ALPASLAN II
ENERJI URETIM VE
MADENCILIK SAN. TIC. A.S.

ALPASLAN II DAM AND HEPP PROJECT

(DAM, HEPP, MATERIAL BORROW AREAS, CRUSHING-SCREENING-WASHING FACILITY, CONCRETE PLANT, RELOCATION ROAD)

FINAL EIA REPORT (VOL.-2 APPENDICES)

MUS PROVINCE,

MERKEZ AND VARTO DISTRICTS

☐ EIA REPORT ■ FINAL EIA REPORT

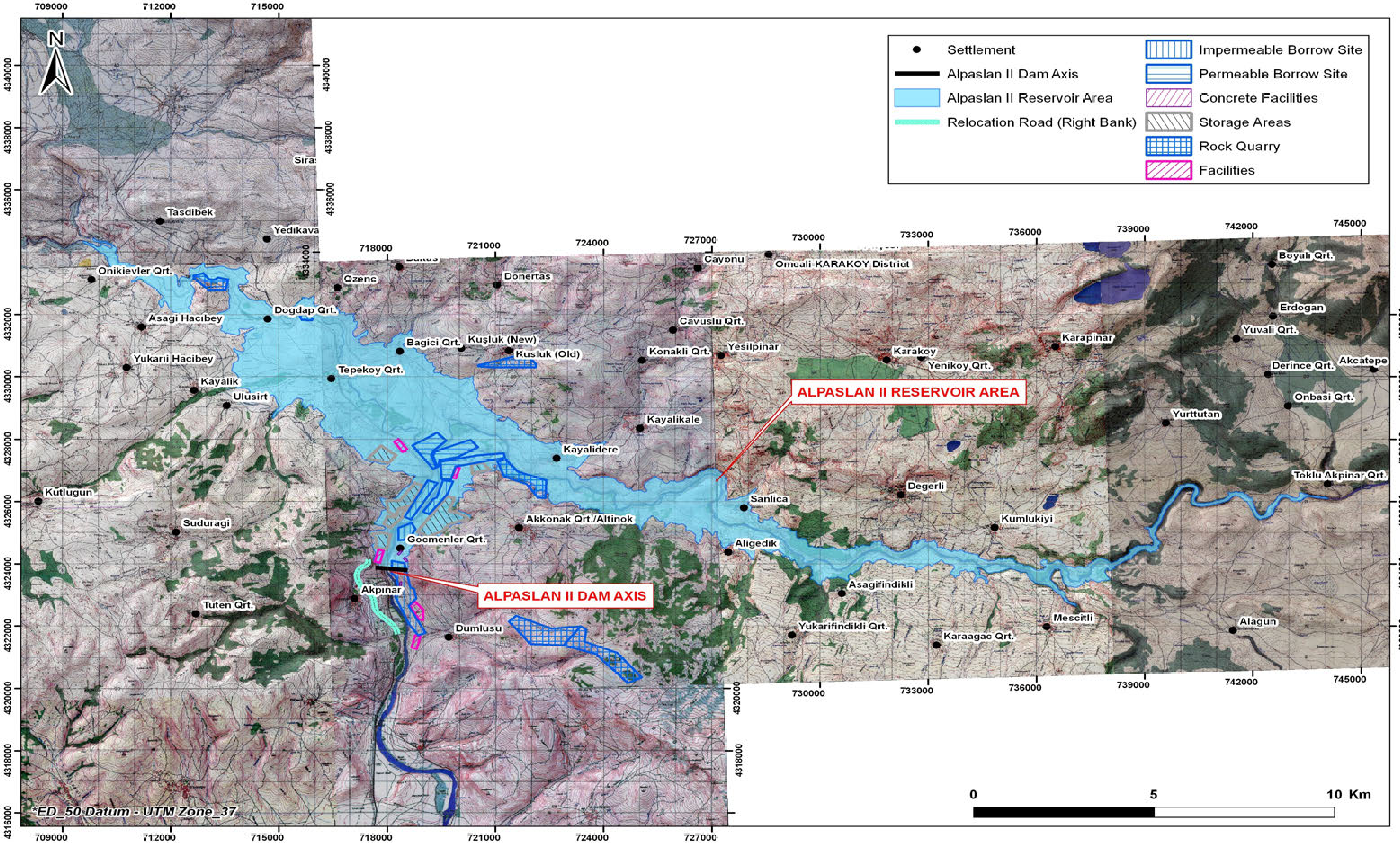
ENCON ENVIRONMENTAL CONSULTANCY CO.

ANKARA, APRIL 2012

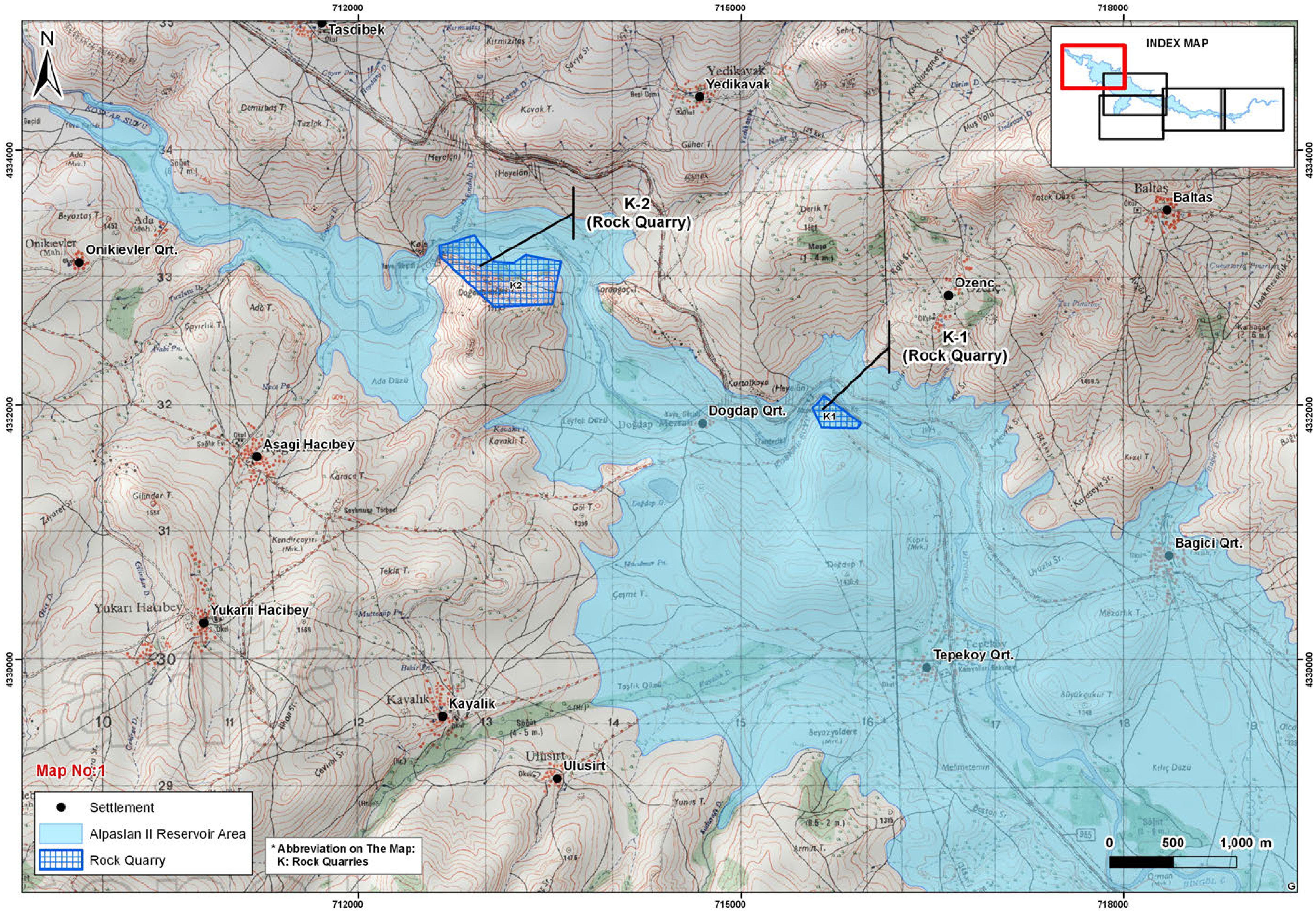
APPENDICES

APP 1

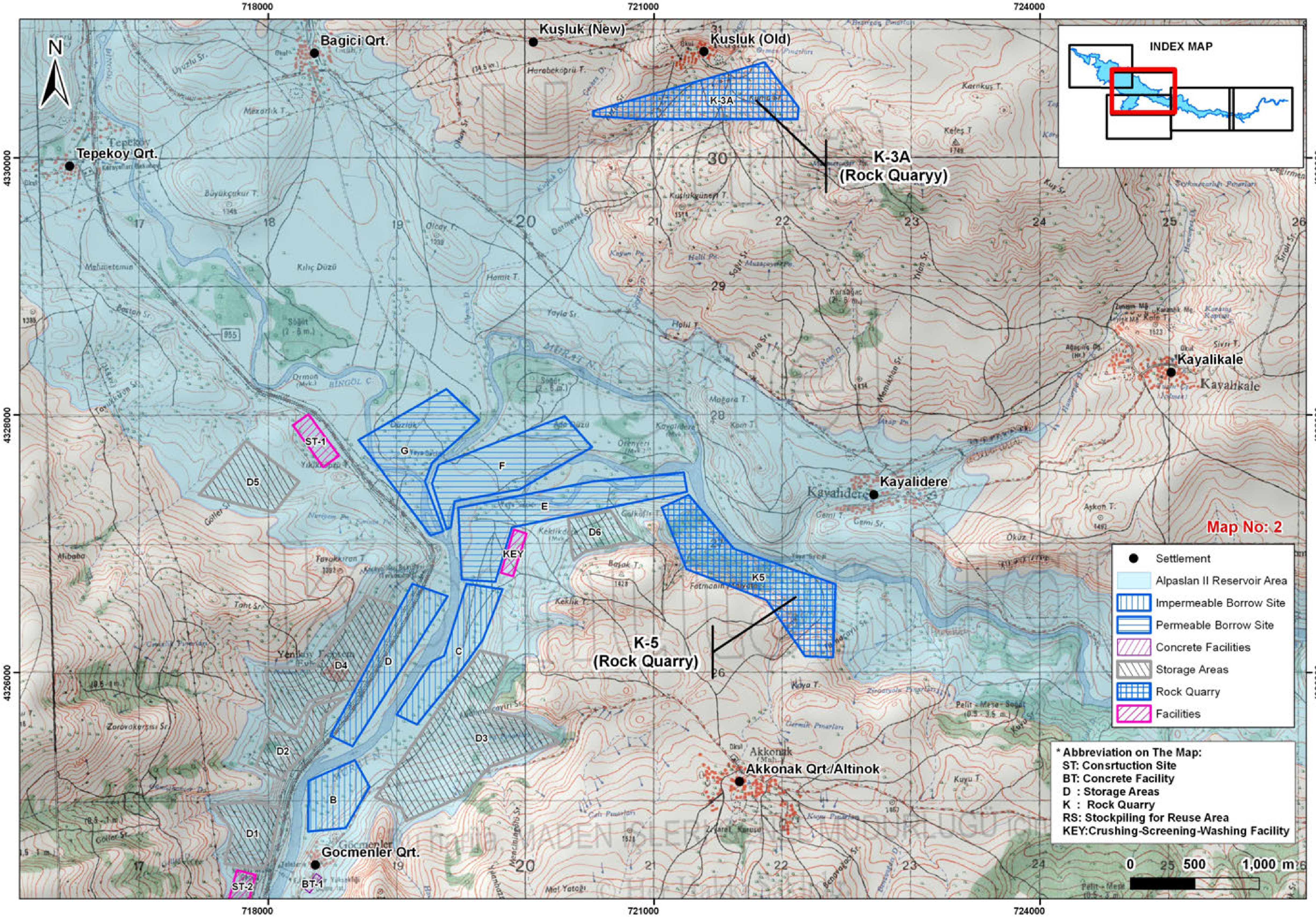
GENERAL LAYOUTS



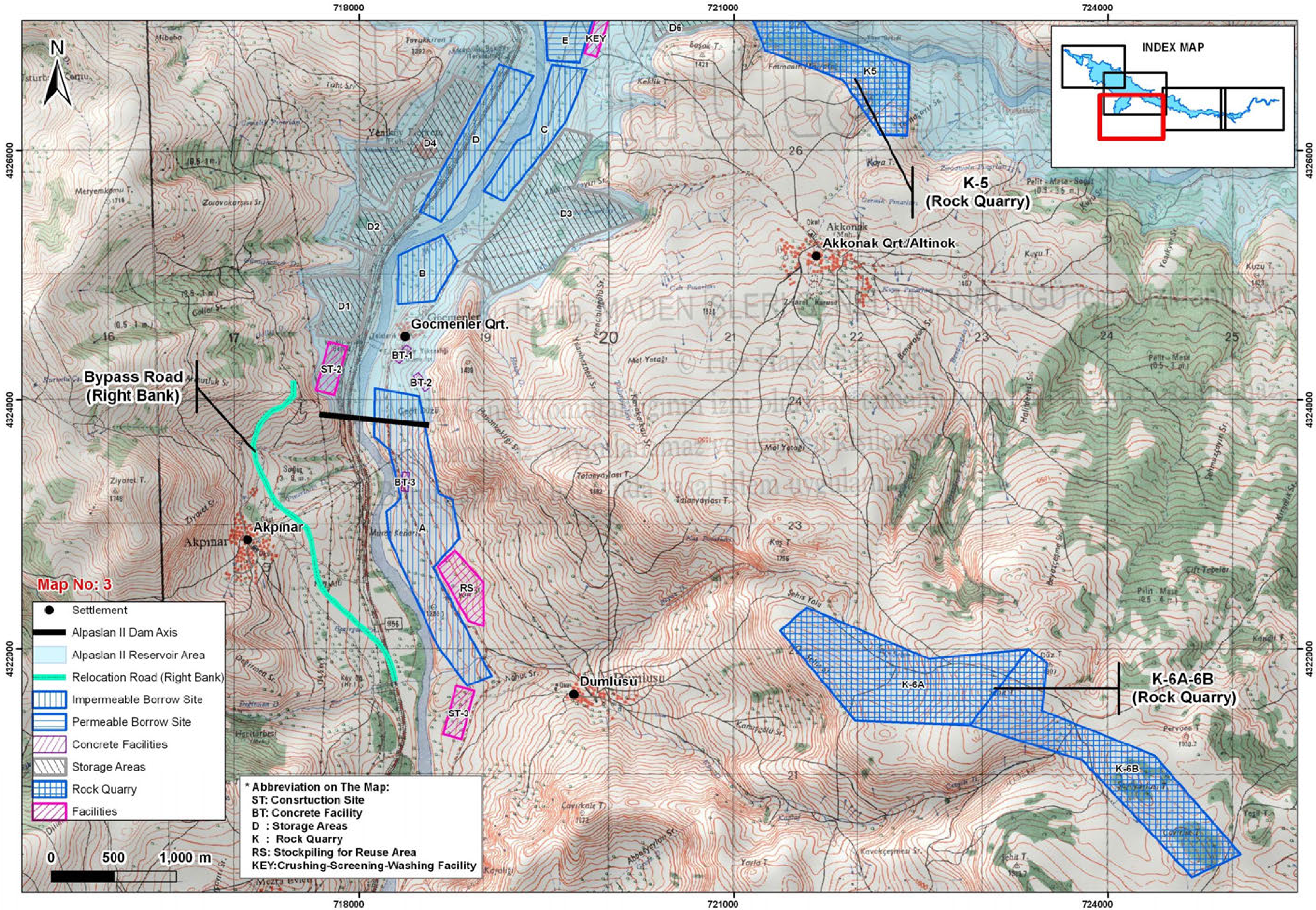
App. 1.1. General Layout – 1



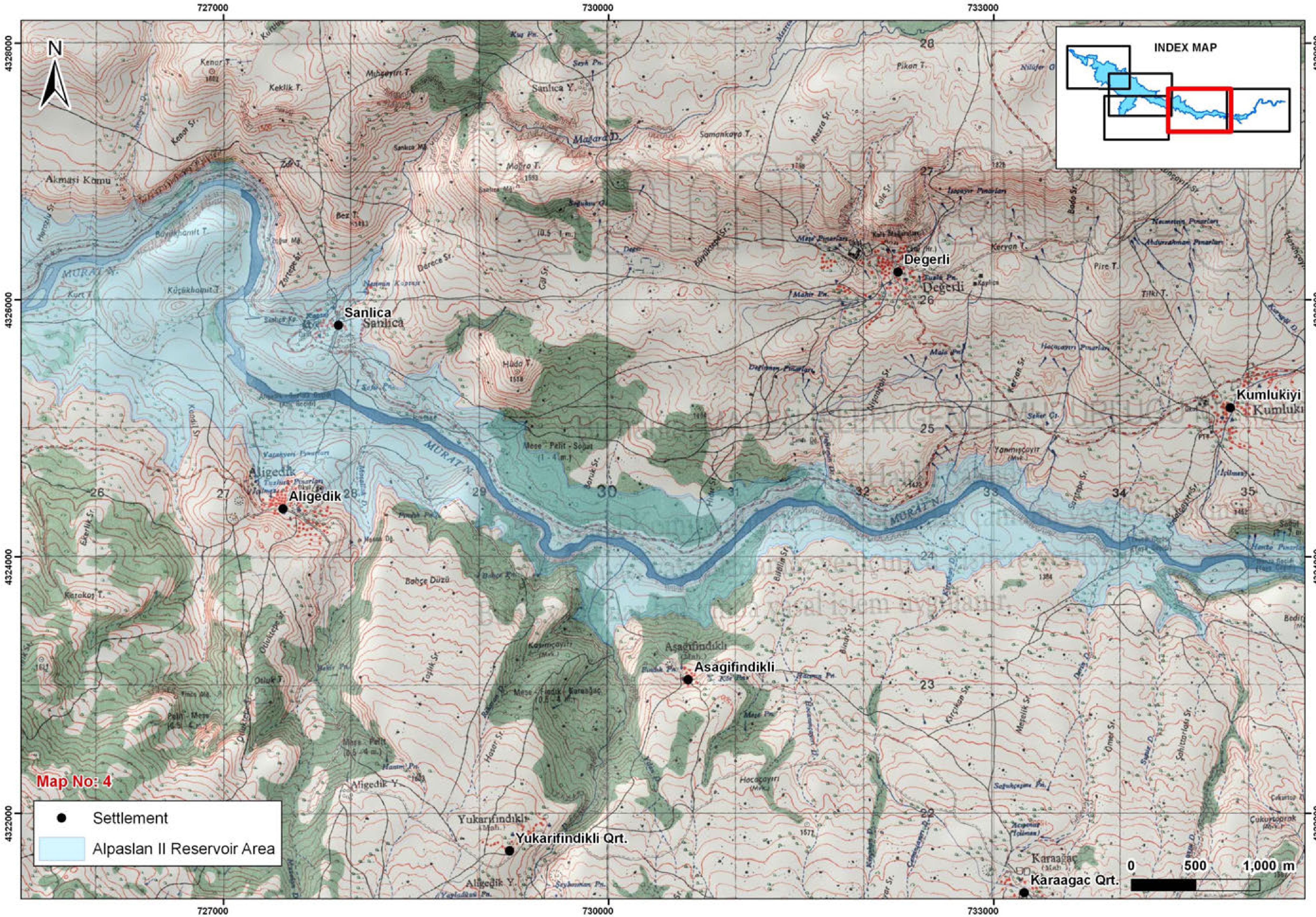
App. 1.2 General Layout – 2



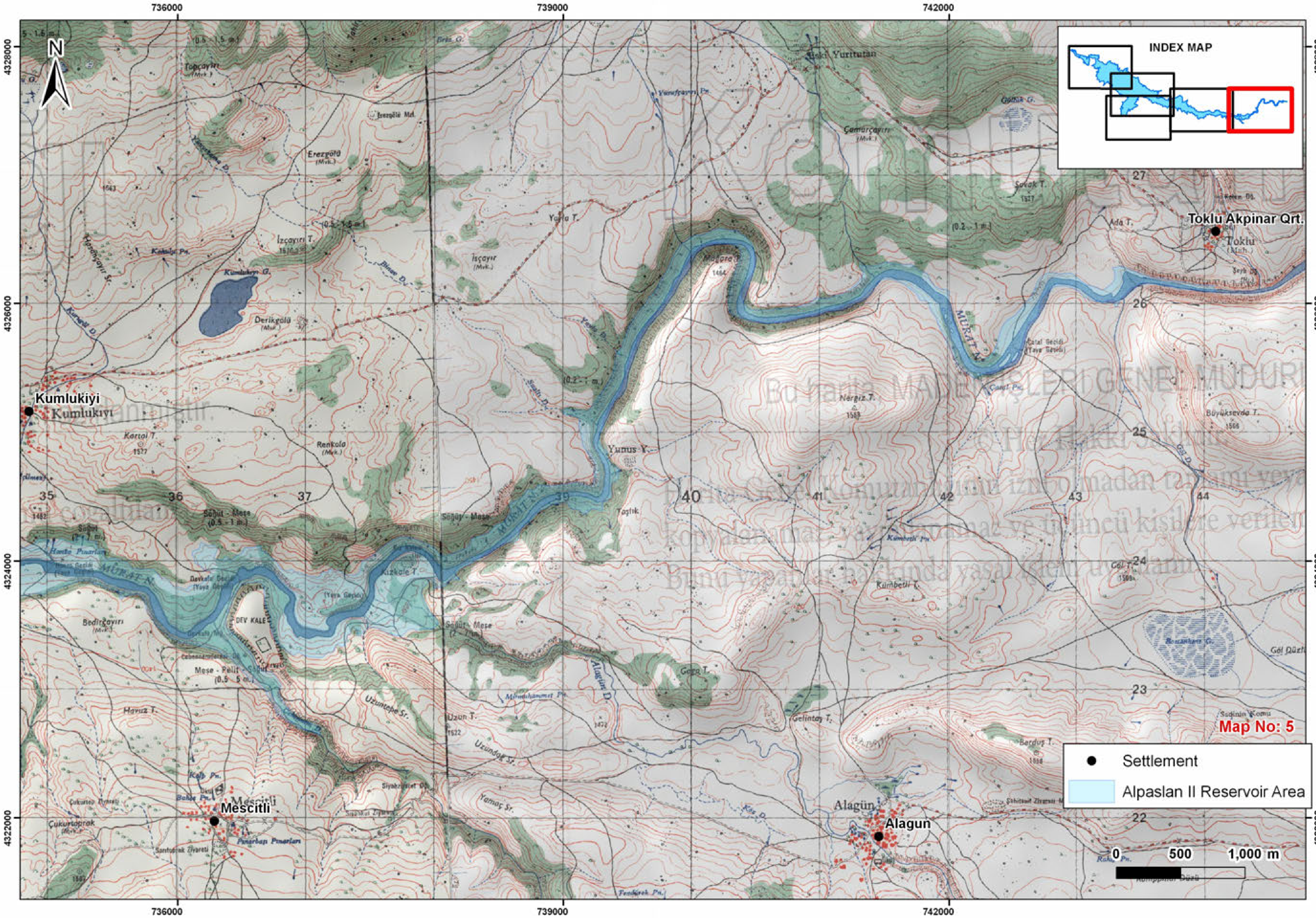
App. 1.3 General Layout – 3



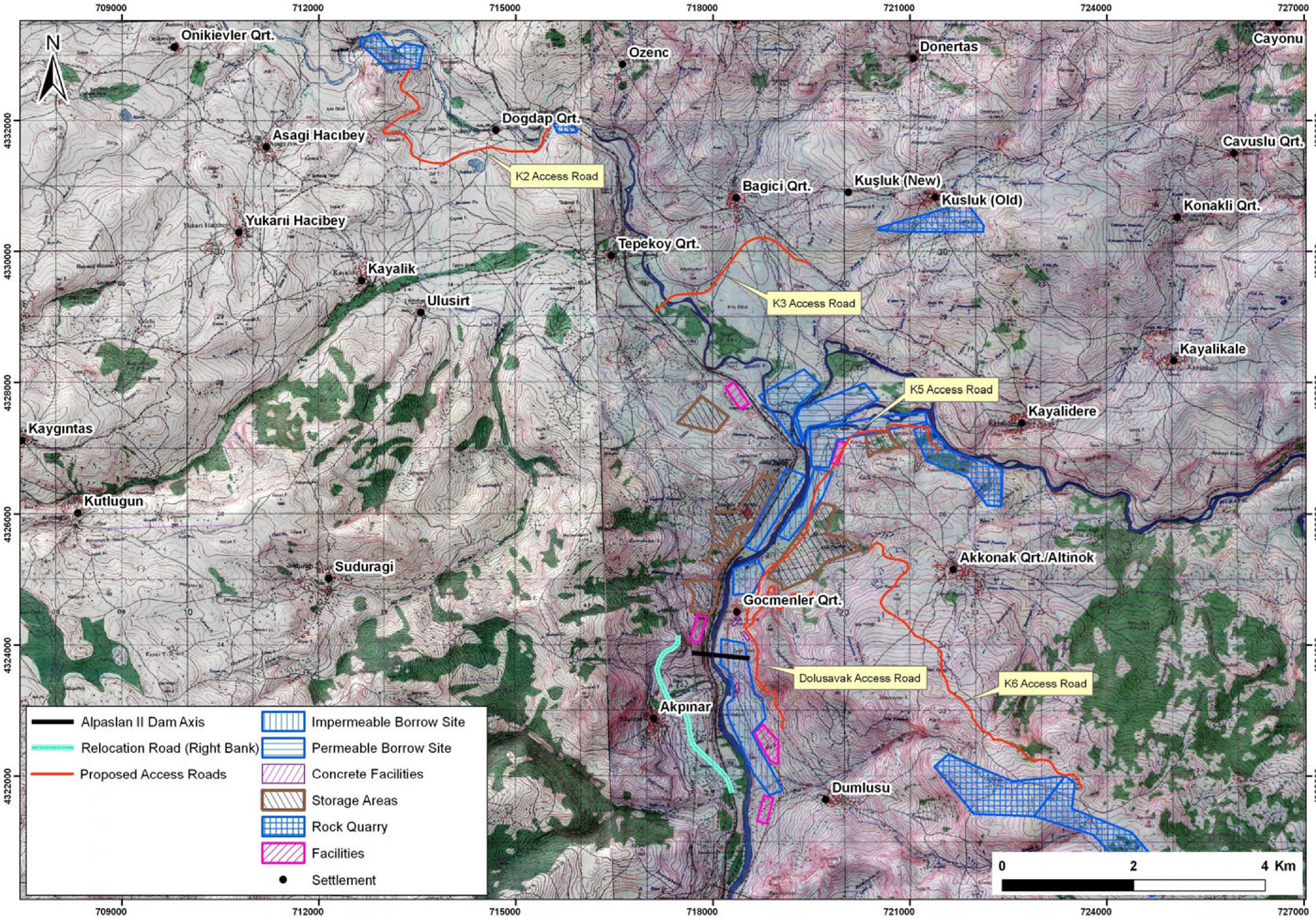
App. 1.4 General Layout – 4



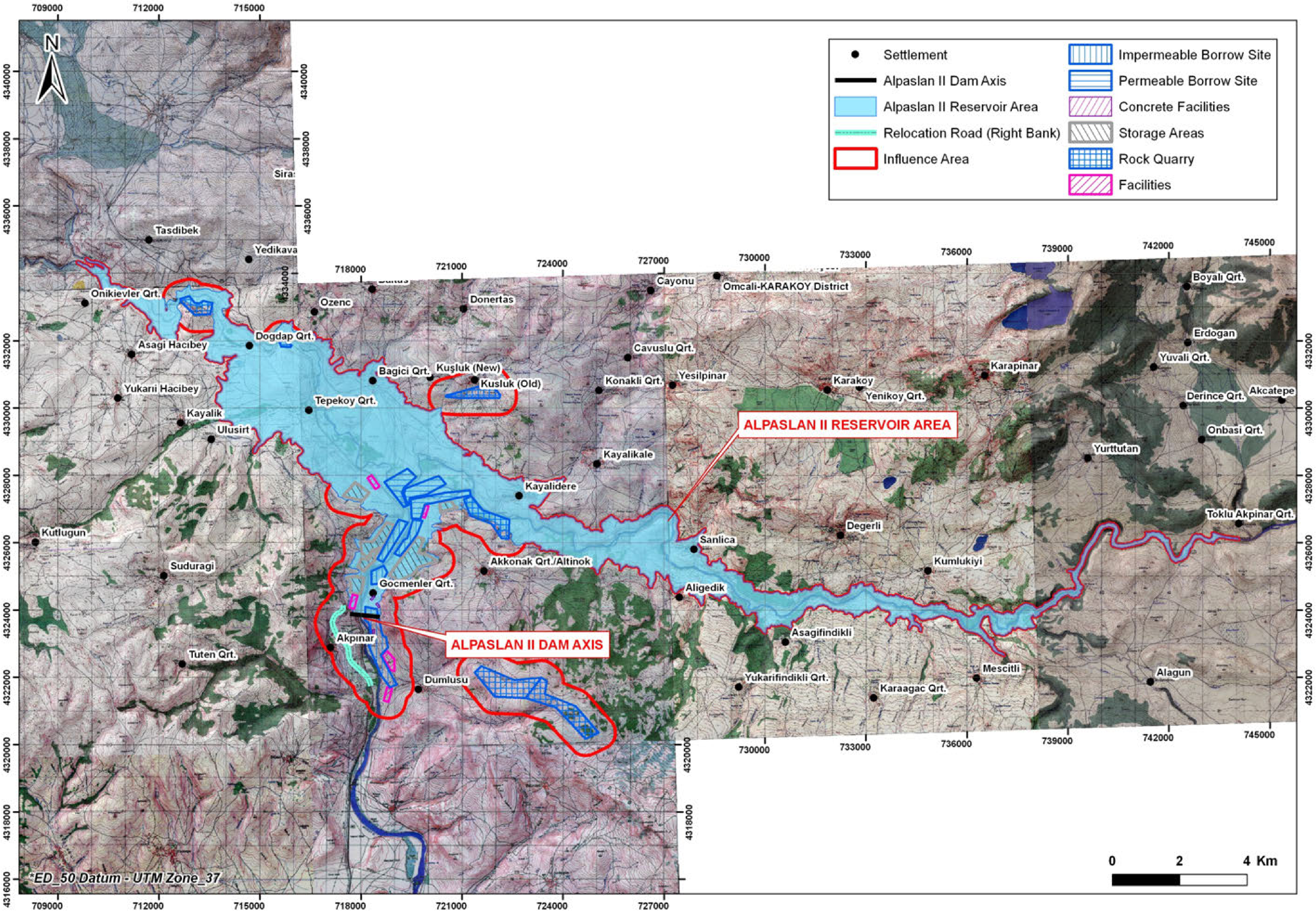
App. 1.5 General Layout – 5



App. 1.6 General Layout – 6



App. 1.7. Access Roads



App. 1.8. Impact Area

APP 2

OFFICIAL LETTERS

Official Letter of SHW regarding the Approval of the Revised Feasibility Report (which covers the capacity increase as well) of Alpaslan II Dam and HEPP Project

T.C.
ÇEVRE VE ORMAN BAKANLIĞI
Devlet Su İşleri Genel Müdürlüğü Etüd ve Plan Dairesi Başkanlığı

Sayı : B.18.1.DSİ.0.10.03.00-118-183825 24.05.'10
Konu : Alpaslan II Barajı ve HES

ÇED PLANLAMA GENEL MÜDÜRLÜĞÜ

4628 sayılı Elektrik Piyasası Kanunu ve bu Kanuna istinaden çıkarılan Elektrik Piyasası Lisans Yönetmeliği hükümleri çerçevesinde Alpaslan II Enerji Üretim San. Tic. A.Ş. tarafından hazırlanıp, incelenmek üzere Genel Müdürlüğümüze gönderilen, Muş İli sınırları içerisinde tesis edilip işletilmesi planlanan Alpaslan II Barajı ve HES projesine toplam 208 MWm / 204 MWe Kurulu güç üzerinden 06.09.2010 tarih ve EÜ/2756-7/1701 Lisans No ile üretim lisansı verilmiştir.

Alpaslan II Barajı ve HES ile ilgili firmasınca Genel Müdürlüğümüze revize fizibilite raporu verilmiş olup, yapılan inceleme sonucunda söz konusu revize fizibilite raporu uygun bulunmuştur. Kuruluşumuzca uygun bulunan fizibilite raporuna göre, söz konusu tesisin toplam 288.66 MWm / 280 MWe Kurulu Güçle işletilmesi planlanmaktadır.

Konuya ilişkin alınacak Kurul Kararınızın Genel Müdürlüğümüze gönderilmesi durumunda Su Kullanım Hakkı Anlaşması 288.66 MWm / 280 MWe kurulu güç değeri üzerinden tadil edilebilecektir.

Ayrıca söz konusu santralın; anılan Kanun kapsamında gerçekleştirilebilmesi için, Su Kullanım Anlaşması öncesi ile gerek proje aşamasında gerekse uygulama aşamasında şirkete bildirilen eksikliklerin yerine getirilmesi, doğabilecek her türlü hidrolojik, jeolojik, teknik ve ekonomik risklerin firmaca yüklenilmesi ve santralın Kuruluşumuz ile firma arasında imzalanacak Su Kullanım Hakkı Anlaşması hükümlerine göre işletilmesi gerekmektedir.

Gereğini ve bilgilerinizi arz ve rica ederim.

Salim FAKIOĞLU
Genel Müdür a.
Daire Başkanı V.

EKLER :
Yönetici Bilgilendirme Formu (1 sayfa)
Genel Vaziyet Planı (1 adet)

DAĞITIM :
Gereği:
Enerji Piyasası Düzenleme Kurumuna (Ek konulmadı)

Bilgi:
ÇED Planlama Genel Müdürlüğü
17. Bölge Müdürlüğü (Ek konulmadı)

Adres : Devlet Mahallesi İnönü Bulvarı NO:16 06100 Çankaya/ANKARA
Ayrıntılı Bilgi İçin : M. ÇEŞME Telefon : Fax:
e-posta : mcesme@dsi.gov.tr Elektronik Ağ: www.dsi.gov.tr

Favorable Opinion Letter of Ministry of Energy and Natural Resources

T.C.
ENERJİ VE TABİİ KAYNAKLAR BAKANLIĞI
Maden İşleri Genel Müdürlüğü
İzleme Daire Başkanlığı

27.06.2011 * 54291

Sayı : B.15.0.MGM.0.01.02.03. – 552032
Konu : HES Projesi

24 Haziran 2011

ALPASLAN II ENERJİ ÜRETİM SANAYİ VE TİCARET A.Ş.
Hoşdere Cad. Fuar Sok. 9/13 Çankaya/ANKARA

İlgi: 29/12/2010 tarih ve 157604 sayılı dilekçeniz.

İlgi'de kayıtlı dilekçenizde, şirketiniz tarafından Muş ili sınırları içerisinde, Murat Nehrinin üzerinde ve Muş ili merkezinden takriben 30 km. mesafede enerji, sulama ve taşkın kontrol maksatlı olara kurulacak olan Alparslan II Barajı ve HES projesi için EPDK'dan 06/09/2010 tarih ve 2756-7 sayılı kararı ile bu tarihten itibaren 49 yıllığına üretim faaliyeti göstermek üzere EÜ/2756-7/1701 nolu üretim lisansının alındığı, üretim lisansının onaylanması üzerine aynı Kanun çerçevesinde DSİ ile Su Kullanım Anlaşmasının imzalandığı, projenin 07/02/1993 tarihinden öncesinde yatırım programına alınması sebebi ile 06/06/2002 tarih ve 24777 sayılı ÇED Yönetmeliğinin geçici 4. maddesi kapsamında değerlendirilerek yönetmelik hükümlerinin uygulanmadığı, ilgili kurumun konu ile ilgili yazılarının mevcut olduğu, DSİ onaylı proje yerleşim planı ve 1/25000 ölçekli haritanın ekte sunulduğu, inşaat edilecek barajın talvegden yüksekliği 99 m olduğu, kret kotu 1371 m. maksimum su seviyesi 1368 m. olduğu, 98 metrelik düşünün değerlendirileceği Alparslan II HES 'in kurulu gücünün 204 MW olduğu, planlanan yıllık enerjinin yaklaşık 724 milyon kWh olduğu, harita ve koordinatları ekte sunulan alanda, kısa zamanda başlayacak proje faaliyetlerinin riske sokulmaması ve ileride telafisi mümkün olmayan sonuçlar doğurmaması için, haritalarda koordinatlı olarak tariflenen alan içerisinde yeni ruhsat haklarının verilmemesi ve mevcut ruhsat taleplerinin yukarıda belirtilen hususlar göz önünde bulundurularak değerlendirilmesi talep edilmiştir.

