manager

- To provide the necessary resources for the successful implementation of this Plan,
- To undertake spot checks on-site to ensure compliance with the requirements set out in this Plan,
- To monitor implementation of the AMI EHS standards and this Plan on site,
- To ensure that all requirements and commitments outlined in this Plan are implemented by relevant staff across all site activities,
- To coordinate with the site HSE Manager to ensure appropriate corrective and preventive measures are in place so that in the event of non-compliance or incidents appropriate measures can be implemented.

HSE Manager

- To ensure the implementation of and compliance with the requirements set out in this Plan,
- To provide assistance to all relevant staff in order to effectively implement and fulfil the requirements outlined in this Plan,
- To ensure that the requirements of this MP are understood by all relevant AMI site staff and employees of subcontractors through training programs conducted regularly,
- Monitor the compliance status with the requirements of this Plan,
- To inspect regularly the areas prone to erosion and to ensure that measures are effectively implemented, monitored and recorded appropriately in line with the requirements set out in this Plan,
- To undertake internal audits to monitor the requirements and to identify any improvements that can be incorporated into this Plan, as well as any defined obligations,
- Review and update, if necessary, to include additional requirements outlined within this Plan.

AMI Site Staff and Subcontractors

- All AMI site staff and employees of subcontractors working on site involved in the implementation of this Plan should follow all the necessary procedures and ensure that all the activities are carried out in line with the requirements of this Plan,
- All AMI site staff and employees of subcontractors involved in the implementation of this MP should ensure that all Project activities carried on site are in line with the requirements of this Plan and the existing legislation,
- All AMI site staff and employees of subcontractors involved in the implementation of this Plan should report any event of incompliance to the HSE Manager.

4. METHODOLOGY

Measures regarding mine closure and rehabilitation phase of the Project are detailed in the Mine Closure and Rehabilitation Plan prepared specific to the Project.

4.1 Erosion and Sediment Control Measures

Excessive erosion and sedimentation are the most visible water quality impacts due to construction activities. Engineering considerations associated with the basic types of erosion and sediment control measures at the GCP construction site are provided.

4.1.1 Erosion Control (EC) Measures

Most natural erosion occurs at slow rates; however, the rate of erosion increases when land is cleared or altered and left unprotected. Construction sites, if unprotected, can erode at rates in excess of one hundred times the natural background rate of erosion. Therefore, understanding the erosion process is essential to the development and implementation of effective erosion control measures at construction sites. The key to erosion control is preventing the detachment of soil particles and reducing the volume of run-off. This is achieved through the use of practices such as minimizing land disturbing activities and maintaining vegetative covers or substituting for lack of growing vegetation by mulching, hydoseeding or applying a compost blanket or erosion control mat.

All inactive soil-disturbed areas at the GCP site, and most active areas prior to the onset of rain, must be protected from erosion. Soil disturbed areas may include relatively flat areas as well as slopes. Typically, steep slopes and large exposed areas require the most robust erosion controls; flatter slopes and smaller areas still require protection, but less costly materials may be appropriate for these areas, allowing savings to be directed to the more robust EC measures for steep slopes and large exposed areas. EC measures must be implemented at slopes and disturbed areas to protect them from concentrated flows.

Some EC measures can be used effectively to temporarily prevent erosion by concentrated flows. These measures, used alone or in combination, prevent erosion by intercepting, diverting, conveying, and discharging concentrated flows in a manner that prevents soil detachment and transport. Temporary concentrated flow conveyance controls may be required to direct run-on around or through the Project in a non-erodible fashion.

A list of potential EC measures proposed for the GCP is given in Table 4-1.

Table 4-1: Erosion Control Measures for the GCP

Measure	Name	Description and Purpose
GCP-EC1	Scheduling	Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of EC while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.
GCP-EC2	Preservation of Existing Vegetation	Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.
GCP-EC3	Hydraulic Mulch	Hydraulic mulch consists of applying a mixture of shredded wood fibre or a hydraulic matrix, and a stabilizing emulsion or tackifier with hydro-mulching equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind.
GCP-EC4	Hydro seeding	Hydro seeding typically consists of applying a mixture of wood fibre, seed, fertilizer, and stabilizing emulsion with hydro mulch equipment, to temporarily protect exposed soils from erosion by water and wind.
GCP-EC5	Geotextiles & Mats	Mattings of natural materials are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, matting may be used to stabilize soils until

Measure	Name	Description and Purpose
		vegetation is established.
GCP-EC6	Earth Dikes and Drainage Swales (diversion structures)	An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, to divert runoff from stabilized areas and disturbed areas, and to direct runoff into sediment basins or traps.
GCP-EC7	Riprap	It is a permanent, erosion-resistant ground cover of large, loose, angular stone with filter fabric or granular underlining. The purposes are to protect the soil from the erosive forces of concentrated runoff, to slow the velocity of concentrated runoff while enhancing the potential for infiltration, and to stabilize slopes with seepage problems and/or non-cohesive soils.
GCP-EC8	Rock Breast Wall	A rock breast wall is a low retaining wall (usually 3 m or less in height) constructed against the base of a slope. The wall is usually built by stacking rocks atop one another in a single, one-rock width course. The purpose is to defend the toe of the slope and to prevent slope damage by erosion, especially piping and spring sapping as a result of seepage exiting from the face of the slope.

4.1.2 Sediment Control Measures

Sediment resulting from excessive erosion is a pollutant. Sedimentation is defined as the settling out of particles transported by water. Sedimentation occurs when the velocity of water is slowed sufficiently to allow suspended soil particles to settle. Larger particles, such as gravel and sand, settle more rapidly than fine particles such as silt and clay. Effective sediment control begins with proper erosion control, which minimizes the availability of particles for settling downstream. In other terms, sediment control is trapping detached soil particles that are being transported and ensuring they are deposited on site to prevent damage to other properties or receiving waters and rivers. This is achieved by such practices as silt fence installation, compost berms or filter socks, and sediment control basins. These measures should be well integrated with the EC measures as summarized in Table 4-2.

SC measures include those practices that intercept and slow or detain the flow of storm water to allow sediment to settle and be trapped. SC measures can consist of installing linear sediment barriers (such as silt fence, sandbag barrier, and straw bale barrier); providing fiber rolls, gravel bag berms, or check dams to break up slope length or flow; or constructing a sediment trap or sediment basin. Linear sediment barriers are typically placed below the toe of exposed and erodible slopes, down-slope of exposed soil areas, around soil stockpiles, and at other appropriate locations along the site perimeter.

The combination of EC and SC measures is usually the most effective means to prevent sediment from leaving the project site and potentially entering storm drains or receiving waters.

A list of potential SC measures proposed for the GCP is given in Table 4-2.

Table 4-2. Sediment Control Measures for the GCP

Measure	Name	Description and Purpose
GCP-SC1	Silt Fence	A silt fence is made of a filter fabric that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.
GCP-SC2	Safety Fence	It is a protective barrier installed to prevent access to an erosion control measure, and aims to prohibit the undesirable use of an erosion control measure by the public.
GCP-SC3	Check Dam	A check Dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing the velocity of

		flowing water, allowing sediment to settle and reducing erosion.
GCP-SC4	Wind Erosion Control	To prevent and alleviate dust problems, it contains the application of water or other dust palliatives.
GCP-SC5	Tracking and controlling vehicles and construction equipment	To prevent and alleviate the vehicle-generated sediment transport. It involves measures such as street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway.
GCP-SC6	Sediment Basin	A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

4.2 Landscape and Reinstatement Measures

Landscape survey and analysis is required for the assessment of the visual, functional and topographical integration between project components and their surroundings considering the following planning elements; existing vegetative structure and topography in the planning area; other land uses and transportation corridors near the Project Area; climate; landscape integrity and environmental connections; and establishment of functional and physical relations of planning area with other surrounding land uses.

Technical specifications for landscaping are also needed to implement plantation plan defining the role of the parties involved into landscaping works, quality of the landscaping materials, the implementation techniques and landscape management. A Project-specific Landscape and Plantation Project will be prepared.

Measures regarding mine closure and rehabilitation phase of the Project are detailed in the Mine Closure and Rehabilitation Plan prepared specific to the Project. This section of the MP should be considered together with the Mine Closure and Rehabilitation Plan.

4.2.1 Landscaping

The strategies and guidelines that will support rehabilitation at the construction site and stabilization of the landscape around the units of GCP are set out under this title. Every effort will be made to minimize the areas disturbed during construction and progressively reshape and revegetate areas with native species as work phases are completed.

At the GCP construction site, much of the construction site will be outside the inundation area and will be reshaped and revegetated with trees, shrubs and grasses as appropriate and in accordance with a detailed landscaping plan to be developed during the detailed design phase. This will be carried out by reconstructing a similar topography and landscape character to the original topography and landscape characteristics of the area. Due to these measures no significant negative impact to the landscape is expected.

4.2.2 Reinstatement

Reinstatement of the site will be performed by reinstatement of the soil by the use of proper means of top and subsoil management. The management also involves restoring of the soil to its original place after the operation of the mine site is completed.

Reinstatement of the site will be performed by bio-restoration of the soil, establishment of the vegetation cover after the construction and reinstatement of the soil by the use of proper means of top and subsoil management.

Table 4-3. Landscape and Reinstatement Measures for the GCP

Measure	Name	Description and Purpose

Measure	Name	Description and Purpose
GCP-LR1	Soil Spreading	It is the placement of construction and landscape materials on the sites of reinstatement by accurately spreading aggregate, soil and groundcover materials.
GCP-LR2	Tree or Shrub Plantation	The planting of trees and shrubs are carried out properly and within the right season for landscape. Visual resources are undertaken during both the construction and operational phases of the project. The implementation and maintenance of landscape compensatory planting measures is a key aspect of this and should be checked to ensure that they are fully realized and that potential conflicts between the proposed landscape measures and any other project works and operational requirements are resolved at the earliest possible date and without compromise to the intention of EC and SC mitigation measures.
GCP-LR3	Permanent Seeding	Establishment of sufficient vegetation cover to reinstate the local plant species and ecology for the longer term. The purpose of the direct seeding is to bio-restoratively establish the original cover of ground vegetation within one year of planting to the percentage it could be possible. Together with tree and shrub plantation and EC and SC measures its aims are to reduce erosion and decrease sediment yield from disturbed areas, to permanently stabilize disturbed areas in a manner that is economical, adaptable to site conditions, and allow selection of the most appropriate plant materials, to improve wildlife habitat and to enhance natural beauty. When necessary, it could be applied using the Hydroseeding.
GCP-LR4	Topsoil Stockpile Management	Proper soil management is expected to facilitate the reestablishment of the original vegetation cover at the area and has crucial importance for the success of the bio-restoration and floristic reinstatement works Its objective is to protect the soil during storage, preserving not only the soil quality but also the vegetative structures such as stolons, rhizomes of perennial plants and seeds of the annual plants.