Talep edilen alanda Genel Müdürlüğümüz teknik elemanlarınca yapılan incelemede, Kamu yararı dikkate alınarak, söz konusu projenin talep edilen alan dahilinde sürdürülmesinde sakınca bulunmadığı tespit edilmiştir.

Mahallinde yapılan tetkik sonucunda yapılan tespitler neticesinde, Alparslan II HES projesinin sağlayacağı Kamu yararları düşünülerek, yapılması planlanan ekli listede verilen koordinatlar dahilindeki Pafta no: j46c3, j47d4, j47d3, j47c4, j46c2 ve 12.526,57 hektarlık alan için Genel Müdürlüğümüzce sakınca bulunmamakta olup, söz konusu alan Genel Müdürlüğümüz kayıtlarında madenciliğe kapalı alan haline getirilmeyerek, ER:3272300 nolu Alparslan II HES Özel İzin Alanı olarak Genel Müdürlüğümüz sistem kayıtlarına işlenmiştir. Bu alanlara yapılacak olan maden ruhsat müracaatları, ilgili kurumlardan izin alınması için 1 (bir) yıl süre verilerek ruhsatlandırılacak alan olarak işlenecek, proje alanında bulunan mevcut maden hakları açısından bu alanda madencilik faaliyetlerinde bulunulmasının istenilmesi halinde Genel Müdürlüğümüzden izin alınmadan faaliyette bulunulmayacağı konusunda talep sahiplerine bilgi verilecektir.

Bilgilerinizi rica ederim.

Yılmaz TÜNEL
Bakan a.
Daire Başkanı

23/06/2011 Müh. : M.EROL
23.06/2011 Müd. V. : M. Halit DURCEYLAN

Mevlana Bulvarı No:76 06100 – Beştepe / ANKARA Ayrıntılı bilgi için:Mad. Yük. Müh. M.EROL
Tel : (0312) 212 80 00 Fax : (0312) 213 84 51 http://www.migem.gov.tr e-posta:migem.@ migem.gov.tr

Official Letter Regarding Approval of Ministry of Agriculture and Rural Areas Related with Usage of Project Area for Non-Agricultural Purposes

T.C.
TARIM VE KÖYİŞLERİ BAKANLIGI
Tarımsal Üretim ve Geliştirme Genel Müdürlüğü

9803

SAYI : TAD/250 11 11 11-2844
KONU : Tarım dışı amaçlı arazi kullanımı

002375 *20.02.03

ANKARA
../../2003

DEVLET SU İŞLERİ GENEL MÜDÜRLÜĞÜNE

İLGİ: a) Muş İl Md.nün 28.11.2002 tarih ve 854-2701 sayılı ve 08.01.2003 tarih ve 59 sayılı yazısı,
b) D.S.İ. Gen. Md.nün 21.11.2002 tarih ve 5093 sayılı yazısı.

Muş İli, Merkez İlçesi, Dumlusu ve Akpınar Köyleri ile Varto İlçesi, Muhacir Zoro, Çalbuhur, Tepeköy, Doğdap, Aşağı Hınzor ve Şantica Köylerinde yer alan 5469 hektar yüzölçüme sahip arazide, DSİ tarafından Alparslan II Barajı ve HES inşaatı kapsamında taşkın kontrolü, sulama ve enerji üretimi yapılmak istendiği belirtilerek, söz konusu alan için tarım dışı amaçlı arazi kullanım izni talep edilmektedir.

Bahse konu arazinin yerinde incelenmesi ile hazırlanan raporların, Bakanlığımız tarafından değerlendirilmesi sonucu, 10 Ağustos 2001 tarih ve 24489 sayılı Resmi Gazetede yayımlanarak yürürlüğe giren "Tarım Arazilerinin Korunması ve Kullanılmasına Dair Yönetmelik" gereği; mera görünümlü araziler ile planlanması düşünülen alanda daha önce çeşitli kanunlarla tahsis edilmiş veya kadimden beri kullanılmakta olan mera, yaylak, kışlak ve kamuya ait otlak ve çayırlar varsa 4342 sayılı Mera Kanunu'nun 14. maddesi kapsamında tahsis amacı değişikliği yapılması, hazine arazileri ile tescil harici alanların ise aynı kanunun 5. maddesinin (b) bendi hükmü gereği incelenmesi ve tarımsal faaliyetlere zarar vermeyecek tedbirlerin alınması şartıyla, söz konusu 5469 hektar arazinin tarım dışı amaçla kullanılması uygun görülmüştür.

Bilgilerinizi ve gereğini rica ederim.

Dr. Hüseyin VELİOĞLU
Bakan a.
Genel Müdür

DAĞITIM

Gereği:
D.S.İ.Genel Müdürlüğü

Bilgi:
Muş İl Müdürlüğü

Agricultural Survey Report

Sn: Murat [illegible]

TARIMSAL ETÜT RAPORU

Etüdü yapılan alan ve yörede karasal iklim hakimdir.Yazlar sıcak ve kurak, kışlar soğuk ve kar yağışlıdır. Yağışların mevsimlere göre dağılımı düzensiz olup yağışların çoğu kışın kar şeklinde düşmektedir. Bölgenin en önemli geçim kaynağı tarım ve hayvancılıktır.

1.1Arazinin Yeri ve Alanı: Etüdü yapılan arazi Muş İli Merkez İlçeye bağlı Dumlusu ve Akpınar Köyleri ile Varto İlçesine bağlı Muhacir Zoro, Çalbuhur, Tepeköy, Doğdap, Aşağı Hınzor ve Şanlıca Köylerini kapsamaktadır.

Doğu Anadolu bölgesinde Fırat Nehrinin kolu olan Murat Nehri Havzasında yer almakta olan bu alan, Alpaslan II Barajı ve HES İnşaatı göl sahasında kalmakta ve toplam yüzölçümü 5469 hektardır.

Söz konusu taşınmazlar Belediye Uygulama imar planı veya mücavir alan sınırları içinde yer almamaktadır.

1.2.Etüdün Amacı :Etüt, Enerji ve Tabii Kaynaklar Bakanlığı Devlet Su İşleri Genel Müdürlüğünün 21.11.2002 tarih ve B 15 1 DSİ 0 10 16 00 /123.Ç-5093 sayılarına istinaden etüt yapılmıştır.

İlgi yazı gereği yapımı planlanan Alpaslan II Barajı ve HES İnşaatı kapsamında göl sahasına isabet eden alanlarda taşkın kontrolü, sulama ve enerji üretimi amacıyla yapılmaktadır.

2.ARAZİ ÖZELLİKLERİ:

Söz konusu bölgede yıllık ortalama yağış 702 mm ve ortalama sıcaklık 9,7 ^{0}C dir.

İncelemeye konu araziler 5469 hektar gibi oldukça geniş bir alanı temsil ettiğinden benzer özelliklerine göre gruplandırılarak değerlendirilmiştir.

Yörede yaygın olarak buğday, arpa, nohut, korunga, fiğ, yonca, Şekerpancarı, Fasulye, Kavun, Karpuz, domates, biber, salatalık, elma, armut, vişne, kiraz, kuru ot vb ürünlerin tarımı yapılmaktadır.

Taşınmaz üzerinde su ürünleri yetiştirilen her hangi bir alan yoktur.

Ekli haritada işaretlenerek tanımlanan tarım arazileri doğal özellikleri ve yapılan tarımsal faaliyet türüne göre aşağıdaki gibi değerlendirilmiştir:

Sulu Dikili Tarım Arazileri (SDT): Taşınmaz üzerinde hali hazırda bitki örtüsü olarak Muhtelif meyve ağaçları ve kimi yerlerde kavak ve söğüt ağaçları bulunmaktadır.Ayrıca seyrek meyve bahçelerinde sebze yetiştiriciliği yapılmaktadır. Bu yer meyvecilik için yörenin bir mikroklima bölgesi niteliğindedir.

Toprağı derin (90-150cm), orta ağır bünyede, orta geçirgen, taşsız, nehre yakın kısımlar alüviyal, yamaca doğru kısımlar kolloviyal bir yapı göstermektedir.Arazi hafif derecede su erozyonuna maruz bir yapı arz etmektedir.

Arazinin kimi yerleri dalgalı ve engebeli olduğundan teraslama şeklinde evleklere ayrılmıştır.Taşınmaz % 2-6 gibi hafif meyildedir.

Sulu Mutlak Tarım Arazileri (SMT): Taşınmaz üzerinde toprak işlemeli tarım yapılmaktadır.Hali hazırda taşınmaz üzerinde buğday üretimi yapılmaktadır.

Toprağı derin (90-150cm), orta ağır bünyede, orta geçirgen, taşsız, kolloviyal bir yapı göstermektedir.Arazi her hangi bir erozyona maruz değildir.taşınmaz düz ve düze yakın (% 0-2) meyildedir.

Sulu Çayır Arazileri (SÇ):Yörede büyük ve küçük baş hayvancılık yaygın olarak yapılmaktadır.Bu nedenle yöredeki hayvanların kaba yem ihtiyacı çayır ve meralardan karşılanmaktadır. Çayırların mülkiyeti şahıslara ait olup genellikle biçilerek değerlendirilmektedir. Sulu çayırlarda bakım ve korumanın tekniğine uygun yapılması durumunda bir mevsimde iki kere biçime gelmesi söz konusu olabilmektedir.

SÇ₁: Arazinin yanından küçük bir dere geçmektedir.ortalama verim kuru çayırlara nazaran daha fazladır.Hayvanların severek yediği ot oranı fazladır.

Toprak sığ (20-50 cm), orta bünyede, orta geçirgen, hafif taşlı bir yapı göstermektedir.Arazi orta derecede su erozyonuna maruz ve % 2-6 gibi hafif meyildedir.

SÇ₂: Murat Nehrinin iki kolu bu kısımda birleşmektedir. Buradaki arazilerde taban suyu yüksektir. Murat Nehrinin Vartodan gelen Bingöl Çayı ve Bulanık kollarının arazi içinde dolaşması nedeniyle sulama olanağına sahiptir.Ortalama verim yöre ortalamasının üstündedir.Hayvanların severek yediği otların oranı fazladır.

Toprak orta derin (50-90 cm), orta kaba bünyede, alüviyal yapıda, orta geçirgen, taşsız bir yapı göstermektedir.Arazi her hangi bir erozyona maruz değildir ve eğimi % 0-2 gibi düz ve düze yakındır.

SÇ₃:Küçük bir alanı temsil etmektedir. Toprak sığ (20-50 cm), orta bünyede, orta yavaş geçirgen, hafif taşlı bir yapı göstermektedir.Arazi her hangi bir erozyona maruz değildir ve eğimi % 0-2 gibi düz ve düze yakındır.

Kuru Çayır Arazileri (KÇ): Ortalama verim Yukarıda bahsedilen sulu çayır arazilerinden düşüktür.

KÇ₁: Küçük bir alanı temsil etmektedir. Kuru ot verimi yöre ortalaması civarındadır.Toprak sığ (20-50 cm), orta bünyede, orta yavaş geçirgen, hafif taşlı bir yapıda, orta derecede su erozyonuna maruz, orta eğimli (% 12-20) bir özellik arz etmektedir.

KÇ₂: Kuru ot verimi yöre ortalaması civarındadır.Toprak sığ (20-50 cm), orta bünyede, orta yavaş geçirgen, hafif taşlı bir yapıda, orta derecede su erozyonuna maruz, kimi yerler engebeli ve dalgalı, orta eğimli (% 12-20) bir özellik arz etmektedir.Arazi üzerinde kısmen söğüt niteliğindeki çalı formları yaygındır.Tepe ve Muhacir Zoro Köyleri yerleşim birimleri bu alan içerisinde kalmaktadır.

KÇ₃: Kuru ot verimi yöre ortalamasının altındadır.Toprak sığ (20-50 cm), orta bünyede, orta yavaş geçirgen, hafif taşlı bir yapıda, orta derecede su erozyonuna maruz, hafif eğimli % 2-6, kimi yerler dalgalı bir özellik arz etmektedir. Çalbuhur Köyü yerleşim birimi bu alan içerisinde kalmaktadır.

KÇ₄: Kuru ot verimi yöre ortalamasının altındadır.Kısmen tarla olarak kullanılmaktadır.Toprak orta derin (50-90 cm), orta bünyede, orta yavaş geçirgen, hafif taşlı bir yapıda, orta derecede su erozyonuna maruz, hafif eğimli % 2-6 gibi bir özellik arz etmektedir. Doğdap Köyü yerleşim birimi bu alan içerisinde yer almaktadır.

Kuru Orta Mera Arazileri (KMO) ve Kuru Zayıf Mera Arazileri (KMO):

Bu kısımlar daha engebeli, dalgalı ve yamaç niteliğinde, çok taşlı ve arazi sınırlamaları fazla olduğundan mera özelliğindedir.Bu nedenle bu kısımların 4342 sayılı mera kanunu kapsamında değerlendirilmesi gerekmektedir.

3.ARAZİ KULLANIM ŞEKİLLERİ:

Etüdü yapılan arazilerde yıl içinde tarımsal faaliyet olarak meyvecilik, buğday, arpa, sebzecilik, kuru ot üretimi, küçük çapta kavak ve söğüt üretimi yapılmıştır.Etüde konu araziler yukarıdaki gruplarda izah edildiği gibi kimi sulu kimi susuzdur.Bölgenin tipik özelliğini arz ettiğinden yörede ortalama verimler bölge ortalamaları civarındadır.

Etüde konu alanın bitki deseni yukarıda sayılan ürünlerle çeşitlendirilebilmektedir.

Etüdü yapılan alanda mera niteliğinde olan araziler bulunduğundan 4342 sayılı mera kanunu kapsamında değerlendirilmesi gerekmektedir.

İncelemeye konu alan, 3575 sayılı zeytinciliğin ıslahı ve yabanilerinin aşılattırılması hakkında kanun ve 1380 sayılı su ürünleri kanunu kapsamında olan yerlerden değildir.

4.SONUÇ VE ÖNERİLER:

4.1.Arazinin genel değerlendirilmesi ve yöre için önemi:İncelemeye konu araziler geniş bir alanı kapladığından farklı özellikler göstermektedir.Muhtemel göl sahası arazileri 8 köyü kapsadığından bu köylerde ikamet eden vatandaşların tek geçim kaynağıdır.

4.2. Kullanım amacındaki değişikliklerin tarımsal üretime etkisi:Çiftçilerin eğitim ve bilgi düzeyleri, ekonomik durumları, arazilerin topoğrafik yapısı ve işletme büyüklüklerinin küçük olması gibi etkenler bilimsel ve tekniğine uygun bir üretimi sınırlandırmaktadır.

Yapılan çalışmalar sonunda Alpaslan II Barajı ve 200 MW enerji santrali ile Muş Ovasında 10150 Ha'ı mevcut sulamalar olmak üzere toplam 78210 Ha sahanın sulanması düşünülmektedir.Arazilerin sulamaya açılmasıyla ürün deseninde ve ortalama verimde artışlar olmaktadır.Ayrıca iklimde de bir yumuşama beklenmektedir.

4.3.Çevre arazilerle ilişkisi: Arazinin çevresini kuşatan komşu araziler rakım ve topoğrafik olarak daha elverişsizdir.

4.5.Ekonomik, ekolojik ve toplumsal yönden değerlendirilmesi:Yörede Ekonomik ve bilimsel bir tarımsal faaliyet yapılmamaktadır.Baraj sahasında kalacak yerleşim birimlerine yeni bir yerleşim yeri gösterilmemesi durumunda, çevre köylerden İlçe Merkezlerine hızlı bir göç beklenmektedir.

4.6.Arazinin kullanım şeklinin sulama suyu veya su ürünleri yönünden toprak ve su kaynaklarına olabilecek etkileri: Arazinin amacının değiştirilerek Baraj sahasına tahsis edilmesi durumunda çevre araziler olumlu etkilenmektedir.

4.7.Arazi sınıfı: Arazi kullanım kabiliyetine, doğal özelliklerine ve yapılan tarımsal faaliyet türüne göre yukarıdaki gibi sınıflandırılarak değerlendirmeler yapılmıştır.

İş bu rapor tarafımızdan tanzim edilerek imza altına alınmıştır.28.11.2002

ETÜDÜ YAPANLAR

Erhan ÖZÜN
Ziraat Mühendisi

A.Melik TAŞ
Ziraat Mühendisi

KONTROL EDEN

Mehmet AYDIN
Prj.İst.Şb.Müd.V

TASDİK EDEN

Fuat AKAYDIN
İl Müdürü

Official Letter is issued by Mus Municipality Related to the Water resources within the project area.

6274093

MEHMET AKİF ERSOY YILI

T.C
MUŞ BELEDİYE BAŞKANLIĞI
İmar ve Şehircilik Müdürlüğü

Sayı : M.49.0.MUŞ.0.00.00.13/ 3452
Konu : İmar Hk.

24.10.2011

ENCON
ÇEVRE DANIŞMANLIK LTD ŞTİ.

İ L G İ : 18.10.2011 Tarih ve E1-356 Sayılı Yazınız.

İlgi Tarih ve Sayılı Yazınıza istinaden İlimiz Merkez Varto ilçeleri sınırları içerisinde Alparslan II Enerji Üretim ve Madencilik San.Tic. A.Ş tarafından yapılması planlanan bölge İmar ve Mücavir alanlarımız dışında olup, söz konusu çalışma bölgesinde su kaynaklarımız bulunmamaktadır.

Gereğini bilgilerine rica ederim.

Necmettin DEDE
Belediye Başkanı

Minare Mahallesi Belediye Caddesi –49400 MUŞ E:mail:ben.leventtohumcu@hotmail.com
Tel (0436) 212 10 15—212 38 21 Fax: (0436) 212 54 15 Ayrıntılı bilgi için itibat:L.TOHUMCU/Harita Tknk.

Official Letter of Mus Municipality Related to the Waste Disposal Permit

T.C
MUŞ BELEDİYE BAŞKANLIĞI
Temizlik İşleri Müdürlüğü

MEHMET AKİF ERSOY YILI

Sayı : M.49.0.MUŞ.0.00.00.27/2826 07/09/2011

Konu : Dilekçeniz Hk.

Sayın: Ali ERPALAK
Alparslan II HES Şantiyesi İdari işler Şefi
<u>MUŞ</u>

İlgi :06/09/2011 tarihli ve 4493 sayılı dilekçeniz.

İlgi tarihli ve sayılı dilekçeniz ile; Alparslan II Barajı ve HES Projesi için yürütülen Çevresel etki değerlendirme çalışmaları kapsamında projenin inşaat ve işletme aşamalarında çalışmalardan kaynaklanacak evsel atıklarınızı bertaraf edilmesini talep etmektesiniz.

Belediyemize ait ruhsatlı ve tahsisli düzenli depolama alanı mevcut olmayıp, arak deresinde bulunan vahşi depolama alanına şehir evsel atıkları dökülmektedir.

Bilgilerinize rica ederim.

Necmettin DEDE
Belediye Başkanı

Minare Mahallesi, Belediye Caddesi – 49100 MUŞ
Tel: (0436) 212 10 15 – 212 38 21 Fax: (0436) 212 54 15

Official Letter of Ministry of Culture and Tourism Regarding the Cultural and Natural Properties in the Project Area

T.C.
KÜLTÜR VE TURİZM BAKANLIĞI
Kültür Varlıkları ve Müzeler Genel Müdürlüğü

SAYI : B.16.KVM.0.10.03.00/s.49.04.05- 137223
KONU : Muş, Merkez ve Varto İlçelerinde Alpaslan II Barajı ve HES Projesi

29 Haziran 2011

Encon Çevre Danışmanlık Ltd.Şti'ne
Reşit Galip Cad. No:120
06700 Gaziosmanpaşa-ANKARA

İLGİ: Encon Çevre Danışmanlık Ltd.Şti.'nin 15.06.2011 gün ve E11.208 sayılı başvurusu

Muş, Merkez ve Varto İlçesi sınırları içinde, Alpaslan II Enerji Üretim ve Madencilik San. Tic. A.Ş. tarafından yapılması planlanan Alpaslan II Barajı ve HES Projesine ilişkin ilgi başvuru ve eklerinin birer örnekleri yazımız ekinde iletilmektedir.

Konunun 2863 sayılı Yasa ve ilgili mevzuat kapsamında Van Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulu Müdürlüğü tarafından incelenerek gerekli işlemlerin yapılması ve yapılan işlemler sonucundan Bakanlığımız Kültür Varlıkları ve Müzeler Genel Müdürlüğü'ne bilgi verilmesi hususunda bilgilerinizi ve gereğini rica ederim.

Şöhret ATASOY
Bakan a.
Daire Başkanı V.

EKLER:
Ek-1 Başvuru örneği ve ekleri (9 sayfa)
2 Harita (6 adet)

DAĞITIM:

Gereği:
-Van Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulu Müdürlüğüne

Bilgi:
-Encon Çevre Danışmanlık Ltd.Şti'ne
Reşit Galip Cad. No:120
06700 Gaziosmanpaşa-ANKARA
(Ek konmadı)

ADRES : II. T.B.M.M. Ulus-Ankara
www.kulturturizm.gov.tr
TEL : 0312 309 02 60(6 hat)
e-posta:kulturvarlikmuze@kulturturizm.gov.tr
FAKS : 0312 309 02 68

Official Letter of Ministry of Culture and Tourism Regarding the Cultural and Natural Properties in the Project Area

T.C.
KÜLTÜR VE TURİZM BAKANLIĞI
Kültür Varlıkları ve Müzeler Genel Müdürlüğü

SAYI :B.16.0.KVM.0.10.03.00 / 49.04.05 -188765
KONU :Muş İli, Merkez İlçe ve Varto İlçesi
Alparslan II Barajı ve HES

1 5 EKİ 2011

ÇEVRE VE ŞEHİRCİLİK BAKANLIĞINA
(Çevresel Etki ve Değerlendirmesi, İzin ve Denetim Genel Müdürlüğü)

İLGİ :a) Çevre ve Şehircilik Bakanlığı Çevresel Etki ve Değerlendirmesi, İzin ve Denetim Genel Müdürlüğünün 20.07.2011 gün ve 402 sayılı yazısı.
b) 10.08.2011 gün ve 167290 sayılı yazımız.
c) Van Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulu Müdürlüğünün 11.08.2011 gün ve 1210 sayılı yazısı.

Muş İli, Merkez ve Varto İlçeleri sınırları içerisinde Alparslan II Enerji Üretim ve Madencilik Sanayi Ticaret A.Ş. tarafından yapılması planlanan Alparslan II Barajı ve HES (288.66MWm/280MWe) projesine ilişkin ilgi (a) yazı incelenmek üzere ilgi (b) yazımız ekinde Mülga Van Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulu Müdürlüğüne iletilmiştir.

Konuya ilişkin cevaben alınan ilgi (c) yazı eki uzman raporunda baraj sahasında sular altında kalacak kültür varlığı olduğundan bahsedilmektedir.

Anılan nedenle 08.05.2010 tarih ve 27575 sayılı Resmi Gazetede yayımlanarak yürürlüğe giren 22.04.2010 tarih ve 765 sayılı Kültür ve Tabiat Varlıklarını Koruma Yüksek Kurulu' nun "Baraj Alanlarından Etkilenen Taşınmaz Kültür Varlıklarının Korunması" ile ilgili İlke Kararının 1. maddesi çerçevesinde envanter ve belgeleme çalışmalarının yapılması gerekmektedir.

Sözkonusu Barajın yapılacağı alanın, bölgeyi tanıyan ve bölgede daha önce çalışmalarda bulunmuş olan, Van Yüzüncü Yıl Üniversitesi, Fen-Edebiyat Fakültesi, Arkeoloji Bölümü öğretim üyelerinden Yrd. Doç. Dr. Hanifi BİBER ve Van Kültür Varlıklarını Koruma Bölge Kurulu Müdürlüğü uzmanlarının oluşturacağı bir komisyon tarafından incelenebilmesi için Yrd. Doç. Dr. Hanifi BİBER' e gerekli iznin Rektörlüğünüzce verilmesi hususunda bilgilerinizi ve gereğini arz ederim.

O. Murat SÜSLÜ
Bakan a.
Genel Müdür

DAĞITIM

Gereği
- VanYüzüncü Yıl Üniversitesi Rektörlüğüne

Bilgi
- Çevre ve Şehircilik Bakanlığına (Çevresel Etki ve Değerlendirmesi, İzin ve Denetim Genel Müdürlüğü)
- Van Kültür Varlıklarını Koruma Bölge Kurulu Müdürlüğüne

II.T.B.M.M. Ulus 06543/ Ankara Tel: 309 02 60 (9 hat) Fax: 311 82 48
www.kulturturizm.gov.tr. E-Mail: kulturvarlikmuze@kulturturizm.gov.tr

Official Letter of Ministry of Culture and Tourism Regarding the Cultural and Natural Properties in the Project Area

GE11.029

T.C.
KÜLTÜR VE TURİZM BAKANLIĞI
Kültür Varlıkları ve Müzeler Genel Müdürlüğü

SAYI : B.16.KVM.0.10.01.00/49.04.05 – 216400
KONU : Muş İli, Merkez ve Varto İlçeleri
Alpaslan II Barajı ve HES

24.10.2011

Encon Çevre Danışmanlık Ltd. Şti.
Reşit Galip Cad. No:120 06700
Gaziosmanpaşa/Ankara

İlgi: a) 15.09.2011 tarih ve 188765 sayılı yazımız
b) Yüzüncü Yıl Üniversitesi Rektörlüğü'nün 05.10.2011 tarih ve 1163 sayılı yazısı

Muş İli, Merkez ve Varto İlçeleri sınırları içinde Alparslan II Enerji Üretim ve Madencilik Sanayi Ticaret A.Ş. tarafından yapılması planlanan Alparslan II Barajı ve HES (288.66 MWm / 280 MWe) projesi alanında Kültür ve Tabiat Varlıklarını Koruma Yüksek Kurulu'nun "Baraj Alanlarından Etkilenen Taşınmaz Kültür Varlıklarının Korunması" başlıklı ilke kararı gereğince üniversitelerden ve Bakanlık uzmanlarından oluşacak bir heyet tarafından mevcut ve olası taşınmaz kültür varlıklarının envanter ve belgeleme çalışmalarının yapılması gerekmektedir.

Söz konusu Barajın yapılacağı alanın bir örneği ilişikte gönderilen ilgi (b) yazı ile çalışmalara katılması uygun görülen Yüzüncü Yıl Üniversitesi, Edebiyat Fakültesi, Arkeoloji Bölümü öğretim üyelerinden Yrd. Doç. Dr. Hanifi BİBER ve Van Kültür Varlıklarını Koruma Bölge Kurulu Müdürlüğü uzmanlarının oluşturacağı bir komisyon tarafından incelenmesi; çalışmalar için gerekli eşgüdümün Van Kültür Varlıklarını Koruma Bölge Kurulu Müdürlüğü tarafından sağlanması; çalışmaların başlatılabilmesi için Yrd. Doç. Dr. Hanifi BİBER'le irtibata geçilmesi ve yapılan işlemler sonucundan bilgi verilmesi hususunda bilgilerinizi ve gereğini arz / rica ederim.

N. Serhad AKCAN
Bakan a.
Genel Müdür Yardımcısı

DAĞITIM:

Gereği:
-Van Kültür Varlıklarını Koruma Bölge Kurulu Müdürlüğüne (Ek konuldu)

Bilgi:
- Muş Valiliğine
(İl Kültür ve Turizm Müdürlüğü)
- Çevre ve Şehircilik Bakanlığına
(Çevresel Etki ve Değerlendirmesi, İzin ve Denetim Genel Müdürlüğü)
- Encon Çevre Danışmanlık Ltd. Şti.
Reşit Galip Cad. No:120
06700 Gaziosmanpaşa/Ankara
- Sn: Hanifi BİBER
Yüzüncü Yıl Üniversitesi
Edebiyat Fakültesi - Arkeoloji Bölümü
Van

Türkiye

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e-posta: kulturvarlikmuze@kulturturizm.gov.tr

Official Letter of Ministry of Culture and Tourism Regarding the Cultural and Natural Properties in the Project Area

GEM, 110

T.C.
KÜLTÜR VE TURİZM BAKANLIĞI
Van Kültür Varlıklarını Koruma
Bölge Kurulu Müdürlüğü

Sayı :B.16.0.KVM.4.65.00.02.49.05/ 09 – 366 — 23./12/2011
Konu :Muş İli, Alpaslan II Barajı ve HES Projesi

Encon Çevre Danışmanlık Ltd. Şti.
Reşit Galip Caddesi, no:120 06700
Balgat / ANKARA

İlgi : Kültür Varlıkları ve Müzeler Genel Müdürlüğü'nün 24/10/2011 tarihli ve216400 sayılı yazısı.

Muş İli Merkez ve Varto İlçesi, sınırları içinde Murat Nehri üzerinde yapılması planlanan Alpaslan II Barajı ve HES projesine ilişkin Van Kültür Varlıklarını Koruma Bölge Kurulu'nun **08.12.2011** tarih ve **64** sayılı kararı ekte sunulmuştur. 2863 Sayılı Kültür ve Tabiat Varlıklarını Koruma Kanunu ve bu kanuna göre çıkarılan Korunması Gerekli Kültür ve Tabiat Varlıklarının Tespiti-Tescili Hakkındaki Yönetmelik gereğince; Tescil edilen korunması gerekli taşınmaz kültür varlıkları kararlarının, Valiliğinizce/Kaymakamlığınızca en geç 3 gün içinde ilan tahtalarına asılması, Belediye hoparlörü ile duyurmak ve Köy Muhtarlığına bildirmek sureti ile ilan edilerek ilan tutanağının Müdürlüğümüze gönderilmesi ve Tapu Kütüğünün beyanlar hanesine, "Korunması Gerekli Taşınmaz Kültür Varlığı" olduğuna dair kayıt konulması gerekmektedir.

Bilgilerinizi ve gereğini arz ve rica ederim.

Haşim ÖLMEZ
Bölge Kurulu Müdürü

EKLER: 1 Kurul Kararı (1 sayfa)
2 Sit Fişi (3 sayfa)

DAĞITIM:

Gereği:
- Muş Valiliğine(Ek 2 konmadı)
  (İl Kültür ve Turizm Müdürlüğü)
  (İl Çevre ve Şehircilik Müdürlüğü)
  (İl Özel İdaresi Genel Sekreterliği)
  (Kadastro Müdürlüğü)
  (Tapu Müdürlüğü)
- Varto Kaymakamlığına(Ek 2 konmadı)
- Varto Tapu Müdürlüğüne(Ek 2 konmadı)
- Encon Çevre Danışmanlık Ltd. Şti. Reşit Galip Caddesi, no:120 06700 Balgat / ANKARA(Ek 2 konmadı)

Bilgi:
- Kültür Varlıkları ve Müzeler Genel Müd
  (Kurullar Dairesi Başkanlığı)
  (Teşvik ve Emlak Dairesi Başkanlığı) (Ek 2 konmadı)
  (Dünya Miras Alanları Plan. ve Tespit Dai. Bşk.)
  (Kazılar ve Araştırmalar Dairesi Başkanlığı) (Ek 2 konmadı)
- Kültür ve Turizm Bakanlığına(Ek 2 konmadı)
  (Yatırım ve İşletmeler Genel Müdürlüğü)
- Çevre ve Şehircilik Bakanlığına(Ek 2 konmadı)
  (Çevresel Etki ve Değ. İzin ve Denetim Genel Müd.)
- İLBANK A.Ş Genel Müdürlüğü (Ek 2 konmadı)
- Tepeköy Köyü Muhtarlığına(Ek 2 konmadı)
- Mescitli Köyü Muhtarlığına(Ek 2 konmadı)
- Sayın Yard.Doç. Dr. Hanifi BİBER(Ek 2 konmadı) YYÜ Edb. Fak. Arkeoloji Bölümü VAN

Kültür Merkezi İdari Bina 2. Kat 65100 – V A N Tel: 0 432 2120858 – 2120851, Faks: 0 432 2120856

Official Letter of Ministry of Culture and Tourism Regarding the Cultural and Natural Properties in the Project Area

49.05/09

T.C.
KÜLTÜR VE TURİZM BAKANLIĞI
VAN KÜLTÜR VARLIKLARINI
KORUMA BÖLGE KURULU

KARAR

Toplantı Tarihi ve No : 08.12.2011 - 04
Karar Tarihi ve No : 08.12.2011 - 64

Toplantı Yeri
ANKARA

Muş İli, Merkez ve Varto İlçeleri sınırları içerisinde, Murat Alpaslan II Enerji Üretim ve Madencilik Sanayi Ticaret A.Ş tarafından yapılması planlanan Alpaslan II Barajı ve HES Projesine ilişkin, Kültür Varlıkları ve Müzeler Genel Müdürlüğü'nün 24/ 10/2011 tarih ve 216400 sayılı yazısı, Kültür ve Tabiat Varlıklarını Koruma Yüksek Kurulu'nun 22.04.2010 tarih ve 765 sayılı İlke Kararı, Kayalıdere Urartu Yerleşmesinin tesciline ilişkin Erzurum Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulunun 27/06/1900 tarih ve 249 sayılı kararı ve 01/12/2011 tarihli Bilim Komisyonu raporu ile Van Kültür Varlıklarını Koruma Bölge Kurulu Müdürlüğü' nün konuya ilişkin hazırlanan 07.12.2011 tarihli ve 66 sayılı uzman raporu okundu, ekleri ve konuya ilişkin bilgi ve belgeler incelendi. Yapılan görüşmeler sonunda;

Muş İli, Merkez ve Varto İlçeleri sınırları içerisinde yer alan Alpaslan II Barajı ve HES projesine ilişkin olarak;
Tepeköy Höyüğü, Doğdab Kalesi ve Mescitli Köyünde bulunan Kız Kalesi'nin 2863 sayılı Kültür ve Tabiat Varlıklarını Koruma Kanununun 6. Maddesindeki özellikleri taşımasından dolayı aynı kanunun 7. Maddesine göre tesciline ve I. Derece Arkeolojik Sit Alanı olarak belirlenmesinin uygun olduğuna, ayrıca bilimsel komisyon raporunda tesciline gerek görülmeyen Abdurrahman Paşa Köprüsünün Kurul Müdürlüğünün Arkeoloji ve Sanat Tarihi uzmanları tarafından tekrar incelenmesine, baraj altında kalacak kültür varlıklarına ilişkin olarak yapılacak kurtarma kazıları ile baraj çalışmalarının eş zamanlı olarak yürütülmesine ve sular altında kalacak höyüklerin kültür katmanlarının belgelenerek gün ışığına çıkarılmasına karar verildi.

BAŞKAN
Prof. Dr.
Oktay BELLİ
(İmza)

BAŞKAN YARDIMCISI
Prof. Dr.
Işık AKSULU
(İmza)

ÜYE
Yrd. Doç. Dr.
Osman AYTEKİN
(İmza)

ÜYE
Yrd. Doç. Dr.
Ayfer YAZGAN
(İmza)

ÜYE
Yrd. Doç. Dr.
Gülsen BAŞ
(İmza)

ÜYE
Ali Kamil YALÇIN
(İmza)

ÜYE
Akif KURTULUŞ
(İmza)

TEMSİLCİ ÜYE
Muş Valiliği Tem.
(Bulunmadı)

ASLININ AYNIDIR
13/12/2011

Haşim ÖLMEZ
Bölge Kurulu Müdürü

Official Letter is issued by Ministry of Transportaton Maritime Affairs and Communications is related to the Relocation Road Construction of Alpaslan II Dam and HEPP Project

T.C.
ULAŞTIRMA, DENİZCİLİK VE HABERLEŞME BAKANLIĞI
Karayolları Genel Müdürlüğü 11. Bölge Müdürlüğü

29 Mart 2012

SAYI : B.11.1.TCK.1.11.06.00- 10069
KONU: Alpaslan II Barajı ve HES Projesi ÇED Raporu

ALPASLAN II ENERJİ ÜRETİM VE MADENCİLİK SAN.TİC.A.Ş.
Ehlibeyt Mah. Ceyhun Atuf Kansu Cad. Başkent Plaza No:106 Balgat/ANKARA

İlgi: 23.03.2012 tarih ve PDIR-ANK-ALP2/12-388 sayılı yazınız.

İlgi yazınızda söz konusu olan Alpaslan II Barajı ve HES Projesi (Baraj, HES, Malzeme Ocakları, Kırma-Taş Eleme-Yıkama Tesisi, Beton Santrali) için hazırlanan ÇED çalışmalarının Çevre ve Şehircilik Bakanlığına sunulabilmesi için kurum görüşü istenmektedir.

Söz konusu Alpaslan II Barajından dolayı firmanız tarafından baraj rezervuar alanında kalan kısım için rölekasyon proje çalışmalarına altlık olacak öneri ripaj güzergahları İdaremize sunulmuştur.Ripaj projelerinin öneri alternatifleri İdaremizce değerlendirilmektedir.

Proje çalışmalarının tamamlanmasına müteakip Kurumumuzla firmanız arasında imzalanacak protokoller neticesinde yol yapım çalışması firmanız tarafından yapılacaktır. ÇED projesi yol projesi ile birlikte yapılıp değerlendirilecektir. Baraj inşaatı ile ilgili kısımlardaki mevcut yol güzergahına ait ÇED çalışması ripaj projesinden sonra sonuçlanabilecektir.

Gereğini bilgilerine rica ederim.

Ahmet YÖNDER
Bölge Müdürü a.
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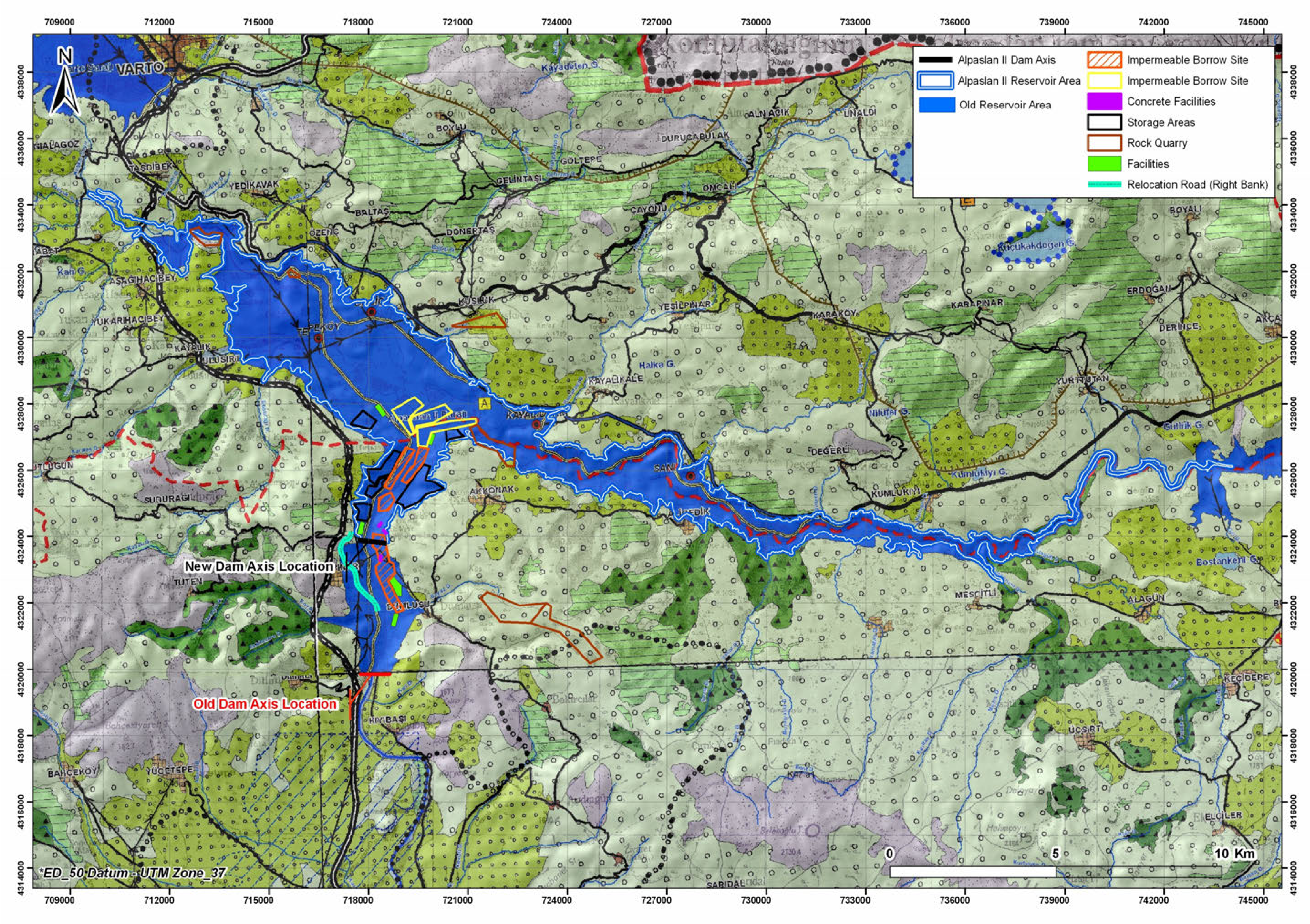
M. Ziya EKEN (Etüt Proje ve Çevre Başmüh.)

APP 3

COORDINATES (CD)

APP 4

ENVIRONMENTAL MASTER PLAN



App. 4.1. Environmental Master Plan and Representations of the Project Units on the Plan

App. 4.2. Environmental Master Plan Legend

1. AMAÇ

Muş, Bitlis ve Van illerini kapsayan 1/100.000 ölçekli Çevre Düzeni Planı'nda temel amaç; dengeli ve sürekli kalkınma amacına uygun olarak ekonomik kararlarla ekolojik kararların bir arada düşünülmesine imkân veren rasyonel doğal kaynak kullanımını sağlamak üzere; planlama bölgesi içindeki kırsaldan kent merkezlerine yaşanan göçün durdurulmasının yanı sıra kente göçen nüfusun tekrar kırsala dönmesini sağlayacak önlemlerin/kararların alınması, bölgenin ekonomik yapısının temellerini oluşturan tarım/hayvancılık sektörünün geliştirilmesine yönelik kararların üretilmesi, göç nedeniyle kentlerde oluşan istihdam fazlası nüfus için istihdam olanaklarının yaratılması, sağlıksız ve çarpık yapılaşmanın yarattığı sorunların ortadan kaldırılması, kentleşme ve sanayileşmenin kontrollü gelişiminin sağlanması ile gelişmelerin sürdürülebilir kılınması, bölgenin ekonomisinde büyük önemi olan mera ve tarımsal arazilerin korunması, ekolojik dengeyi bozacak müdahalelerin engellenmesi, kültürel ve doğal değerlerin korunmasını sağlayacak, arazi kullanım deseninin yönlendirilmesidir.

2. KAPSAM

1/100.000 Ölçekli Çevre Düzeni Planı çalışması, belirlenen amaç doğrultusunda, planlama bölgesini oluşturan Muş, Bitlis ve Van illerinin bütününde, 2035 yılına yönelik olarak, planlama kararlarını doğrudan ya da dolaylı etkileyecek sorunların saptanması, yasal, doğal ve yapay eşiklerin belirlenmesi, koruma kararlarının ve sektörel gelişme önerilerinin, koruma-kullanma dengesi gözetilerek arazi kullanım kararlarına dönüştürülmesini kapsamaktadır.

3. PLANLAMA HEDEFLERİ

1/100.000 ölçekli Muş- Bitlis- Van Planlama Bölgesi Çevre Düzeni Planının amacı uygun gerçekleştirilmesi, belirlenen hedeflere ulaşılabilmesi için, ülke ölçeğinde kalkınma planlarından, yerel birimlerce üretilen plan kararları ve geliştirilen yatırım programlarına kadar, mekansal gelişmeleri ve demografik hareketleri yönlendirecek tüm kararların derlenmesi ve bir arada yorumlanması zorunludur.

Belirlenen amaç doğrultusunda;

- Planlama Bölgesini oluşturan alan bütününde koruma-kullanma dengesini gözetmek,
- Doğal, kültürel, tarihsel, sosyal ve ekonomik değerlerini korumak ve geliştirmek,
- Ulusal ve yerel tercihler doğrultusunda, mevcut ve gelişmesi olası sektörleri desteklemek,
- Ortak sorunlara ortaklaşılan çözümleri geliştirmek,
- Yerel katılımı ve ortaklığı sağlamak,
- Alt ölçekte yapılacak planları yönlendirecek, bütüncül planlama kararlarını üretmek

çalışmanın temel hedefleri olarak belirlenmiştir.

4. TANIMLAR

4.1. Bakanlık: T.C. Çevre ve Orman Bakanlığı'dır.

4.2. Uygulamadan Sorumlu İdareler: T.C. Çevre ve Orman Bakanlığı, Planlama Bölgesi içinde yer alan Valilikler, İl Özel İdareleri, Muş, Bitlis, Van illerindeki İl Belediyeleri, İlçe Belediyeleri ve Belde Belediyeleri ile konusuna göre yetkili kurum ve kuruluşlardır.

4.3. İlgili Kurum ve Kuruluşlar: Bu planın yapımı sırasında işbirliği yapılan, görüşleri alınan, uygulama aşamasında ve alt ölçekli planlama çalışmalarında görüşlerine başvurulacak olan, ilgili mevzuat doğrultusunda yetkilendirilen kurum ve kuruluşlardır.

4.4. Kentsel Yerleşme Alanları: Bu planla belirlenmiş kentsel yerleşik alanlar ve kentsel gelişme alanları ile bu alanlarla bütünleşen diğer kentsel kullanım alanlarından oluşan bütünü ifade eder.

4.5. Kentsel Yerleşik Alanlar: İl, İlçe ve Belde Belediye sınırları içinde var olan, içinde boş alanları barındırsa da büyük oranda yapılaşmış olan alanlardır.

4.6. Kentsel Gelişme Alanları: Bu planın hedef yılı ilişkin nüfus kabulleri ile ilke ve stratejilere göre bu planla kentsel yerleşime uygun bulunan, organize sanayi ve sanayi alanları dışındaki diğer kentsel kullanımların geliştirileceği alanlardır.

4.7. Brüt Yoğunluk: Projeksiyon sonucu elde edilen ve kabul edilen kentsel nüfusun kentsel gelişme alanlarına oranıdır. (kişi/ha.)

4.8. Kırsal Yerleşme Alanları: Kentsel yerleşme alanları dışında kalan köy ve mezraları kapsayan, 3194 sayılı İmar Kanunu'nun ilgili Yönetmeliği uyarınca köy yerleşik alanı ve civarına ilişkin sınır tespiti yapılmış / yapılmamış ve bu planda sınırları şematik olarak gösterilmiş veya plan ölçeği gereği gösterilememiş olan alanlardır.

4.9. Köy ve Mezraların Yerleşik Alanı ve Civarı: Köy ve mezraların cami, köy konağı gibi köy ortak yapıları ile köy nüfusuna kayıtlı ve köyde sürekli oturanlar tarafından, yapımı tarihinde yürürlükte bulunan mevzuat hükümlerine uygun olarak inşa edilmiş yapıların toplu olarak bulunduğu yerlerde mevcut binaların en dışta olanlarının dış kenarlarından geçirilen çizginin içinde kalan alan köy yerleşik (meskûn) alanını; bu çizgi ile 100 m. dışından geçirilecek olan, valiliklerce tespit edilerek İl Özel İdaresince karara bağlanan sınırın içinde kalan alan köy yerleşik alanı civarını tanımlar.

4.10. Organize Sanayi Bölgeleri (OSB): 4562 sayılı "Organize Sanayi Bölgeleri Kanunu"na göre OSB statüsü kazanmış/kazanacak alanlardır.

4.11. Sanayi Alanları: Orta ve büyük ölçekli sanayi işletmelerinin yer aldığı 1593 sayılı "Umumi Hıfzıssıhha Kanunu" ve ilgili yönetmeliğine uygun olarak, çevre ve sağlık koşulları gözetilerek bir arada yer almaları öngörülen her türlü sanayi tesislerine ayrılan alanlardır.

4.12. Depolama Alanları: Endüstriyel hammadde ve mamul ürünler ile tarım ürünlerinin açık ya da kapalı depolanması amacıyla düzenlenmiş alanlardır.

4.13. Küçük Sanayi Siteleri: Küçük ölçekte sanayi işletmelerinin yer aldığı, daha çok doğrudan kentliye yönelik hizmet üreten 1593 sayılı "Umumi Hıfzıssıhha Kanunu" ve ilgili yönetmeliğine uygun olarak çevre ve sağlık koşulları açısından ayrılmaları ve gruplaşmaları gerekli görülen iş türlerinin bir arada konumlandığı alanlardır.

4.14. Organize Tarım/Hayvancılık Bölgeleri: Tarım ve hayvancılık faaliyetlerinin sürdürüleceği ve tarımsal ürünlerin katma değerlerini artırmaya yönelik araştırma, geliştirme ve üretim birimleri ile ürün toplama, depolama, saklama alanları; tarımsal amaçlı yapılar ve tarımsal amaçlı entegre tesislerin toplu olarak (organize şekilde) yer alabileceği alanlardır.

4.15. Teknopark Alanları: Yüksek/İleri teknoloji kullanan ya da yeni teknolojilere yönelik küçük ya da orta ölçekli firmaların, belirli bir üniversite ya da araştırma kurumunun olanaklarından yararlanarak teknolojik bir buluşu ticari bir ürün, yöntem ya da hizmet haline dönüştürmek için faaliyet gösterdikleri (ve bu yolla bölgenin kalkınmasına katkıda bulundukları) aynı üniversite ya da araştırma kurumu yakınında kurulmuş sitelerdir.

4.16. Üniversite Yerleşke Alanları: Lisans, Lisansüstü Eğitim, Araştırma-Bilgi Üretim ve İletişim Merkezi işlevlerini yüklenen ve içerisinde Teknoparkların da yer alabileceği alanlardır.

4.17. Askeri Alanlar: 2565 sayılı "Askeri Yasak Bölgeler ve Güvenlik Bölgeleri Kanunu" uyarınca belirlenmiş alanlardır.

4.18. Büyük Alan Kullanımı Gerektiren Kamu Kuruluş Alanları: Kent bütününe ve çevresine hizmet eden, içerisinde kamu hizmet birimlerinin yer aldığı alanlardır.

4.19. Konut Dışı Kentsel Çalışma Alanları: İçinde karayolu servis hizmetleri verecek tesisler, şehirlerarası, uluslararası taşımacılık ile ilgili kargo, lojistik faaliyetleri, yanıcı parlayıcı patlayıcı mal içermeyen depolar, beton santralleri, kirletici etkisi ve atığı olmayan imalathaneler, resmi yada özel, idari, sosyal kültürel tesisler, çok amaçlı salonlar, sağlık, eğitim, yurt, spor tesisleri, bölgesel marketler, iş ve ticaret merkezleri ile bu faaliyetlerin gerektirdiği teknik altyapı tesislerinin yer aldığı alanlardır.

4.20. Turizm Merkezleri: Kültür ve turizm koruma ve gelişim bölgeleri içinde veya dışında, öncelikle geliştirilmesi öngörülen; yeri, mevkii ve sınırları 4957/2634 sayılı Turizmi Teşvik Kanunu uyarınca T.C. Kültür ve Turizm Bakanlığı'nın önerisi ve Bakanlar Kurulu kararıyla tespit ve ilan edilen/edilecek, turizm hareketleri ve faaliyetleri yönünden önem taşıyan alanlardır.

4.21. Turizm Tesis Alanları: Turizm amaçlı tesislerin ve bu tesislerin tamamlayıcı unsurlarının yer aldığı/alacağı kullanım alanlarıdır.

4.22. Kış Sporu ve Kayak Merkezleri: Kayak yapılması amacıyla farklı noktalar arasında ulaşıma yönelik teleferik, telesiyej, teleski, telekabin gibi mekanik düzenlemeler ile konaklama tesislerinin yer alabileceği alanlardır.

4.23. Ekoturizm Alanları: Doğal kaynakların sürdürülebilirliğini güvence altına alarak; yayla turizmi, ornitoloji (kuş gözleme) turizmi, foto safari, akarsu sporları (kanoraftıng), çiftlik turizmi, botanik (bitki inceleme) turizmi, bisiklet turları, atlı doğa yürüyüşü, kamp-karavan turizmi, mağara turizmi, dağ turizmi ve doğa yürüyüşü, botanik (bitki inceleme) gibi turizm faaliyetlerinin gerçekleştirildiği alanlardır.

4.24. Termal Turizm Tesis Alanları: Mineralize termal sularla çamurların, yörelerinde çevre ve iklim faktörleri bileşiminde insan sağlığını olumlu etkilemek için fizik tedavi, rehabilitasyon, egzersiz, diyet gibi destek tedavilerle koordineli kür uygulamalarının gerçekleştirildiği tesislerin bir ya da birkaçının konaklama tesisleri ile bir arada düzenleneceği alanlardır.

4.25. Bölge Parkı ve Büyük Kentsel Yeşil Alanlar: Kentlerin içinde ya da çevresinde, yaşayanların dinlenme, gezinti, spor ve eğlenme gereksinimlerini karşılamaya yönelik düzenlenen aktif ya da pasif nitelikli geniş yeşil alanlardır.

4.26. Fuar, Panayır ve Festival Alanları: Her türden ürün ya da hizmetlerin, teknolojik gelişmelerin, bilgi ve yeniliklerin tanıtımı, pazar bulunabilmesi ve satın alınabilmesi, teknik işbirliği, geleceğe yönelik ticari ilişki kurulması ve geliştirilmesi için, belirli bir takvime bağlı olarak gerçekleştirilen, zaman açısından sınırlandırılmış tanıtım etkinliklerinin gerçekleştirileceği açık ve kapalı sergileme ve satış tesislerinin yapılacağı alanlardır.

4.27. Tarım Arazileri: Sahip olduğu toprak ve iklim özelliklerinin farklı türlerde tarımsal üretim için uygun olduğu belirlenen ve günümüzde tarımsal üretimin gerçekleştiği, sahip olduğu nitelikleriyle korunması ve kullanılması uygun bulunan alanlardır.

4.27.1. Mutlak Tarım Arazileri: Bitkisel üretimde; toprağın fiziksel, kimyasal ve biyolojik özelliklerinin kombinasyonu yöre ortalamasında ürün alınabilmesi için sınırlayıcı olmayan, topoğrafik sınırlamaları yok veya çok az olan; ülkesel, bölgesel veya yerel önemi bulunan, halihazır tarımsal üretimde kullanılan veya bu amaçla kullanıma elverişli olan arazilerdir.

4.27.2. Marjinal Tarım Arazileri: Mutlak tarım arazileri dışında kalan, toprak ve topografik sınırlamalar nedeni ile üzerinde sadece geleneksel toprak işlemeli tarımın yapıldığı arazilerdir.

4.27.3. Özel Ürün Arazisi: Mutlak tarım arazileri dışında kalan, toprak ve topografik sınırlamaları nedeniyle yöreye adapte olmuş bitki türlerinin tamamının tarımının yapılamadığı ancak özel bitkisel ürünlerin yetiştiriciliği ile su ürünleri yetiştiriciliğinin ve avcılığının yapılabildiği, ülkesel, bölgesel veya yerel önemi bulunan arazilerdir.

4.27.4. Dikili Tarım Arazisi: Mutlak ve özel ürün arazileri dışında kalan ve üzerinde yöre ekolojisine uygun çok yıllık ağaç, ağaçcık ve çalı formundaki bitkilerin tarımı yapılan, ülkesel, bölgesel veya yerel önemi bulunan arazilerdir.

4.28. Tarımsal Amaçlı Yapılar: Toprak koruma ve sulamaya yönelik altyapı tesisleri, entegre nitelikte olmayan besicilik ve su ürünleri üretim ve muhafaza tesisleri ile zorunlu olarak tesis edilmesi gerekli olan müştemilatlar, mandıralar, üreticinin bitkisel üretime bağlı olarak elde ettiği ürünü için ihtiyaç duyacağı yeterli boyut ve hacimde depolar, un değirmeni, tarım alet ve makinelerinin muhafazasında kullanılan sundurma ve çiftlik atölyeleri, seralar, yöresel nitelik taşıyan tarımsal ürünlerden, özelliği nedeniyle, hasattan sonra iki saat içinde işlenmediği taktirde ürün kalitesi ve besin değerinin kaybolmasının söz konusu olduğu ürünlerin işlenmesi ve depolanması için kurulan tesisler ile Tarım ve Köy İşleri Bakanlığı tarafından tarımsal amaçlı olduğu kabul edilen, entegre nitelikte olmayan tesislerdir.

4.29. Çayır ve Mera Alanları: 4342 sayılı "Mera Kanunu" kapsamında yer alan, hayvanların otlatılması ve otundan yararlanılması için tahsis edilen ya da bu amaçla kullanılabile cek alanlardır.

4.30. Kayalık ve Taşlık Alanlar: Jeolojik oluşumları nedeniyle ya da erozyon sonucu topraksız kalmış doğal karakteri korunacak alanlardır.

4.31. Orman Alanları: 6831/3373 sayılı "Orman Kanunu" uyarınca saptanmış/ saptanacak alanlardır.

4.32. 2-B Alanları: 6831 sayılı Orman Kanunu'nun 2. maddesinin (b) bendine göre hazine adına orman sınırları dışına çıkarılmış alanlardır.

4.33. Doğal ve Ağaçlık Karakteri Korunacak Alanlar: Orman rejimine tabi olmayan, ancak sahip olduğu doğal bitki örtüsü ve ağaçlık karakterinin korunması gereken alanlardır.

4.34. Fundalık Alanlar: Verimli tarımsal ovalar ile yüksek kesimlerdeki ormanlar arasındaki geçiş bölgelerinde yayılım gösteren ve vejetasyon yapısının bütünlüklü olarak korunması önerilen alanlardır.

4.35. Ağaçlandırılacak Alanlar: Bulundukları yörenin doğal bitki örtüsüne uygun olarak ağaçlandırılma çalışmaları yapılan ya da yapılması önerilen alanlardır.

4.36. Mesire Alanları: Planda hangi kullanımda kaldığına bakılmaksızın 2873 sayılı "Milli Parklar Kanunu" ile 6831 sayılı "Orman Kanunu"na göre tespit ve tescil edilmiş veya edilecek Rekreasyonel ve estetik kaynak değerlere sahip alanlarda kamunun dinlenme, eğlenme (rekreatif) yönünde günübirlik ve/veya geceleme ihtiyaçlarını karşılayan ve arazi kullanım özelliklerine göre gerekli yapı, tesis ve donatılarla kullanıma açılan veya açılmak üzere T.C. Çevre ve Orman

Bakanlığı'nca ayrılan orman ve orman rejimine tabi sahalar ile Orman Genel Müdürlüğü'nün özel mülkiyetinde, işletilmesi Çevre ve Orman Bakanlığı'na verilmiş sahalardır.

4.37. Yaban Hayatı Koruma ve Geliştirme Sahaları: 4915 sayılı "Kara Avcılığı Kanunu" kapsamında, yaban hayatı değerlerine sahip, korunması gerekli yaşam ortamlarının bitki ve hayvan türleri ile birlikte mutlak olarak korunduğu ve devamlılığının sağlandığı sahalardır.

4.38. Tabiat Anıtı: Doğa ve doğa olaylarının meydana getirdiği özellikleri ve bilimsel değere sahip ve milli park esasları dahilinde korunan doğa parçalarıdır.

4.39. Sulak Alanlar: Alçak gelgitte derinliği altı metreyi aşmayan Van Gölü'nü de kapsayan, doğal ya da yapay, sürekli ya da geçici, durgun ya da akar, tatlı, acı ya da tuzlu bütün sular ile bataklık, sazlık, ıslak çayır ve turbalıklardır.

4.40. Sit Alanları: 2863 sayılı "Kültür ve Tabiat Varlıklarını Koruma Kanunu" uyarınca ilan edilen alanlardır.

4.40.1. Arkeolojik Sit: İnsanlığın varoluşundan günümüze kadar ulaşan eski uygarlıkların yer altında, yer üstünde ve su altındaki ürünlerini, yaşadıkları devirlerin sosyal, ekonomik ve kültürel özelliklerini yansıtan her türlü kültür varlığının yer aldığı yerleşmeler ve alanlardır.

4.40.2. Doğal Sit: Jeolojik devirlerle, tarih öncesi ve tarihi devirlere ait olup, ender bulunmaları veya özellikleri ve güzellikleri bakımından korunması gerekli yer üstünde, yer altında veya su altında bulunan korunması gerekli alanlardır.

4.40.3. Kentsel Sit: Mimari, yerel, tarihsel, estetik ve sanat özelliği bulunan ve bir arada bulunmaları sebebiyle tekar tekar taşıdıkları değerden daha fazla değeri olan kültürel ve doğal çevre unsurlarının (yapılar, bahçeler, bitki örtüleri, yerleşim dokuları, duvarlar) birlikte bulundukları alanlardır.

4.40.4. Tarihi Sit: Ulusal tarihimiz ve askeri harp tarihi açısından önemli tarihi olayların gerçekleştiği ve doğal yapısıyla birlikte korunması gerekli alanlardır.

4.41. İçme ve Kullanma Suyu: İnsanların günlük faaliyetlerinde içme, yıkanma, temizlik ve bu gibi ihtiyaçları için kullandıkları, sağlaması gereken özellikleri TS 266 ile belirlenmiş olan, bir toplu su temini sistemi aracılığıyla çok sayıda tüketicinin ortak kullanımına sunulan sulardır.

4.42. İçme ve Kullanma Suyu Rezervuarı: "Su kirliliği kontrol Yönetmeliğinde" tanımlanan ve Devlet Su İşleri Genel Müdürlüğü'nce belirlenen içme ve kullanma suyu temin edilen doğal göller veya bu amaçla oluşturulan baraj rezervuarlarıdır.

4.43. İçme ve Kullanma Suyu Kaynakları: İçme ve kullanma suyu temini amacıyla, "İnsani Tüketim Amaçlı Sular Hakkında Yönetmelik" hükümlerine göre koruma altına alınan su kaynaklarıdır.

4.43.1.İçme ve kullanma suyu koruma kuşakları: "Su Kirliliği Kontrolü Yönetmeliği"nde tanımlanan ve Devlet Su İşleri Genel Müdürlüğü'nce maksimum su seviyesine göre oluşturulan, derecelendirilmiş koruma kuşak alanlarıdır.

4.44. Atık Su Arıtma Tesisi Alanları: Evsel ve endüstriyel atık suların "Kentsel Atık Su Arıtımı Yönetmeliği" uyarınca belirlenen kurallara uygun biçimde arıtıldığı ve bertaraf edildiği tesislerin kurulduğu/kurulacağı alanlardır.

4.45. Atık Bertaraf, Depolama ve Geri Kazanım Tesis Alanları: Üreticisi tarafından atılmak istenen ve toplumun huzuru ile özellikle çevrenin korunması bakımından, düzenli bir şekilde bertaraf edilmesi gereken katı maddelerin ve arıtma çamurunun ilgili mevzuat uyarınca belirlenen kurallara uygun olarak depolandığı ya da bertaraf edildiği tesislerin kurulduğu/kurulacağı alanlardır.

4.46. Tehlikeli Atık Bertaraf Tesisi Alanları: "Tehlikeli Atıkların Kontrolü Yönetmeliği"nde tanımlanan atıkların, ayrı yönetmelikte tanımlanan kurallara ve Atık Yönetimi Genel Esaslarına ilişkin Yönetmelikte belirtilen kurallara uygun olarak bertarafının sağlandığı tesislerin kurulduğu/kurulacağı alanlardır.

4.47. Maden Tesisleri ve Ocaklar: 3213 sayılı "Maden Kanunu" ve ilgili yönetmelik hükümlerine tabi olan ve gruplara ayrılarak tanımlanmış madenler, maden sahaları, madenlerin işletme tesisleri ile geçici tesisler ve ocakların bulunduğu alanlardır.

4.48. Özel Kanunlara Tabi Alanlar: Özel Çevre Koruma Bölgeleri, 2873 sayılı Milli Parklar Kanununa tabi olan alanlar, Tabiatı Koruma Alanları, Tabiat Parkları, Tabiat Anıtları, Yaban Hayatı Koruma ve Geliştirme Sahaları, Kültür ve Turizm Koruma ve Gelişim Bölgeleri, Turizm Merkezleri vb. gibi farklı ölçeklerde planlama yetkileri yerel yönetimler dışındaki kurumlara verilmiş olan alanlardır.

4.49. Sulak Alanlar: "Su Kuşları Yaşama Ortamı Olarak Uluslararası Öneme Sahip Sulak Alanlar Hakkındaki Sözleşme"ye Göre (Ramsar Sözleşmesi), amacı bakımından alçak gelgitte derinliği 6m.'yi aşmayan deniz suyu alanlarını da kapsamak üzere, doğal ya da yapay, sürekli ya da geçici, durgun ya da akar, tatlı, acı ya da tuzlu bütün sular ile bataklık, sazlık, ıslak çayır ve turbalık alanlardır.

4.49.1. Sulak Alan Bölgeleri: Açık su yüzeyleri, lagünler, nehir ağızları, tuzlalar, geçici ve sürekli tatlı ve tuzlu su bataklıkları, sulak çayırlar, sazlıklar ve turbalıklar gibi habitatların oluşturduğu bölgelerdir.

4.49.2. Ekolojik Etkilenme Bölgeleri: Sulak alan ekosistemi ile ilişkili ve sistemi destekleyen göl, akarsu, kuru, kumsal, çalılık, ağaçlık, orman, çayır, mera vb alanlarda habitatların oluştuğu bölgelerdir.

4.49.3. Tampon Bölge: Sulak alan havzasının coğrafi durumu, topoğrafik özellikleri ve arazinin mevcut kullanım durumuna göre; sulak alan ekosistemini korumak maksadı ile ayrılan ve sulak alanın su toplama sınırını geçmemek veya topoğrafik, coğrafik olarak bir sınır değeri bulunmayan düz alanlarda varsa ekolojik etkilenme bölgesinden yoksa sulak alan bölgesinden itibaren azami 2500 metreyi geçmemek üzere ayrılan bölge.

4.50. Önemli Doğa Alanları: Canlı türlerinin sağlıklı topluluklar oluşturmaları ve yaşam döngülerini devam ettirmeleri için gerekli tüm coğrafyaların, doğal özelliklerinin bozulmadan saklanması ilkesi doğrultusunda, doğadaki canlı türlerinin nesillerini sürdürebilmeleri için özel önem taşıyan, korunması gerekli coğrafyalardır. Bu kavram, canlı türleri ve doğal kaynaklarla birlikte yeryüzünün en özel doğal alanlarının korunmasını amaçlamaktadır.

4.51. Jeolojik Sakıncalı Alanlar: Aktif heyelan alanları, sıvılaşma riski taşıyan zeminlerin bulunduğu alanlar, depreme aşırı duyarlı alanlar, aktif fay hatlarının bulunduğu alanlar, tahkimat amaçlı oluşturulmuş kıyı dolgu alanları, kumsallar, plaj kumulları, alüvyon yelpazeleri, % 70 ve üzerinde topografik eğimi olan yamaçlardır.

4.52. Akaryakıt İstasyonları: Dağıtıcı ve bunlarla tek elden satış sözleşmesi yapmış bayilerce ilgili mevzuata uygun (teknik, kalite ve güvenlik) olarak kurulup, bir veya farklı alt başlıktan birer akaryakıt dağıtıcısının tescilli markası altında faaliyette bulunan ve asıl olarak araçların akaryakıt, madeni yağ, otogaz, LPG, temizlik ve zorunlu olarak bakım ile kullanıcıların tüplü LPG hariç diğer asgari ihtiyaçlarını karşılayacak imkanları sunan yerlerdir.

5. ÇEVRE DÜZENİ PLANI GENEL İLKELERİ

Muş- Bitlis-Van Planlama Bölgesi 1/100.000 Ölçekli Çevre Düzeni Planında genel ilke ve hedefler çerçevesinde planlama kararları belirlenmiştir. Bu kararların başında yerleşmelerin kimliklerini, birbirleri ile ilişkilerini belirleyen tanımların oluşturulması ve ülke içindeki ekonomik ve sosyal gelişim stratejilerinin belirlenmesi gelmektedir.

5.1. Koruma İlkeleri:

5.1.1. İçme ve kullanma suyu ile tarımsal sulama amacıyla kullanılan ve kullanılacak olan barajların, rezervuarların, yer altı su kaynaklarının korunması, suların her alanda dengeli ve verimli kullanımının sağlanması.

5.1.2. 2863 Sayılı Kültür ve Tabiat Varlıklarını Koruma Kanunu uyarınca belirlenen sit alanlarının, kültür ve tabiat varlıklarının korunmasının sağlanması.

5.1.3. Orman alanlarının ve orman özelliği gösterdiği belirlenen ağaçlık alanların, fındıklık-çalılık alanların doğal karakterinin korunması.

5.1.4. İlgili mevzuat doğrultusunda mera olarak belirlenmiş olan alanlar ile mera amacıyla kullanılan alanların korunması. Mera olarak kullanılan ancak henüz mera olarak tescil edilmemiş alanların tescil işlemlerinin tamamlanması.

5.1.5. Sulama yatırımları gerçekleştirilmiş alanlar ile ilgili kuruluşların yatırım programında yer alan sulama alanlarının korunması.

5.1.6. Nitelikli tarım toprakları başta olmak üzere, tarımsal amaçlarla kullanılan, kullanılabilecek olan tarım arazilerinin korunması.

5.1.7. Ulusal ve uluslararası mevzuatla belirlenmiş/belirlenecek hassas alan ve ekosistemlerin, biyolojik çeşitliliğin korunması.

5.1.8. Flora ve fauna açısından zengin sulak alanlar, akarsular, göller, sazlık alanlar ve önemli doğa alanlarının korunması.

5.1.9. Yaban hayatının, nesli tehlike altında olan türlerin yaşama ve üreme alanlarının korunması.

5.1.10. Göl ve akarsu kıyı ekosistemlerinin korunması.

5.1.11. Van Gölü'nün katı atıklar ve atık suların zararlı etkilerinden korunması esas olup, bu amaçla düzenli depolama ve arıtma sistemlerine geçilmesi.

5.1.12. Erozyon, heyelan, taşkın vb. afetlerden korunmaya ilişkin önlemlerin alınması.

5.2. Geliştirme İlkeleri:

5.2.1. Kentsel ve kırsal mekansal gelişme gereksinimlerinin "Koruma-Kullanma Dengesi" gözetilerek karşılanması.

5.2.2. Tüm gelişme alanlarının doğal eşikler dikkate alınarak, verimli tarım alanlarına ve doğal kaynak değerlerine zarar vermeyecek biçimde geliştirilmesi.

5.2.3. Planlama Bölgesi içinde yer alan yerleşmelerin, sosyal ve teknik altyapı standartları yüksek, sağlıklı yaşanabilir yoğunlukta gelişmesinin sağlanması.

5.2.4. Endüstriyel gelişmelerin "Organize Sanayi Bölgeleri" içine yönlendirilmesi .

5.2.5. Sektörel gelişmelerin, yerel potansiyeller de dikkate alınarak, dengeli kalkınmayı gözetecek biçimde geliştirilmesi.

5.2.6. Tarımsal üretim ve hayvancılığın desteklenmesi, geliştirilmesi.

5.2.7. 4342 sayılı Mera Kanunu kapsamında kalan alanlarda ilgili mevzuat kapsamında, belirlenecek kurallara uygun bir şekilde kullandırılmasını, bakım ve ıslahının yapılarak verimliliklerinin artırılmasını ve sürdürülmesini, kullanımlarının sürekli olarak denetlenmesi.

5.2.8. Planlama bölgesinin sahip olduğu arkeolojik, doğal, kültürel ve rekreasyonel değerlerin koruma kullanma dengesi gözetilerek turizm faaliyetlerinin geliştirilmesinde/çeşitlendirilmesinde kullanılmasını sağlamak.

5.3. Planlama İlkeleri:

5.3.1. Kentsel ve kırsal gelişme yönlerinin ve alanlarının, hedef yıla ilişkin nüfus kabulleri ve gelişme potansiyelleri doğrultusunda belirlenmesi.

5.3.2. Mekansal kullanım kararlarının, koruma kararları ve sektörel gelişme eğilimleri dikkate alınarak verilmesi.

5.3.3. Endüstriyel gelişmelerin mevzii kararlarla korunacak alanlar içinde yapılaşmasını önleyecek kararların geliştirilmesi, mevcut tesislerin çevresel etkilerinin kontrol altına alınması.

5.3.4. Atıklardan kaynaklanan çevre kirliliğinin kısa süre içinde giderilmesi amacıyla, atık bertaraf ve depolama tesislerinin, su temini ve atık su geri kazanım tesislerinin hizmet birlikleri aracılığıyla yapılması ve işletilmesinin sağlanması.