5. SOIL CHARACTERISTICS OF THE PROJECT AREA

Great soil groups, soil depth classes, erosion classes, slope classes, problematic areas and land use capability classes of the Project Area are evaluated with data from digital soil survey maps prepared by the former General Directorate of Rural Services. Distribution of the great soil groups of the Project Area is given in Table 5-1 and Figure 5-1. As can be seen, the major great soil groups in the Project Area and its vicinity is Brown Forest Soils with coverage area of 56.81%.

Table 5-1: Distribution of Great Soil Groups in the Project Area

Great Soil Groups	ha	%
Aluvial Soils (A)	3.88	0.79
River Beds (IY)	21.19	4.34
Coluvial Soils (K)	15.68	3.21
Brown Forest Soils (M)	323.14	66.20
Non Calcareous Brown Forest Soils (N)	124.22	25.45
TOTAL (*)	488.10	100.0

(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).

At the Project Area and its vicinity major limitation is the soil depth for plant growth and water holding capacity. The distribution of the soil depth classes are presented in Table 5-2 and Figure 5-2. More than 85% of the Project Area has shallow and very shallow soils (< 50 cm). Only 8.49% of the Project Area has more than 50 cm soil depth.

Table 5-2: Distribution of Soil Depth Classes at the Project Area

Soil Depth Classes	ha	%
Deep (> 90 cm)	21.19	4.34
Moderate (50 - 90 cm)	3.88	0.79
Shallow (20 - 50 cm)	50.26	10.30
Very Shallow (0 - 20 cm)	384.84	78.85
Barren Rocks - Settlements - River Beds	27.93	5.72
TOTAL (*)	488.10	100.0

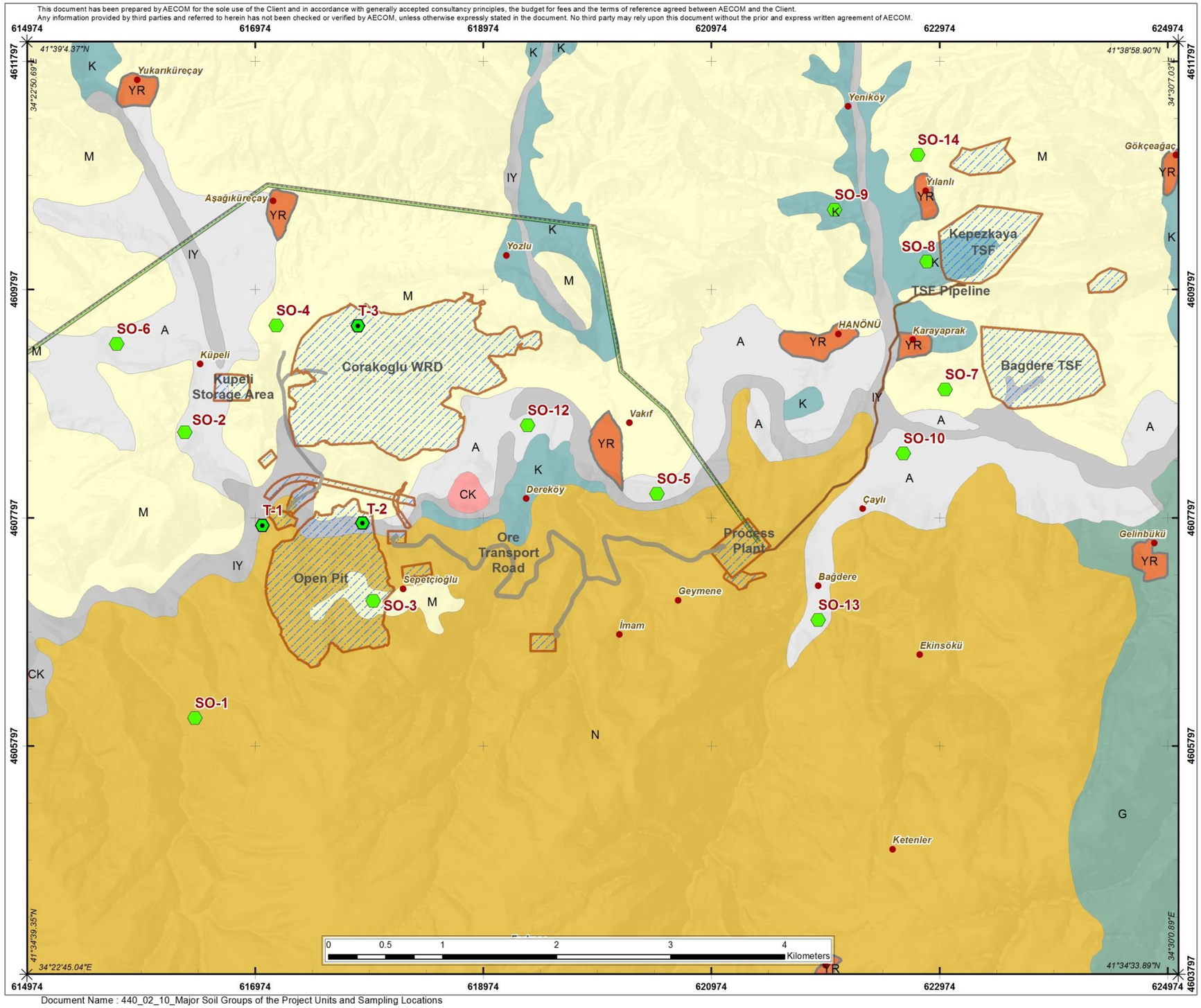
(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).

The soil database also has soil map unit slope classes. Average slope values of the map unit delineations were used to determine the soil slope phases. Distribution of the slope classes of the Project Area and its vicinity can be seen in Table 5-3 and Figure 5-3. Slope class information also will be presented in the topographical information section in detail.

Table 5-3: Distribution of Slope Classes at the Project Area

Slope Classes	ha	%
Flat / Nearly Flat (0 - 2 %)	21.19	4.34
Moderately Steep (6 - 12 %)	19.55	4.01
Strongly Sloping (12 - 20 %)	40.73	8.34
Moderately Steep (20 - 30 %)	259.80	53.23
Steep and Very Steep (> 30 %)	22.61	4.63
Non Soil Areas	124.22	25.45
TOTAL (*)	488.10	100.0

(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).



Document Name : 440_02_10_Major Soil Groups of the Project Units and Sampling Locations

LEGEND

- Previous Locations for Soil Sampling
- AECOM Soil Sampling Locations
- Proposed Project Units
- Roads
- Energy Transmission Line
- Settlement Areas

Major Soil Groups

- Aluvial Soils (A)
- Barren Rocks (CK)
- Brown Forest Soils (M)
- Coluvial Soils (K)
- GrayisBrown Podsolic Soils (G)
- Non Calcareous Brown Forest Soils (N)
- River Beds (IY)
- Salt Affected Soils (CE)
- Settlements

AECOM

Tel: +90 312 442 98 63
Fax: +90 312 442 98 63
environment.turkey@aecom.com
www.aecom.com
Mustafa Kemal Mah.
Dumlupınar Bulvarı No: 266
Tepe Prime B Blok Suite No:51
06800 Çankaya/Ankara Turkey

Project Name: ESIA Disclosure Package for Acacia Mine Inc. (AMI) Gökırmak Copper Project

Map Title: Major Soil Groups of the Project Units

Client: Acacia Mine Inc. (AMI)

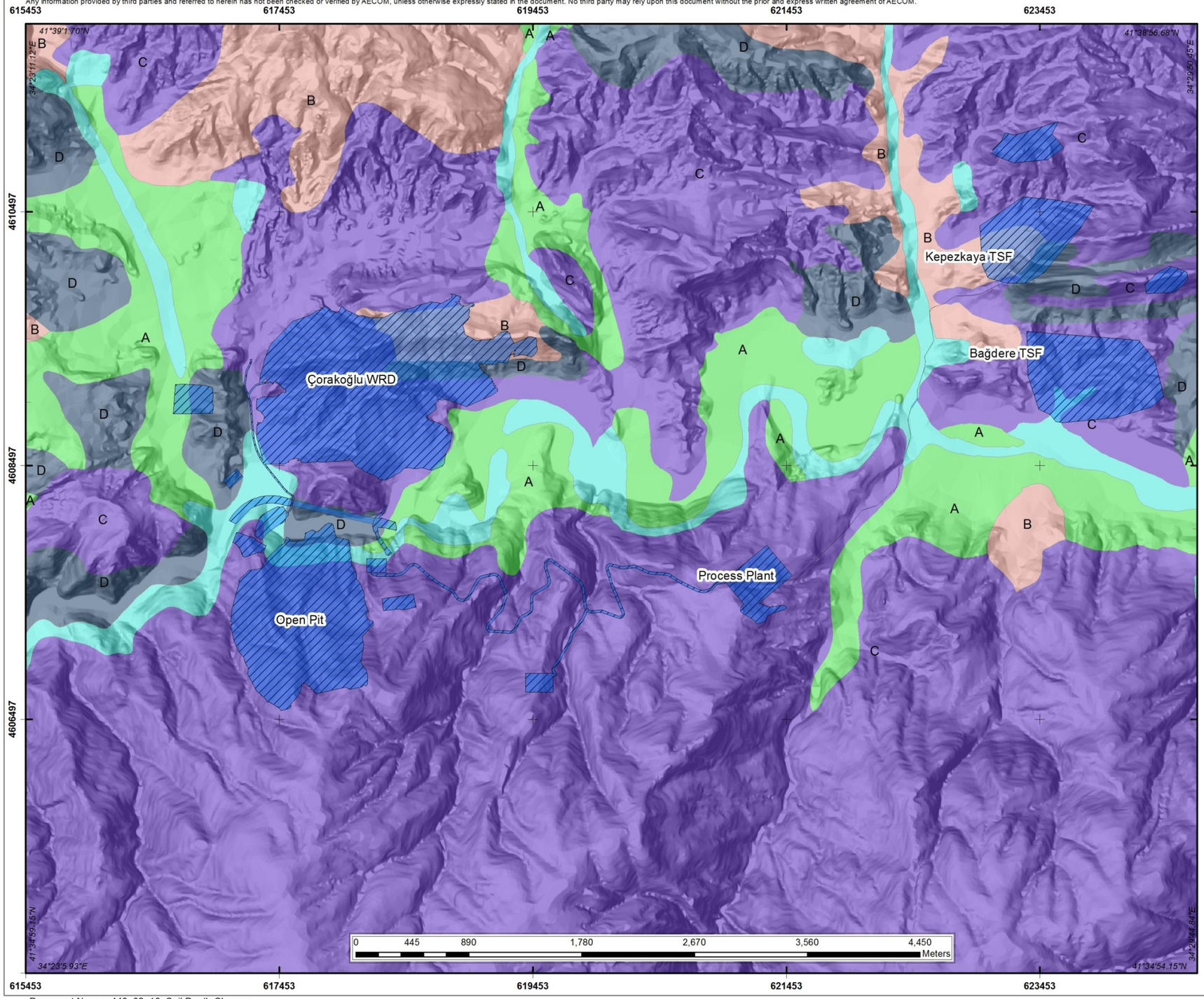
Project Group: Environment | Project Code: 440.02.10