6. GENEL HÜKÜMLER

6.1. Çevre Düzeni Planı kararları, plan hükümleri ve plan açıklama raporu ile bir bütündür.

6.2. Onaylanan 1/100.000 ölçekli çevre düzeni planlarının birer kopyası planlama bölgesini oluşturan üç valiliğe bakanlık tarafından gönderilir. Planın ilgili kurum ve kuruluşlara dağıtılmasından valilikler sorumludur.

6.3. Bu plandan ölçü alınarak imar uygulamasına geçilemez. Bu plan ile belirlenen kentsel gelişme alanları, bu alanların tamamının yerleşime açılacağını göstermez. Bu alanların sınırları, alt ölçekli planlama çalışmalarında ilgili kurum ve kuruluşların görüşleri ile doğal, yapay ve yasal eşikler doğrultusunda, bu planda ve plan hükümleri ekinde yer alan tabloda belirlenen hedef nüfus ve alansal büyüklük dikkate alınarak kesinleştirilir.

6.4. Kentsel gelişme alanlarının nazım imar planları, bu planın yerleşmeler için öngördüğü projeksiyon nüfusu, alansal büyüklük, ilke ve stratejiler dikkate alınarak, bütüncül yapılacak olup, uygulama imar planları etaplar halinde planlanabilir.

6.5. Bu planın onayından sonra, planın ilkeleri, stratejileri, kararları ve hükümlerine uygun olmak koşulu ile 1/25.000 ölçekli çevre düzeni planları 5302 sayılı "İl Özel İdaresi Kanunu" hükümlerine göre yapılabilir.

6.6. Bu planda kentsel yerleşme alanı olarak tanımlanmış alanlarda, planın onayından önce düzensiz olarak yapılaşmış alanların çevre kalitesinin yükseltilmesi amacıyla sağlıklılaştırılması ve yenilenmesi esastır.

6.7. Bu planın onama tarihinden önce mevzuata uygun olarak onaylanmış mevzi imar planları yürürlüktedir. Yürürlükteki mevzi imar planlarında Çevre düzeni planının ilkelerine aykırı değişiklik veya ilave yapılamaz.

Söz konusu planlarda yapılacak yol kaydırması, uygulama ve aplikasyon hatalarının giderilmesi gibi değişiklik talepleri, yoğunluk arttırıcı, işlev değişikliği kararları içermediği sürece ilgili idare tarafından değerlendirilir.

6.8. Plan sınırları içerisinde yer alan sit alanlarında (planda gösterilen veya gösterilmeyen) ilgili koruma bölge kurulları tarafından alınmış kurul kararları ile bu planın onayından önce onaylanmış koruma amaçlı imar planları yürürlüktedir.

6.9. Bu planın onayından sonra ilan edilecek sitler ile koruma amaçlı imar planı bulunmayan sitlerde ilgili idarelerce hazırlanacak koruma amaçlı imar planları ilgili kurum ve kuruluşlarının görüşleri alınmak üzere ilgili Koruma Kurullarınca değerlendirilir.

6.10. Bu planın ilke ve stratejileri doğrultusunda yapılacak alt ölçekli planlarda, ilgili kurum ve kuruluşların görüşleri alınacaktır.

6.11. Bu plan sınırları içinde, kamu yararının gerektirdiği, güvenlik, sağlık, eğitim, v.b. sosyal donatı alanları, belediye hizmet alanı, büyük kentsel yeşil alanlar, kent veya bölge / havza bütününe yönelik her türlü atık bertaraf tesisleri ve bunlarla bütünleşmiş geri kazanım tesisleri, arıtma tesisleri, sosyal ve teknik altyapı, karayolu, demiryolu, denizyolu, havaalanı, baraj, enerji üretimi ve enerji iletimi ve doğalgaz depolamasına ilişkin kullanımların alt ölçekli planları, ÇED Yönetmeliği kapsamında kalanlar için "Çevresel Etki Değerlendirmesi Olumlu" veya "Çevresel Etki Değerlendirmesi Gerekli Değildir" kararının bulunması, ÇED Yönetmeliği kapsamı dışında olanlar için ise ilgili kurum ve kuruluşların uygun görüşü olması kaydı ile Çevre Düzeni Planı değişikliğine gerek olmaksızın ilgili idaresince hazırlanır ve onaylanır. Onaylanan planlar sayısal ortamda veri tabanına işlenmek üzere Bakanlığa gönderilir. Söz konusu tesisler / tesis alanları amacı dışında kullanılamaz.

6.12. Bu plan sınırları içinde, kentsel ya da kırsal yerleşme alanları içinde ya da dışında ihtiyaç duyulması halinde; Toplu Konut İdaresi'ne (TOKİ) tahsis edilmiş alanlarda TOKİ tarafından üretilecek toplu konut alanlarına ve Özelleştirme İdaresi Başkanlığı'nca yürütülen faaliyetlerin alan kullanım türlerine ilişkin imar planları bu planın koruma, gelişme ve planlama ilkeleri ve nüfus kabulleri doğrultusunda değerlendirilir ve ilgili kurum ve kuruluş görüşleri alınarak ilgili idarelerince onaylanır. Onaylanan alt ölçekli planlar sayısal ortamda veri tabanına işlenmek üzere Bakanlığa gönderilir.

6.13. Her türlü sosyal, kültürel donatı alanı ve teknik altyapı mevzuatla belirlenmiş standartlara uygun olarak alt ölçekli planlarda belirlenecektir.

6.14. Bu planda önerilen devlet yatırımlarına (demiryolu, karayolu, havalimanı v.b.) ilişkin kullanım kararlarının işlerlik kazanabilmesi için ilgili kurumca yatırım programına alınması gereklidir. Bu planın onayından sonra karara bağlanmış olan devlet yatırımları, bu planın ilke ve stratejileri doğrultusunda bu plana işlenir.

6.15. Plan sınırları içerisinde, nazım imar planı çalışmalarında afet riskinin (deprem, sel, heyelan v.b.) değerlendirilmesi, yerleşime esas jeolojik/jeoteknik etütlerin yaptırılması zorunludur. Aktif fay hatlarının bulunduğu alanlarda, taşkın riski bulunan alanlarda ve sıvılaşma riski yüksek alanlarda, yapılacak etütler doğrultusunda gerekli önlemlerin plan kararına dönüştürülmesi zorunludur.

6.16. Bu plan sınırları içindeki tüm orman sayılan yerlere ve orman alanlarına ilişkin konularda 6831 sayılı "Orman Kanunu" uyarınca uygulama yapılacaktır.

6.17. Kirlilik yaratması muhtemel her türlü faaliyet için, faaliyet türüne göre çevre kirliliğini önleme yönünde alınması gereken önlemler ve yapılması gereken işlerin alt ölçekli planlama çalışmalarında belirlenmesi zorunludur.

6.18. Bu planın koruma, gelişme ve planlama ilkelerine aykırı imar planları, değişikliği ve revizyonu yapılamaz.

6.19. Bu planın onayından önce mevzuata uygun olarak yer seçmiş ve yapılaşmış olan sanayi tesislerinde kirliliği önleyici her türlü tedbirin alınması zorunludur.

6.20. Verimli tarım toprakları ve fiilen sulanan veya sulama projeleri ilgili kuruluşlar tarafından hazırlanmış ve yatırım programına alınmış/alınacak tarım topraklarının tarımsal üretim amaçlı korunması zorunludur. Kısmen de olsa kırsal ve kentsel gelişme amaçlı kullanılması zorunlu alanlar için DSİ'nin uygun görüşünün alınması zorunludur.

6.21. Bu plan sınırları içerisinde hedef yıl nüfus dengelerini ve plan bütünlüğünü bozucu yönde noktasal sanayi, konut, ikinci konut, v.b. kullanım kararları oluşturulamaz.

6.22. Bu plan, plan uygulama hükümleri ve plan açıklama raporunda yer almayan konularda, konusu ve ilgisine göre yürürlükteki kanun, tüzük, yönetmelik, tebliğ ve standartlar uygulanır. Bu planın onayından sonra yürürlüğe girecek hukuki metinler ve mevzuatta olabilecek değişiklikler de planlama sınırı içerisinde plan değişikliğine gerek kalmaksızın geçerli olacaktır.

6.23. Bu planda, planın ölçeği gereği gösterilmemiş köy, mahalle ve mezra gibi kırsal yerleşik alanlarda bu planın kırsal alanlarla ilgili 7.1.2. ve 7.1.3. nolu plan hükümleri uygulanır.

6.24. Bu planın onayından sonra idari sınırlarda olabilecek değişikliklerde, plan değişikliğine gerek kalmaksızın yeni idari sınırlar geçerli olacaktır.

6.25. Enerji kaynak alanları 5346 sayılı "Yenilenebilir Enerji Kaynaklarının Elektrik Enerjisi Üretimi Amaçlı Kullanımına İlişkin Kanun" çerçevesinde değerlendirilir.

6.26. Katı Atıkların Düzenli toplanması ve depolanması esas olup bu alanlarda "Katı Atıkların Kontrolü Yönetmeliği" hükümlerinde belirlenen kriterler çerçevesinde uygulama yapılacaktır.

6.27. Planlama alanı bütününde toplu arıtma sistemlerine geçilmesi konusunda entegre projelere ağırlık verilecektir.

6.28. İçme suyu ile tarımsal amaçlı sulama suyu kapsamında kullanılan ve kullanılacak olan barajların su kaynakları ve çevresindeki su toplama havzaları ilgili yönetmelik hükümleri uyarınca korunacaktır.

6.29. Havzadan havzaya, bölgeden bölgeye sınır aşan yüzeysel suların havza içerisinde yer alan ilgili idarelerce korunarak kirletilmeden kullanılmasının sağlanması esastır. Kirliliği önleyici tedbirler ilgili idareler tarafından alınacaktır.

6.30. İçme ve kullanma suyu kaynağı olarak belirlenmiş alanlarda "Su Kirliliği Kontrolü Yönetmeliği" hükümleri geçerlidir. İçme ve kullanma suyu koruma kuşakları içerisinde yer alan tüm kırsal ve kentsel yerleşmelerin altyapıları öncelikle iyileştirilecektir.

6.31. Ulusal ve uluslararası mevzuatla belirlenmiş veya belirlenecek olan hassas alan ve ekosistemler ile flora ve fauna açısından zengin alanlar korunacaktır.

6.32. 5226/3386/2863 sayılı "Kültür ve Tabiat Varlıklarını Koruma Kanunu" uyarınca belirlenen ve belirlenecek olan (Kentsel, Arkeolojik, Doğal, Tarihi) sitler korunacaktır.

6.33. Sulak alan olarak ilan edilen alanlarda, sulak alan yönetim planı oluşturuluncaya kadar "Sulak Alanların Korunması Yönetmeliği" hükümlerine uyulacaktır. Ulusal Sulak Alan Komisyonu (USAK) tarafından alana ilişkin yönetim planının oluşturulması durumunda, çevre düzeni planı değişikliğine gerek kalmadan yönetim planı hükümleri geçerli olacaktır.

6.34. Sulak alan niteliğinde olup henüz sulak alan statüsü kazanmamış alanlar korunacaktır.

6.35. Bu planda önerilen sanayi alanlarının, organize sanayi bölgeleri olarak geliştirilmesi için ilgili idarelerce T.C. Sanayi ve Ticaret Bakanlığı nezdinde girişimde bulunulması sağlanacaktır.

6.36. Mevcut organize sanayi bölgelerindeki çevre sorunlarını önlemek amacıyla, arıtma tesisi bulunmayan bölgelerde arıtma tesisleri iş termin planına göre yapılacaktır. Bu tesislerin verimli çalıştırılması zorunludur.

6.37. İhtiyaç duyulması halinde, akaryakıt ve bakım istasyonlarına ait alt ölçekteki planlar ilgili mevzuatlar ve ilgili kurum kuruluş görüşleri doğrultusunda, ilgili idareler tarafından değerlendirilerek bu planda değişiklik yapılmadan onaylanabilir.

6.38. Bu planda arazi kullanım kararı getirilen, ancak kurum görüşleri doğrultusunda, plan ile getirilen arazi kullanım kararının uygulanması mümkün olmayan alanlarda, arazinin tespit edilen niteliğine göre ilgili plan hükümleri doğrultusunda uygulamaya devam edilir.

6.39. Onaylı İmar Planı Bulunan Kentsel Yerleşme Alanları:

6.39.1. Bu planın onayından önce ilgili idaresince onaylanmış olan ve bu planın ilkelerine, arazi kullanım türlerine, büyüklüklerine ve nüfus kabullerine uygun nazım ve uygulama imar planı bulunan alanlarda, uygulama bu imar planları doğrultusunda sürdürülecektir. Söz konusu imar planlarında, bu planın genel ilkelerine, arazi kullanım türlerine, büyüklüklerine ve nüfus kabullerine aykırı nazım ve uygulama imar planı revizyonu yapılamaz.

6.39.2. Çevre Düzeni Planında kentsel yerleşik alan olarak gösterilmiş olan, büyük oranda yapılaşmasını tamamlamış alanlarda mevzuata uygun olarak onaylanmış imar planı kararları doğrultusunda uygulamaya devam edilir.

6.39.3. Bu planın onayından önce kentsel yerleşik alanlar içinde yer seçmiş ve mevzuata uygun biçimde onaylanmış imar planı bulunan sanayi alanlarında, onaylı planlarında belirlenen yapılaşma koşulları geçerli olup, bu alanlarda hiçbir şekilde endüstriyel yapılaşmada yoğunluk artışı getirecek plan değişikliği / revizyonu ve ilavesi yapılamaz.

6.40. Bu planda kentsel yerleşik alan olarak gösterilen, fakat imar planı bulunmayan alanların, bu planın ilke ve stratejileri ile nüfus kabullerine uygun olarak imar planlarının ivedilikle yapılması zorunludur. İmar planları bütün olarak yapılacaktır.

6.41. Bu plan, mevzuata aykırı olarak yapılaşmış yapılar için herhangi bir hak oluşturmaz. Bu planın onayından önce mevzuata aykırı olarak yapılaşmış olan yapılara, ilgili kanunlar uyarınca ilgili idaresince işlem yapılır.

6.42. Alt ölçekli planlar yapılırken erozyon tehdidi altındaki bölgelerin ağaçlandırılmasına ve taşkın alanlarında derelerin ıslahına ve korunmasına ilişkin plan kararları üretilecektir. "Akarsu ve Dere Yataklarının Islahı" ve "Dere Yatakları ve Taşkınlar" konulu Başbakanlık Genelgeleri çerçevesinde uygulama yapılır. Akarsu yataklarından kum-çakıl alma işlemlerinin kontrol altına alınması amacıyla Çevre ve Orman Bakanlığı'nın "Kum, Çakıl ve Benzeri Maddelerin Alınması, İşletilmesi ve Kontrolü Yönetmeliği"ne uygun şekilde faaliyetler gerçekleştirilir. Erozyon tehdidi altındaki alanlarda yapılacak ağaçlandırma çalışmalarında, Çevre ve Orman Bakanlığı'nın "Ağaçlandırma Yönetmeliği" ile "Ağaçlandırma ve Erozyon Kontrolü Hizmetlerine İlişkin Usul ve Esaslar" çerçevesinde uygulama yapılır.

6.43. Özel Kanunlara Tabi Alanlar:

6.43.1. Özel kanunlarla planlama yetkisi verilen alanların sınırları ve bu alanlara ilişkin varsa ilgili kurumlarca alt ölçeklerde alınmış planlama kararları bu planla bütünleştirilmiştir. Bu alanlarda, bu planın koruma, gelişme ve planlama ilkeleri doğrultusunda, yetkili kurumlarca planlama ve koruma çalışmalarının yapılması esastır.

6.43.2. Bu alanlarda, bu planın onayından önce mevzuata uygun olarak yürürlüğe konmuş olan her tür ve ölçekteki planlar, ilgili kanunlar uyarınca yürürlüktedir.

6.43.3. Bu alanlarda, ilgili kanun hükümleri saklı kalmak kaydı ile bu planda belirlenen arazi kullanım kararlarının sürekliliğinin sağlanması esastır.

6.43.4. Bu alanlarda, bu plan ile belirlenmiş/belirlenecek, hassas alanların, ekoloji ve ekosistem bütünlüğünün devamlılığının sağlanması, koruma kararlarının yaşama geçirilmesi esastır.

6.43.5. Bu alanlarda, sorumlu Bakanlık ya da kuruluşların, kendi yetkisindeki alanların planlanmasında sürdürülebilir kalkınma ve sürdürülebilir çevre ilkelerini gözeterek planlama yapması esastır.

6.43.6. Bu alanlarda veya yakın çevresinde bulunan/bulunması muhtemel hassas alanları, orman alanlarını, tarım alanlarını, sulak alanları vb. alanları tehdit edici yönde ve yoğunlukta yapılaşma kararı getirilemez.

6.43.7. Bu alanlarda çevre kirliliğini önlemek için her türlü tedbirin alınması zorunludur.

6.43.8. Bu alanlar içerisinde yer alan su kaynaklarının korunması esas olup, Su Kirliliği Kontrol Yönetmeliği hükümlerine uyulacaktır.

6.43.9. Bu alanlarda her türlü katı ve sıvı atığın bertarafı için gerekli tesisler yapılır ve hiçbir atık önlemler alınmadan alıcı ortama verilemez.

6.44. Yakma veya düzenli depolamanın yanı sıra fiziksel/kimyasal/biyolojik önişlem ünitelerini içeren entegre atık bertaraf veya geri kazanım tesislerinin yer seçiminde, atığın en yakın ve en uygun olan tesiste bertaraf edilmesi ilkesi çerçevesinde, bölgenin atık miktarı dikkate alınarak ilgili kurum ve kuruluşların görüşü doğrultusunda tesisin yer seçimi belirlenir.

6.45. Barajlara ilişkin uygulama aşamasında baraj gövdesi ve maksimum su kotu altında kalacak olan taşınmazların kamulaştırılarak taşınması, DSİ Genel Müdürlüğünün ilgili yönetmelikleri ve ilgili mevzuat uyarınca yapılacaktır. Taşınacak veya tasfiye edilecek yerleşik alanların yeniden iskânı halinde yeni yer seçimi ve alt ölçekli planları çevre düzeni planı değişikliği yapılmaksızın ilgili kurum ve kuruluşların görüşleri alınarak ilgili idaresince yapılabilecek, onaylanan planlar veri tabanına işlenmek üzere Bakanlığa gönderilecektir.

6.46. Bu planda sembol olarak gösterilen kullanım türlerinde, sembolün bulunduğu alan planın ölçeği gereği yer seçimi kararı verilmiş kesin alan olmayıp bu kullanıma ilişkin yer seçimi ilgili kurum ve kuruluşların görüşleri alınarak alt ölçekli planlarla yapılabilecektir. Ayrıca bu planın ölçeği gereği arazi kullanım türünün ve sınırlarının gösterim tekniği nedeniyle (sembol, yol vb.)algılanamadığı alanlarda bu planın diğer hükümleri dikkate alınarak alt ölçekli planlarda yetkili idarelerce kullanım kararı belirlenir.

7. ÖZEL HÜKÜMLER

7.1. Yerleşme Alanları

7.1.1. Kentsel Yerleşme Alanları: Bu planda kentsel yerleşik alanlar ve kentsel gelişme alanları olarak gösterilmiş olan alanların bütünüdür. Bu planda kentsel yerleşme alanları için yapılmış olan nüfus kabulü esas olmak üzere, kentsel yerleşmeler içindeki yoğunluk dağılımı imar planlarında yapılacaktır. İmar planında yer alacak nüfus, o yerleşme için bu planda getirilen toplam nüfus kabulünü aşamaz.

7.1.1.1. Bu alanlarda; konut ve konut kullanımına hizmet verecek sosyal, kültürel donatı ve teknik altyapı tesisleri ile toptan ve perakende ticaret türleri, küçük sanayi, konut dışı kentsel çalışma alanları, endüstriyel atık su üretmeyen küçük ölçekli üretim yerleri ve ticari depolama kullanımları yer alabilir. Büyük ölçekli sanayi, sanayi depolamaları gibi kullanımlar bu alanlar içinde yer alamaz. Kentsel yerleşik alanlarda var olan sanayi tesisleri, ekonomik ömrü dolduğunda sanayi alanlarına taşınacaktır.

7.1.1.2. Kentsel yerleşme alanları kapsamında önerilen nüfusun ihtiyacı olan sosyal ve teknik altyapı alanları, planların kapsamlarının gerektirdiği biçimde alt ölçekteki planlarda (nazım imar planı ve uygulama imar planları) belirlenecektir.

7.1.1.3. Bu planda kentsel yerleşme alanı olarak gösterilmiş olsun ya da olmasın, bağlı bulundukları kentsel yerleşme merkezlerinden kopuk biçimde konumlanan, belediye sınırları içine alınarak mahalleye dönüşmüş/dönüşecek kırsal yerleşme alanlarında yapılacak alt ölçekli planlamalarda; Çevre Düzeni Planında önerilmiş gelişme alanı varsa bu alan sınırları da dikkate alınarak, gelişme alanı belirlenmemiş yerleşim birimlerinde ise varsa geçmişte belirlenmiş köy yerleşik alanı ve civarına ilişkin sınırlar da dikkate alınarak, yerleşmenin kendi ihtiyacı kadar alanın alt ölçekli planları hazırlanacaktır. Alt ölçekli planlamalarda, yerleşmenin sahip olduğu geleneksel doku ve yapılaşma özellikleri ile çevresindeki alanın doğal özellikleri planlama aşamasında dikkate alınarak plan kararları üretilecektir.

7.1.2. Kırsal Yerleşme Alanları: Bu planda sınırları şematik olarak gösterilmiş olan köy statüsüne sahip yerleşmeler ile bunların mahalle ve bağlı mezralarını kapsayan bu alanlarda, koruma ve gelişim ilkelerine uygun imar planlarının hazırlanması esastır. Planı bulunmayan köy ve mezralar ile belediye sınırları içine katılarak mahalleye dönüştürülmüş/dönüştürülecek kırsal yerleşmelerin yerleşik alanlarında uygulama imar planları yapılıncaya kadar aşağıdaki koşullar uygulanır.

7.1.2.1. İlgili idarece, mevzuata göre onaylanmış bulunan köy yerleşik alanı ve civarına ilişkin sınırlar geçerlidir.

7.1.2.2. Yerleşik alan ve civarına ilişkin sınır tespiti yapılmamış olan köylerle ilgili sınır tespit çalışmaları ilgili idaresince en kısa sürede tamamlanacak, sayısal ortamda veri tabanına işlenmek üzere Bakanlığa gönderilecektir.

7.1.2.3. Onaylı uygulama imar planı bulunmayan köyler ile belediye sınırları içine katılarak mahalleye dönüşmüş kırsal yerleşmelerde uygulama imar planları yapılıncaya kadar, köy yerleşik alanı sınırları içinde ve henüz köy yerleşik alan sınırı belirlenmemiş yerlerde ise tapuda köy içi mevkii içinde yer almak kaydıyla konut, tarım ve hayvancılık amaçlı yapılar yapılabilir.

Bu alanlarda yapılaşma koşulu;

Emsal: 0,50 (müştemilatlar emsale dahildir)

En Fazla Yapı Yüksekliği: 6,50 (2 kat)

Silo, samanlık, yem deposu vb. yapılar için max. Bina yüksekliği ihtiyaç doğrultusunda belirlenir.

7.1.2.4. Kırsal yerleşme alanlarında uygulama imar planları yapılıncaya kadar, konut, tarım ve hayvancılık amaçlı yapılara ilişkin uygulamalar, bu plan ile verilmiş yapılaşma koşullarını aşmamak kaydıyla, 3194 sayılı İmar Kanunu uyarınca çıkarılmış, "Plansız Alanlar İmar Yönetmeliği"nde belirtilen esaslara göre yapılır.

7.1.2.5. Kırsal yerleşme alanlarında, genel ihtiyaçlara yönelik olarak yapılacak idari, sosyal ve ticari tesisler (köy konağı, ibadethane, okul, spor alanı, harman yeri, mezarlık, pazar yeri, sağlık ocağı, sağlık evi, postane, su deposu, karakol, köy bakkalı, köy kahvesi ve lokantası, alt yapı tesisleri v.b.) için yapılaşma koşulları ilgili idaresince belirlenir. Bu kullanımlar dışındaki her türlü faaliyet için (turizm, günübirlik veya bölgesel ticaret kullanımları v.b.) imar planı yapılması zorunlu olup; Emsal 0.50 ve en fazla yapı yüksekliği: 6,50 m. (2 kat) geçemez.

7.1.3. Kırsal Yerleşme Alanlarında Planlama: Belediye mücavir alanı dışındaki ve içindeki köylerde, belediye sınırları içine alınarak mahalleye dönüşen/dönüşecek köylerde yapılacak alt ölçekli planlamalarda, Çevre Düzeni Planında önerilmiş gelişme alanı varsa bu sınırlara da uyularak, gelişme alanı önerilmemiş ise köy yerleşik alanı ve civarında belirlenmiş olan 100 metre genişliğindeki alanda, yapılacak nüfus projeksiyonları doğrultusunda, köyün kendi gereksinimi kadar alanın alt ölçekli planları hazırlanacaktır. Köyün sahip olduğu geleneksel doku ve yapılaşma özellikleri ile çevresindeki alanın doğal özelliklerinin planlama aşamasında dikkate alınarak plan kararları üretilecektir.

7.2. Çalışma Alanları:

7.2.1. Organize Sanayi Bölgeleri (OSB): 4562 sayılı Organize Sanayi Bölgeleri Kanunu'na göre OSB statüsü kazanmış/kazanacak alanlarda OSB Kanunu ve ilgili Yönetmeliklerin hükümleri uygulanır. Onaylı alt ölçekli planı bulunan alanlarda alt ölçekli plan kararlarına göre uygulama sürdürülür.

7.2.1.1. Organize sanayi bölgelerinde bu planın genel kullanım, koruma ve gelişme ilke ve hedefleri çerçevesinde, ilgili kurum ve kuruluş görüşleri doğrultusunda yer tespiti ve uygulaması yapılacaktır. Ancak, altyapı yatırımları vb. nedenlerle yapılacak zorunlu ilaveler dışında, aynı türden organize sanayi bölgesi ilave yer seçimi veya yeni OSB yer seçimi yapılabilmesi için, mevcut OSB'nin en az % 75 doluluk oranına ulaşması gerekmektedir.

7.2.1.2. Bu planın onayından sonra, Organize Sanayi Bölgelerine, OSB Yer Seçim Komisyonu'nca yer seçimi yapılarak Sanayi ve Ticaret Bakanlığı'nca ilave edilen alanların bu planda değişikliğe gerek kalmaksızın alt ölçekli planları hazırlanabilir.

7.2.2. Teknoparklar: Yapılaşma koşulları, 4691 sayılı Teknoloji Geliştirme Bölgeleri Kanunu uyarınca hazırlanacak alt ölçekli nazım imar planı ve uygulama imar planlarında belirlenecektir.

7.2.3. Sanayi Alanları: Çevre Düzeni Planı öncesinde onaylı imar planı bulunan ve kısmen yapılaşmış olan sanayi alanlarında aşağıdaki hükümlere uyulması zorunludur.

7.2.3.1. Bu alanlarda yer alan/alacak, atık suyu olan sanayi tesislerinin atık su arıtma tesisi oluşturması zorunludur. Mevcut kurulu sanayi tesislerinin, atık su arıtma tesislerini 5491 /2872 sayılı Çevre Kanunu hükümleri uyarınca yapmaları ve işletmeleri zorunludur.

7.2.3.2. Bu alanlarda kurulacak sanayi ve depolama türlerine göre "İş Yeri Açma ve Çalışma Ruhsatlarına İlişkin Yönetmelik" uyarınca mülkiyet içerisinde Sağlık Koruma Bandı bırakılacaktır.

7.2.3.3. Bu alanlarda, nazım ve uygulama imar planları onanmadan uygulama yapılamaz.

7.2.3.4. Sanayi alanlarında yapılaşma koşulları, mevzuat, tür, teknoloji vb. unsurlar dikkate alınarak alt ölçekli planlarda belirlenecektir.

7.2.3.5. Çevre kirliliğini önlemek amacıyla belirlenen önlemler ile birlikte "Su Kirliliği Kontrolü Yönetmeliği"nin "Teknik Usuller Tebliği"nde belirtilen kriterler sağlanmadan hiçbir yapı ve tesise iskan ve işletme ruhsatı verilemez.

7.2.3.6. Sanayi amaçlı yapılaşacak parsellerde, emsal dahilinde sanayi hammadde ve mamul madde depoları, idari büro ve servis mekanları da oluşturulabilir.

7.2.3.7. Bu alanlarda yer alacak tesislerin ÇED'e tabi olması halinde ÇED Yönetmeliği hükümleri uygulanır.

7.2.3.8. Yeni oluşacak sanayi taleplerinin bu bölgelere yönlendirilmesi ve aynı sanayi faaliyet türlerinin bir araya getirilmesi sağlanacaktır.

7.2.3.9. Bu planla belirlenmiş olan sanayi alanlarındaki yapılanmalar "Organize Sanayi Bölgeleri Uygulama Yönetmeliği" hükümlerine uygun olarak gerçekleştirilecektir.

7.2.3.10. Bu planın onayından sonra ihtiyaç olması halinde, Planın koruma, kullanma dengelerini gözeten ilke kararları kapsamında öncelikle toprak niteliğinin düşük olduğu alanlarda, ilgili kurum ve kuruluşların uygun görüşleri alınarak minimum 20 ha. alanı sahip olacak şekilde sanayi alanları yer seçimi Bakanlığın görüşüne sunulur.

7.2.4. Küçük Sanayi Sitesi Alanları: Yürürlükteki imar planlarında küçük sanayi sitesi alanı olarak belirlenmiş alanlarda onaylı imar planı hükümleri geçerli olup, söz konusu plan çerçevesinde uygulamaya devam edilecektir. Bu alanlarda yoğunluk arttırıcı plan değişikliği yapılamaz. Yeni küçük sanayi sitesi alanları bu planda Kentsel Yerleşme Alanı olarak gösterilen alanlarda yer alabilir. Yer seçimleri bu kullanımların çevresel etkileri de dikkate alınarak ilgili idareler tarafından ilgili mevzuat çerçevesinde belirlenecektir. Bu alanlara ilişkin olarak hazırlanacak alt ölçekli plan çalışmalarında ilgili kurum ve kuruluşların görüşleri alınarak yapılaşma koşulları alt ölçekli planlarda belirlenecektir.

7.2.5. Depolama Alanları:

7.2.5.1. Bu alanlarda işyeri açma ve çalışma ruhsatlarına ilişkin mevzuat uyarınca depolama türlerine göre mülkiyet içerisinde gerekli sağlık koruma bandı bırakılacaktır.

7.2.5.2. Bu alanlarda açık ve kapalı depolama ve stok alanı, yükleme ve boşaltma alanları, açık ve kapalı otoparklar, garajlar, altyapı tesis alanları yer alabilir. Bu alanlarda yapılacak tesislerin çevresinin ağaçlandırılması zorunludur. Açık ve kapalı depolama tesisleri türü ve yapılaşma koşulları ihtiyaca göre alt ölçekli planlarda belirlenecektir.

7.2.5.3. Bu alanlarda "Tekel dışı bırakılan patlayıcı maddeler ve av malzemesi ve benzerlerinin üretim, ithal, taşınması, saklanması, depolanması, satışı, kullanılması, yok edilmesi, denetlenmesi usul esaslarına ilişkin tüzük"te belirtilen, çevresel olumsuz etkisi bulunan malzemeler için depolama binası yapılamaz. Sadece sanayi ham ve üretim malzemeleri depolanabilir.

7.2.6. Tarımsal Amaçlı Yeraltı Depolama Alanları: Bu alanlardaki uygulamalar ilgili idaresince, gerekli statik hesabı ve proje detayları hazırlanarak ilgili kurum ve kuruluşların görüşleri doğrultusunda planlama alt bölgesi planı yapılmamış olsa da, yeterli hacim ve boyutta alt ölçekli planlar ile yapılabilir. Ancak, yer altı deposu üzerinde bulunan hali hazır arazinin üst ölçekli plandaki kullanımının değiştirilmeyeceğine dair plan uygulama hükmünün ve gerekli açıklamanın alt ölçekli planlara eklenmesi zorunludur.

7.2.7. Konut Dışı Kentsel Çalışma Alanları: İçinde karayolu servis hizmetleri verecek tesisler, şehirlerarası, uluslararası taşımacılık ile ilgili kargo, lojistik faaliyetleri, yanıcı parlayıcı patlayıcı mal içermeyen depolar, kirletici etkisi ve atığı olmayan imalathaneler, resmi yada özel, idari, sosyal kültürel tesisler, çok amaçlı salonlar, bölgesel marketler, iş ve ticaret merkezleri ile bu faaliyetlerin gerektirdiği teknik altyapı tesislerinin yer aldığı alanlardır. Bu alanlara ilişkin yapılanma koşulları nazım ve uygulama imar planında belirlenecektir.

7.2.8 İskeleler/Balıkçı Barınakları/Limanlar: Söz konusu kullanımlar büyüklüklerine bağlı olarak alansal veya sembolik olarak gösterilmiştir.

7.2.8.1. Bu alanlarda yapılanma koşulları; 3621/3830 sayılı Kıyı Kanunu ve İlgili Yönetmelikleri, 5491/2872 sayılı Çevre Kanunu ve İlgili Yönetmelikleri'ne uyularak hazırlanacak alt ölçekli planlarda belirlenecektir.

7.3. Büyük Alan Gerektiren Kamu Kuruluş Alanları: Kent bütününe ve çevresine hizmet eden, içerisinde kamu hizmet birimlerinin yer aldığı alanlardır. Mevcut kamu kuruluş alanlarında, çevre düzeni planı onayından önce ilgili idarece onaylanmış 1/5000 ölçekli Nazım İmar Planı ve 1/1000 ölçekli Uygulama İmar Planı koşulları geçerlidir. Çevre Düzeni Planı sonrasında yapılaşmaya açılacak olan kamu kuruluş alanlarında, yapılaşma koşulları alt ölçekli planlarda belirlenecektir.

7.4. Üniversite Yerleşkeleri: Lisans, lisans üstü eğitim, araştırma-bilgi üretim ve iletişim merkezi işlevlerini üstlenen alanlardır. Mevcut üniversite yerleşkelerinde, çevre düzeni planı onayından önce ilgili idarece onaylanmış 1/5000 ölçekli Nazım İmar Planı ve 1/1000 ölçekli Uygulama İmar Planı koşulları geçerlidir. Çevre Düzeni Planı sonrasında yapılaşmaya açılacak olan üniversite yerleşkelerinde yapılaşma koşulları alt ölçekli planlarda belirlenecektir.

7.5. Tarım Arazileri:

7.5.1. Tarım alanlarında yapılacak ifraz işlemlerinde 5403 Sayılı "Toprak Koruma ve Arazi Kullanımı Kanunu" ve bu kanuna istinaden çıkarılmış yönetmelik hükümleri uyarınca işlem yapılır. Bu planda yer alan tarım alanları "tarım arazileri" olarak tek gösterim altında gösterilmiş olup 5403 sayılı Kanun ve ilgili yönetmeliğinde tanımlanan "tarım arazileri sınıflaması" ayrılmamıştır.

7.5.2. Tarım arazileri sınıflaması, Tarım ve Köy İşleri Bakanlığınca yapılacak, yaptırılacaktır. Tarımsal nitelikli alanlarda, belirlenmiş/belirlenecek olan tarım arazileri sınıflamalarında yapılaşma koşulları, uygulama hükümlerinin ilgili maddelerinde belirlenen koşullara göre gerçekleştirilecektir.

7.5.3. Tarım dışı kullanım taleplerinin, öncelikle verimi en düşük tarım alanlarında değerlendirilmesi esastır.

7.5.4. Tarım arazilerinin amaç dışı kullanım taleplerinde, 5578/5403 Sayılı "Toprak Koruma ve Arazi Kullanım Kanunu" çerçevesinde işlem yapılacaktır.

7.5.5. Tarımsal amaçlı yapılar kullanım amacı dışında kullanılamaz ve dönüştürülemez.

7.5.6. Bu planda tarım alanı olarak belirlenmiş olan alanlar ile tarım alanlarının kullanım ve yapılaşma koşullarının geçerli olduğu alanlarda, bu plan ile belirlenmiş olan yapılanma koşulları maksimum değerlerdir. Bu değerler, yetiştirilen ürün ve toprak özelliklerine bağlı olarak, gerekiyorsa belirli kesimlerde alt ölçekli plan kararları ile sınırlandırılabilir.