Design: A. Korkmaz | Last Update: 17/08/2017 - 05:26 (korkmaz / TRANKRIPC31746)

Coordinate System: Projection: Transverse Mercator
Coordinate System: WGS 1984 UTM Zone 36N | Sheet Size: A3

Service Layer Credits: Sources: Esri, DeLorme, USGS, NPS

Figure 5-1: Distribution of Great Soil Groups at the Project Area and its Vicinity



LEGEND

- Proposed Project Units
- Planned Footpint

Soil Depth Classes

- Barren Rocks - Settlements - River Beds
- Deep (> 90 cm)
- Moderate (50 - 90 cm)
- Shallow (20 - 50 cm)
- Very Shallow (0 - 20 cm)

AECOM

Tel: +90 312 442 98 63
Fax: +90 312 442 98 63
environment.turkey@aecom.com
www.aecom.com
Mustafa Kemal Mah.
Dumlupınar Bulvarı No: 266
Tepe Prime B Blok Suite No:51
06800 Çankaya/Ankara Turkey

Project Name: ESIA Disclosure Package for Acacia Mine Inc. (AMI)
Gokirmak Copper Project

Map Title: Soil Depth Classes

Client: Acacia Maden İşletmeleri A.Ş.

Project Group: Environment | Project Code: 440.02.10

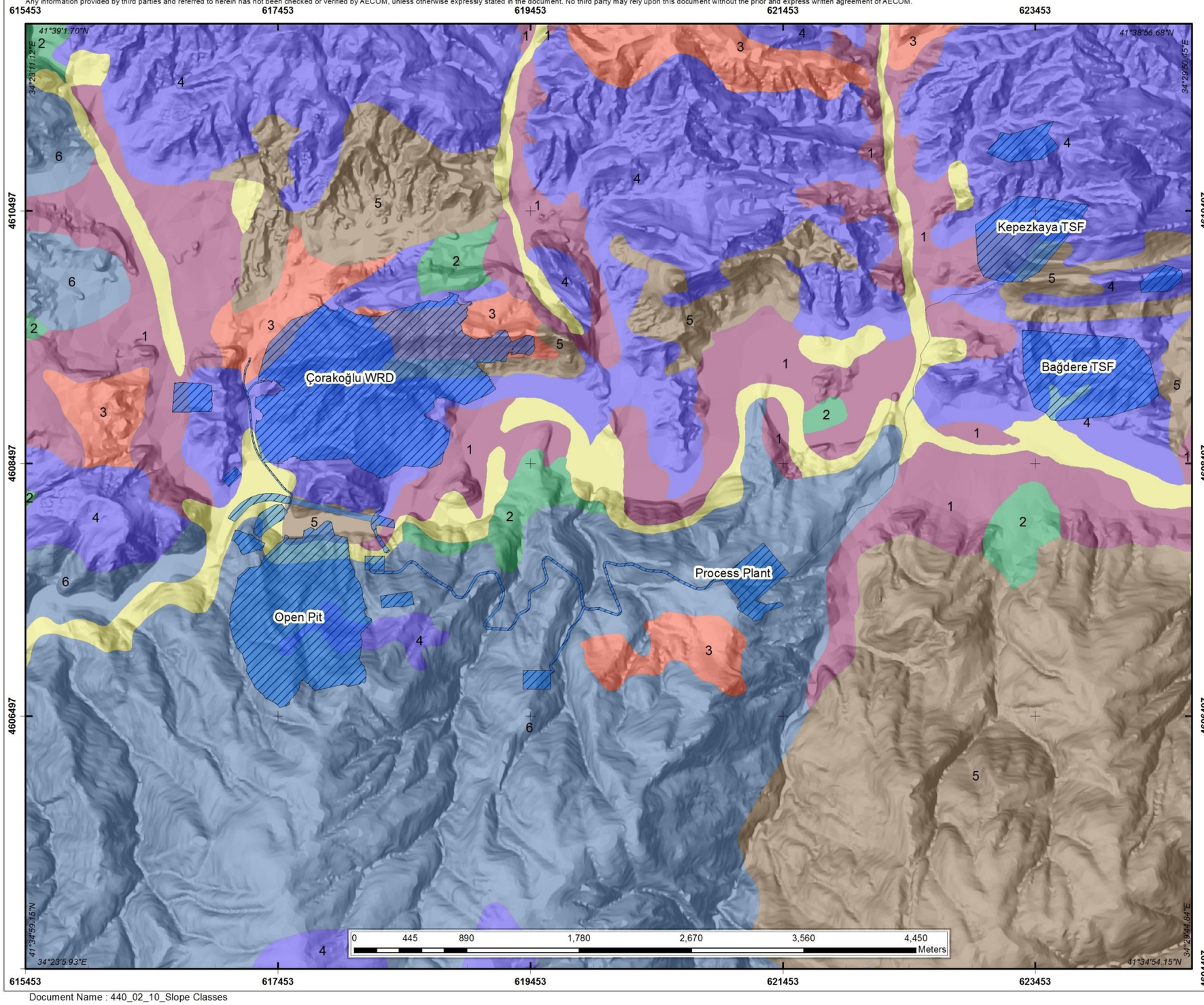
Design: A. Korkmaz | Last Update: 17/08/2017 - 04:46 (korkmaz / TRAKR1PC31746)

Coordinate System: Projection: Transverse Mercator
Coordinate System: ED 1950 UTM Zone 36N | Sheet Size: A3

Service Layer Credits: Corine Land Cover

Document Name : 440_02_10_Soil Depth Classes

Figure 5-2: Distribution of Soil Depth Classes at the Project Area and its Vicinity



LEGEND

- Proposed Project Units
- Planned Footpint

Slope Classes

- Non Soil Areas
- Gently Sloping (2 - 6 %)
- Level / Nearly Level (0 - 2 %)
- Moderately Steep (20 - 30 %)
- Moderately Steep (6 - 12 %)
- Steep & Very Steep (> 30 %)
- Strongly Sloping (12 - 20 %)

AECOM

Tel: +90 312 442 98 63
Fax: +90 312 442 98 63
environment.turkey@aecom.com
www.aecom.com
Mustafa Kemal Mah.
Dumlupınar Bulvarı No: 266
Tepe Prime B Blok Suite No:51
06800 Çankaya/Ankara Turkey

Project Name:	ESIA Disclosure Package for Acacia Mine Inc. (AMI) Gokirmak Copper Project
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Design: A. Korkmaz	Last Update: 17/08/2017 - 04:46 (korkmaz / TRAKR1PC31746)
Coordinate System: Projection: Transverse Mercator Coordinate System: ED 1950 UTM Zone 36N	Sheet Size: A3
N W E S	Service Layer Credits: Conne Land Cover

Document Name : 440_02_10_Slope Classes

Figure 5-3: Distribution of Slope Classes at the Project Area and its Vicinity

Slope steepness is also other soil limitation at the Project Area. Only 9.7% of soils have lower than 12% slope. Steep and very steep soils (> 30%) cover 37.84% of the Project Area.

Erosion levels are evaluated according to the classification derived from the digital soil map as follows:

- Level 1: None or very little
- Level 2: Moderate erosion
- Level 3: Severe erosion
- Level 4: Very severe erosion

Distribution of the soil erosion classes of the Project Area is given in Table 5-4 and Figure 5-4.

Table 5-4: Distribution of Soil Erosion Classes at the Project Area

Erosion Classes	**ha**	**%**
No Erosion or Slight	21.19	4.34
Moderate	19.55	4.01
Severe	275.71	56.49
Very severe	149.03	30.53
Non Soil Areas	22.61	4.63
TOTAL (*)	488.10	100.0

(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).

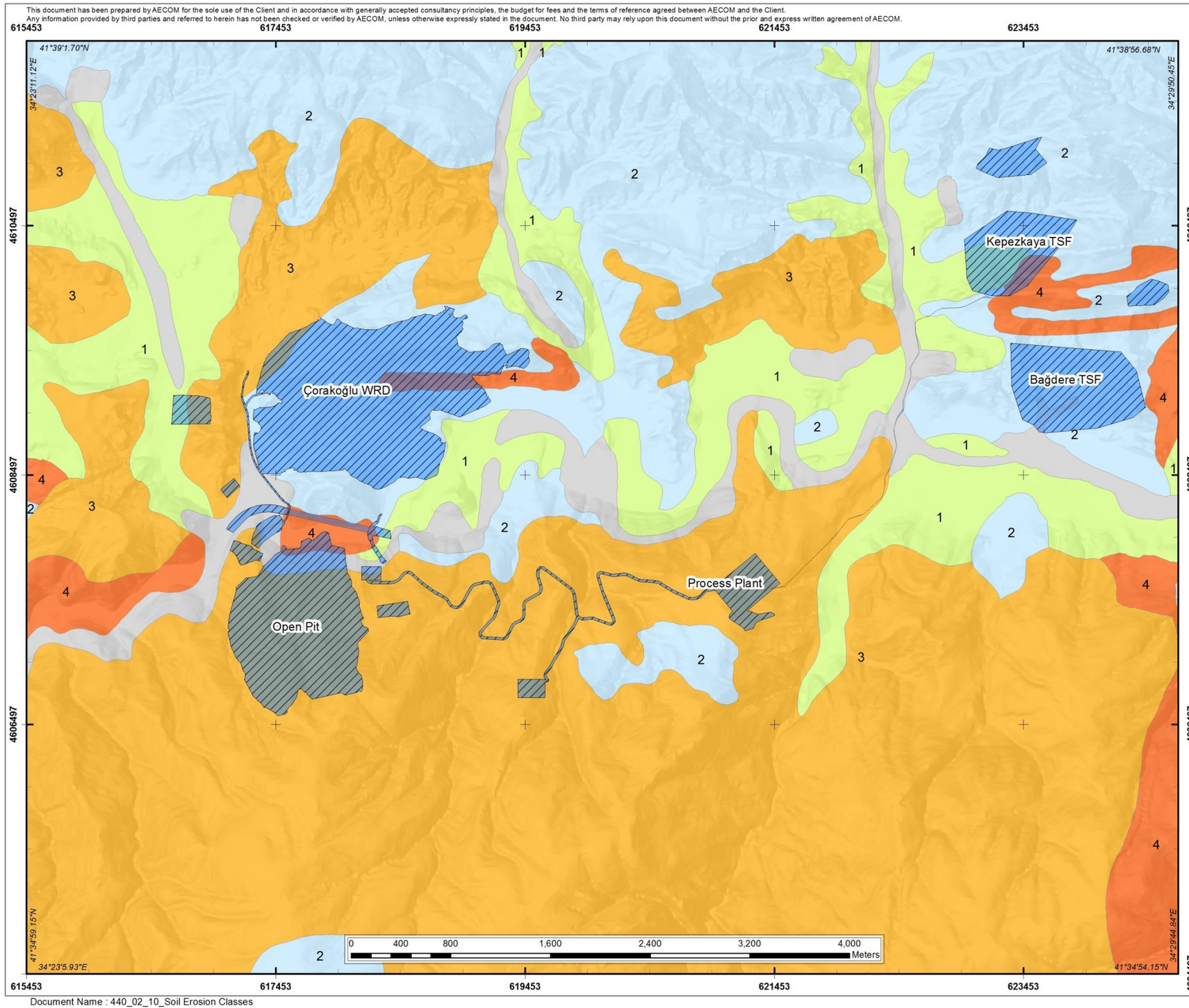
Due to the steepness of the soil, more than 40% of the soils at the Project Area have severe or very severe soil erosion. Factors such as vegetation cover, slope gradient, shallow soil formation, and intensive rainfall favor soil erosion at the Project Area. For this purpose, soil erosion and sediment control measures have vital importance for the Project Area.