7.18. Büyük Açık ve Yeşil Alanlar:

7.18.1. Bölge Parkları ve Rekreasyon Alanları: Halkın açık ve yeşil alan gereksinimleri başta olmak üzere eğlence, dinlenme ve piknik gereksinimlerinin karşılanacağı, açık, kısmen kapalı olarak düzenlenen günübirlik ihtiyaçları karşılayacak tesisler, oyun alanları, açık spor ve su oyun alanları vb. ile yeşil bitki örtüsü bulunan alanlardır. Bu alanlarda yapılacak, geliştirilen projenin ayrılmaz parçası niteliğinde olan kapalı yapılarda emsal E=0.05'i geçemez, yapı yüksekliği kullanım türünün gereklerine göre alt ölçekli planlarda belirlenecektir.

7.18.2. Fuar, Panayır ve Festival Alanları: Ulusal ya da Uluslararası nitelikte ticari maddelerin yada hizmetlerin periyodik süreli yada süresiz sergilendiği alandır. Bu alanlarda prestij yapıları, gösteri ve sergi yapıları ile geniş servis mekanları yer alabilir. Yapılanma koşulları alt ölçekli planlarda belirlenecektir.

7.18.3. Ağaçlandırılacak Alanlar: Bu alanlar, orman niteliğini kaybetmiş açıklıklar, erozyona uğrayan alanları, jeolojik nedenler vb. nedenlerle planlarda ağaçlandırılması önerilen alanları ve yerleşmelerin çevresinde yeşil kuşak oluşturulması amacıyla düzenlenmiş pasif yeşil alanları kapsar. Bölgede taşkın ve erozyonu önlemek amacıyla, taşkın riski olan dere ve akarsu kenarlarında, eğimi %40'ın üzerinde olan alanlar ağaçlandırılacak alanlar olarak belirlenerek, bu alanların, mülkiyet durumuna bağlı olarak ilgilileri tarafından ağaçlandırılması zorunludur.

7.19. Turizm Alanları:

7.19.1. Turizm Merkezleri: 4957/2634 sayılı "Turizmi Teşvik Kanunu" uyarınca Kültür ve Turizm Bakanlığı tarafından yapılacak/yaptırılacak turizm amaçlı planlarda yapılaşma koşulları belirlenecektir.

7.19.2. Turizm Tesis Alanları: Turizm kullanımı amaçlı planlaması önerilen alanlardır. Bu alanda turizme yönelik tesisler ile tamamlayıcı unsurları yer alabilir. Yapılanma koşulları alt ölçekli planlarda belirlenecektir.

7.19.3. Günübirlik Turizm Tesis Alanı: Turizm potansiyeli bulunan alanlarda, kamping ve konaklama ünitelerini içermeyen, duş, gölgelik, soyunma kabini, wc gibi altyapı tesislerinin yanı sıra yeme-içme, eğlence ve spor tesisleri ile yerel özellik taşıyan el sanatları ürünlerinin sergi ve satış ünitelerini içeren yapı ve tesislerin yer alabileceği alanlardır. Yapılanma koşulları alt ölçekli planlarda belirlenecektir.

7.19.4. Kış Sporları ve Kayak Merkezi: Yapılaşma koşulları, tesisin niteliği ve kurulduğu alanın özellikleri dikkate alınarak alt ölçekli planlarda belirlenecektir.

7.19.5. Termal Turizm Alanları: Termal turizm tesis alanlarında termal kaynakların korunması esastır. Bu alanlarda, ilgisine göre diğer turizm alanlarında geçerli olan kurallar geçerlidir. Termal turizm tesis alanlarında yapılaşma koşulları alt ölçekli planlarda belirlenecektir.

7.19.6. Kamping Alanları: Bu alanlarda konaklama ihtiyacını taşınabilir yapılarla (Çadır, karavan vb.) sağlayan turizm amaçlı kullanımlar yer alabilir. Bu alan içinde yapılacak ortak kullanıma yönelik üniteler için emsal E=0.08, En fazla yapı yüksekliği H=4.50 m. (1 kat), En küçük parsel= 3000 m² olacaktır.

7.20. Su Toplama Havzaları, İçme ve Kullanma Suyu Koruma Kuşakları, Yeraltı Suyu Kaynakları ve Kaynak Koruma Alanları:

7.20.1. Suyun dengeli ve verimli kullanımı esastır. Havzada su kaynaklarının korunmasına ilişkin yapılacak çalışmalar Su Kirliliği Kontrolü Yönetmeliği çerçevesinde İl Çevre ve Orman Müdürlüğü tarafından yapılacaktır.

7.20.2. İçme ve kullanma suyu temin edilen kıta içi yüzeysel su kaynaklarının korunmasında Su Kirliliği Kontrol Yönetmeliğinin ilgili hükümleri geçerlidir.

7.20.3. Bu plan kapsamında kalan su havzalarının tamamında DSİ Genel Müdürlüğünce ya da ilgili idare tarafından Havza Planının hazırlanması esastır.

7.20.4. İçme ve kullanma suyu temin edilen kıta içi yüzeysel su kaynaklarına ilişkin özel hüküm belirleninceye kadar Su Kirliliği Kontrolü Yönetmeliği hükümleri geçerlidir. İçme ve kullanma suyu temin edilen kıta içi yüzeysel su kaynaklarının Su Kirliliği Kontrolü Yönetmeliği 16'ncı maddesi kapsamında Özel Hüküm belirleme çalışmasının yapılması durumunda belirlenen özel hükümler her tür ve ölçekteki planlara işlenir.

7.20.5. İçme ve kullanma su kaynaklarının sürdürülebilir koruma ve kullanımına yönelik yapılacak olan havza koruma veya özel hüküm belirleme çalışmalarında bu plan ile getirilen nüfus projeksiyonları kullanılır.

7.20.6. Bu plan sınırları içerisinde ilgili idarece bu planın projeksiyon hedef yılı baz alınarak, su projeksiyonlarının yapılması esas olup suyun verimli kullanılması için gerekli tedbirler (suyun fiyatlandırılması, vergilendirilmesi, su kullanım yöntemleri, geri kazanım, açık kanaldan kapalı kanala ve yağmurlama veya damlatma sistemine geçilmesi gibi vb.) ilgili idarece alınacaktır.

7.20.7. DSİ Genel Müdürlüğü'nce su dağıtımı konusunda sistem kurulmasına ilişkin entegre proje üretilecektir. Yeraltı sularının gelişigüzel kuyular açılarak kullanımı önlenecektir.

7.20.8. Yeraltı su kaynaklarının fiziksel, kimyasal, biyolojik ve bakteriyolojik özelliklerini olumsuz yönde etkileyecek atık su deşarjına izin verilemez.

7.20.9. İçme ve Kullanma Suyu amaçlı kuyuların çevresinde "İnsani Tüketim Amaçlı Sular Hakkında Yönetmelik"te tanımlanan Kurul tarafından, kaynağın yer aldığı jeolojik formasyon, topoğrafik ve hidrojeolojik şartlar göz önüne alınarak koruma alanı belirlenir ve tapu kaydına işlenir.

7.20.10. Yeraltı su kaynaklarının mevcut miktarının korunması için her türlü kullanıma ilişkin olarak ilgili kurum ve kuruluşlardan izin ve tahsis belgesi alınması zorunludur.

7.20.11. Yer altı suyunda bir kirlilik oluştuğunun ilgili idarece yapılan izleme ve denetimler sonunda belirlenmesi durumunda gerekli tedbirler alınacak ve Çevre ve Orman Bakanlığı'na bildirilecektir.

7.20.12. Yeraltı su seviyesinin tehlikeli boyutlara düşmesini engellemek için, yeraltı su potansiyeli DSİ Genel Müdürlüğünce belirlenir. DSİ Genel Müdürlüğünce belirlenen yeraltı su potansiyelini korumak amacıyla verilen tahsisler iptal edilir veya yeniden düzenlenir.

7.20.13. Su kaynaklarının zarar görmesine neden olacak biçimde, su kaynakları koruma alanları içinde taş ocağı, maden işletmesi vb. ocaklar açılamaz, patlatma yapılamaz. Su Kirliliği Kontrolü Yönetmeliği hükümlerine uyulur.

7.21. Kaynak Suları Şişeleme ve Ambalajlama Tesisleri:

7.21.1. Kaynak suları şişeleme ve depolama alanları ve potansiyel gereksinim, Devlet Su İşleri Genel Müdürlüğü ve diğer ilgili kuruluşlardan alınacak görüşler doğrultusunda ilgili idarece belirlenir. Yapılacak tesislerde, ilgili kurum ve kuruluş görüşleri doğrultusunda hazırlanacak imar planları, ilgili idarece onanmadan uygulama yapılamaz. Onaylanan planlar sayısal ortamda veri tabanına işlenmek üzere Bakanlığa gönderilir. Söz konusu tesisler amacı dışında kullanılamaz.

7.21.2. Bu tesislerde yapılanma koşulları, "Doğal Kaynak, Maden ve İçme Suları ile Tıbbi Suların İstihsali, Ambalajlanması ve Satışı Hakkında Yönetmelik" hükümlerine göre belirlenir.

7.22. Maden İşletme Tesisleri, Geçici Tesisler ve Ocaklar:

7.22.1. Madencilik faaliyetlerinde 3213 sayılı Maden Kanunu ve buna bağlı yönetmelik hükümlerine uyulur.

7.22.2. Maden ruhsat sahasında kurulmak istenen geçici tesis için Maden İşleri Genel Müdürlüğünden geçici tesis olduğuna dair belge alınması zorunludur.

7.22.3. Maden ruhsatlı sahalarda, ihtiyaç duyulan geçici tesisler ilgili kurum ve kuruluşlardan izin almak kaydı ile yapılabilir.

7.22.4. Geçici tesislerin kullanımı maden ruhsatının veya maden rezervinin işletme süresi ile sınırlıdır. Geçici tesisler kullanım süresinin bitmesi durumunda kaldırılır.

7.22.5. Maden işletme ruhsatı alınan alanlar, bu Çevre Düzeni Planının veri tabanına işlenmek üzere, Maden İşleri Genel Müdürlüğünce, 1/25.000 ölçekli, koordinatlı haritalara işlenerek, sayısal olarak Çevre ve Orman Bakanlığı'na gönderilir.

7.22.6. Madencilik faaliyet sahalarında ÇED Yönetmeliği ve diğer mevzuat hükümlerine uyulacaktır.

7.22.7. Geçici tesis niteliğinde olmayan ve ÇED Yönetmeliği kapsamındaki maden sanayileri öncelikle bu planda yer alan sanayi alanlarına yönlendirilecektir. Ancak işletme ruhsatı alınan maden sahalarından çıkarılan madenlerin, işlenmesi amacıyla gerek duyulacak sanayi tesisleri için uygun sanayi alanının bulunmaması ya da çıkarılan madenin yerinde işlenmesinin zorunlu olduğu durumlarda; bu planda yer alan herhangi bir koruma kararı bulunmayan ya da ilgili mevzuat doğrultusunda alınmış koruma kararı bulunmayan alanlarda, ilgili tüm kurum ve kuruluşların görüşleri doğrultusunda, gerekli izinler alınarak maden çıkarım alanı içinde maden işletmeye yönelik sanayi tesisleri kurulabilir. Bu tesisler kuruluş amacı dışında kullanılamaz. Bu tesisler, ruhsat süresi sonunda kapatılarak kaldırılır.

7.22.8. Madencilik faaliyetlerinde çevreye zarar verilmemesi için her türlü önlem tesis sahiplerince alınacaktır.

7.22.9. İçme ve kullanma suyu rezervuarlarının mutlak, kısa ve orta mesafeli koruma kuşaklarında madencilik faaliyetlerine izin verilmez.

7.22.10. İçme ve kullanma suyu rezervuarlarının uzun mesafeli koruma kuşaklarında yapılacak madencilik faaliyetleri sırasında içme suyunun kirletilmemesi esastır.

7.22.11. İçme ve kullanma suyu rezervuarlarının uzun mesafeli koruma alanının yatay olarak ilk 3 km. genişliğindeki bölümünde; galeri yöntemi patlatmalar, kimyasal ve metalürjik zenginleştirme işlemleri yapılamaz. Madenlerin çıkarılmasına; sağlık açısından sakınca bulunmaması, mevcut su kalitesini bozmayacak şekilde çıkartılması, faaliyet sonunda arazinin doğaya geri kazandırılarak terk edilmesinin taahhüt altına alınması, koşullarıyla izin verilebilir.

Bu alandaki faaliyetlerden oluşan atık suların; Su Kirliliği Kontrol Yönetmeliği'ndeki ilgili sektörün alıcı ortama deşarj standartlarını sağlayarak havza dışına çıkartılması, ya da geri dönüşümlü olarak kullanılması zorunludur.

7.22.12. Uzun mesafeli koruma kuşaklarının ikinci bölümünde, ilk 3 km.lik bölümünün bittiği yerden başlayarak su toplama havzasının sınırına kadar olan alandaki faaliyetlere, oluşan atık suların Su Kirliliği Kontrol Yönetmeliği'ndeki Tablo-5'ten Tablo-21'e kadar olan deşarj standartlarını sağlayarak havza dışına çıkarılması veya geri dönüşümlü olarak kullanılması şartıyla izin verilebilir.

7.22.13. İçme ve kullanma suyu rezervuarlarının koruma alanlarında bulunan derelerden kum ve çakıl çıkartılması amacıyla kum ocağı açılmasına izin verilmez.

7.22.14. Maden ruhsatının süresinin veya rezervin bitmesi halinde işletme sahasının "çevre ile uyumlu hale getirilmesini" içeren projenin ilgili idareye sunulması ve ilgili idareye yazılı taahhütte bulunulması zorunludur.

7.22.15. Birinci sınıf gayri sıhhi müesseseler kapsamına giren maden üretim faaliyetleri ve veya bu faaliyetlere dayalı olarak üretim yapılan tesislerin etrafında mülkiyeti sınırlarında sağlık koruma bandı bırakılması zorunludur. Sağlık koruma bandı içerisinde mesken veya insan ikametine mahsus yapılaşmaya izin verilmez.

7.22.16. Bu planın onayından önce, tesis kullanıcılarına ulaşılamayan ve faaliyeti sona ermiş / terk edilmiş kum-çakıl / taş / maden ocakları, iyileştirme projesi; Valilik denetiminde ilgili idareye yaptırılır, uygulama Valilik tarafından denetlenerek sonuçlandırılır.

7.23. Enerji Üretim Alanları ve Enerji İletim Tesisleri:

7.23.1. Enerji üretim alanlarında, ilgili kurum ve kuruluşlardan alınan izinler ve Enerji Piyasası Düzenleme ve Denetleme Kurulunca verilecek lisans kapsamında, Bakanlığı'nın uygun görüşü alınması koşuluyla, ilgili kurum ve kuruluş görüşleri doğrultusunda hazırlanan nazım ve uygulama imar planları, ilgili idaresince onaylanmasını müteakip uygulamaya geçilir. Onaylı imar planları, sayısal ortamda, bilgi için Bakanlığa gönderilir.

7.23.2. Enerji iletim tesislerinde, ÇED Yönetmeliği hükümleri vasıtasıyla, Çevre ve Orman Bakanlığı'nın uygun görüşü alınması koşuluyla, çevre düzeni planı değişikliğine gerek kalmaksızın, ilgili kurum ve kuruluş görüşleri doğrultusunda hazırlanan nazım ve uygulama imar planları, ilgili idaresince onaylanır ve planlar bilgi için Bakanlığa gönderilir.

7.24. Atık Bertarafı, Depolama ve/veya Geri Kazanım Tesis Alanı: Çevre Düzeni Planı bütünü içinde her türlü atıkların (kimyasal, tıbbi, tehlikeli atık, katı atık) kaynağında ayrı toplanması, bunların depolama alanlarına taşınması, transfer istasyonlarının kurulması, geri kazanım ile ilgili işlemlerin yürütülmesi ve bertaraf edilmesi gibi iş ve işlemleri kapsayan atık yönetimi sisteminin kurulması ile ilgili çalışmalar T.C. Çevre ve Orman Bakanlığı, Valilikler, Belediyeler tarafından tamamlanacaktır. Mahalli idare hizmet birlikleri veya ajanslar atık yönetim sisteminin kurulmasını üstlenebilirler. Bu alanlarda, Atık Yönetimi Genel Esaslarına İlişkin Yönetmelik, Katı Atıkların Kontrolü Yönetmeliği, Kimyasal Atıkların ve Tehlikeli Atıkların Kontrolü Yönetmelikleri hükümleri uygulanır.

Yakma veya düzenli depoların yanısıra fiziksel/kimyasal/biyolojik önişlem ünitelerini içeren entegre atık bertaraf veya geri kazanım tesislerinin yer seçiminde, atığın en yakın ve en uygun olan tesiste bertaraf edilmesi ilkesi çerçevesinde, bölgenin atık miktarı dikkate alınarak ilgili kurum ve kuruluşların görüşü doğrultusunda tesisin yer seçimi belirlenir.

7.24.1. Tehlikeli Atık Bertaraf Tesis Alanları: Tehlikeli atıkların depolama işlemi sırasında alınan önlemlerin yeterli olduğu veya atığın özelliği sebebi ile depolama işleminde çevrenin olumsuz yönde etkilenmeyeceğinin bilimsel olarak ispat edilmesi hallerinde, atıklar depolanabilir veya bu amaçla depo tesisi kurulmasına izin verilebilir. Çevre düzeni planı bütünü içinde her türlü tehlikeli atıkların ilgili mevzuatta belirtilen standartları sağlayacak şekilde bertaraf edilmesi zorunludur.

7.25. Arıtma Tesisi Alanları: Çevre Düzeni Planı bütünü içinde her türlü atık suların ilgili mevzuatta belirtilen standartları sağlayacak şekilde arıtılması ve/veya bertaraf edilmesi zorunludur. Bu alanların yer seçim ve uygulaması bu planın ilkeleri çerçevesinde ilgili kurum ve kuruluşların görüşleri alınarak belediyeler, kurum ve kuruluşlar, mahalli idare hizmet birlikleri tarafından yapılabilir.

Planlama bölgesinde bulunan yüzeysel su kaynaklarının su kalitesinin olumsuz yönde etkilenmesini önlemek amacıyla, atık suların, akarsu, toprak v.b. gibi alıcı ortamlara veren ve nüfusu yoğun olan ilçe ve belde belediyelerinin kanalizasyon sistemleri ve arıtma tesisleri tamamlanacaktır.

7.26. Karayolu Kenarında Yapılacak Tesisler: Ülke ve bölgesel niteliği olan ve planda gösterilen yollardan cephe alacak tesislerde; 2918 sayılı Karayolları Trafik Kanunu gereğince çıkartılan "Karayolları Kenarında Yapılacak Ve Açılacak Tesisler Hakkındaki Yönetmelik" ve "Karayolları Kenarında Yapılacak Ve Açılacak Tesisler Hakkında Yönetmeliğe Değişiklik Yapılmasına Dair Yönetmelik" koşulları ile Enerji Ve Tabii Kaynaklar Bakanlığı'nın ilgili tebliğlerinde belirtilen hükümler uygulanır.

7.26.1. Belediye ve mücavir alan sınırları içinde ve dışında karayolları kenarında yapılacak tesislerde 2918 sayılı "Karayolları Trafik Kanunu" ve "Karayolları Kenarında Yapılacak ve Açılacak Tesisler Hakkında Yönetmelik" ile 5015 sayılı "Petrol Piyasası Kanunu" ve ilgili yönetmelik hükümlerine uyulacaktır.

7.26.2. Karayolları Genel Müdürlüğü'nün sorumluluğundaki karayolu güzergahlarında, belirlenmiş olan standartlardan az olmamak üzere, yapı yaklaşma mesafesi bırakılacaktır. Karayolları Genel Müdürlüğü tarafından planlanacak yeni devlet yollarının kent içi geçişlerinde, kamulaştırma sınırının o yolun çevreye vereceği olumsuzlukları göz önüne alacak biçimde standardında belirtilenden daha geniş tutulması sağlanacaktır.

7.26.3. Karayolu servis alanlarında yer alacak yapılar, akaryakıt ve LPG satış istasyonları ile bu tür tesislerle birlikte düzenlenecek servis istasyonu, konaklama tesisi, kamping, yeme içme tesisi vb. ile turizm amaçlı teşhir ve satış birimleri ile günübirlik tesisler gibi karayoluna hizmet verecek tesislerdir. Bu amaçlı yapılacak yapılara ilişkin hazırlanacak alt ölçekli planlarda, ilgili kurum ve kuruluşların uygun görüşlerinin alınması zorunludur.

7.26.4. Karayolu kenarında veya diğer kara ulaşım güzergahlarında yapılacak akaryakıt ve bakım istasyonu alanlarında, 1/100.000 ölçekli çevre düzeni planı değişikliğine gerek kalmaksızın, imar planlarının ilgili kurum ve kuruluş görüşleri doğrultusunda, ilgili idaresince onaylanmasını müteakip uygulamaya geçilir.

7.27. Doğalgaz Boru Hatları, Enerji İletim Tesisleri ve İçme Suyu Boru Hatları:

7.27.1. Doğalgaz boru hatları ve tesisleri çevresindeki planlama ve imar uygulama çalışmalarında ilgili kuruluştan aksine bir görüş alınmadığı takdirde; doğalgaz boru hattı güzergah şeridi üzerinde yapılaşmaya kesinlikle izin verilmeyecektir. Boru hattı kamulaştırma şeridi üzerinde yapı niteliği taşımayan yaya ve trafik yolları geçişleri ve boru ekseni üzerinde süreklilik arz etmeyecek yol, su, elektrik v.s. gibi teknik altyapı projeleri için ilgili kurumun izninin alınması gereklidir.

7.27.2. Kentlere içme suyu taşıyan ana boru hattının geçtiği alanlarda yapılacak alt ölçekli planlama çalışmalarında DSİ' nin görüşü alınacaktır.

7.27.3. Alt ölçekli planlama çalışmalarında; TEİAŞ'ın (Türkiye Elektrik İletim Anonim Şirketi) yetki ve sorumluluğunda bulunan 36 kv. üstündeki enerji iletim tesisleri (iletim hatları ve trafo merkezleri) ile ilgili faaliyetlere ilişkin TEİAŞ Genel Müdürlüğü'nün görüşü alınacak ve "Elektrik Kuvvetli Akım Yönetmeliği"ndeki hükümlere göre uygulama yapılacaktır.

7.27.4. Enerji iletim hatlarına ilişkin ilgili idaresince tanımlanan, mevzuatla belirlenen yaklaşma sınırları minimum mesafeler olarak kabul edilecektir.

7.28. Mezarlık Alanları: Plan sınırları içinde yer alan yerleşmelerin gereksinim duydukları mezarlık alanları için, ilgili mevzuat doğrultusunda belirlenen sınırlamalara uygun biçimde, kamu kurum ve kuruluş görüşleri de alınarak, çevre düzeni planında değişiklik yapılmasına gerek duyulmadan alt ölçekli planları yapılabilir. Bu planda gösterilemeyen, onaylı alt ölçekli imar planı bulunan mezarlık alanlarının planları yürürlüktedir.

7.29. Su Ürünleri Üretim Alanları:

7.29.1. Su ürünleri üretim alanlarının 1380 sayılı "Su Ürünleri Kanunu" ve ilgili yönetmelikleri uyarınca yapılacak yer seçimlerinde, ilgili kurum ve kuruluşların görüşlerinin alınması ve bu planda kullanım kararı belirlenmiş alanlara (Turizm Alanları, Yerleşme Alanları, Kıyı Yapıları vb) ve koruma statüsüne sahip alanlara (Doğal Koruma Alanları, Sit Alanları, Sulak Alanlar vb.) olası olumsuz etkilerinin önlenmesi için mesafe, hakim rüzgar yönü vb. ölçütlerin göz önünde bulundurulması esastır.

7.29.2. Bu alanlarda 1380 sayılı "Su Ürünleri Kanunu", 3830/3621 sayılı "Kıyı Kanunu" 5491/2872 sayılı "Çevre Kanunu" ve ilgili yönetmelikleri ile yürürlükteki diğer mevzuat hükümleri doğrultusunda uygulama yapılacaktır.

7.30. Patlayıcı Madde Depoları: Bu planda gösterilen sanayi ve depolama alanları içinde niteliği gereği yer alamayan, "Tekel Dışı Bırakılan Patlayıcı Maddelerle Av Malzemesi ve Benzerlerinin Üretimi, İthali, Taşınması, Saklanması, Depolanması, Kullanılması, Yok Edilmesi, Denetlenmesi Esaslarına İlişkin Tüzük"te tanımlanan maddelerin üretimi, atık bertarafı ve depolanması için yapılacak tesislerin, yer seçimi, izin, ruhsat gibi her türlü iş ve işlemleri, ilgili mevzuat doğrultusunda, bu planın koruma ilkelerine aykırı olmamak koşuluyla, alt ölçekli planlar doğrultusunda yapılabilir. Bu amaçla onaylanan planlar, veri tabanına işlenmek üzere sayısal ortamda Bakanlığa gönderilir. Söz konusu tesisler amacı dışında kullanılamaz.

7.31. Sakıncalı Alanlar

7.31.1. Jeolojik Sakıncalı Alanlar:

7.31.1.1. Jeolojik, jeomorfolojik, hidrolojik ve depremsellik yönünden sakıncalı olan bu alanlarda; 1/5.000 ölçekli nazım imar planları ve 1/1.000 ölçekli uygulama imar planlarının yapımı sırasında, ilgili mevzuat doğrultusunda hazırlanan "yerleşime uygunluk amaçlı jeolojik ve jeoteknik etütlerin" sonuçlarına uygun düzenleme yapılması zorunludur. Yerleşime uygun olmayan alanlar alt ölçekli planlarda açık alan ve/veya rekreasyon alanı olarak düzenlenecektir.

7.31.1.2. Bu alanlardan, "Afet Bölgesi" olarak ilan edilen/edilecek olan bölgeler için 7269 sayılı "Umumi Hayata Müessir Afetler Dolayısıyla Alınacak Tedbirlerle Yapılacak Yardımlara Dair Kanun" ve bununla ilgili diğer mevzuat hükümleri geçerlidir.

7.31.1.3. Kesinlikle yapılaşmaya izin verilmeyecek alanlar dışında kalan, önlemli alanlar ve diğer alanlarda da yapılaşma türü ve koşulları alt ölçekli planlarda, ayrıntılı jeolojik ve jeoteknik etüt sonuçları dikkate alınarak belirlenecektir.

7.31.2. Taşkın Alanları:

Akarsu ve dere yatakları çevresinde, taşkın alanlarında taşkın önleme çalışmaları tamamlanıncaya kadar yapılaşmaya izin verilemez. 1/5.000 ölçekli Nazım İmar Planı ile 1/1.000 ölçekli Uygulama İmar Planlarında taşkından korunmayı ve zararlarını azaltmayı amaçlayan kararlar ve yapılaşma koşulları geliştirilecektir.

8. KENTSEL YERLEŞİM ALANI BÜYÜKLÜKLERİ

Muş-Bitlis-Van Planlama Bölgesi 1/100.000 Ölçekli Çevre Düzeni Planı uyarınca gerçekleştirilecek alt ölçekli her tür planlama çalışmasında, bu bölümde yer verilen alansal büyüklüklere ve planın hedef yılına yönelik nüfus kabullerine uyulacaktır.

(Not : Kentsel Yerleşme Büyüklükleri Tablolarında mevcut planlı alanlarda, sadece kentsel kullanımlar dikkate alınmış, plan sınırları içinde yer alan tarım alanları, ağaçlandırılacak alanlar, mera alanları, orman alanları vb. kullanımlar hesaplama dışı tutulmuştur.)

8.1. Muş İli Kentsel Yerleşme Büyüklükleri

YERLEŞME	2009 YILI NÜFUSU	2035 YILI NÜFUSU	MEVCUT PLANLI ALAN (ha.)	2035 YILI PLANLI ALAN (ha.)
Muş Merkez	72.774	180.000	2539,68	2539,68
Karaağaçlı	3.138	3.500	104,60	56,43
Kırköy	2.647	5.500	81,63	73,77
Kızılağaç	4.090	6.000	122,66	162,16
Konukbekler	4.581	16.000	119,43	234,00
Serinova	2.641	4.000	104,89	105,26
Sungu	5.800	15.000	152,71	161,29
Yağcılar(Yeşilova)	2.348	7.000	82,00	60,87
Yaygın	4.685	12.500	270,00	312,00
Bulanık	21.352	40.000	411,74	296,30
Elmakaya	2.418	4.500	108,13	71,43
Erentepe	4.089	10.000	258,00	258,00
Karaağıl	1.997	3.000	Onaylı imar planı bulunmamaktadır	100,00
Mollakent	1.764	6.000	127,66	127,66
Rüstemgedik	3.125	8.500	154,03	217,95
Sarıpınar	2.629	6.000	70,71	70,59
Uzgörür	2.741	6.000	107,93	116,26
Yemişen	1.666	4.500	93,75	93,75
Yoncalı	1.983	3.000	154,42	71,43
Hasköy	13.389	36.000	342,00	342,00
Düzkışla	2.421	5.500	138,92	152,78
Korkut	3.102	7.500	208,33	208,33
Altınova	2.776	5.000	151,99	116,28
Karakale	1.897	4.500	Onaylı imar planı bulunmamaktadır	112,59
Malazgirt	19.130	40.000	800,58	1052,63
Gölkonu	1.867	4.500	94,01	70,31
Konakkuran	2.173	3.000	149,62	100,00
Varto	9.585	17.000	363,12	257,58

8.2. Bitlis İli Kentsel Yerleşme Büyüklükleri

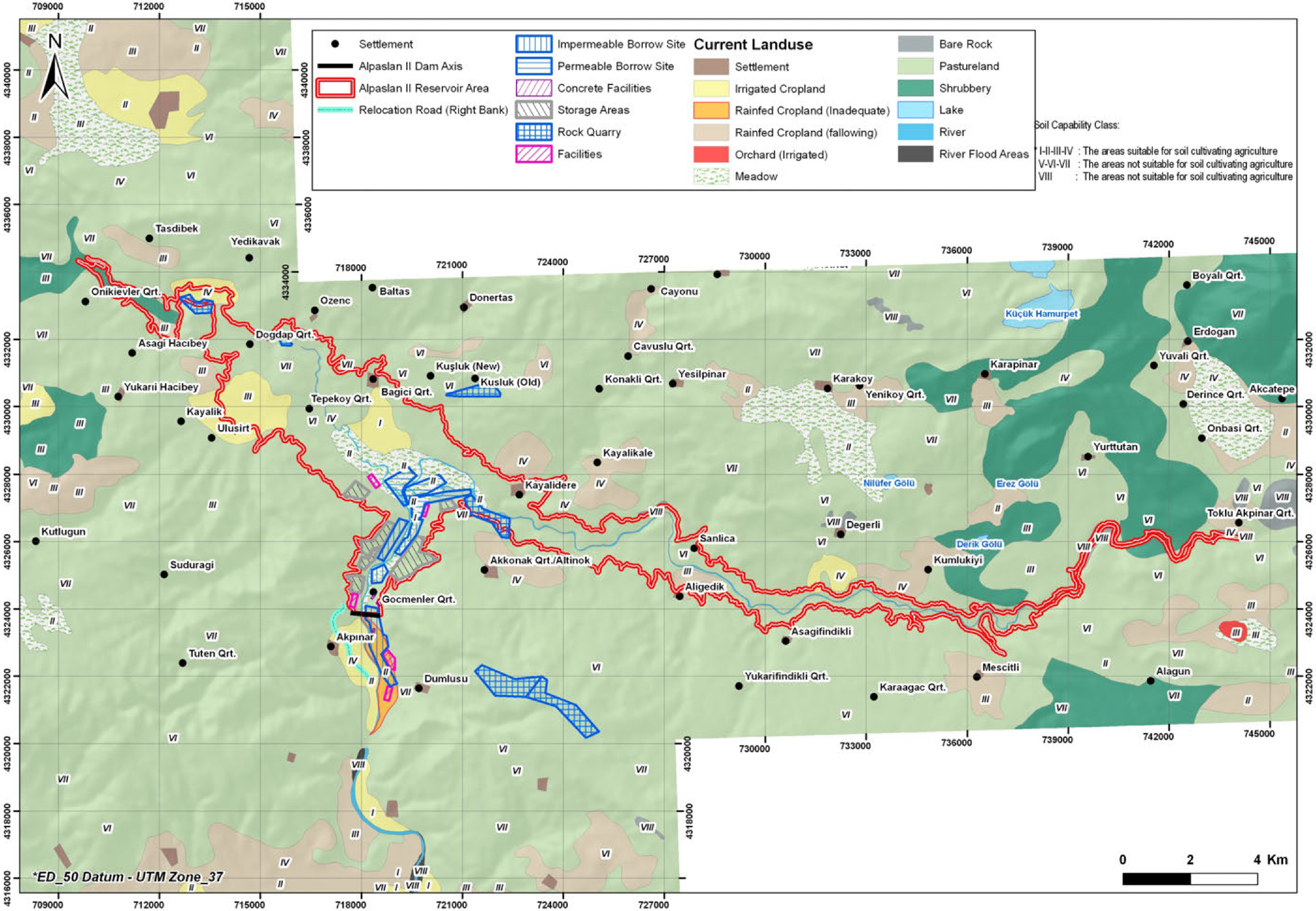
YERLEŞME	2009 YILI NÜFUSU	2035 YILI NÜFUSU	MEVCUT PLANLI ALAN (ha.)	2035 YILI PLANLI ALAN (ha.)
Bitlis	46.062	140.000	2496,75	2496,75
Yolalan	2.858	3.000	97,55	58,96
Adilcevaz	14.428	55.000	1695,00	705,13
Aydınlar	3.488	9.500	135,52	146,00
Ahlat	19.078	50.000	1220,80	833,33
Ovakışla	3.794	7.500	207,85	133,93
Güroymak	20.256	38.500	460,29	493,59
Günkırı	4.260	8.500	119,29	170,00
Gölbaşı	4.919	8.000	172,70	153,85
Hizan	9.896	22.000	172,00	209,52
Kolludere	800	2.000	40,00	38,00
Mutki	2.302	5.000	63,35	62,50
Kavakbaşı	1.556	4.000	54,62	43,48
Koyunlu	1.459	3.000	74,50	29,70
Tatvan	56.996	80.000	1005,91	1017,00