Stoney surfaces are a major problem at the Project Area and covers more than 65% of the area, whilst rock surfaces cover less than 1% of the area. Distribution of the problematic areas at the Project Area is given in Table 5-5 and Figure 5-5.

Table 5-5: Distribution of the Problematic Areas at the Project Area

Other Soil Properties	**ha**	**%**
Non Stoney & Rocky Areas	194.09	39.76
Rock Surfaces	5.61	1.15
Stoney Surfaces	288.39	59.08
TOTAL (*)	488.10	100.0

(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).



LEGEND

- Proposed Project Units
- Planned Footpint

Soil Erosion Classes

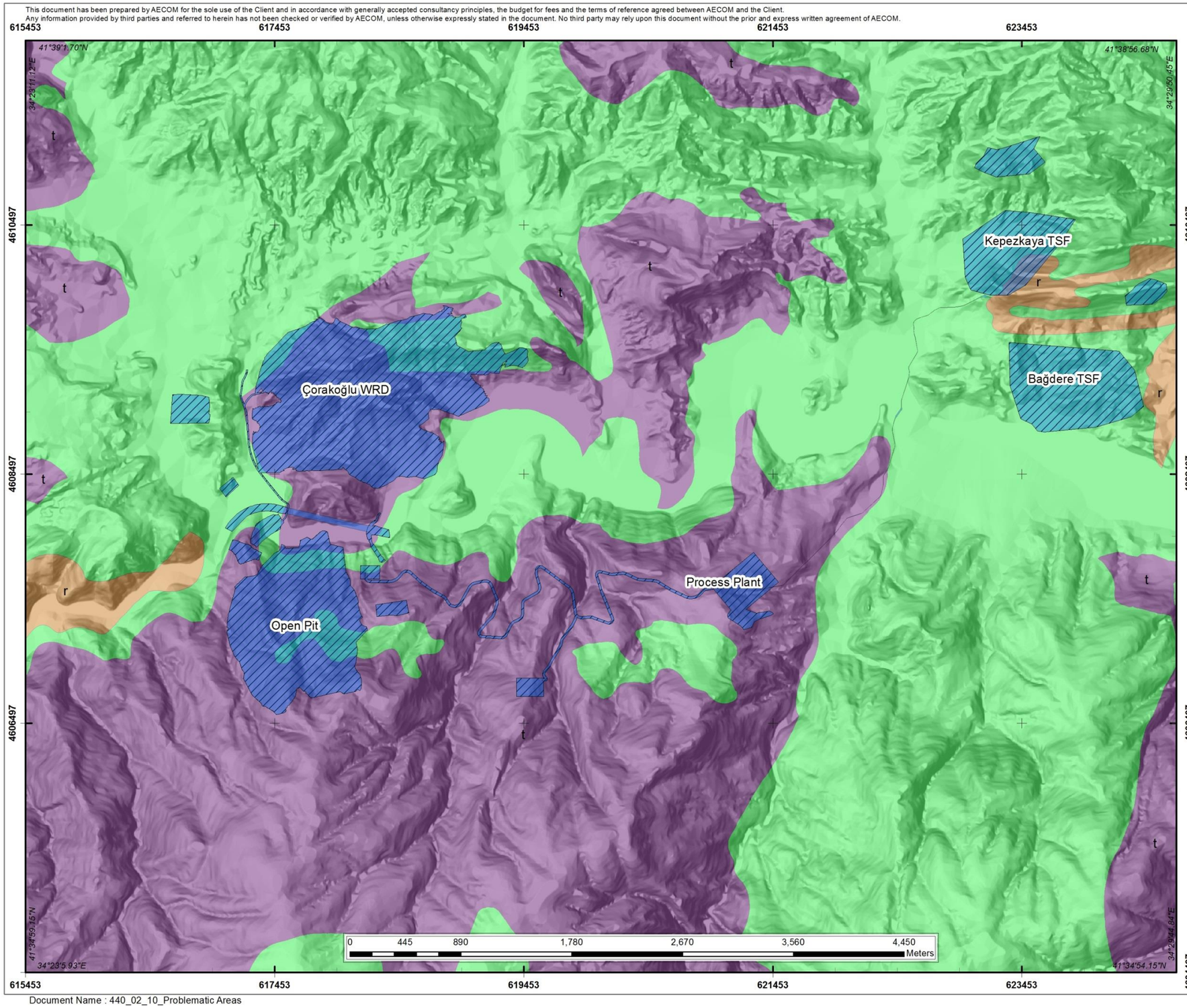
- Moderate
- No Erosion or Slight
- Non Soil Areas
- Severe
- Very Severe

AECOM
Tel: +90 312 442 98 63
Fax: +90 312 442 98 63
environment.turkey@aecom.com
www.aecom.com
Mustafa Kemal Mah.
Dumlupınar Bulvarı No: 266
Tepe Prime B Blok Suite No:51
06800 Çankaya/Ankara Turkey

Project Name:	ESIA Disclosure Package for Acacia Mine Inc. (AMI) Gökırmak Copper Project
Map Title:	Soil Erosion Classes
Client:	Acacia Maden İşletmeleri A.Ş.
Project Group: Environment	Project Code: 440.02.10
Design: A. Korkmaz	Last Update: 17/08/2017 - 04:49 (korkmaz / TRAKR1PC31746)
Coordinate System: Projection: Transverse Mercator Coordinate System: ED 1950 UTM Zone 36N	Sheet Size: A3
N W E S	Service Layer Credits: Corine Land Cover

Document Name : 440_02_10_Soil Erosion Classes

Figure 5-4: Distribution of Soil Erosion Classes at the Project Area and its Vicinity



LEGEND

- Proposed Project Units
- Planned Footpint

Problematic Areas

- Non Stonny & Rocky Areas
- Rock Surfaces
- Stonny Surfaces

AECOM

Tel: +90 312 442 98 63
Fax: +90 312 442 98 63
environment.turkey@aecom.com
www.aecom.com

Mustafa Kemal Mah.
Dumlupınar Bulvarı No: 266
Tepe Prime B Blok Suite No:51
06800 Çankaya/Ankara Turkey

Project Name:	ESIA Disclosure Package for Acacia Mine Inc. (AMI) Gokirmak Copper Project
Map Title:	Problematic Areas
Client:	Acacia Maden İşletmeleri A.Ş.
Project Group: Environment	Project Code: 440.02.10
Design: A. Korkmaz	Last Update: 17/08/2017 - 04:45 (korkmaz / TRAKR1PC31746)
Coordinate System: Projection: Transverse Mercator Coordinate System: ED 1950 UTM Zone 36N	Sheet Size: A3
	Service Layer Credits: Corine Land Cover

Document Name : 440_02_10_Problematic Areas

Figure 5-5: Distribution of Problematic Areas at the Project Area and its Vicinity

Land Use Capability Classes (LUCC) at the Project Area has been identified based on the soil capability classes used by the Ministry of Food, Agriculture and Livestock as given in Table 5-6 while distribution of the LUCC of the Project Area is provided in Table 5-7 and Figure 5-6.

Table 5-6: Soil Capability Classes and Arability

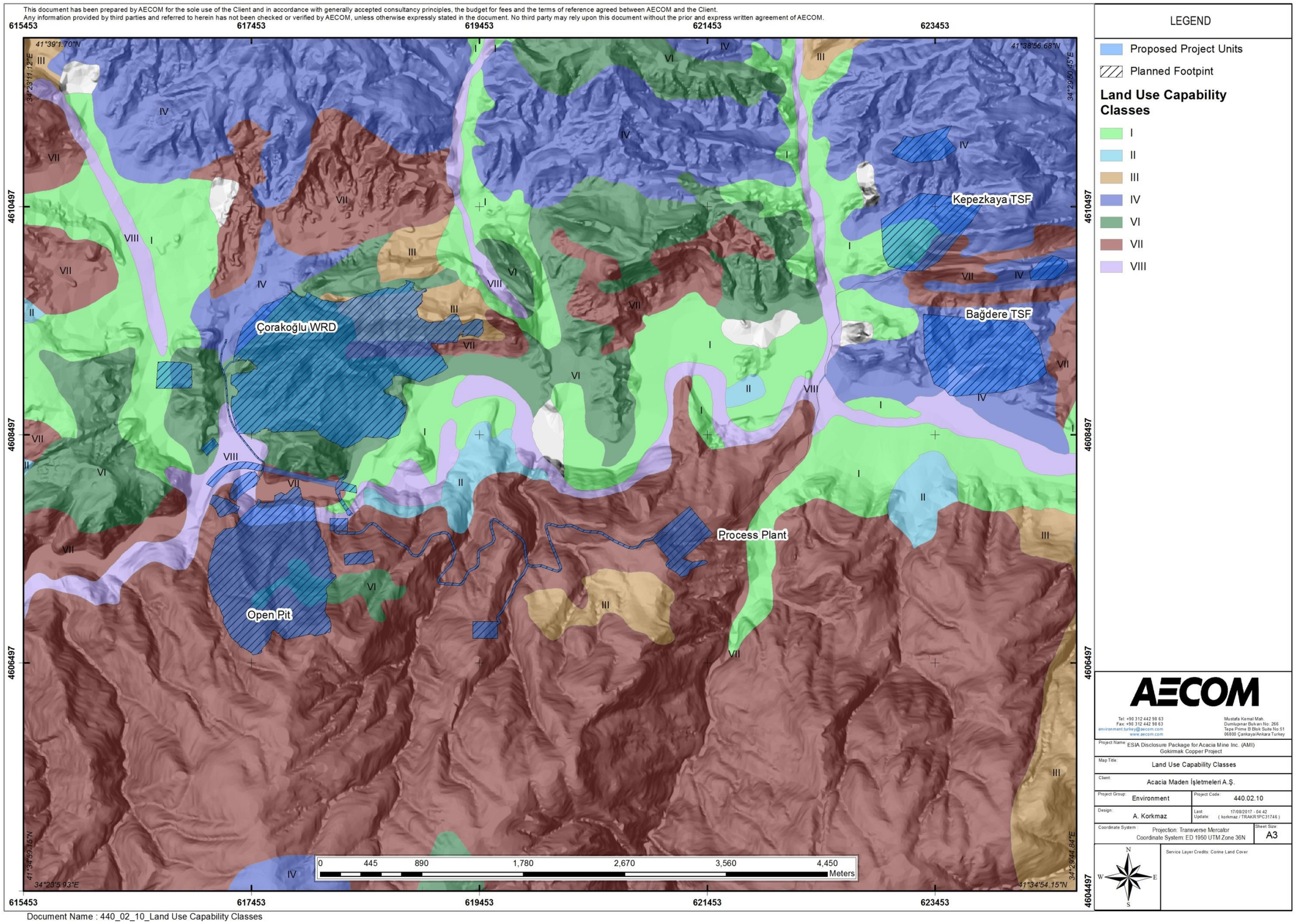
Capability Class	Arability	Factors Limiting Agriculture
I	It is arable for many crop types.	There is no or little limitation.
II	It is suitable for long term cultivation of several types of crops.	Special mitigation measures are required for soil and water loss.
III	It is suitable for the cultivation of specific crops that provide special mitigation measures. Generally, it needs special care during agricultural use.	It is prone to erosion and artificial drainage is required during cultivation.
IV	With suitable ploughing, some special agricultural crops can be cultivated. Generally, it needs special care during agricultural use.	There are serious limitations related with soil depth, stone content, humidity and inclination.
V	This class includes soils that are even or slightly inclined, stony or very moist. These are not suitable for ploughing and cultivation. Generally they are used	They have weak drainage and a structure not suitable for ploughing.
VI	This is not suitable for ploughing and cultivation. They are mostly used as pasture and forestry area.	Very serious limitations are present owing to inclination and shallow soil.
VII	It is not economic for agricultural activities; however it is suitable for weak pasture or afforestation areas.	There are limitations owing to shallow soil, stone content, inclination and erosion.
VIII	It is not suitable for vegetation. It can be used for recreational purposes or as wild life protection area.	It is lacking soil.

Table 5-7: Distribution of the LUCC at the Project Area

LUCC	ha	%
I	19.55	4.01
III	34.59	7.09
IV	100.09	20.51
VI	165.86	33.98
VII	146.82	30.08
VIII	21.19	4.34
TOTAL (*)	488.10	100.0

(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).

Soil slope, limited soil depth, and high soil erosion limit the soil use for agricultural purposes at the Project Area. Soils suitable for cultivation (Class I, III and IV) cover less than 30% of the Project Area which are mainly located on Gökırmak Aluvial Plains. Soils that are not suitable for cultivated crops (Class VII and VIII) cover more than 40% of the Project Area.



Document Name : 440_02_10_Land Use Capability Classes

Figure 5-6: Distribution of the LUCC at the Project Area and its Vicinity

Land use data of the Project Area and its vicinity were derived from digital soil survey maps prepared by the former General Directorate of Rural Services. Distribution of the land use classes is given in Table 5-8 and Figure 5-7. As can be seen from Table 5-8, only 5% of the Project Area is agricultural (dry and irrigated) area and most of the area (more than 85 %) is covered with forest and shrub vegetation.

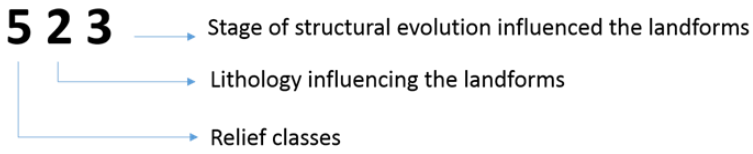
Table 5-8: Distribution of the Land Use Classes at the Project Area

Land Use	ha	%
Dry Farming (K)	13.36	2.48
Irrigated Agriculture (S)	13.98	2.60
Rang Land & Meadow (M)	22.25	4.14
Shrubs (F)	127.05	23.62
Forest (O)	346.42	64.40
Non Soil Areas	14.83	2.76
TOTAL (*)	537.87	100.0

(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).

Geomorphology map of the Project Area was prepared based on the Geomorphology Map of Turkey (1:1,000,000 scale) prepared by Erol (1991) and published by the General Directorate of Mineral Research and Exploration.

Geomorphology map units were designed with 3 digits by Erol (1991) describing relief classes (first digit), lithology influencing the landforms (second digit) and stage of structural evolution influenced by the landforms (third digit) as given below:

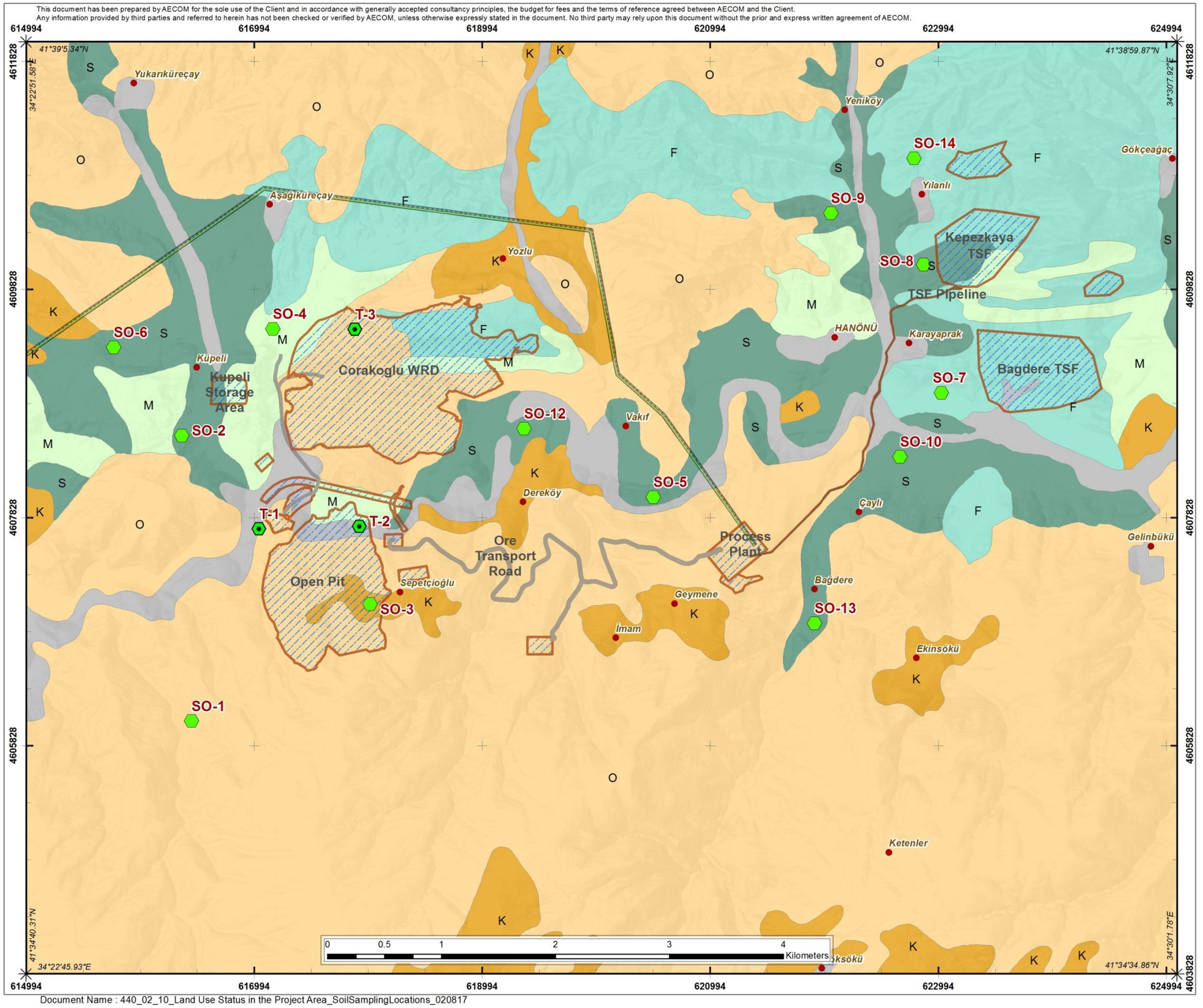


Geomorphology map unit digit explanations are given in Table 5-9.

Table 5-9: Geomorphology Map (Erol, 1991) Unit Digit Explanations

1st Digit	Description
8	Flat topped surfaces (mountains)
6	Flat topped surfaces (hills)
5	High plateaus on older formations
2nd Digit	Description
1	Sandstone, conglomerate, flysch formations
2	Alternating clay, marl, limestone
3	Limestone, marmor
4	Schist, Gneiss
8	Ophiolite, serpentine
3rd Digit	Description
1	Crystaline Paleozoic - Mesozoic
2	Folded Mesozoic
3	Folded Lower Tertiary

Geomorphology map of the Project Area and its vicinity is given in Figure 5-8 and the distribution of the existing geomorphological units within the Project Area is given in **Error! Reference source not found.**. It s hould be noted that larger area was selected for the analysis of geomorphological information at the Project Area and its vicinity.