8.3. Van İli Kentsel Yerleşme Büyüklükleri

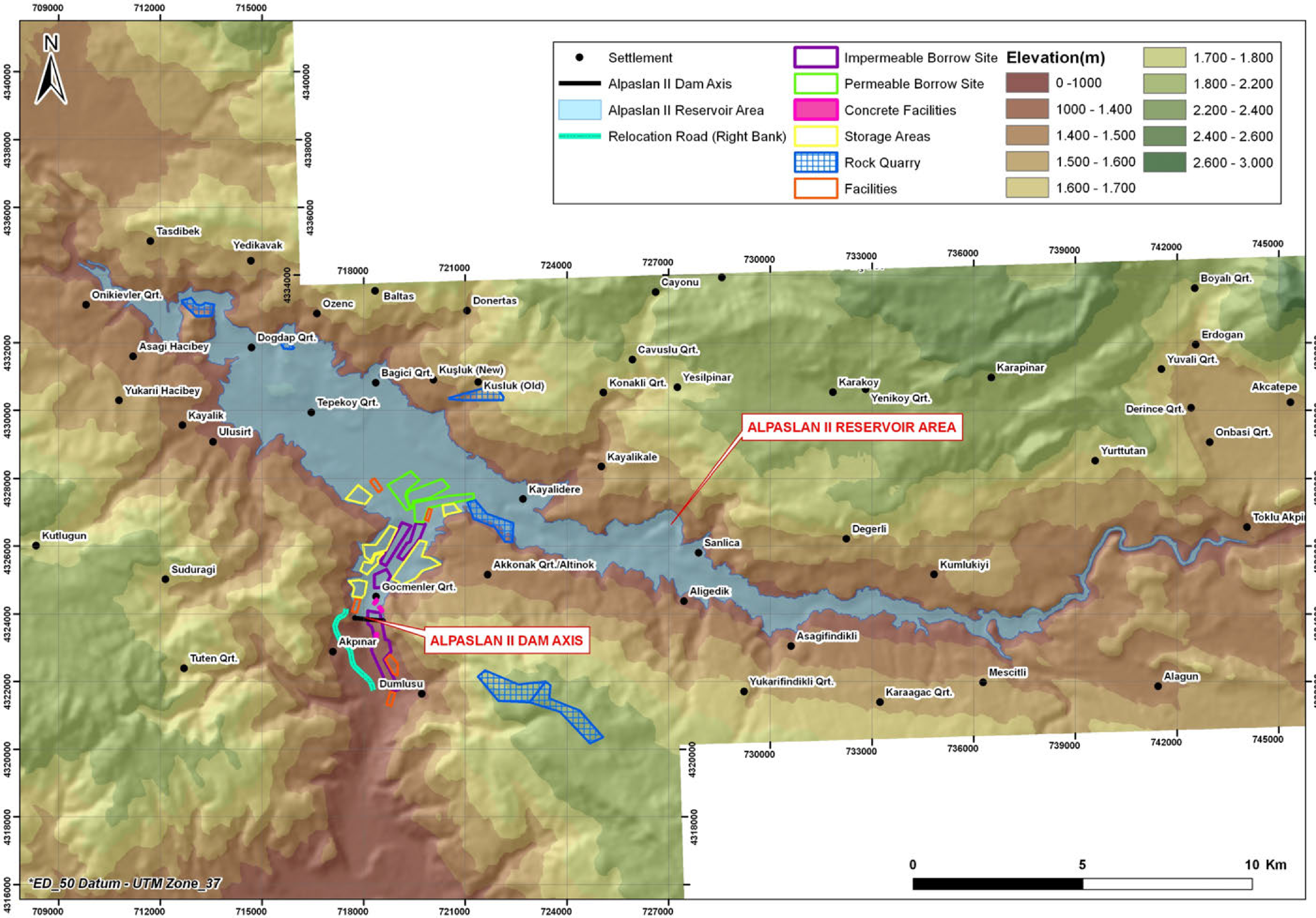
YERLEŞME	2009 YILI NÜFUSU	2035 YILI NÜFUSU	MEVCUT PLANLI ALAN (ha.)	2035 YILI PLANLI ALAN (ha.)
Van	360.810	750.000	7548,00	7561,00
Bostaniçi	19.687	56.000	327,94	486,25
Erçak	4.017	5.000	253,07	166,67
Bahçesaray	3.282	7.000	135,68	106,06
Başkale	12.362	23.000	337,92	310,81
Çaldıran	13.354	24.000	479,56	400,00
Çatak	6.353	11.000	68,42	125,00
Edremit	12.426	25.000	325,78	312,50
Çiçekli	4.785	7.000	228,08	129,63
Erciş	74.850	135.000	1762,19	1687,50
Çelebibağı	13.271	50.000	844,00	762,00
Kocapınar	4.251	8.500	185,29	212,50
Gevaş	10.452	17.800	708,23	698,15
Akdamar (Uysal)	2.354	6.000	132,00	120,00
Gürpınar	5.166	15.000	354,14	375,00
Muradiye	14.615	21.000	747,37	525,00
Ünseli	3.353	6.500	212,23	260,00
Özalp	10.166	25.000	380,19	518,00
Sağmalı	3.211	10.000	173,43	172,41
Saray	3.581	10.000	147,85	147,85

APP 5

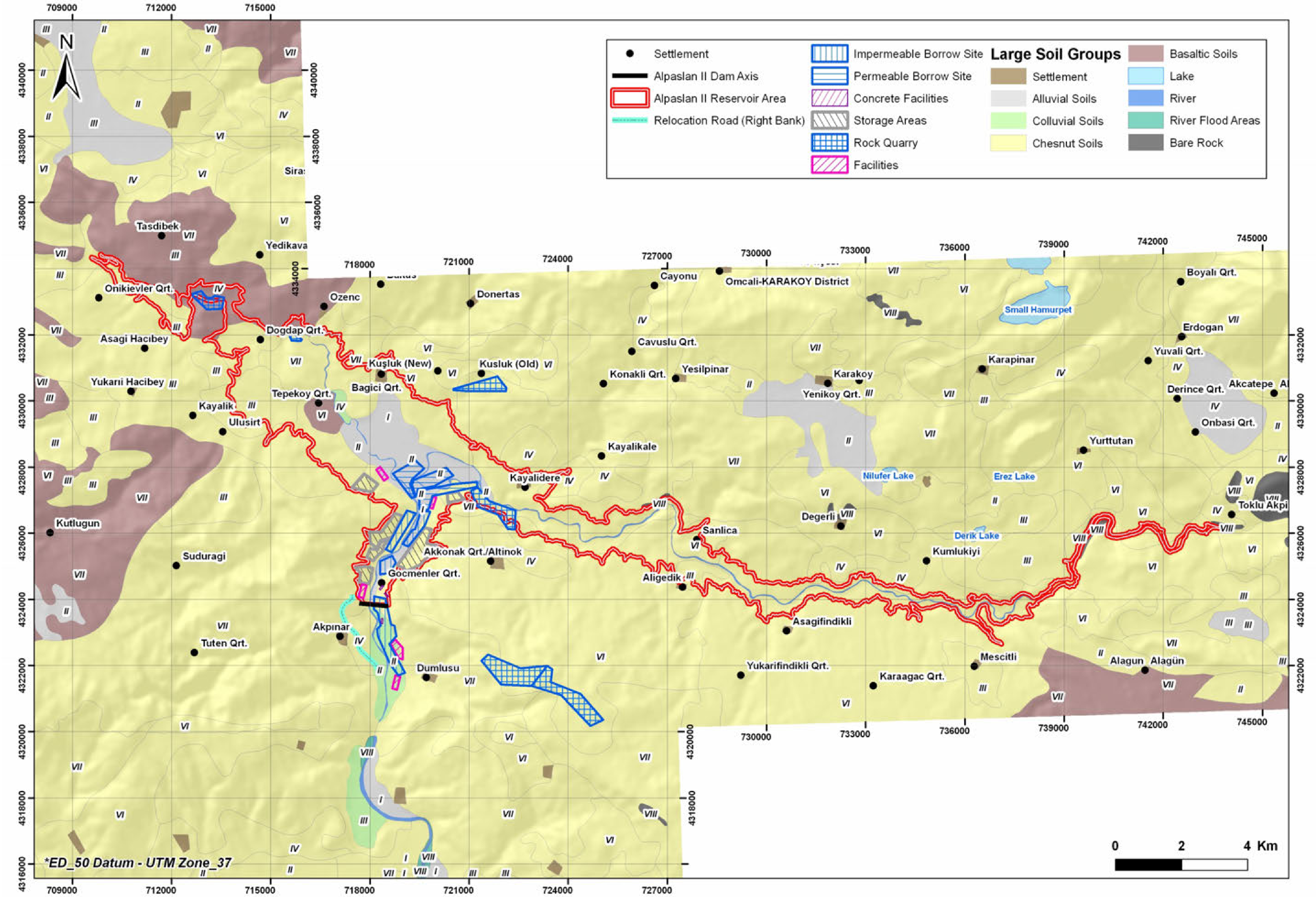
MAPS



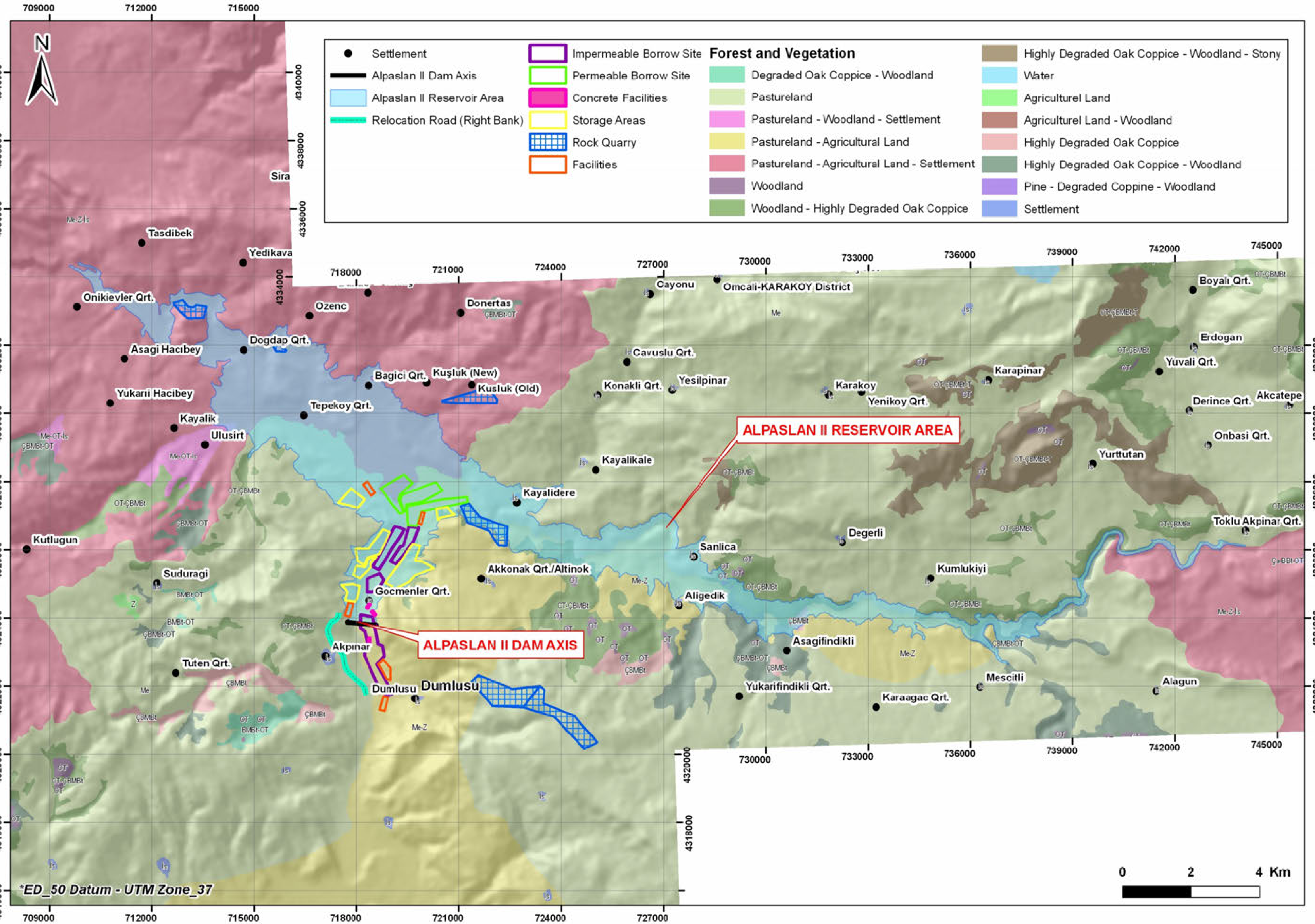
App. 5.1. Existing Land Use Map



App. 5.2. Elevation Map



App. 5.3. Main Soil Groups Maps



App. 5.4. Stand and Vegetation Map

APP 6

METEOROLOGICAL BULLETIN

Approved Meteorological Bulletin

T.C.
ÇEVRE ve ORMAN BAKANLIĞI
DEVLET METEOROLOJİ İŞLERİ GENEL MÜDÜRLÜĞÜ

Enlem	38.1												
Boylam	41.28												
Yükseklik	1650			17778-VARTO					1976 - 2010				
Parametre	Rasat S. (	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
Ortalama Basınç (hPa)	24	855.0	853.4	851.5	851.6	851.8	849.6	847.8	849.1	852.2	855.5	856.0	855.5
Maksimum Basınç (hPa)	24	867.4	867.2	867.7	864.4	861.7	859.6	857.2	857.7	861.2	864.8	867.6	866.9
Minimum Basınç (hPa)	24	838.6	834.5	832.9	837.3	840.1	840.2	838.7	841.4	844.1	844.2	839.2	834.7
Ortalama Saat 7 Sıcaklık (°C)	34	-10.8	-9.6	-3.8	3.6	8.9	13.1	16.7	15.5	10.1	4.9	-0.7	-6.2
Ortalama Saat 14 Sıcaklık (°C)	34	-4.6	-2.7	2.8	11.2	17.4	23.5	29.2	29.8	25.3	17.1	7.8	-0.6
Ortalama Saat 21 Sıcaklık (°C)	34	-8.7	-7.0	-1.0	6.7	11.7	16.4	21.0	21.1	15.8	9.3	2.1	-4.4
Ortalama Sıcaklık (°C)	34	-8.2	-6.6	-0.7	7.1	12.4	17.4	22.0	21.9	16.7	10.1	2.8	-3.9
Ortalama Sıcaklığın 5 °C ve Büyük Günler Sayısı Ortalamas	34			2.6	20.0	28.7	28.2	29.2	28.3	28.2	28.2	9.9	0.6
Ortalama Sıcaklığın 10 °C ve Büyük Günler Sayısı Ortalamı	34			0.2	7.1	22.5	28.1	29.2	28.3	27.8	17.0	0.2	
Maksimum Sıcaklıkların Ortalaması (°C)	34	-3.2	-1.2	4.5	13.0	19.3	25.4	30.9	31.4	26.8	18.6	9.1	0.7
Minimum Sıcaklıkların Ortalaması (°C)	34	-12.7	-11.3	-5.2	1.7	5.7	8.9	12.7	12.5	8.1	3.6	-2.0	-7.7
Maksimum Sıcaklık Günü	34	1	21	30	23	31	29	30	1	9	3	3	4
Maksimum Sıcaklık Yılı	34	2000	2010	2008	2008	1990	1980	2000	2000	2007	1978	1990	2010
Maksimum Sıcaklık (°C)	34	8.6	11.4	21.4	27.0	29.4	35.0	40.5	38.5	36.9	29.0	20.4	17.7
Maksimum Sıcaklığın 30 °C ve Büyük Günler Sayısı Ortalar	34						2.5	19.4	20.9	5.4			
Maksimum Sıcaklığın 25 °C ve Büyük Günler Sayısı Ortalar	34				0.2	2.5	18.9	28.2	27.8	21.1	2.8		
Maksimum Sıcaklığın 20 °C ve Büyük Günler Sayısı Ortalar	34			0.1	2.2	14.2	26.2	29.1	28.2	26.8	13.2	0.1	
Maksimum Sıcaklığın -0,1 °C ve Küçük Günler Sayısı Ortal	34	19.8	15.0	4.1	0.0							1.3	11.9
Gün İçindeki Maksimum Sıcaklık Farkı (°C)	34	22.7	20.1	22.7	22.8	23.0	24.2	25.6	25.5	28.8	27.8	23.0	21.2

KAYITLARINA UYGUNDUR

T.C.
ÇEVRE ve ORMAN BAKANLIĞI
DEVLET METEOROLOJİ İŞLERİ GENEL MÜDÜRLÜĞÜ

Enlem	38.1												
Boylam	41.28												
Yükseklik	1650			17778-VARTO						1976 - 2010			
Parametre	Rasat S. (	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
Minimum Sıcaklık Günü	34	7	23	3	1	1	3	11	24	29	23	30	27
Minimum Sıcaklık Yılı	34	1983	1985	1985	1987	1984	1997	1992	2009	2009	1977	1993	2002
Minimum Sıcaklık (°C)	34	-31.1	-33.4	-31.3	-11.3	-3.3	1.0	4.5	4.7	-1.0	-7.5	-21.4	-31.0
Minimum Sıcaklığın -0,1 °C ve Küçük Günler Sayısı Ortalan	34	28.7	26.2	24.3	8.1	0.5				0.1	3.4	19.4	28.8
Minimum Sıcaklığın -3 °C ve Küçük Günler Sayısı Ortalama	34	26.4	23.2	16.0	2.0	0.0					0.9	11.7	22.7
Minimum Sıcaklığın -5 °C ve Küçük Günler Sayısı Ortalama	34	24.5	20.3	11.9	0.9						0.2	6.1	18.5
Minimum Sıcaklığın -10 °C ve Küçük Günler Sayısı Ortalam	34	17.8	13.9	5.0	0.1							0.9	9.8
Minimum Sıcaklığın -15 °C ve Küçük Günler Sayısı Ortalam	34	11.1	8.5	2.1								0.2	4.8
Minimum Sıcaklığın -20 °C ve Küçük Günler Sayısı Ortalam	34	5.6	3.6	1.0								0.1	1.8
Minimum Sıcaklığın 20 °C ve Büyük Günler Sayısı Ortalama	34							0.1	0.0				
Minimum Sıcaklığın 15 °C ve Büyük Günler Sayısı Ortalama	34						0.2	5.4	3.8	0.1			
Minimum Sıcaklığın 10 °C ve Büyük Günler Sayısı Ortalama	34				0.2	1.4	8.9	25.1	25.0	6.3	0.4		
Minimum Sıcaklığın 5 °C ve Büyük Günler Sayısı Ortalamas	34			0.2	4.6	17.4	27.1	29.1	28.2	25.2	10.2	1.0	0.0
Ortalama Toprak Üstü Minimum Sıcaklık (°C)	29	-14.7	-13.6	-6.9	0.1	3.4	6.0	9.6	9.2	4.9	1.1	-3.8	-9.6
Minimum Toprak Üstü Minimum Sıcaklık (°C)	29	-34.5	-36.1	-32.8	-14.6	-6.0	-2.1	1.2	-1.3	-4.1	-11.0	-23.2	-36.0
Toprak Üstü Minimum Sıcaklığın -0,1 °C ve Küçük Günler S	29	28.0	25.9	25.0	13.4	2.5	0.1		0.0	1.3	10.4	22.5	29.2
Toprak Üstü Minimum Sıcaklığın -3 °C ve Küçük Günler Sa	29	26.0	23.4	18.6	4.6	0.3				0.1	3.7	16.1	25.2
Toprak Üstü Minimum Sıcaklığın -5 °C ve Küçük Günler Sa	29	24.1	21.4	14.4	2.1	0.0					1.1	11.5	20.9
Toprak Üstü Minimum Sıcaklığın -10 °C ve Küçük Günler S	29	18.7	16.0	6.9	0.3						0.1	3.2	13.1
Ortalama Buhar Basıncı (hPa)	34	2.8	3.1	4.4	6.5	8.4	10.2	11.6	11.6	9.2	7.3	5.3	3.8
Ortalama Saat 7 Nisbi Nem (%)	34	79.1	81.1	83.5	82.4	77.9	74.6	71.9	73.3	77.3	85.1	85.5	82.9
Ortalama Saat 14 Nisbi Nem (%)	34	64.8	63.1	59.3	48.0	40.4	33.7	27.7	27.3	29.5	37.9	50.6	65.0
Ortalama Saat 21 Nisbi Nem (%)	34	77.3	78.5	76.6	67.5	62.3	53.4	43.9	42.5	48.0	65.5	76.3	79.6

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Enlem	38.1												
Boylam	41.28												
Yükseklik	1650			17778-VARTO						1976 - 2010			
Parametre	Rasat S. (	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
Ortalama Nem (%)	34	73.7	74.2	73.1	65.9	60.1	53.9	47.8	47.7	51.6	62.8	70.8	75.8
Minimum Nem (%)	34	16	23	15	10	9	6	4	5	5	5	10	13
Ortalama Saat 07 Bulutluluk	34	6.9	7.0	6.8	6.2	4.3	1.9	1.1	1.0	1.5	3.9	5.3	7.1
Ortalama Saat 14 Bulutluluk	34	6.5	6.4	6.5	7.0	6.3	4.2	2.9	2.7	2.9	4.7	5.5	6.9
Ortalama Saat 21 Bulutluluk	34	6.2	6.2	6.1	5.9	5.0	2.9	1.7	1.5	1.7	3.8	4.8	6.5
Ortalama Bulutluluk	34	6.6	6.5	6.5	6.4	5.2	3.0	1.9	1.7	2.0	4.1	5.2	6.8
Ortalama Açık Günler Sayısı	34	5.4	5.1	4.7	3.1	4.4	12.4	17.4	17.4	16.4	10.8	8.2	5.3
Ortalama Bulutlu Günler Sayısı	34	9.5	8.9	11.1	15.0	19.3	13.9	11.6	10.6	11.1	13.5	11.6	8.9
Ortalama Kapalı Günler Sayısı	34	14.3	12.6	12.4	10.1	5.5	1.9	0.2	0.2	0.8	5.7	9.3	16.8
Saat 07 Toplam Yağış Ortalaması (mm)	29	18.8	26.6	29.4	32.5	20.8	5.9	2.5	3.0	5.1	21.9	23.8	24.9
Saat 14 Toplam Yağış Ortalaması (mm)	29	11.8	12.6	17.0	20.3	13.5	4.9	1.6	1.2	2.8	12.6	14.7	16.3
Saat 21 Toplam Yağış Ortalaması (mm)	29	12.0	12.7	17.9	22.4	23.7	12.3	6.0	3.2	3.0	17.4	17.1	14.1
Toplam Yağış Ortalaması (mm)	34	51.1	61.3	77.9	87.3	65.0	27.6	10.7	7.7	11.3	63.9	64.6	67.3
Maksimum Yağış (mm)	34	32.8	35.0	57.0	46.7	58.2	33.0	26.2	44.4	22.1	93.0	59.6	30.8
Yağışın 0,1 mm ve Büyük Olduğu Günler Sayısı Ortalaması	34	9.4	10.1	11.4	12.7	12.6	6.6	2.9	2.0	2.5	9.0	8.1	11.1
Yağışın 10 mm ve Büyük Olduğu Günler Sayısı Ortalaması	34	1.3	2.1	2.4	2.9	1.9	0.7	0.3	0.2	0.4	2.3	2.4	2.4
Yağışın 50 mm ve Büyük Olduğu Günler Sayısı Ortalaması	34			0.1		0.0					0.1	0.0	
Kar Yağışlı Günler Sayısı	34	9.1	9.0	8.1	2.1	0.1					0.3	2.4	8.3
Kar Örtülü Günler Sayısı	34	21.8	21.6	17.0	3.3	0.1					0.2	3.1	15.9
Maksimum Kar Kalınlığı (cm)	34	78	112	100	88	9					14	38	60
Sisli Günler Sayısı Ortalaması	34	3.1	2.3	1.3	0.2						0.1	1.4	2.2
Dolulu Günler Sayısı Ortalaması	34			0.1	0.4	0.3	0.2	0.1	0.1	0.0	0.0	0.1	
Kırağılı Günler Sayısı Ortalaması	34	1.6	0.0	1.2	1.4	0.1				0.1	3.4	8.9	3.9

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Enlem	38.1												
Boylam	41.28												
Yükseklik	1650			17778-VARTO						1976 - 2010			
Parametre	Rasat S. (	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
Toplam Orajlı Günler Sayısı Ortalaması	28		0.0	0.2	1.1	2.6	2.3	0.7	0.7	0.4	0.2	0.1	
Saat 07 Ortalama Rüzgar Hızı (m_sec)	34	0.6	0.6	0.7	0.7	0.7	0.5	0.4	0.3	0.4	0.5	0.6	0.6
Saat 14 Ortalama Rüzgar Hızı (m_sec)	34	1.2	1.3	1.8	3.0	3.0	2.5	2.2	2.3	2.6	2.2	1.7	1.2
Saat 21 Ortalama Rüzgar Hızı (m_sec)	34	0.7	0.8	1.0	1.3	1.4	1.4	1.5	1.5	1.2	1.0	0.9	0.7
Ortalama Rüzgar Hızı (m_sec)	34	0.9	0.9	1.2	1.7	1.7	1.4	1.4	1.4	1.4	1.2	1.1	0.8
Maksimum Rüzgar Hızı (m_sec) ve Yönü	34	23.4 WS	25.0 NW	28.5 SW	28.1 NNE	25.4 WN	25.2 WS	24.6 NNE	20.1 NNE	22.3 NW	21.4 WN		
Fırtınalı Günler Sayısı Ortalaması	34	0.2	0.2	0.2	0.4	0.9	0.4	0.4	0.3	0.4	0.2	0.2	0.2
Kuvvetli Rüzgarlı Günler Sayısı Ortalaması	34	0.7	0.7	1.3	3.4	4.7	3.0	2.9	3.8	3.3	2.7	1.4	0.6
N Yönünde Rüzgarın Esme Sayıları Toplamı	34	179	142	231	286	218	240	293	310	282	276	255	274
N Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	2.0	2.1	2.2	2.2	2.1	1.9	2.0	1.6	1.7	1.7	1.7	1.6
NNE Yönünde Rüzgarın Esme Sayıları Toplamı	34	152	113	190	351	284	433	835	745	386	344	215	125
NNE Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	2.1	2.0	2.2	1.9	2.0	2.3	2.6	2.2	1.5	1.6	1.8	1.8
NE Yönünde Rüzgarın Esme Sayıları Toplamı	34	422	375	543	740	953	1168	1729	1976	1425	1274	649	485
NE Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.7	1.6	1.9	1.9	1.9	1.9	2.0	1.8	1.4	1.3	1.3	1.4
ENE Yönünde Rüzgarın Esme Sayıları Toplamı	34	365	401	552	706	836	894	1230	1426	1227	1027	667	409
ENE Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.8	1.7	1.9	1.8	1.7	1.8	1.9	1.6	1.4	1.4	1.4	1.4
E Yönünde Rüzgarın Esme Sayıları Toplamı	34	258	236	313	434	586	579	832	830	758	668	428	314
E Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.9	1.9	2.1	1.9	2.0	1.9	1.8	1.6	1.4	1.6	1.6	1.5
ESE Yönünde Rüzgarın Esme Sayıları Toplamı	34	249	296	395	592	681	595	677	723	622	553	494	429
ESE Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.6	1.7	1.8	2.0	1.8	1.8	1.7	1.6	1.5	1.4	1.4	1.4
SE Yönünde Rüzgarın Esme Sayıları Toplamı	34	290	228	284	590	606	598	749	934	608	563	449	301
SE Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.4	1.4	1.6	2.0	1.9	1.8	1.6	1.6	1.4	1.4	1.2	1.3
SSE Yönünde Rüzgarın Esme Sayıları Toplamı	34	322	282	433	891	1211	1266	1495	1320	1163	1073	683	363

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Enlem	38.1												
Boylam	41.28												
Yükseklik	1650			17778-VARTO						1976 - 2010			
Parametre	Rasat S. (	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
SSE Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.4	1.4	1.8	2.1	2.2	2.0	1.8	1.8	1.7	1.5	1.4	1.4
S Yönünde Rüzgarın Esme Sayıları Toplamı	34	487	396	411	680	976	853	1083	1163	1047	706	787	557
S Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	0.9	1.1	1.5	2.3	2.3	2.0	1.7	1.9	1.9	1.7	1.1	1.1
SSW Yönünde Rüzgarın Esme Sayıları Toplamı	34	1155	985	1282	1895	2313	2182	1780	1998	2260	2043	1657	1527
SSW Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.0	1.1	1.3	1.8	1.8	1.6	1.5	1.5	1.5	1.2	1.1	1.0
SW Yönünde Rüzgarın Esme Sayıları Toplamı	34	2580	2551	2244	2362	2462	2447	2171	2087	2250	2670	3067	3702
SW Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	0.9	0.9	1.1	1.8	1.7	1.4	1.2	1.4	1.4	1.2	1.1	0.8
WSW Yönünde Rüzgarın Esme Sayıları Toplamı	34	4322	4119	3666	2913	2607	2397	1744	1637	2246	2878	3522	4504
WSW Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	0.9	1.0	1.3	1.7	1.6	1.4	1.3	1.3	1.5	1.1	1.2	0.9
W Yönünde Rüzgarın Esme Sayıları Toplamı	34	2587	2226	2830	1952	1659	1284	1075	967	1164	1554	2191	2856
W Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.0	1.1	1.2	1.6	1.5	1.3	1.1	1.1	1.3	1.0	1.1	1.0
WNW Yönünde Rüzgarın Esme Sayıları Toplamı	34	1725	1567	2175	2123	1988	1616	1400	1386	1579	1925	1646	1844
WNW Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.4	1.4	1.6	2.0	1.9	1.5	1.3	1.2	1.2	1.2	1.3	1.3
NW Yönünde Rüzgarın Esme Sayıları Toplamı	34	778	891	1029	1059	1141	1003	954	1095	1135	1037	808	906
NW Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.5	1.7	1.7	1.9	1.9	1.5	1.3	1.2	1.2	1.3	1.5	1.4
NNW Yönünde Rüzgarın Esme Sayıları Toplamı	34	289	199	278	349	423	469	516	592	562	473	300	239
NNW Yönünde Rüzgarın Ortalama Hızı (m_sec)	34	1.7	2.2	2.0	2.0	2.1	1.9	1.6	1.4	1.2	1.3	1.4	1.4
Ortalama 5 cm. Toprak Sıcaklığı (°C)	29	-3.0	-2.4	2.2	9.7	16.2	22.5	27.2	27.9	22.5	13.6	5.3	-0.1
Minimum 5 cm. Toprak Sıcaklığı (°C)	29	-17.5	-15.4	-11.0	-0.8	1.2	4.2	8.0	11.5	4.3	0.3	-6.2	-13.4
Ortalama 10 cm. Toprak Sıcaklığı (°C)	29	-2.6	-2.3	1.8	9.3	15.5	21.6	25.9	26.7	22.0	13.7	5.6	0.5
Minimum 10 cm. Toprak Sıcaklığı (°C)	29	-16.8	-12.7	-8.5	-0.7	1.5	5.0	14.5	12.9	7.4	3.1	-2.6	-9.7
Ortalama 20 cm. Toprak Sıcaklığı (°C)	27	-1.6	-1.9	1.3	8.6	14.7	20.5	24.9	25.8	21.7	14.0	6.1	1.3
Minimum 20 cm. Toprak Sıcaklığı (°C)	27	-12.7	-10.3	-7.1	-0.6	2.5	7.4	17.1	16.0	10.8	3.6	-1.8	-7.5

İbrahim USLUOĞLU
Bilgi İşlem ... Şube ...
KAYITLARINA UYGUNDUR

T.C.
ÇEVRE ve ORMAN BAKANLIĞI
DEVLET METEOROLOJİ İŞLERİ GENEL MÜDÜRLÜĞÜ

Enlem	38.1												
Boylam	41.28												
Yükseklik	1650				17778-VARTO					1976 - 2010			
Parametre	Rasat S. (	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
Ortalama 50 cm. Toprak Sıcaklığı (°C)	29	1.3	0.3	1.7	7.6	13.5	18.6	22.6	24.3	21.6	15.8	8.9	4.0
Minimum 50 cm. Toprak Sıcaklığı (°C)	29	-4.2	-2.8	-1.4	-0.3	7.8	13.5	17.7	20.7	16.4	7.6	2.7	-1.0
Ortalama 100 cm. Toprak Sıcaklığı (°C)	29	4.5	3.0	3.0	6.4	10.9	15.1	18.8	21.0	20.5	17.0	11.9	7.5
Minimum 100 cm. Toprak Sıcaklığı (°C)	29	1.7	0.9	0.6	0.8	6.5	11.7	15.4	18.3	17.0	11.5	6.2	4.0
Ortalama Açık Yüzey Buharlaşması (mm)													
Maksimum Açık Yüzey Buharlaşması (mm)													
Ortalama Günlük Toplam Güneşlenme Süresi (sa-da)													
Ortalama Global Güneşlenme Şiddeti (cal+cm²)													
Maksimum Günlük Toplam Güneşlenme Şiddeti (cal+cm²)													
Ortalama Deniz Suyu Sıcaklığı (°C)													
Maksimum Deniz Suyu Sıcaklığı (°C)													
Minimum Deniz Suyu Sıcaklığı (°C)													

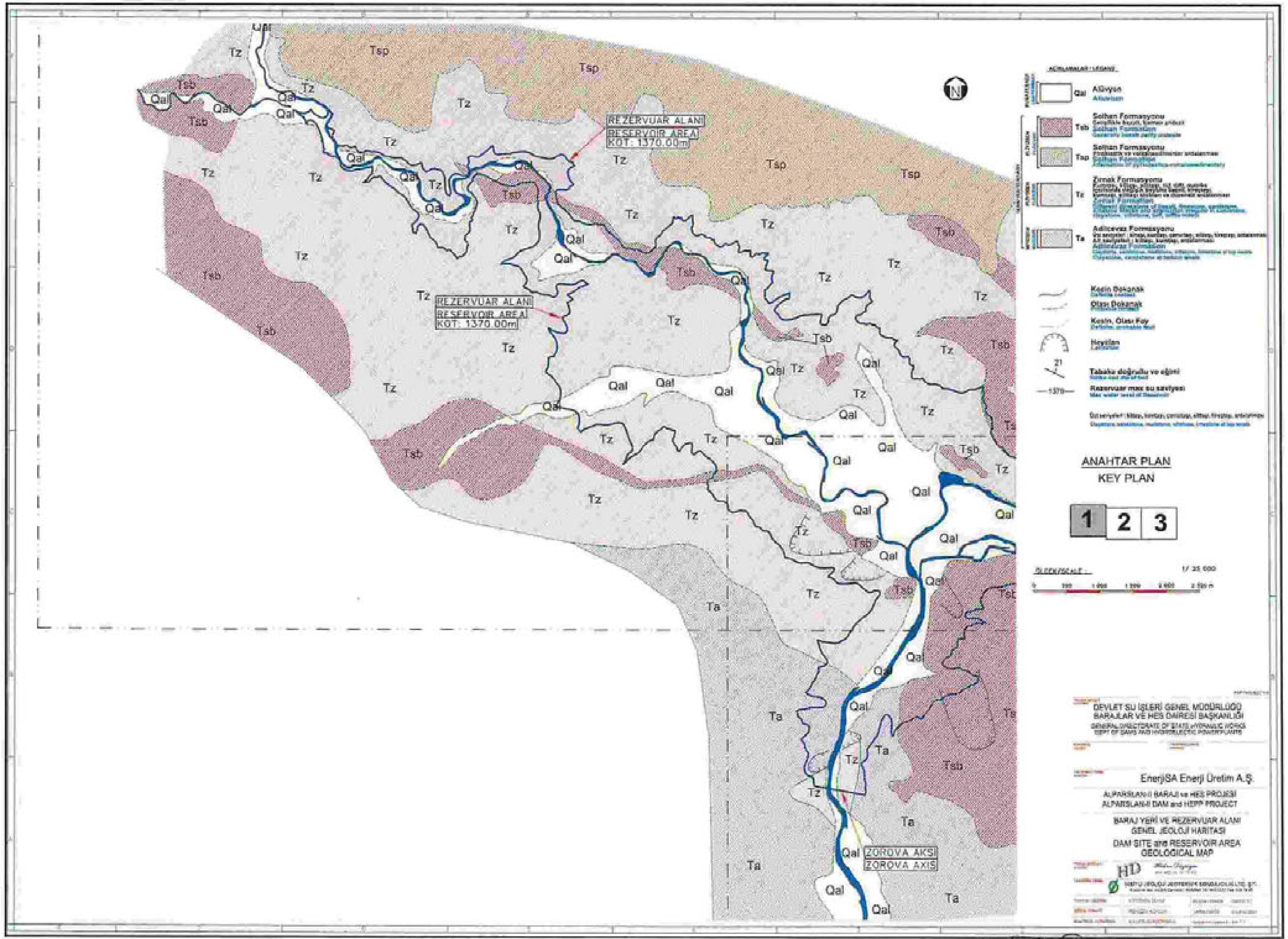
KAYITLARINA UYGUNDUR

APP 7

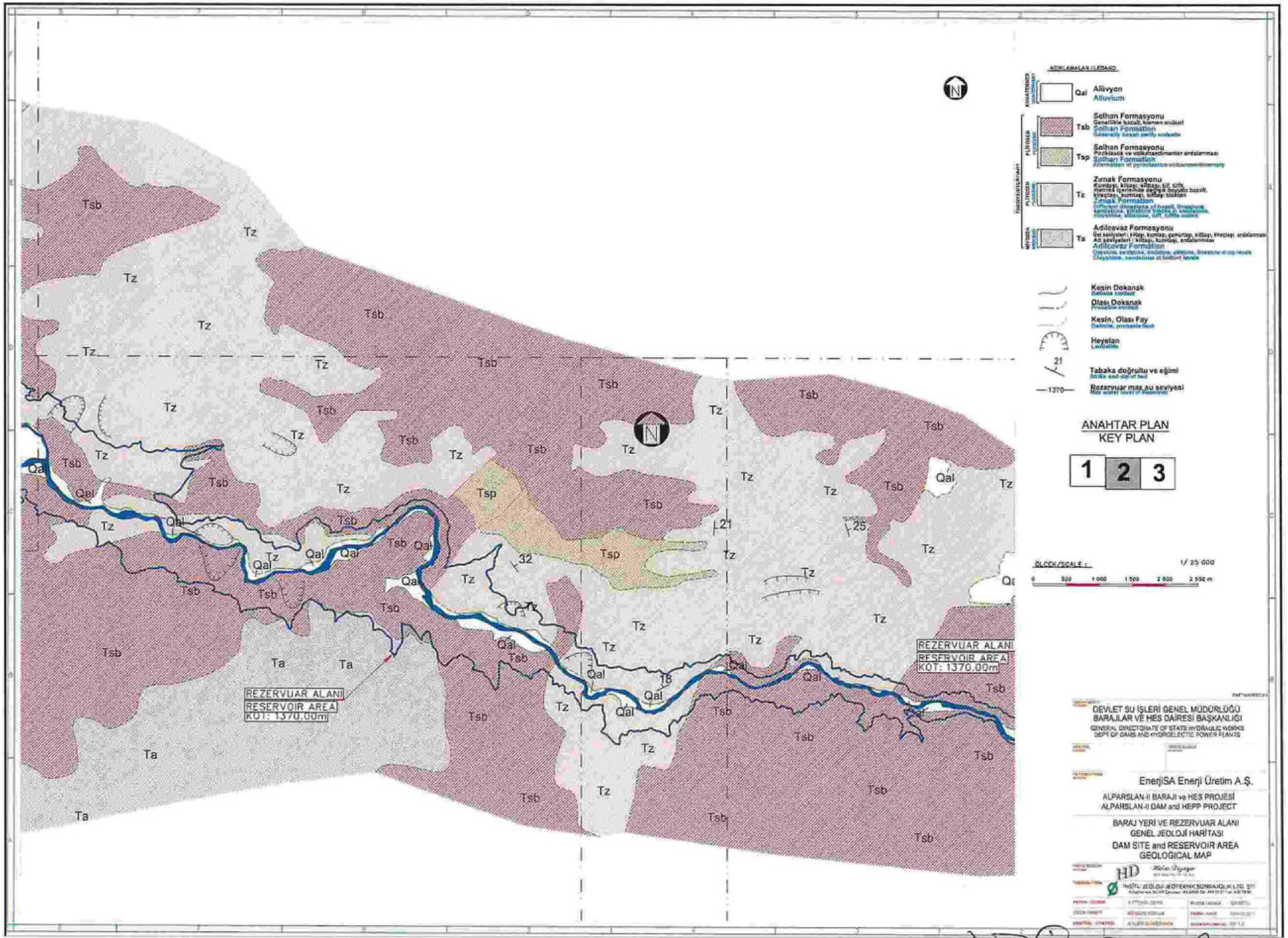
GEOTECHNNICAL SURVEY REPORT
(CD)