LEGEND

- Previous Locations for Soil Sampling
- AECOM Soil Sampling Locations
- Proposed Project Units
- Roads
- Energy Transmission Line
- Settlement Areas

Existing Land Use

- Non Soil Areas
- Shrubs (F)
- Dry Farming (K)
- Rang Land & Meadow (M)
- Forest (O)
- Irrigated Agriculture (S)

AECOM

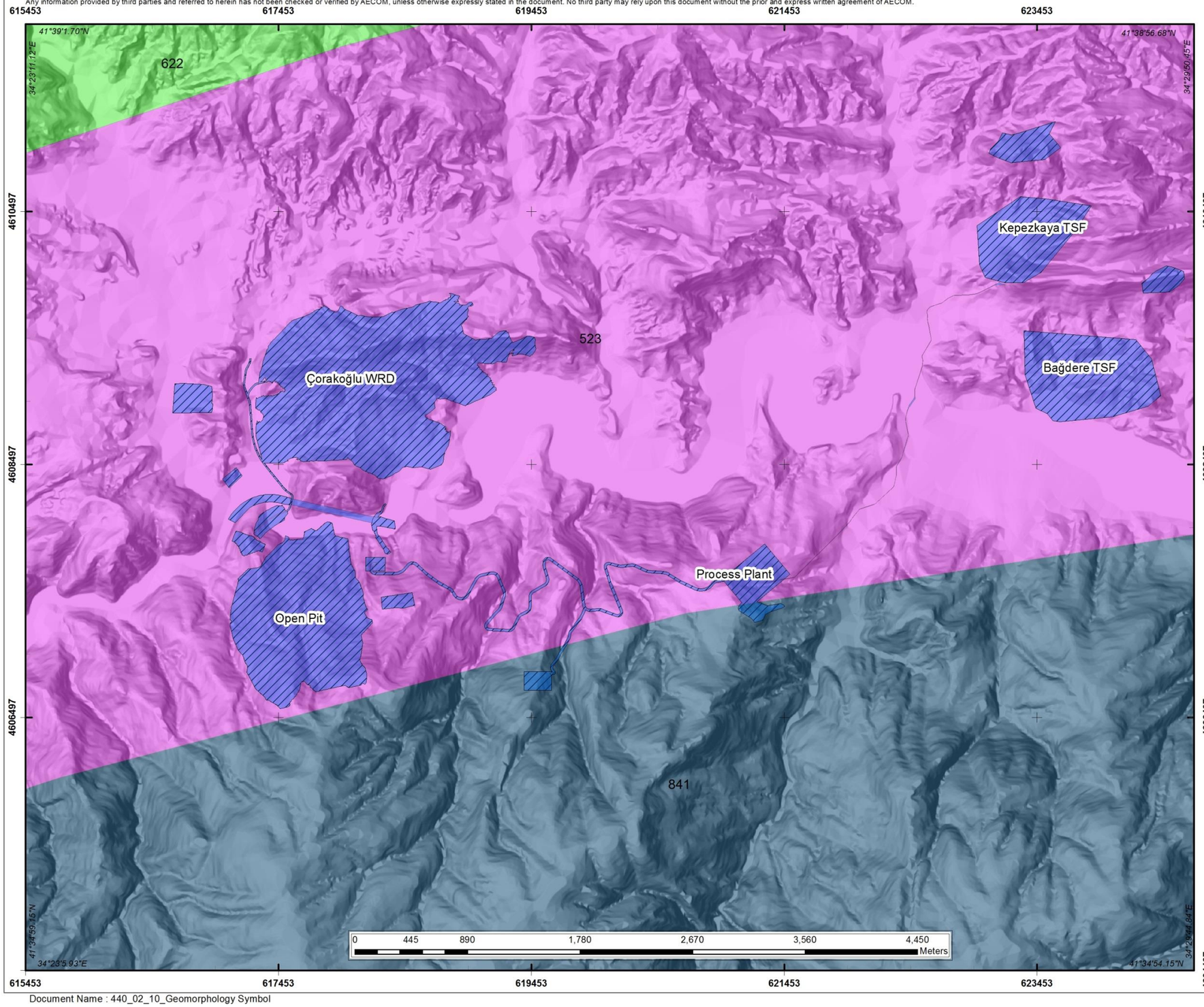
Tel: +90 312 442 98 63
Fax: +90 312 442 98 63
environment.turkey@aecom.com
www.aecom.com

Mustafa Kemal Mah.
Dumlupınar Bulvarı No: 266
Tepe Prime B Blok Suite No:51
06800 Çankaya/Ankara Turkey

Project Name:	ESIA Disclosure Package for Acacia Mine Inc. (AMI) Gökırmak Copper Project
Map Title:	Land Use Status in the Project Area
Client:	Acacia Mine Inc. (AMI)
Project Group: Environment	Project Code: 440.02.10
Design: A. Korkmaz	Last Update: 05/09/2017 - 11:38 (korkmaz / TRAKR1PC31746)
Coordinate System: Projection: Transverse Mercator Coordinate System: WGS 1984 UTM Zone 36N	Sheet Size: A3
N W E S	Service Layer Credits:

Document Name : 440_02_10_Land Use Status in the Project Area_SoilSamplingLocations_020817

Figure 5-7: Distribution of the Land Use Classes at the Project Area and its Vicinity



LEGEND

- Proposed Project Units
- Planned Footpint

Geomorphology Symbol

- 523
- 622
- 841

AECOM

Tel: +90 312 442 98 63
Fax: +90 312 442 98 63
environment.turkey@aecom.com
www.aecom.com

Mustafa Kemal Mah.
Dumlupınar Bulvarı No: 266
Teşe Prime B Blok Suite No:51
06800 Çankaya/Ankara Turkey

Project Name:	ESIA Disclosure Package for Acacia Mine Inc. (AMI) Gokirmak Copper Project
Map Title:	Geomorphology Symbol
Client:	Acacia Maden İşletmeleri A.Ş.
Project Group: Environment	Project Code: 440.02.10
Design: A. Korkmaz	Last Update: 17/08/2017 - 04:40 (korkmaz / TRAKR1PC31746)
Coordinate System: Projection: Transverse Mercator Coordinate System: ED 1950 UTM Zone 36N	Sheet Size: A3

N W E S

Service Layer Credits: Corine Land Cover

Document Name : 440_02_10_Geomorphology Symbol

Figure 5-8: Geomorphology Map of the Project Area and its Vicinity

Table 5-10: Distribution of the Existing Geomorphological Units within the Project Area

Geomorphology Symbol	ha	%
523	476.00	88.5
841	61.87	11.5
TOTAL (*)	537.87	100.0

(*) Total area refers to the total Project Area. For the internal roads within the Project Area, a buffer zone of 20 m is taken (10 m to each side of the road from its center).

6. SITE OBSERVATIONS

The first phase of the study included a desktop study to gather background information regarding the Project Area and its vicinity. Afterwards, site visit and field surveys were carried out by Prof. Dr. Günay Erpul and Prof. Dr. İlhami Bayramin from Ankara University, Faculty of Agriculture.

During this site visit the following actions were undertaken:

The temporary and permanent Project Areas were assessed from overall EC, SC and LR perspectives.

Project Area was inspected for the preparation of an EC and SC strategy. Observations of the site conditions provided the greatest level of detail for characterizing potential EC and SC concerns.

The landscape was assessed in relation to shape, scale, colour and texture. The Project impacts to these landscape elements were evaluated in detail. Application of medium and long-term landscape measures were identified which will mitigate impacts from the Project activities.

The lack of local topsoil, access to water, safe access and steep slopes were taken into consideration when determining landscape options.

The general view of the undisturbed state of parts of the GCP site is given in Figure 6-1. Due to the steepness and harshness of topography and geology of the location, erosion and sediment control (ESC) measures should be taken at the Project Area. The site is composed of bulk rocks, which reduces the risk of soil and sediment contamination and transport to the river during the construction activities. However, it is necessary to stabilize the downslope side of the cuts in order to contain the fall-downs of the larger materials like debris and rock fragments and to check slopes sliding down given construction cuts will be implemented on the slopes, which are nearby the river. Therefore, a rock-lined wall (riprap) or rock breast wall against the base of the slope should be constructed in order to prevent the river pollution from cut/fill materials (GCP-EC7 or GCP-EC8). Additionally, diversion structures (diversion canals or ditches) to be built at the toes of the above-road cuts, (GCP-EC6) should be implemented in order to divert runoff. The runoff water should be securely diverted to the natural water courses together with the implementation of the measures related with sediment control (GCP-SC1 and GCP-SC3). This natural or pre-construction pattern of the slopes should be taken into consideration during LRP works (GCP-LR1, GCP-LR2, GCP-LR3 and GCP-LR4). The closure phase of the Project will follow the Mine Closure and Rehabilitation Plan.

Figure 6-1: General View of Parts of the GCP Site

As seen in Figure 6-2, the construction site is located directly nearby the river. Therefore, a rock-lined wall (riprap) should be constructed along the site in order to prevent the pollution of river from the materials

expected to be generated during the land disturbances for vegetation clearance and cut/fill activities (GCP-EC7).

Figure 6-2: Construction Site at the GCP

Some measures have already been implemented at the GCP mine construction site and a retaining wall along the river at the site has been constructed as shown in Figure 6-3.

Figure 6-3: Retaining Wall Along the River at the GCP Mine Construction Site

Generally, soil profiles have A/C and A/R horizons on sloping area under forest cover, showing very limited top soil resources. Therefore, the fertile top soil must be conserved by properly stocking in the reserved storage area to be later used for landscape and reinstatement works (GCP-LR1 and GCP-LR4) at the site. Soil profile samples from the GCP construction site are given in Figure 6-4.

Figure 6-4: Soil Profile Samples from the GCP Construction Site

Unlike the Project sites as given in Figure 6-1 and Figure 6-2, there is considerable soil depth and vegetative cover at some locations. Especially, in gently sloping colluvial areas and flat aluvial areas (river terraces) found at the river banks, there is a great deal of soil resources (see Figure 6-5 and Figure 6-6).

Figure 6-5: Gently Sloping Colluvial Areas (to the left) and Flat Alluvial River Terraces (to the right) at the River Banks of Watershed around GCP Construction Site

The general view of the undisturbed slopes is given in Figure 6-6. Slopes are stable with small scrubs and woody plant covers, and accordingly shows no risks in terms of ESC. This natural or pre-construction pattern of the slopes should be taken into consideration during LRP works (GCP-LR1, GCP-LR2, GCP-LR3 and GCP-LR4).

Figure 6-6: General View of Watershed around GCP Construction Site

Additionally, diversion structures (diversion canals or ditches) to be built at the toes of the above-road cuts, (GCP-EC6) are significant to contain run-off water. The runoff water should be securely diverted to the natural water courses together with the implementation of the measures inducing sedimentation (GCP-SC1 and GCP-SC3).