APP 8

GEOLOGICAL MAP



App 8.1. Geological Map-1



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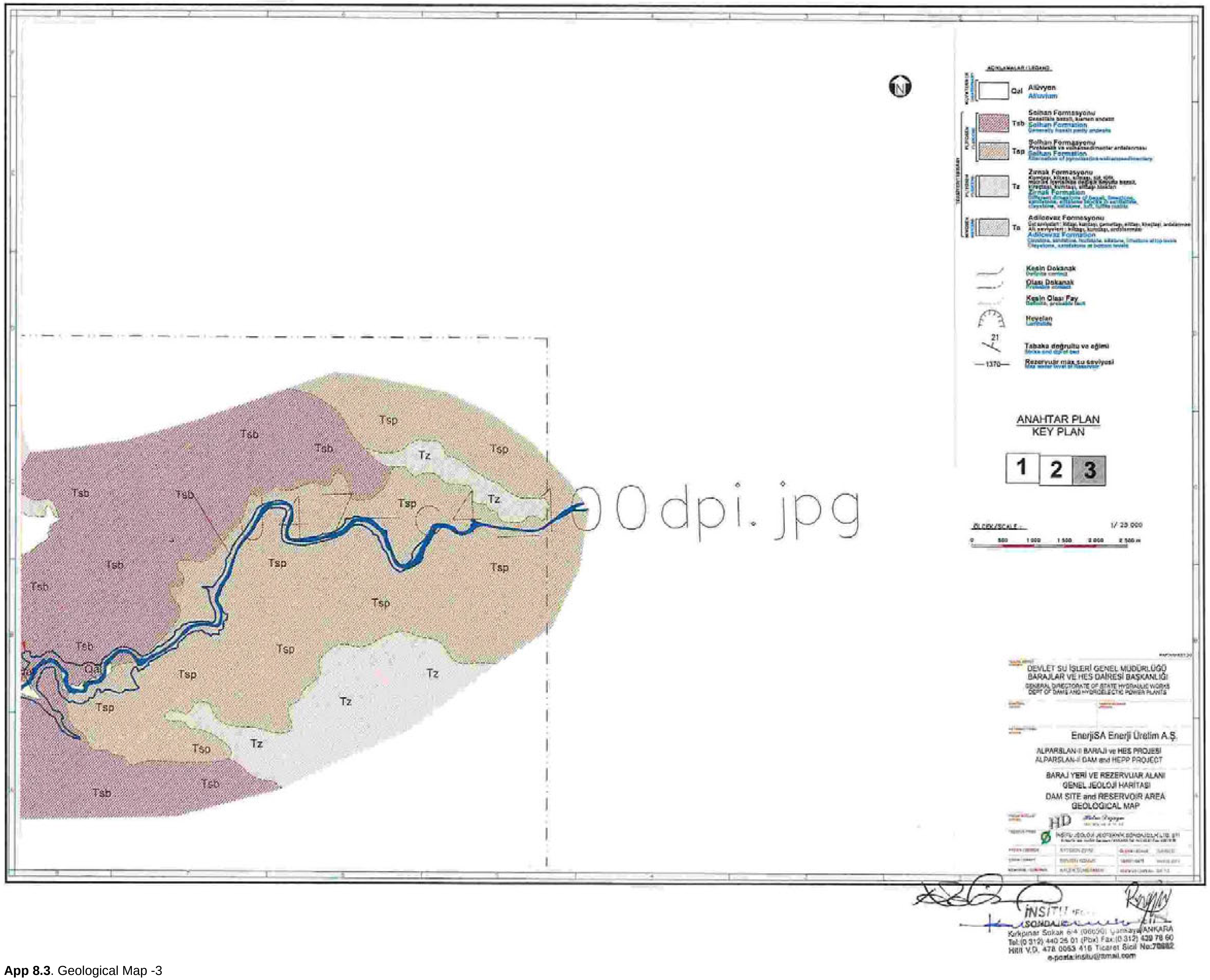
App 8.2. Geological Map -2



App 8.3. Geological Map -3

APP 9

SEISMIC HAZARD ASSESSMENT REPORT

ENERJISA Inc., Ankara

ASSESSMENT of SEISMIC HAZARD for ALPASLAN II DAM PROJECT SITE

M. Erdik, M. B. Demircioğlu, K. Şeşetyan, C. Yenidoğan

Boğaziçi University
Kandilli Observatory and Earthquake Research Institute
Department of Earthquake Engineering

June 2011, İstanbul

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1 INTRODUCTION

This report is prepared upon the request of ENERJI Inc. to investigate the earthquake hazard needed in connection with the earthquake resistant design of Alpaslan II Dam in Turkey.

The Alpaslan II Dam project site is located in the Southeast Anatolian region, on the Murat River, about 30km North of Muş City. The location of the Alpaslan II Dam site is given in Figure 1. The proximity of the project site to the major active tectonic entities makes a thorough assessment of the earthquake hazard and a reliable earthquake resistant design philosophy imperative for the optimum design and safety of the dam.

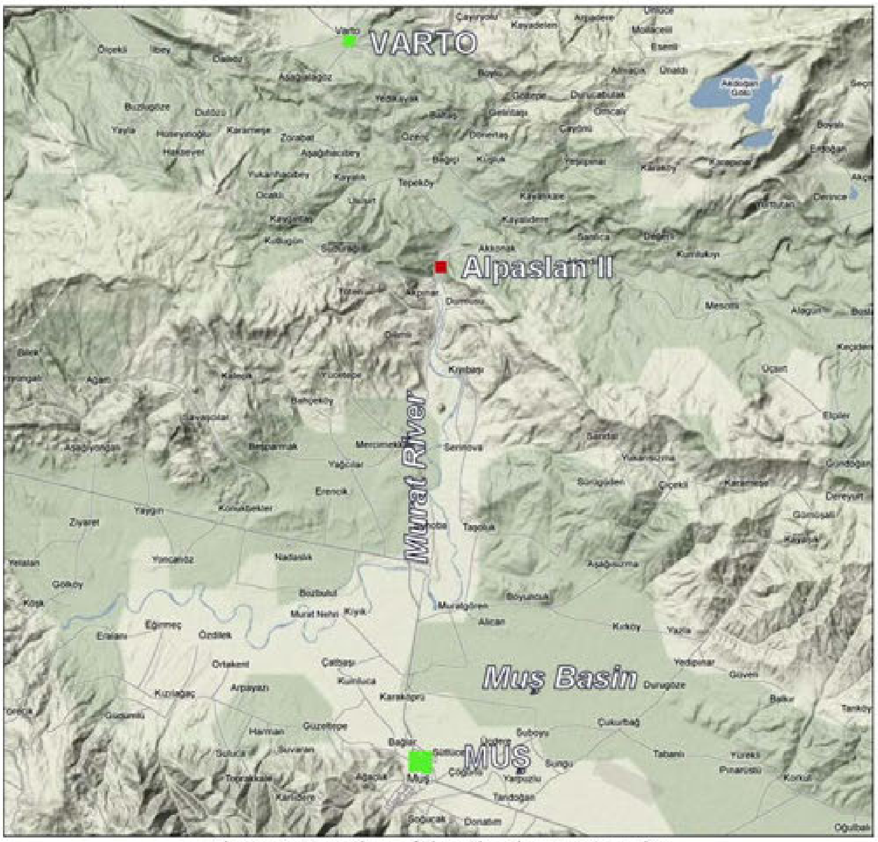

Figure 1. Location of the Alpaslan II Dam site

The guidelines published by the Committee on Seismic Aspects of Dam Design of the International Commission on Large Dams (ICOLD) calls for a two level design. The present report encompasses a review of the relevant earthquake resistant design criteria applicable to the project and assessment of the seismic hazard both in probabilistic and deterministic approaches based on the active seismo-tectonic structure of the region.

3

2 DESIGN BASIS GROUND MOTION

The current guidelines published by the Committee on Seismic Aspects of Dam Design of the International Commission on Large Dams (ICOLD) calls for a two level design based on Operating Basis Earthquake (OBE) and Maximum Design Earthquake (MDE) that corresponds to the Maximum Credible Earthquake (MCE).

Operating Basis Earthquake (OBE)
ICOLD Guidelines (1989). "The Operating Basis Earthquake (OBE) represents the level of ground motion at the dam site at which only minor damage is acceptable, the dam, appurtenant structures and equipment should remain functional and damage easily repairable from the recurrence of the earthquake not exceeding the OBE".

FEMA (2005). "The OBE is an earthquake that produces ground motions at the site that can reasonably be expected to occur within the service life of the project. The associated performance requirement is that the project functions with little or no damage, and without interruption of function. The purpose of the OBE is to protect against economic losses from damage or loss of service. Therefore, the return period may be based on economic considerations".

USACE (1995, 2007): "The OBE is an earthquake that can reasonably be expected to occur within the service life of the project, that is, with a 50% probability of exceedance during the service life (corresponding to a return period of 144 years for a project with a service life of 100 years). …… The OBE is determined by a PSHA."

The memorandum of General Directorate of State Hydraulic Works of Turkey numbered B.18.1.DSI.0.14.72.00 on Earthquake Hazard Analysis states 144 years for the average return period for OBE.

Maximum Credible Earthquake (MCE)
ICOLD (1989, 2010). "The MCE (Maximum Credible Earthquake) is the largest conceivable earthquake that appears possible along a recognized fault or within a geographically designated tectonic province, under the presently known or presumed tectonic framework".

ICOLD (2010), dropping the definition of MDE, further states that "The most severe ground motion affecting a dam site due to an MCE scenario is referred to as the MCE ground motion.

FEMA (2005). "The MCE is the largest earthquake magnitude that could occur along a recognized fault or within a particular seismotectonic province or source area under the current tectonic framework".

USACE (1995, 2007): "This earthquake is defined as the greatest earthquake that can reasonably be expected to be generated by a specific source on the basis of seismological and geological evidence. Since a project site may be affected by earthquakes generated by various sources, each with its own fault mechanism, maximum earthquake magnitude, and distance from the site, multiple MCE's may be defined for the site, each with characteristics ground motion parameters and spectral shape. The MCE is determined through a DSHA".

Where there are several potential earthquake sources, the Controlling MCE is that which would result in the most severe or strongest ground motions at the site. It is noted that the probability of occurrence of the MCE is not included in its definition.

Wieland (2006, 2007 and 2010), as the Chairman, ICOLD Committee on Seismic Aspects of Dam Design, states that: *"due to the problems involved in estimating of the corresponding ground motion, the MCE is usually defined statistically with a typical return period of 10,000 years"*.

Maximum Design Earthquake (MDE)

ICOLD (1989). The Maximum Design Earthquake (MDE) will produce the maximum level of ground motion for which the dam should be designed or analyzed. For dams whose failure would present a great social hazard, the MDE will normally be characterized by a level of motion equal to that expected at the dam site from the occurrence of the MCE. The impounding capacity of the dam must be maintained when subjected to that seismic load.

ICOLD (2010) drops the term "MDE" and switches to the term "SEE", in line with other related codes.

FEMA (2005). "The MDE or Safety Evaluation Earthquake (SEE) is the earthquake that produces the maximum level of ground motions for which a structure is to be designed or evaluated. The MDE or SEE may be set equal to the MCE or to a design earthquake less than the MCE, depending on the circumstances. Factors to consider in establishing the size of MDE are the hazard potential classification of the dam, criticality of the project function, and the turnaround time to restore the facility to operability. In general, the associated performance requirement for the MDE is that the project performs without catastrophic failure, such as uncontrolled release of the reservoir, although significant damage or economic loss may be tolerated".

USACE (1995, 2007): "The MDE is the maximum level of ground motion for which a structure is designed or evaluated. As a minimum, for other than critical structures, the MDE ground motion has a 10% probability of being exceeded in a 100-year period, (or a 1000-year return period). For critical structures, the MDE ground motion is the same as the maximum credible earthquake (MCE) ground motion."

IBC (2009), ASCE 7-10 (2010): Uses the "Maximum Considered Earthquake (MCE)" to define the 2%/50 (2475 year average return period) earthquake ground motion, based on probabilistic methods. As such, it is analogous to MDE. Deterministically it represents the ground motion that would result from the Maximum Credible Earthquake.

On the basis of these evaluations and considerations the following design basis ground motion levels can be decided:

Operating Basis Earthquake (OBE)

On the basis of ICOLD (1989 and 2010), the Operating Basis Earthquake will be determined as the probabilistically assessed earthquake ground motion for an average return period of 145 years which corresponds to a 50% probability of exceedance in 100 years. This should be considered a minimum return period. Under the action of this level of ground motion, the dam, appurtenant structures and equipment should remain functional (essentially respond in elastic ranges of deformation) and, if any, the minor damage should be easily repairable.

Safety Evaluation Earthquake (SEE)

On the basis of ICOLD (2010), the Safety Evaluation Earthquake (in ICOLD 1998, MDE) is the maximum level of ground motion for which the dam should be designed or analyzed. For dams whose failure would present a great social hazard the SEE will normally be characterized by a level of motion equal to that expected at the dam site from the occurrence of a deterministically-evaluated maximum credible earthquake or of the probabilistically-evaluated earthquake ground motion with a very long return period, for example 10,000 years. Although the memorandum of General Directorate of State Hydraulic Works of Turkey numbered B.18.1.DSI.0.14.72.00 on Earthquake Hazard Analysis suggests a average return period of 475 years for the probabilistic assessment of MDE (now, SEE) for the 1st degree earthquake hazard zone (and 2475 years for other zones) of Turkey. In the light of the ICOLD recommendations and also in line with the Turkish Code for the Earthquake Resistant Design of Ports, Harbors and railroad bridges, the return period for the probabilistically computed SEE needs to be taken as 2475 years, as a minimum value.

As such, SEE will be determined to correspond either to the deterministic MCE (with the appropriate use of standard deviation increase) or the probabilistically assessed earthquake ground motion for an average return period of 2475 years (4% probability of exceedance in 100 years). Under the action of this ground motion level the stability of the dam and life safety must be ensured with no uncontrolled release of water from the reservoir. It is recommended to design safety-critical elements such as the bottom outlet and/or spillway gates for the SEE.

3 ACTIVE TECTONICS

Turkey lies within the Mediterranean sector of the Alpine-Himalayan orogenic system, which runs west east from the Mediterranean to Asia. The Alpine orogeny is produced as a result of the compressional motion between Europe and Africa, whereas the Himalayan orogeny has resulted from the India-Asia collision. The tectonic evolution of the Eastern Mediterranean region is dominated by the effects of subduction along the Aegean arc and of continental collision in eastern Anatolia and the Caucasus as a result of northward motion of the Arabian plate (Taymaz et al., 2007). The resulting combination of is causing the Turkish plate to move southwestward, bounded by strike-slip fault zones: the North Anatolian Fault Zone (NAFZ) to the north and the East Anatolian Fault Zone (EAFZ) to the south (Figure 2). Three major structures govern the neotectonics of Turkey: these are the right lateral North Anatolian Fault Zone (NAFZ), left lateral East Anatolian Fault Zone (EAFZ) and the Aegean-Cyprian Arc. The Anatolian wedge between NAFZ and EAFZ moves westward away from the Eastern Anatolia, the collision zone between the Arabian and Eurasian plates. The Alpaslan II Dam site is located in the north of the Bitlis Suture Zone, very close to the junction of North and East Anatolian Fault Zones. The neotectonic entities of the Eastern Anatolian are indicated in Figure 3.

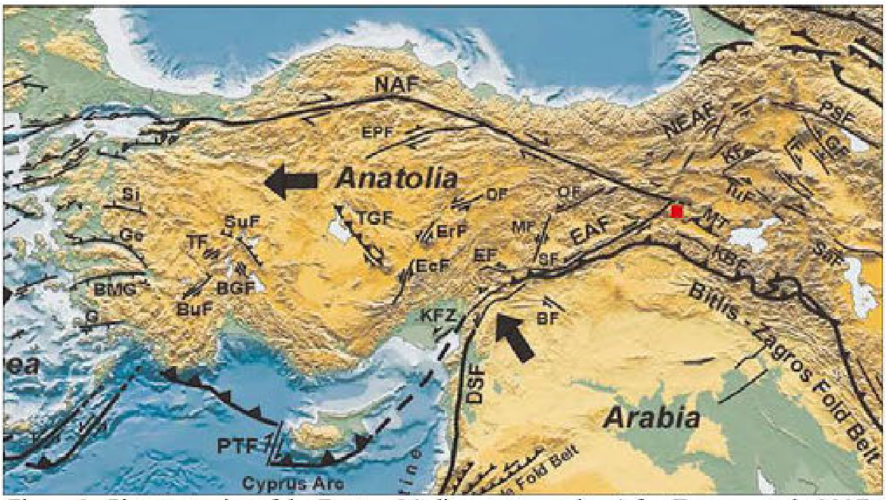

Figure 2. Plate tectonics of the Eastern Mediterranean region (after Taymaz et al., 2007). *Location of the Alpaslan II Dam site is marked with a red square. NAF, North Anatolian Fault; EAF, East Anatolian Fault; DSF, Dead Sea Fault; NEAF, North East Anatolian Fault; OF, Ovacık Fault; MT, MuşThrust Zone; TuF, Tutak Fault; Kavakbaşı Fault.*

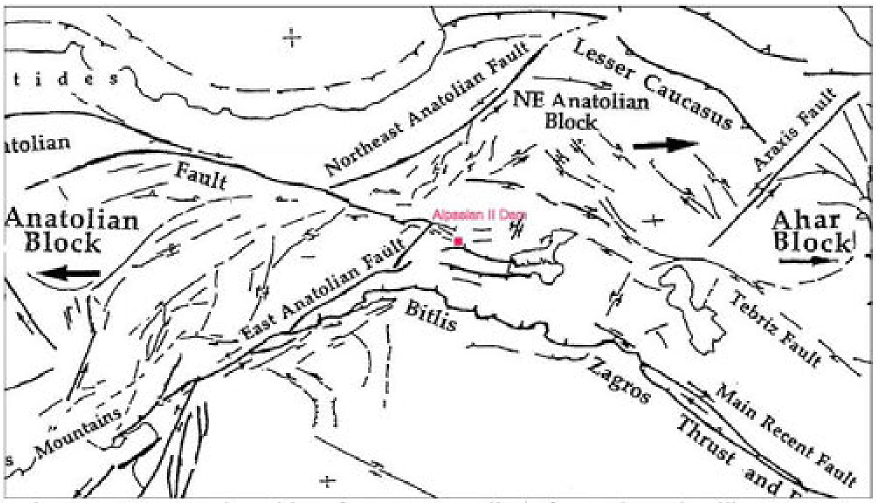

Figure 3. Neo-tectonic entities of Eastern Anatolia (After Barka and Reilinger, 1997).

Figure 4 illustrates the main neo-tectonic features that would control the earthquake hazard at the Alpaslan II Dam site. The fault lineaments indicated on this figure are taken from the official neo-tectonic map of Turkey (Şaroğlu et al., 1992). As it can be assessed, in addition to North and East Anatolian Fault Zones, the Varto Fault and the Muş Thrust are the important tectonic entities to be considered for earthquake hazard estimation. Dhont and Chorowicz (2006) state that the Muş basin lie immediately to the north of the Bitlis belt. The Muş basin, bounded to the north by the Muş Thrust, is regarded as ramp basins of compressional origin.

Figure 4. The main neo-tectonic features that control the earthquake hazard at the Alpaslan II Dam site.

Varto fault system extends over 50 km forming a large mostly extensional horsetail. Most of the deformation is localized on the Main Varto Fault that is in strait continuation of the fourth segment of the North Anatolian Fault. This main strand, located exactly at the foot of the Bingöl half-caldera, accommodates mostly strike-slip faulting (Figure 5 and 6, after Hubert-Ferrari at al, 2009).

The horsetailing of the Varto Fault (System), illustrated in Figure 6, is formed by nearly E-W trending three parallel fault segments which are called from north to the south, Varto segment, Mt. Leylek segment, Çayçatı segment (Sancar et al., 2011). Several morphotectonic features that indicate long period of pure strike-slip fault activity, have been identified on Varto segment. INSITU (2010) also reports that the Varto Fault System essentially consists of three parallel fault segments, named Varto, Leylakdağ and Çayçatı, with prominent right-lateral strike slips (Figure 7), and associates them with a an MCE of Mw>6.8.

Varto Fault System has produced two major earthquakes, 31 May 1946 (Ms=5.9) and 19 August 1966 (Ms=6.8), in the last century. In 1966, the Varto M=6.8 earthquake (Wallace 1968; Ambraseys & Zatopek 1968) ruptured its eastern part. Sancar et al., (2011) claim that the 1966 Varto earthquake did not create surface rupture on Varto segment while it seen on Mt. Leylek Segment and Çayçatı Segment. They further state that the Varto segment was most probably not ruptured neither in 1946 nor in 1966 Varto earthquakes, therefore it constitutes a seismic gap.

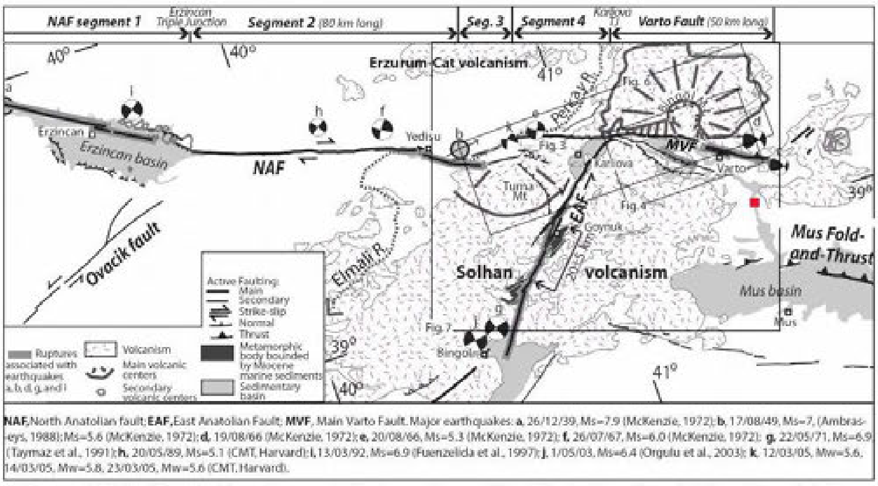

Figure 5. The Triple Junction and the location of the Varto Fault and Muş Thrust (after Hubert-Ferrari at al, 2009). Dam site, indicated with red square, is about 8km south of the Varto Fault.

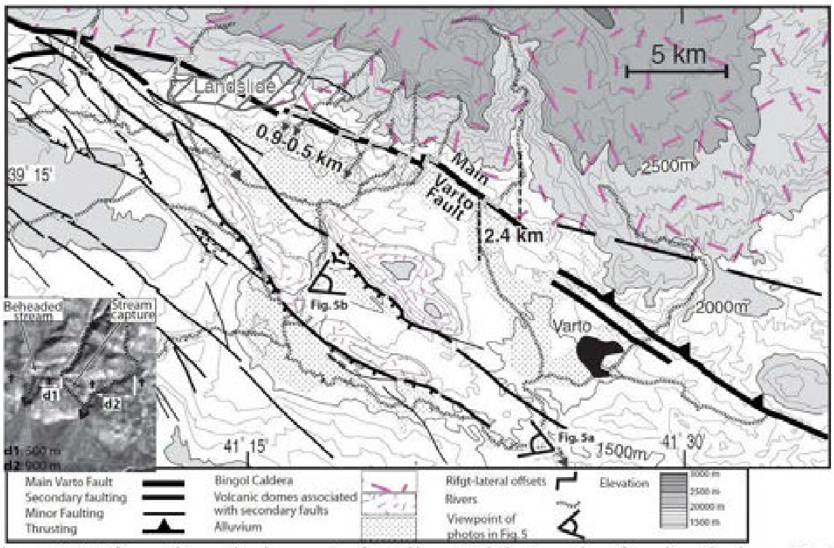

Figure 6. Deformation splaying east of Karliova Triple Junction forming the large Varto horsetail with parallel segments (see location in Figure 2). Main Varto Fault accommodates mainly right-lateral deformation with a thrusting component (after Hubert-Ferrari at al, 2009).

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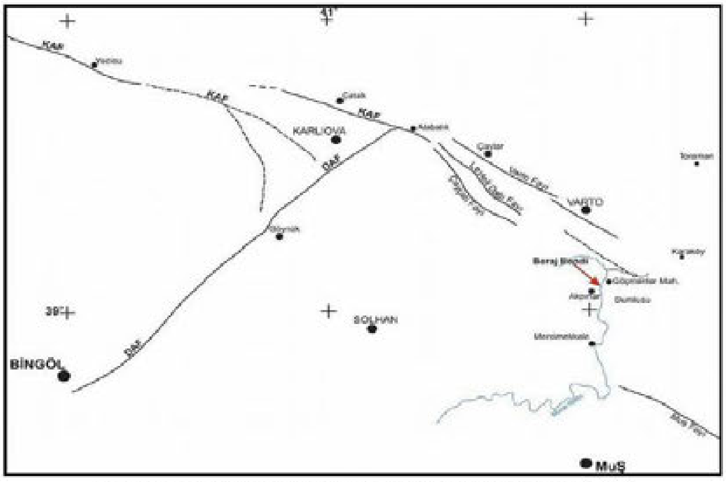

Figure 7. Regional active faults (After, INSITU, 2010)

4 SEISMICITY OF THE REGION

Catalogues of historical seismicity have been analyzed and combined to form a historical seismicity map of the region, to be used afterwards in the delineation of the seismic source zones. The historical seismicity of Eastern Anatolian province is presented in Figure 9. The closed historical events to the Alpaslan II dam site are the 19 August 1966 Varto (Mw6.8) with epicentral intensities of VIII-IX (MMI), 07 March 1966 Varto with an epicentral intensity of VII, and 31 May 1946 Üstükran events .

Table 1. The earthquakes with magnitude M≥ 5.5 (with the exception of the 1998 Karlıova earthquake) in the vicinity of the Karlıova Triple Junction from the 1784 Elmalı earthquake

Event ID	Date	LAT	LON	Location	M	Reference
1	18.07.1784	39.5	40.2	Elmalı	7.6	AJ
2	12.05.1866	39.2	41	Gönek	7.2	AJ
3	31.05.1946	39.3	41.2	Ustukran	5.7	AJ,EY
4	17.08.1949	39.4	40.65	Kıgı-Karliova	6.9	A,EY
5	07.03.1966	39.1	41.6	Varto-Hinis	5.6	MK,EY
6	19.08.1966	39.2	41.6	Varto	6.8	AZ,MK,EY
7	20.08.1966	39.4	40.9	Varto-Kigi	6.2	AZ,AJ,MK
8	20.08.1966	39.06	40.76	Goynuk	5.5	DW
9	26.07.1967	39.5	40.4	Kigi	5.9	AJ,MK,EY
10	22.05.1971	38.83	40.52	Bingol	6.8	*
11	13.04.1998	39.13	41.04	Kalıova	5	KOERI,HRV

AJ: Ambraseys and Jackson (1998); EY: Eyidoğan et al., (1991); A: Ambraseys (2001); MK: McKenzie (1972); AZ: Ambraseys and Zatopek (1968); DW: Dewey (1976); KOERI: Kandilli Observatory and Earthquake Engineering Institute.; HRV: Harvard CMT

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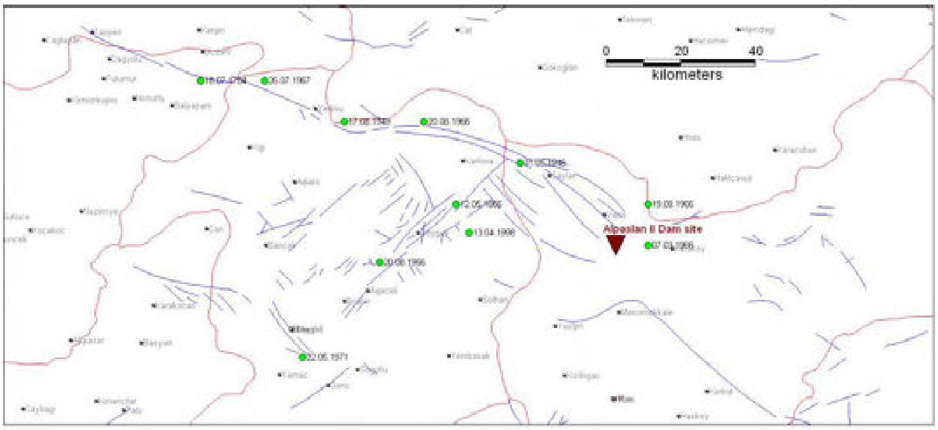

Figure 8. Epicenters of the earthquakes with magnitude M≥5.5 (with the exception of the 1998 Karlıova earthquake) occurred in the vicinity of the Karlıova Triple Junction from the 1784 Elmalı earthquake to date

The neotectonic entities of the Eastern Anatolian Region together with the location of the major earthquakes and their ruptures are indicated in Figure 9 (After Barka and Reilinger, 1997) and in Figure 10 (Kandilli Observatory).

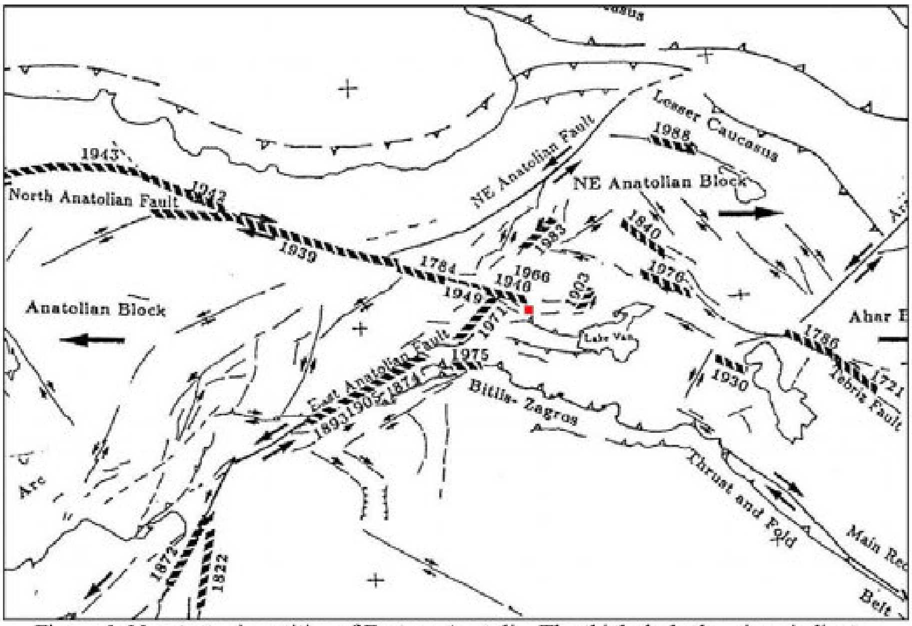

Figure 9. Neo-tectonic entities of Eastern Anatolia. The thick dashed regions indicates ruptures associated with the earthquakes (After Barka and Reilinger, 1997).

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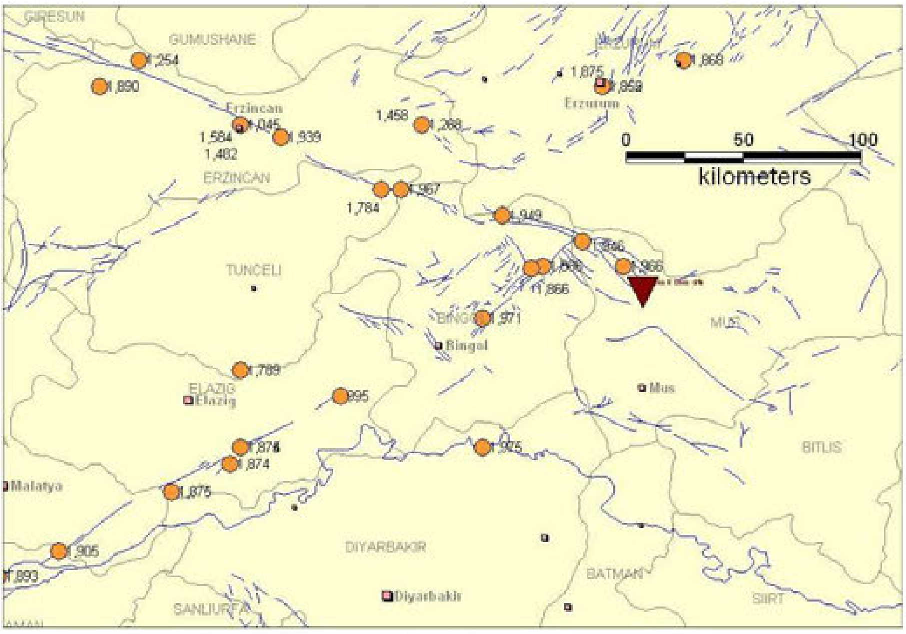

Figure 10. Major historic earthquakes and associated fault ruptures

Figure 11 represents the seismicity of the 20th century with **M** $\geq$ 4.0, whereas; Figure 12 represents that of the last decade again with **M** $\geq$ 4.0. Locations of the major instrumental earthquakes of 20th century that could have effected or strongly felt at the dam site are illustrated in Figure 13.