Although most of the land disturbances will take place at the near-river steep slopes, there will be some activities at the top soil rich areas, which are relatively on gentler slopes (see Figure 6-5). Therefore, it is necessary to strip the organically rich fertile topsoil to the depth of solum[1] (A and B horizons, if exists) and conserve properly at a dedicated topsoil storage area to be used for landscape and reinstatement works (GCP-LR1 and GCP-LR4).

The land disturbances on the very steep slopes for constructing the derivation tunnels and the spillway of the GCP can be seen in Figure 6-7. As already seen at the site, the slope is rather steep and composed of loosened materials highly susceptible to the erosion. Obviously, rill and gully erosion processes and movement of material down the slope are expected to occur at some places. Thus, during the construction, ESC measures as temporary geo-textile silt fences (GCP-SC1), diversion structures (diversion canals or ditches) (GCP-EC6) and temporary hydroseeding (GCP-EC4) should be effectively used to prevent sediment-laden surface runoff from reaching the river.

Figure 6-8 shows the construction works for road cuts at the mining area of GCP on the hills mostly covered with forest. The steepness and harshness of topography and geology and soils of the location reveals the need for taking the ESC measures at the site. Particularly, as the road cut activities will be implemented on the slopes, which are located nearby and upslope of the river, it is necessary to stabilize the downslope side of the road cuts in order to contain the fall-downs of the larger materials like debris and rock fragments and to check slopes sliding down. To implement this successfully along the road, constructing a rock breast wall or a rock-lined wall (riprap) against the base of the slope is critical for preventing the river pollution from cut/fill materials (GCP-EC7 or GCP-EC8). Some places of the disturbed slopes for access road cuts, especially those on irregular contours, indicate signs of gully erosion processes (Figure 6-8).

Diversion structures (diversion canals or ditches) to be built at the toes of the above-road cuts (GCP-EC6) are significant to contain runoff water. The runoff water should be securely diverted to the natural water courses together with the implementation of the measures inducing sedimentation (GCP-SC1 and GCP-SC3). This natural or pre-construction pattern of the slopes should be taken into consideration during LRP works (GCP-LR1, GCP-LR2, GCP-LR3 and GCP-LR4).

[1] The solum (plural, sola) in soil science consists of the surface and subsoil layers that have undergone the same soil forming conditions. The base of the solum is the relatively unweathered parent material (Source: Wikipedia).

Figure 6-7: Derivation tunnel (top) and Spillway (bottom) Construction at the GCP Mine Construction Site

Figure 6-8: Construction Works for Road Cuts at the GCP Mine Site (to open access or service roads)

Culvert and diversion structures have already been built at the road crossing and the toes of the above-road cuts (Figure 6-9) at the GCP construction site. Maintenance and cleaning of water structures are also very substantial immediately following intensive rainfall. As can be seen in Figure 6-9, sediment deposition has already started piling up at the outlet of culvert and inside the toe ditch.

Figure 6-9: Culvert and Toe Ditch (built at a road crossing and along access road cuts)

Similarly, Figure 6-10 shows the progression of deposition inside the toe ditch along road cuts, signifying the necessity of regular maintenance and cleaning works to have water structures operate appropriately.

Figure 6-10: Progression of Deposition inside Toe Ditch along Access Road Cuts

Figure 6-11 shows the general view of the areas along the river that will be diverted for the operation of the GCP. Although the river will be diverted and there would be no risk for active sediment transport to the river system, during construction activities at the site, landscape and reinstatement works (GCP-LR1 and GCP-LR4) should be implemented by re-contouring and planting. Fill slopes from road construction cuts, which directly join to the river, should be very well-established by vegetative cover.

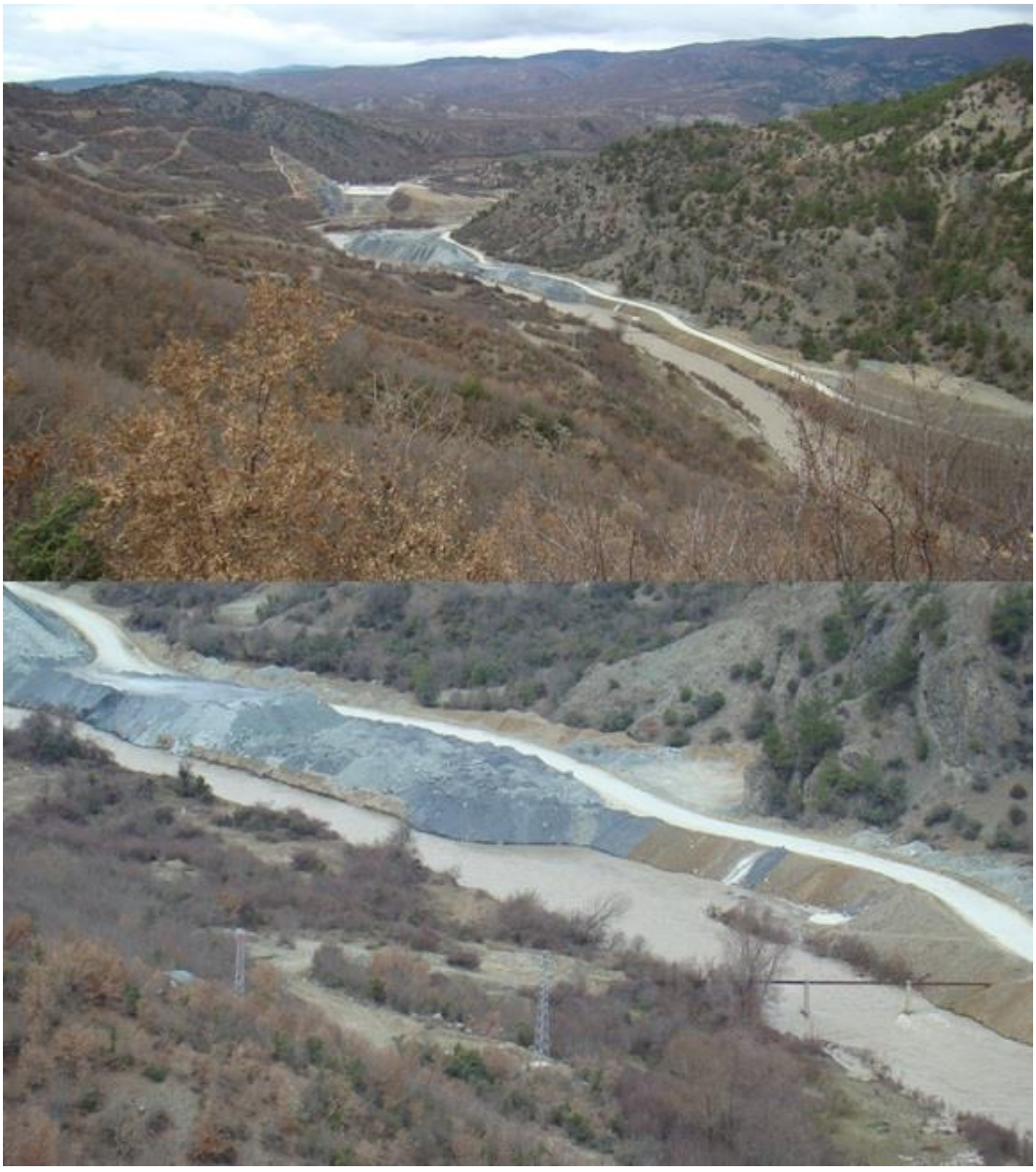


Figure 6-11: General View of the Areas along the River (to be diverted for the operation of GCP)

Additionally, the storage area at the site is shown along the slopes of the road construction (Figure 6-11), piling up of materials from diversion tunnel construction which are not suitable for vegetation.

After reducing the slope degrees by re-contouring, run-off waters and water ways should be contained on these slopes by diversion canals and ditches (GCP-EC6 and GCP-SC3) and overland flow effects on slope faces should be restrained. Afterwards, suitable locations should be stabilized by establishing permanent grass stands (hydro seeding) and tree plantation (GCP-EC4 and GCP-LR2) after spreading fertile top soil at the given depth (stored at the site by top soil management). In particular, after laying topsoil, the slopes must be rehabilitated (for establishing permanent grass stands and tree plantation) after being brought into conformity with the existing topography by reducing the degrees and re-contouring. By diversion structures (diversion

canals or ditches) to be built at the toes of the cuts (GCP-EC6), the runoff water should be securely diverted to the natural water courses.

Figure 6-12: Topsoil Management at the GCP Construction Site

Figure 6-12 shows topsoil piles at the GCP construction site. Since the soil resources at the site are very limited under forest cover, the fertile top soil should be scraped and later conserved and managed appropriately (GCP-LR1 and GCP-LR4). The topsoil resources should be stored with a given cross-sectional area in dedicated topsoil management locations and should be protected by a cover. Otherwise, not only wind erosion but also splash and sheet erosion processes and material fall-downs and slides will result in an increase in potential sediment transports to the natural waterways from these piles. In order to prevent or alleviate the sediment transport caused by dust-generated wind erosion during the construction activities, application of water or other dust palliatives must be performed (GCP-SC4). Lastly, by diversion structures (diversion canals or ditches), the overland water flows over and through the storage area must be prevented (GCP-EC6). The diversion ditches to be built around the piles are significant to prevent soils lost by water erosion to reach the natural waterways.

Fertile topsoil stored in given cross-sectional area and protected by vegetative cover and engineering structures will be used for landscape and reinstatement works during the rehabilitation phase of the Project.

The storage areas for deep underground materials in the different parts of the GCP construction site are shown in Figure 6-13. Similar to those of topsoil, these materials should be stored within a given cross-sectional area at these locations and should be protected by a cover. Otherwise, not only by the wind erosion but also by splash and sheet erosion processes and material fall-downs and slides, an increase in potential sediment transports to the natural waterways is expected from these piles. Especially, in order to prevent or alleviate the sediment transport caused by dust-generated wind erosion cases during the construction activities of the GCP mining, application of water or other dust palliatives should be performed (GCP-SC4). Lastly, by diversion structures (diversion canals or ditches), the water run-off over and through the storage area must be prevented (GCP-EC6). The diversion ditches to be built around the piles are significant to prevent soils lost by water

erosion to reach the natural waterways. Also, re-contouring or re-shaping of these slopes would be required to bring into conformity, to some extent, with the existing topography.

Figure 6-13: Underground Material Management at the GCP Construction Site (On-site material storage)

Figure 6-14: Vegetation Clearance Works at the GCP Construction Site

In some parts of the GCP construction site, to a given extent, vegetation clearance works have been performed and will be performed (see Figure 6-14). After clearance, it is necessary to strip the organically rich fertile topsoil to the depth of solum (A and B horizons) and stockpile and conserve properly in another site to be used for landscape and reinstatement works (GCP-LR1 and GCP-LR4).

Figure 6-15: Some Mass Movements (falls, slides and flows) on the Cut Slopes at the GCP Construction Site

Considerable land disturbances would result from cut activities at the GCP construction site. Figure 6-15 shows some mass movements (falls, slides and flows) on the cut slopes at the GCP construction site. To prevent slopes from sliding, after reducing the slope degrees by re-contouring, run-off waters and water ways should be contained on these slopes by diversion canals and ditches (GCP-EC6 & GCP-SC3) and overland flow effects on slope faces should be restrained. Later, suitable locations should be stabilized by establishing permanent grass stands (hydroseeding) and tree plantation (GCP-EC4 & GCP-LR2). For the cases where recontouring is not possible, a rock breast wall (GCP-EC8) should be constructed.

The land disturbances implemented for constructing cut slopes are shown in Figure 6-16. There are significant material flow downs occurring from the steep cut slopes. Because the runoff water is not controlled and not diverted by engineering structures in the cut slopes, rill erosion, channels and incisions are already formed. In order to maintain permanent seeding or tree plantation on these slopes, splash, sheet and rill erosions should be contained. If ESC measures were not implemented, the benefits expected from the hydromulching and vegetative cover could not be obtained, and grass seeds would be washed out down the slopes by splash, sheet and rill erosion processes. Conclusively, the surface water management is needed (GCP-EC6) for sustaining the mechanical and bio-technical ESC measures (GCP-EC4 & GCP-LR2) in this locality (top-slope diversion canals or ditches, down slope diversion structures at the toes, culverts etc.).

These slopes were cut sort of steep to the extent that seeding and planting works could not be sustained properly; they should be brought to the suitable slope degrees (note that they must not be steeper than 2H/1V; 2 horizontal and 1 vertical) (re-contouring or re-shaping of the slopes). With diversion structures (diversion canals or ditches) (GCP-EC6) at the top or head of the re-contoured slopes, to control the overland water flows and to restrain their erosive damages over the slope faces are very significant. And, with the diversion structures to be constructed at the toes of the above-road cuts, the runoff water should also be securely diverted to the natural water courses. If there is no convenient waterway, a drainage canal with energy dissipaters (chutes) should be built up over the slope faces. Otherwise, it is anticipated that runoff water running on road surfaces and overtopping and overflowing the faces of the downward cut slopes could cause additional soil erosion and sliding problems. After slope face flows and natural water courses are controlled, by means of permanent seeding (hydroseeding) and tree plantation (GCP-EC4 & GCP-LR2), the cut slopes for the access road construction should be stabilized.

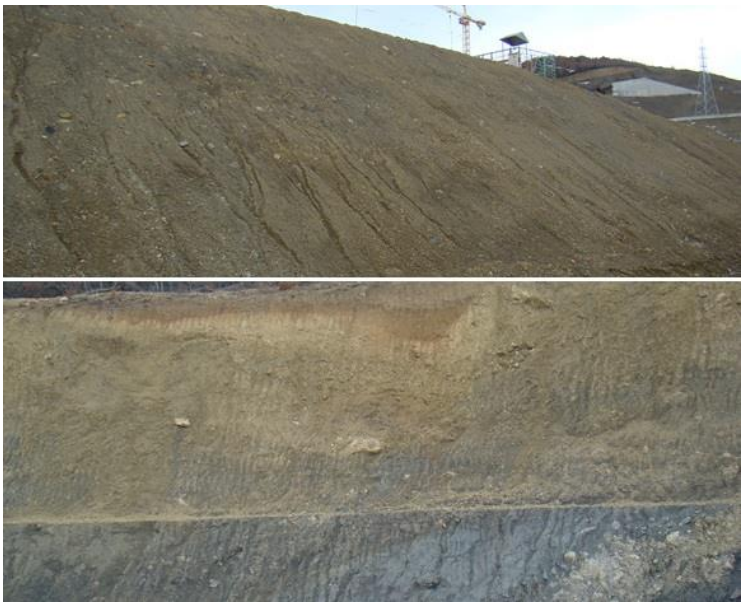


Figure 6-16: Formation of Rill Erosion, Channels and Incisions on the Cut Slopes at the GCP construction site

Figure 6-17: Fill Slopes along with Engineering Structures at the GCP Construction Site

Fill slopes along with engineering structures at the GCP construction site are shown in Figure 6-17. Culvert and diversion structures are already built at the road crossing and the toes of the above-road cuts (GCP-EC6) at the GCP construction site (see Figure 6-17). These slopes were filled properly to the extent that seeding and planting works could be sustained easily. Rather long slopes were also broken by berms and temporary and permanent diversion structures were implemented for breaking the slope lengths successfully (GCP-EC6).

However, the slopes should be stabilized by means of permanent seeding (hydroseeding) and tree plantation (GCP-EC4 & GCP-LR2).

In conclusion, the surface water management is already implemented (GCP-EC6) by the mechanical ESC measures (GCP-EC4), but the bio-technical ones (GCP-LR2) in this locality are still needed.

Figure 6-18: Processing Plant Site of the GCP Mine Site

Figure 6-18 shows the processing plant of the GCP mine site. Although the site is not located nearby the river, there is still a risk of material transport from these disturbed areas through the sediments arriving to the natural water ways by the processes of splash, sheet, rill and gully erosion processes. Relatively longer fill slopes should be broken by contour trenches (slope breakers) to reduce the speed of runoff. Afterward, they require the vegetation cover establishment by small scrubs and woody plants after smoothing (GCP-EC4 and GCP-LR2)

7. MITIGATION MEASURES

Mitigation measures and reinstatement activities for the GCP Mine Site are proposed to remove, minimize and/or compensate for adverse effects of the Project activities as given in Table 7-1.

Table 7-1: Mitigation Measures for the GCP

No	Site	Observations	Mitigation Measures	
			GCP-EC & GCP-SC	**GCP-LR**
1	The tunnel and water related structures construction area	The construction facility area is directly nearby the river, constructing a rock-lined wall (riprap) along the site is required for preventing the river pollution from the materials possible to arise during the land disturbances for vegetation clearance and cut/fill activities. Additionally, diversion structures to be built at the toes of the above-road cuts, are significant to contain runoff water. The runoff water should be securely diverted to the natural water courses together with the implementation of the measures inducing sedimentation. After construction, this natural or pre-construction pattern of the slopes should be taken into consideration during LRP works.	EC6, EC7, SC1, SC3	LR1, LR2, LR3, LR4
2	Topsoil management	It is necessary to strip the organically rich fertile topsoil to the depth of solum and stockpile and conserve properly in another site to be used for landscape and reinstatement works.		LR1, LR4
3	Derivation tunnel	During the construction such ESC measures as temporary geo-textile silt fences, diversion structures and temporary hydroseeding should be effectively used to prevent sediment-laden surface runoff to reach the river.	EC6, EC4, SC1	
4	Road cuts	Diversion structures to be built at the toes of the above-road cuts, are significant to contain runoff water. The runoff water should be securely diverted to the natural water courses together with the implementation of the measures inducing sedimentation. After construction, this natural or pre-construction pattern of the slopes should be taken into consideration during LRP works. Particularly, for road cut activities, to be implemented on the slopes, which are nearby the river, it is necessary to stabilize the downslope site of the road cuts in order to contain the fall-downs of the larger materials like debris and rock fragments and to check slopes sliding down. To implement this successfully along the road, constructing a rock breast wall or a rock-lined wall (riprap) against the base of the slope is critical for preventing the river pollution from cut/fill materials.	EC6, EC7, EC8, SC1, SC3	LR1, LR2, LR3, LR4

5	Maintenance and cleaning works	Maintenance and cleaning of water structures are also very substantial immediately following intensive rainfall.		
6	River bed after diversion	Fill slopes from road construction cuts, which directly join to the river, should be very well-established by vegetative cover. Therefore, after reducing the slope degrees by recontouring, runoff waters and water ways should be contained on these slopes by diversion canals and ditches and overland flow effects on slope faces should be restrained. Later, suitable locations should be stabilized by establishing permanent grass stands (hydroseeding) and tree plantation after spreading fertile top soil at the given depth stored in the site by top soil management. By diversion structures (diversion canals or ditches) to be built at the toes of the cuts, the runoff water should be securely diverted to the natural water courses.	EC4, EC6, SC3,	LR1, LR2, LR4
7	Topsoil management	Since the soil resources of the site are very limited under forest cover, the fertile top soil, to the depth of solum (A plus B horizons), should be scraped and later conserved by properly stocking. The topsoil resources should be stored with a given cross-sectional area in this location and should be protected by a cover.	EC6, SC4	LR1, LR4
8	Storage for underground materials	Similar to those of topsoil, these materials should be stored with a given cross-sectional area in this location and should be protected by a cover. Also, re-contouring or re-shaping of these slopes would be required to bring into conformity, to some extent, with the existing topography.	EC6, SC4,	
9	Vegetation clearance	After clearance, it is necessary to strip the organically rich fertile topsoil to the depth of solum (A and B horizons) and stockpile and conserve properly in another site to be used for landscape and reinstatement works.		LR1, LR4
10	Mass movements on the cut slopes	To prevent slopes from sliding, after reducing the slope degrees by re-contouring, runoff waters and water ways should be contained on these slopes by diversion canals and ditches and overland flow effects on slope faces should be restrained. Later, suitable locations should be stabilized by establishing permanent grass stands (hydroseeding) and tree plantation. For the cases where the re-contouring is not applicable, to construct a rock breast wall is required.	EC4, EC6, EC8, SC3	LR2
11	Rill erosion on the cut slopes	To maintain permanent seeding or tree plantation on these slopes, splash, sheet and rill erosions should be contained. If ESC measures were not put into practice, the	EC4, EC6	LR2

		benefits expected from the hydromulching and vegetative cover could not be obtained, and grass seeds would be washed out down the slopes by splash, sheet and rill erosion processes.		
12	Fill slopes	The slopes should be stablized by means of permanent seeding (hydroseeding) and tree plantation.	EC4	LR2
13	Processing Plant	The prevention of surface water entry to the slope faces of fills or directly through the fills by diversion structures of uphill should be implemented. Or, by constructing check dams within the wadis (gullies), the velocity of the concentrated downslope flows should be reduced and sedimentation should be promoted in the dams. Relatively longer fill slopes should be broken by contour trenches (slope breakers) to reduce the speed of runoff. Afterward, they require the vegetation cover establishment by small scrubs and woody plants after smoothing.	EC4, EC6, SC3,	LR2

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