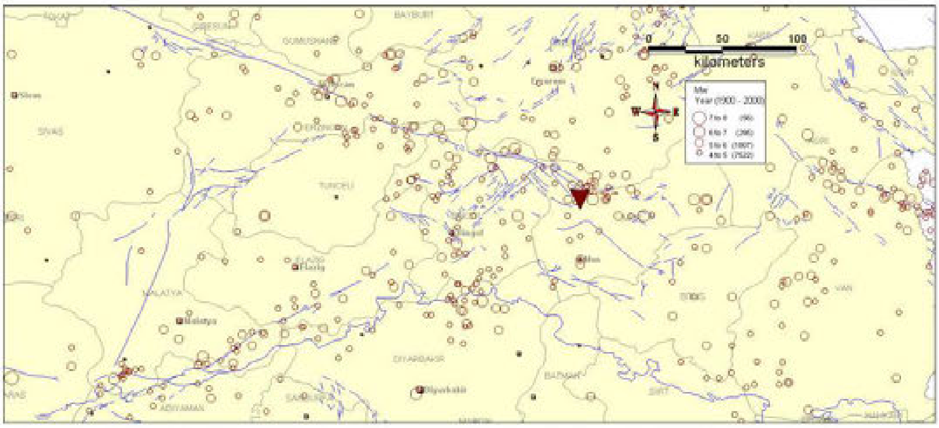

Figure 11. Seismicity of the East Anatolian tectonic province (between 1900 – 2000 year with M>4.0)

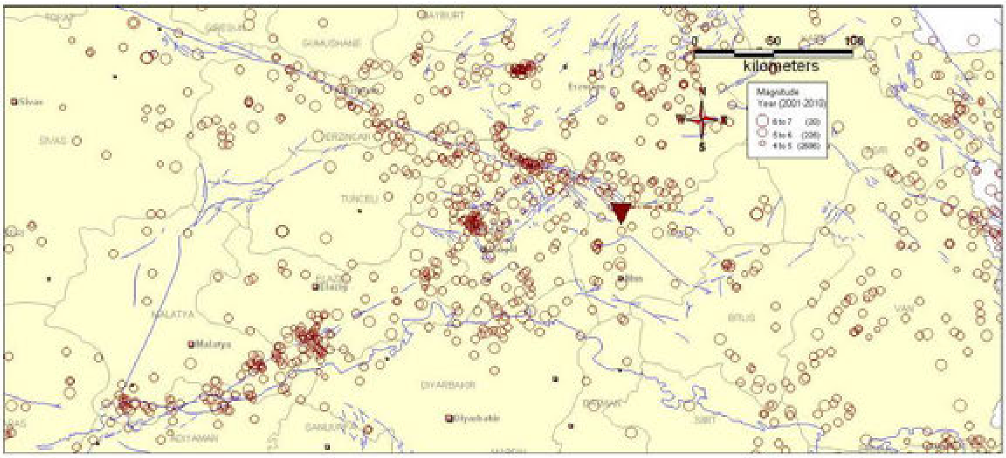

Figure 12. Seismicity of the East Anatolian tectonic province (2000 – 2010)

Figure 13. Location of the major instrumental earthquakes of 20th century that could have effected or strongly felt at the dam site

As it can be assessed from the seismicity described and illustrated, the Alpaslan II dam site has been affected by numerous earthquakes with magnitudes reaching Mw6.8 at distances as close as 8km (1966 Varto Earthquake). However, the magnitude of the earthquakes that took place in the immediate vicinity of the dam site during the last 110 years was less than M5.

5 SEISMIC SOURCE ZONATION

A seismic source zone is defined as a seismically homogenous area, in which every point within the source zone is assumed to have the same probability of being the epicenter of a future earthquake. An ideal delineation of seismic source zones requires a complete comprehension of the geology, tectonics, paleoseismology, historical and instrumental seismicity, and other neotectonic features of the region under study. However, it is not always possible to compile detailed information in all these fields for the majority of the world. Thus, frequently, seismic source zones are determined with two fundamental tools; a seismicity profile and the tectonic regime of the region under consideration. Seismic source zones used in this study are defined according to the principles that: Source boundaries should be defined with regard to the subsequently applied seismic hazard methodology; Sources (or regions) should be defined as areas with seismic characteristic which are as homogeneous as possible; Between sources (regions) of different seismic potential, the boundary should be located close to the highest concentration around the hard core of the most active ones; In areas possessing statistically sufficient number of reliable events, boundaries should be mainly based on seismic data as an expression of tectonic activity and backed up by tectonic arguments; In case of an insufficient number of events or a large number of uncertainties attached to the events, existence of a boundary has been decided by arguments based on the most dominant tectonic or seismic features.

5.1 Seismic Sources

The seismic source zonation used in this study is essentially based on the seismic source zonation model of Turkey developed within the context of a project conducted for the Ministry of Transportion Turkey, aiming the preparation of an earthquake resistant design code for the construction of railways, seaports and airports (DLH, 2007). The main improvement of this model when compared to previous studies (e.g. GSHAP, 1993-SESAME, 2003-TEFER, 2000 etc.) is the representation of main fault traces (such as the North Antolian and the East Anatolian Faults) with linear sources. Previous models used only areal zones to define seismic sources. In order to account for the spatially more diffuse moderate size seismicity around these faults, limited areal strips of widths of at least several kilometers were assigned even if the associated faults were well expressed on the surface. These areal strips encompasses secondary and en-echelon faults associated with the main tectonic lineaments.Earthquakes with $M_w \geq 6.5$ are assumed to take place on the linear zones, whereas the smaller magnitude events associated with the same fault zone are allowed to take place in the surrounding areal zones. In addition to linear and areal source zones background seismicity zones are defined to model the diffuse seismicity and floating earthquakes that are located outside these distinctly defined source zones and to differentiate zones where no significant earthquake has taken place. The source zonation model is presented in Figure 54. A summary of the source zone information is presented in Table 2.

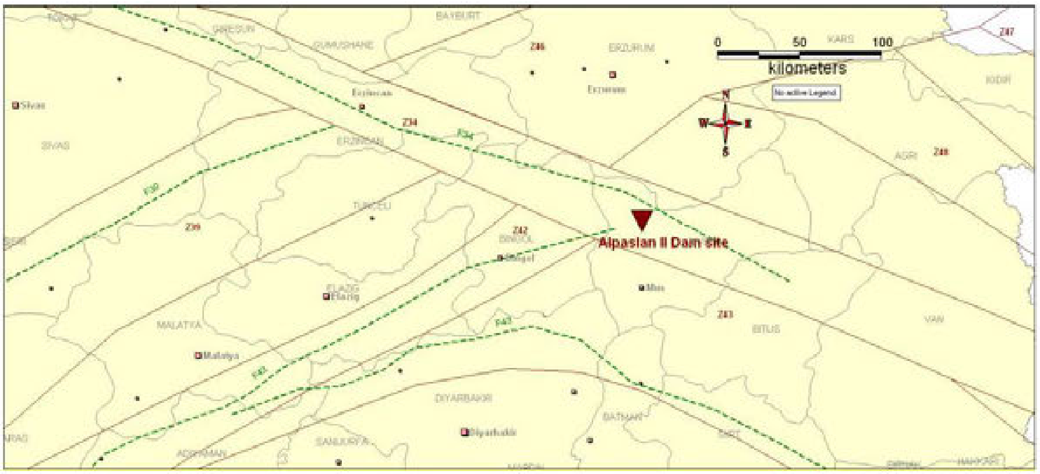

Figure 5. The seismic source zonation model

5.2 Recurrence Relationships

The empirical recurrence relationship for earthquakes (Gutenberg and Richter Model, Richter, 1954) is

$$\log N = a + b M \qquad (1)$$

where N is the number of the earthquakes above the magnitude M in a given region and within a given period and a and b are regression constants, has been extensively used in many seismicity studies and has also been confirmed to hold for micro-earthquakes. The coefficient "a" depends on size of the zone and the time period of the sample used and b represents a constant believed to be a characteristic of the region.

The earthquake catalogues are often biased due to incomplete reporting for smaller magnitude earthquakes in earlier periods. Thus to fit the recurrence relationship to a region, one should choose among using
(1) a short sample that is complete in small events or
(2) a longer sample that is complete in larger events or
(3) a combination of the two data sets to complete the deficient data thereby obtaining a homogeneous data set.

A direct attempt to fit these data to a regression relationship may result in quadratic or higher order expressions to accommodate the inherent bias and inhomogeneity of the data. In the method used in this study, an artificially homogeneous data set is simulated through the determination of the period over which the data in a given magnitude group are completely reported (Stepp, 1973). The computed recurrence parameters as well as the maximum magnitudes associated with the source zones are presented in Table 2.

Table 2. The seismicity parameters associated with the source zonation model

Seismic Zone	Fault Name	Mechanism	a	b	M_{min} - M_{max}
Z34 Outer zone	North Anatolian FAult	Right Lateral Strike Slip	5.0	0.8	5.0 – 6.7
Z34 Inner line					6.8 – 7.9
Z39 Outer zone	Göksun Fault	Left Lateral Strike Slip	2.7	0.7	5.0 -6.9
Z39 Inner line					7.0 – 7 .5
Z42 Outer zone	East Anatolian Fault	Left Lateral Strike Slip	4.6	0.9	5.0 – 6.7
Z42 Inner line					6.8 – 7.9
Z43 Outer zone	Bitlis – Zagros Thrust and Fold Belt	Reverse and Thrust	4.7	1.0	5.0 – 6.6
Z43 Inner line					6.7 – 7.0
Z46	North East Anatolian Fault Zone	Left and Right Lateral Strike Slip	5.6	1.1	5.0 - 7.7
Z48	Tebriz Fault Zone	Right Lateral Strike Slip	4.4	1.0	5.0 - 7.3

5.3 Ground Motion Prediction Equations

In the year 2003, a series of research activities has been initiated to obtain ground motion prediction equations based on the extensive ground motion dataset accumulated in the last decades. These ground motion prediction models have been published as Campbell and Bozorgnia (2008), Boore and Atkinson (2008), Chiou and Youngs (2008), Abrahamson and Silva (2008) and Idriss (2008). These models employ an extensive number of attributes related to source, propagation path and site conditions, and as such are appropriate tools especially for site specific hazard assessment. Review of the NGA models indicate reduced ground motion estimations particularly at short-periods (e.g., peak acceleration) and large magnitudes when compared to traditional relationships such as Boore et al. (1997) (**Error! Reference source not found.**Figure 11). This reduction is more pronounced in short distances and does not exceed 10% especially for the NEHRP B/C boundary computations (Site class NEHRP B/C boundary is also referred to as engineering bedrock conditions which according to National Earthquake Hazard Reduction Program -NEHRP, 1997, 2003 Provisions, is defined as sites with an average shear wave velocity of 760m/s at the upper 30m)..

The geologic and tectonic similarity between Californian and Anatolian regions allows for the use of the ground motion prediction models developed for the western US, for seismic hazard assessment studies in Turkey. On the other hand, the NGA prediction models are also based on a large dataset including strong ground motion data from Turkey. Based on these two premises, the present hazard assessment study is conducted for NEHRP B/C boundary site conditions, using the ground motion prediction models developed by Campbell and Bozorgnia (2008), Boore and Atkinson (2008) and Chiou and Youngs (2008). The hazard values obtained from the probabilistic analysis represent the average of the results obtained using these ground motion prediction models

6 PROBABILISTIC ASSESSMENT OF THE SEISMIC HAZARD

6.1 Methodology

The general methodology of calculating probabilistic seismic hazard is well established in literature (Cornell 1968). The method involves two separate models: a seismicity model describing a geographical distribution event sources and the distribution of magnitudes, and an attenuation model describing the effect at any site given as a function of magnitude and source-to-site-distance. The seismicity model may comprise a number of source regions, the seismicity of which should be expressed in terms of a recurrence relationship of events with magnitudes greater or equal to a certain value. The attenuation model relates the earthquake intensity (i.e. the effect of it, as a general term) at a site to magnitude, distance, source parameters and site conditions.

For forecasting seismic occurrences numerous models have been developed. The simplest stochastic model for earthquake occurrences is the Homogeneous Poisson Model, which is used in this study. For the earthquake events to follow that model, the following assumptions are in order:

1. Earthquakes are spatially independent;
2. Earthquakes are temporally independent;
3. Probability that two seismic events will take place at the same time and at the same place approaches zero.

Obviously for the above assumptions to be applicable to a data set, it should be free of fore- and aftershocks. This has been achieved in our study by removing all the dependent events from the earthquake catalogue.

The recurrence relationship of the events is expressed with the help of the empirical relationship first defined by Gutenberg - Richter: $\log N = A - bM$ where N is the number of shocks with magnitude greater or equal to M per unit time and unit area, and A and b are seismic constants for any given region. The source regions may be described as lines representing the known faults or areas of diffuse seismicity, so that M may be related to unit length or unit area. The value of N will also generally be found assuming that M has upper and lower bounds M_1 and M_o.

Using an application of the total probability theorem the probability per unit time that that ground motion amplitude a* is exceeded can be expressed as follows (McGuire, 1993):

$$P[A > a^* \text{ in time t}]/t = \sum_i v_i \int\int G_A|_{m,r}(a^*) f_m(m) f_r(r|m)\, dm\, dr \quad (2)$$

where $P[I \leq i|m,r]$ is the probability that the maximum effect I is less than i. Given m and r, $f_m(m)$ is the probability density function for magnitude, and $f_r(r|m)$ is the probability distribution function for distance. $f_r(r|m)$ is dependent on the geometric nature of the source.

6.2 Software used in the Analysis

For the probabilistic hazard analysis SEISRISK III (Bender and Perkins, 1987) routine, in-house improved with graphical pre- and post-processors, is used. In this program, the temporal recurrence of seismic events is assumed to be represented by a homogeneous Poisson process with complete temporal independence.

6.3 Probabilistic Seismic Hazard Assessment Results

Probabilistic earthquake ground motion results obtained for the Alpaslan II Dam site corresponding to random horizontal component associated with various return periods and for engineering bedrock (NEHRP B/C boundary, Vs30=760m/s) outcrop conditions are presented in Table 3a. In this table, the results for the average return period 475 and 10000 years were also provided respectively for the code based design of building type structures and to set a point pf reference. The associated vertical ground motion response parameters can be taken as 2/3 of those associated horizontal components (Table 3b).

Table 3a. Probabilistic Seismic Hazard Assessment Results (Random horizontal component, at NEHRP B/C Boundary outcrop, Vs30=760m/s)

Average Return Period (years)	PGA (g)	5% Damped SA (g) (T=0.2s)	5% Damped SA (g) (T=1.0s)
OBE - 145	0.43	0.95	0.26
475	0.62	1.37	0.40
SEE - 2475	0.96	2.12	0.60
10000	1.23	2.77	0.88

Table 3b. Probabilistic Seismic Hazard Assessment Results (Vertical component, at NEHRP B/C Boundary outcrop, Vs30=760m/s)

Average Return Period (years)	PGA (g)	5% Damped SA (g) (T=0.2s)	5% Damped SA (g) (T=1.0s)
OBE - 145	0.29	0.63	0.17
475	0.41	0.91	0.27
SEE - 2475	0.64	1.42	0.40
10000	0.82	1.85	0.59

On the basis of the geotechnical reports, entitled "Alpaslan II Baraji ve HES Projesi Zorova Aks Yeri Sıvılaşma Potansiyeli Değerlendirme Raporu, prepared by Zemin Etüd ve Tasarım A.Ş., Kasım, 2010", "Report on Estimation of Geotechnical Earthquake Engineering Parameters at the Alpaslan II Dam Project Site, Prepared by Anatolian Geophysical for EnerjiSA Group, November 30, 2010" and "Alpaslan II Baraji ve HES Projesi 2nd Stage Geological & Geotechnical Information and Summary Geotechnical Report, prepared by İNSİTU Geology, Geotechnics and Drilling Co. Ltd., November 2010", Alpaslan II dam will be essentially founded on rock formations after about 10m excavation. Dam embankment at the left bank spillway area is located over Adilcevaz Formation, which shows a lithologic structure of alternation of sandstone, conglomerate, limestone, claystone and mudstone. Some part of left bank, thalweg and right bank are located over the Zırnak Formation, which has a lithology formed of greenish grey claystone and sandstone. The shear wave velocities measured indicate that the upper 30m average shear wave velocities, Vs30, (under the dam foundation) vary between 450m/s and 750m/s with an average value of about 600m/s. Such a dam foundation media can be assumed to correspond to NEHRP Site Class "C".

Using the amplitude and period dependent spectral amplification factors contained in IBC (2009) or NEHRP (2006) the site-specific short period and 1s spectral acceleration parameters has been computed and provided in Tables 4a and 4b.

Table 4a. Site Specific Probabilistic Seismic Hazard Assessment Results (Maximum Rotated Horizontal Component, at NEHRP Site Class C outcrop)

Average Return Period (years)	5% Damped SA (g) (T=0.2s)	5% Damped SA (g) (T=1.0s)
OBE - 145	0.95	0.40
SEE - 2475	2.12	0.77

Table 4b. Site Specific Probabilistic Seismic Hazard Assessment Results (Vertical component, at NEHRP Site Class C outcrop)

Average Return Period (years)	5% Damped SA (g) (T=0.2s)	5% Damped SA (g) (T=1.0s)
OBE - 145	0.63	0.27
SEE - 2475	1.42	0.52

7 DETERMINISTIC ASSESSEMENT OF THE SEISMIC HAZARD

INSITU (2010) reports that on the basis of the field investigations, no active faults effecting the geological units associated with the dam site (Adilcevaz, Zırnak and Solhan formations) and the Quaternary deposits have been observed.

From the information provided in Chapter 3 and 4, it can be assessed that the dam site is located at 8km to the Varto Fault System and 15km to Muş Thrust.

Based on the preceding definition of the design basis ground motion, seismo-tectonic considerations and the relatively dormant character (compression rate of about 1.4mm/year, Reilinger et al., 2006) of the Muş Thrust it will be appropriate and prudent to consider an Mw=7.2 strike-slip earthquake, associated with the Varto Fault at the shortest distance of 8km from the Alpaslan II Dam Site, as the MCE event. The selected MCE event is 0.4 magnitude units higher that the maximum recorded earthquake (1966 Varto M6.8 earthquake) coincides with the characteristic earthquake magnitude observed on the North Anatolian Fault (Erdik at al., 2004) and also in conformance with the applicable fault rupture length versus magnitude relationships (Wells and Coppersmith, 1994).

The deaggregation studies that we have previously carried out for the probabilistic earthquake hazard assessments where the hazard is essentially controlled by a major strike-slip fault (Erdik at al., 2011) indicate the standard deviation amounts (Epsilon) that needs to be considered in the attenuation (GMPE) relationships for the computation of the ground motion parameters associated with this scenario earthquake will be about Epsilon = 2.0 for the 2475 year average return period. This Epsilon value is associated with a 4.5% exceedance probability for a log-normal ground motion parameter distribution.

In other terms, the ground motion parameter that might be recorded or computed from a record at a specific site (say, the spectral acceleration at period T, (SA(T)) from an earthquake with a magnitude (M) and distance (R) is typically modeled as a lognormal variable. That is, the logarithm of SA(T), which we denote as ln(SA(T)) has a normal distribution, with mean (μ) and standard deviation (σ).

$$\ln(SA(T)) = f(M, R, \alpha) + \varepsilon\sigma \tag{3}$$

Here α represents the regression variables other that M and R (such as source mechanism and site conditions) and $\varepsilon\sigma$ is the error term. Epsilon (ε) is a measure of the deviation of ground motion parameter (SA(T)) from the predicted median value (Bazzurro and Cornell, 1999). Epsilon is defined as the number of standard deviations by which an observed logarithmic spectral acceleration differs from the mean logarithmic spectral acceleration of a ground-motion prediction (attenuation) equation.

For the SEE (i.e. 2475 year return period) level ground motion the associated exceedance probabilities (which apply to the distribution of the spectral amplitude obtained from the attenuation relationship for given magnitude (Mw7.2) and distance (8km)) is 4.5%. The empirical response spectra corresponding to these parameters is provided in Figure 15, using attenuation relationships of Chiou and Youngs (2008), Abrahamson and Silva (2008), Campbell and Bozorgnia (2008), Boore and Atkinson (2008) and Campbell and Bozorgnia (2008).

The applicability of these attenuation relationships to Europe-Mediterranean region has been already substantiated (Stafford at al., 2008). As it can be assessed the PGA values and Ss and S1 spectral acceleration amplitudes that can observed from Figure 15 are quite similar to the probabilistic values reported in Table 3a for the 2475 year average return period.

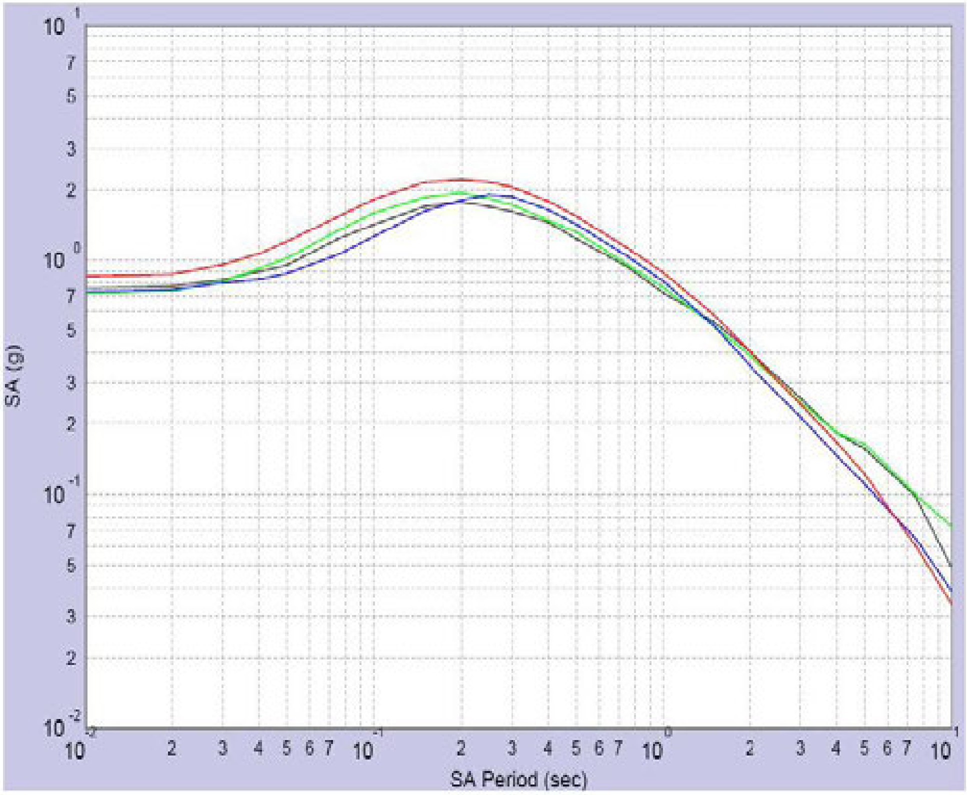

Figure 15. Deterministic MCE Response spectra (random horizontal component on outcropping engineering rock, 5% damped) obtained for a Mw=7.2 strike-slip event at 8km fault distance, Vs30 = 600 m/s, Exceedance Probability = 0.045.

Chiou & Youngs (2008): Magnitude = 7.2, Fault Type = Strike-Slip, Rupture Top Depth = 0.0, Dip = 90.0, Aftershock = false, Vs30 = 600, Depth 1.0 km/sec = 100.0, DistanceRup = 8.0, (distRup-distJB)/distRup = 0.0, (distRup-distX)/distRup = 0.0, Std Dev Type = Total, Exceed. Prob. = 0.045

Abrahamson & Silva (2008): Magnitude = 7.2, Fault Type = Strike-Slip, Rupture Top Depth = 0.0, Dip = 90.0, Down-Dip Width (km) = 10.0, Vs30 = 600.0, Depth 1.0 km/sec = 100.0, DistanceRup = 8.0, (distRup-distJB)/distRup = 0.0, (distRupdistX)/distRup = 0.0, Std Dev Type = Total, Vs30 Type = Inferred, Gaussian Truncation =None, Exceed. Prob. = 0.045

Campbell & Bozorgnia (2008): DistanceRup = 8.0, (distRup-distJB)/distRup = 0.0, Vs30 = 600.0, Depth 2.5 km/sec = 1.0, Magnitude = 7.2, Fault Type =Strike-Slip, Rupture Top Depth = 0.0, Dip = 90.0, Component = Average Horizontal (GMRotI50), Std Dev Type = Total, Gaussian Truncation = None, Exceed. Prob. = 0.045

Boore & Atkinson (2008): DistanceJB = 8.0, Vs30 = 600.0, Magnitude = 7.2, Fault Type = Strike-Slip, Std Dev Type = Total, Gaussian Truncation = None, Exceed. Prob. = 0.045

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8 DESIGN BASIS GROUND MOTION

Noting that the deterministic SEE level ground motion spectral parameters are good coincidence with the probabilistic results the use of the following (Table 5a, b) short period and 1s period site-specific 5% damped spectral acceleratios will be proposed for the performance based design of the Alpaslan II Dam and related facilities.

Table 5a. Site Specific Horizontal Spectral Amplitudes

Design Basis	5% Damped SA (0.2s)	5% Damped SA (1s)
OBE	0.95g	0.40g
SEE	2.12g	0.77g

Table 5b. Site-Specific Vertical Spectral Amplitudes

Design Basis	5% Damped SA (0.2s)	5% Damped SA (1s)
OBE	0.63g	0.27g
SEE	1.42g	0.52g

The OBE and SEE level design basis 5% damped free-field horizontal design basis response spectra are plotted in Figure 6 and Figure 7 using the NEHRP spectral shape stipulated in IBC (2009) and ASCE 7-10 (2011). The vertical response spectra for can be obtained as 2/3 of the corresponding horizontal response spectra.

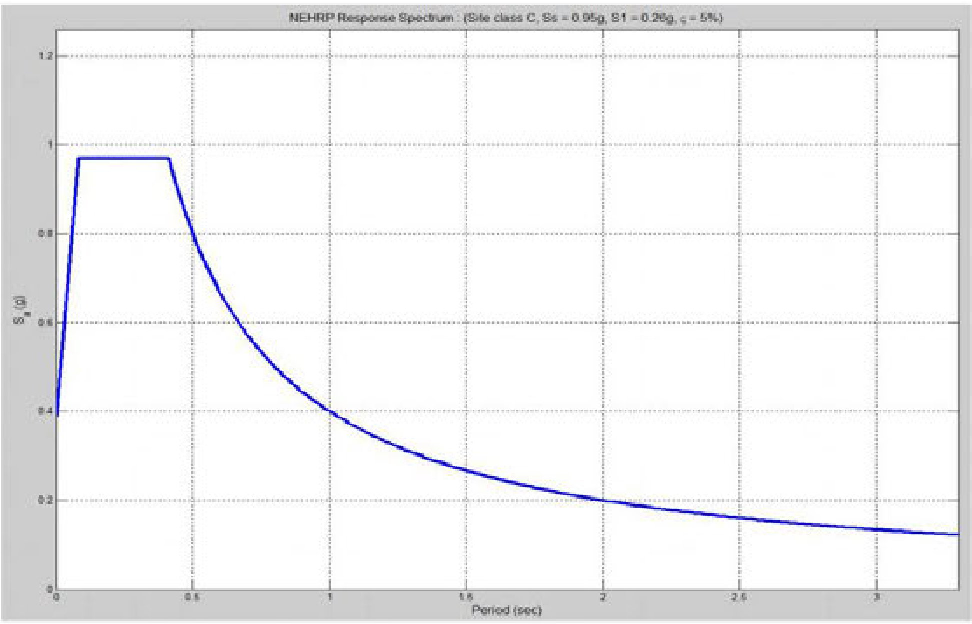

Figure 6. OBE level design basis 5% damped free-field horizontal response spectrum

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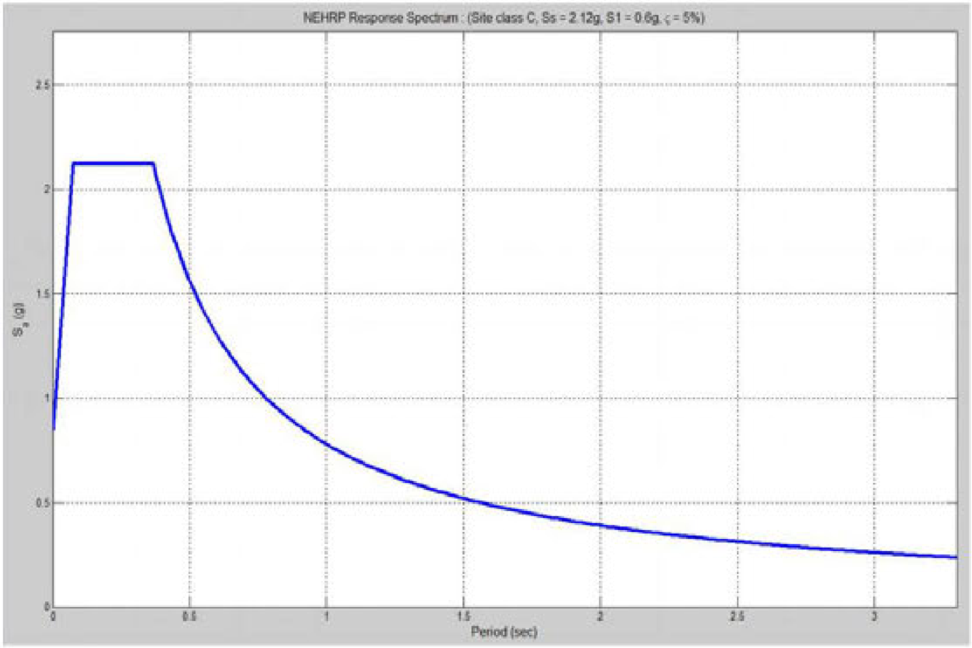

Figure 7. SEE level design basis 5% damped free-field horizontal response spectrum

9 SPECTRUM COMPATIBLE TIME-HISTORIES

Ground motion time histories needed for time domain analysis under OBE and SEE level earthquake excitation will be provided for the horizontal and vertical components. For two dimensional analysis any 10x2 horizontal components and the vertical component can be used.

The modification of the time history to fit a spectrum can be performed with a variety of different modification models. In this study the wavelet adjustment methodology based on Tseng and Lilanand (1988) and the computer code is written by N. A. Abrahamson (1993) will be utilized. Wavelet adjustment of recorded accelerograms has the same advantages as the Fourier adjustment methods but leads to a more focused correction in the time domain thus introducing less energy into the ground motion and it also preserves the non-stationary characteristics of the original ground motion as expressed above. Oscillator impulse response function in reverse time order and Tapered cosine wave were used as adjustment models in the spectral matching procedure.

10 sets of original records, carefully selected, for the spectrum matching procedure are listed in Table 6.

Table 6. Earthquake records selected for spectral matching

Earthquake	Fault Mechanism	Station	Component	Closest Distance(km)
1999, M=7.14 Duzce,Türkiye	Strike Slip	Lamont1061	1061 E 1061 N 1061-V	23.42
1999, M=7.14 Landers,USA	Strike Slip	USGS 5070 North Palm Spring	NPS000 NPS090 NPS-UP	26.84
	Strike Slip	CDMG 12149 Desert Hot Spring	DSP000 DSP090 DSP-UP	21.78
	Strike Slip	CDMG 22170 Joshua Tree	JOS000 JOS090 JOS-UP	11.03
	Strike Slip	SCE 23 Coolwater	CLW-LN CLW-TR CLW-UP	19.74
	Strike Slip	USGS 5071 Morongo Valley	MVH000 MVH090	17.32
1999, M=7.4 Kocaeli,Türkiye	Strike Slip	ERD 99999 Arcelik	ARC000 ARC090 ARCDWN	13.49
	Strike Slip	ERD 99999 Gebze	GBZ000 GBZ270 GBZ-UP	10.92
1979, M= 6.53 Imperial Valley,USA	Strike Slip	UNAMUCSD 6604 Cerro Prieta	H-CPE147 H-CPE237 H-CPEDWN	15.19
	Strike Slip	USGS 5051 Parachute Test Site	H-PTS225 H-PTS315 H-PTS-UP	12.69

The sets of spectrum compatible time histories, together with comparison their response spectra with the target spectra are provided in Figure 18 through Figure 81. The corresponding digital data will also be made available.

Spectrum Compatible Horizontal Component of Earthquake Records at OBE Level

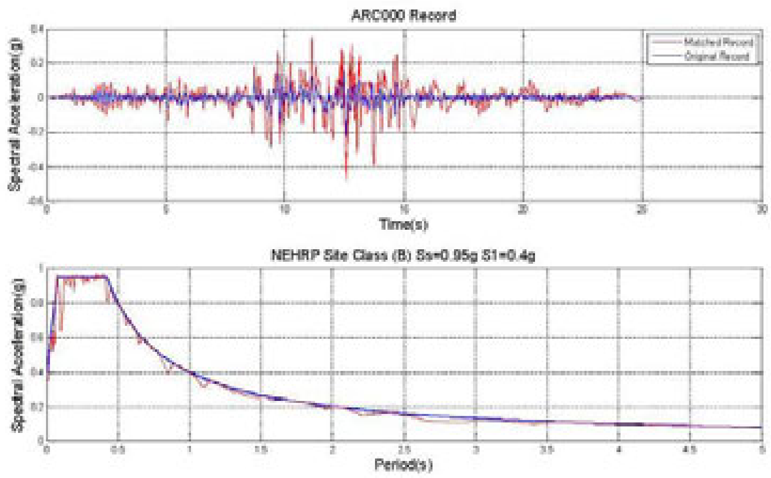

Figure 18. Spectrum compatible generated ARC000 record of Kocaeli earthquake for OBE level

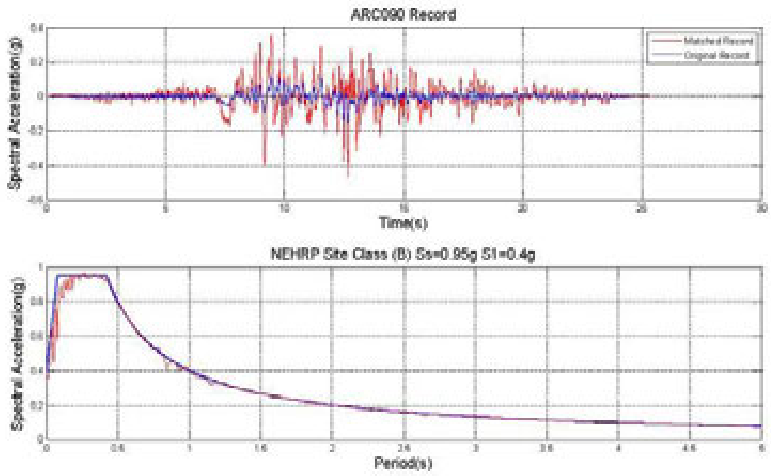

Figure 19. Spectrum compatible generated ARC090 record of Kocaeli earthquake for OBE level

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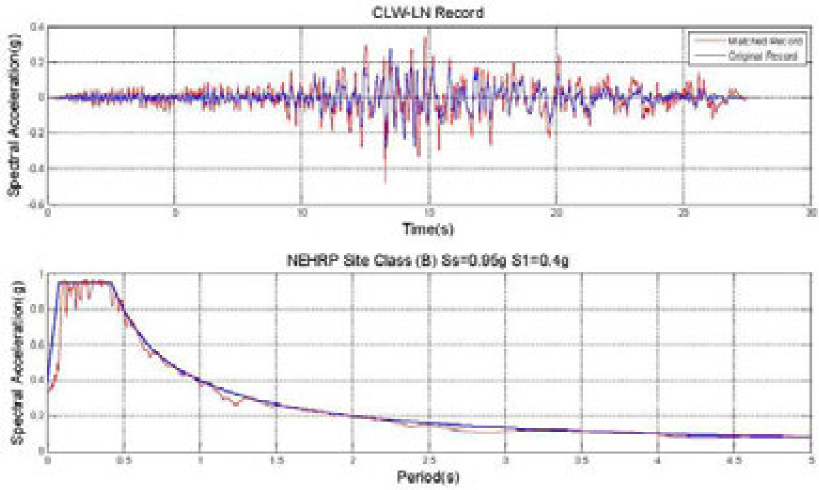

Figure 20. Spectrum compatible generated CLW-LN record of Landers earthquake for OBE level

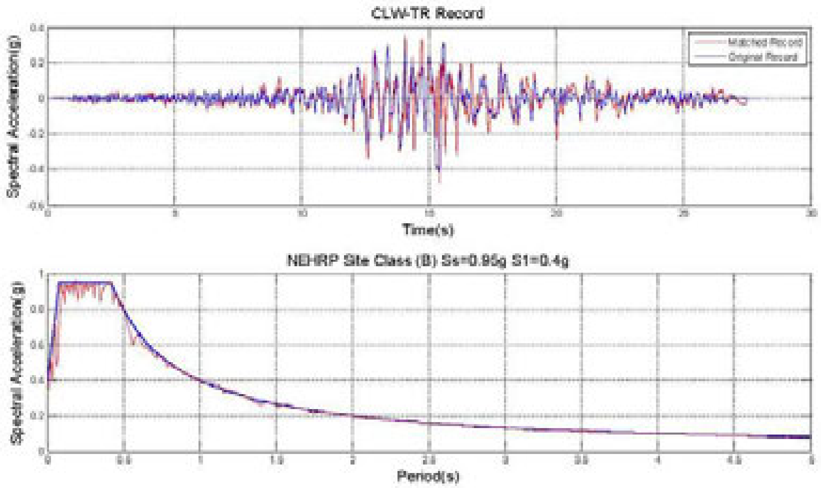

Figure 21. Spectrum compatible generated CLW-TR record of Landers earthquake for OBE level

26

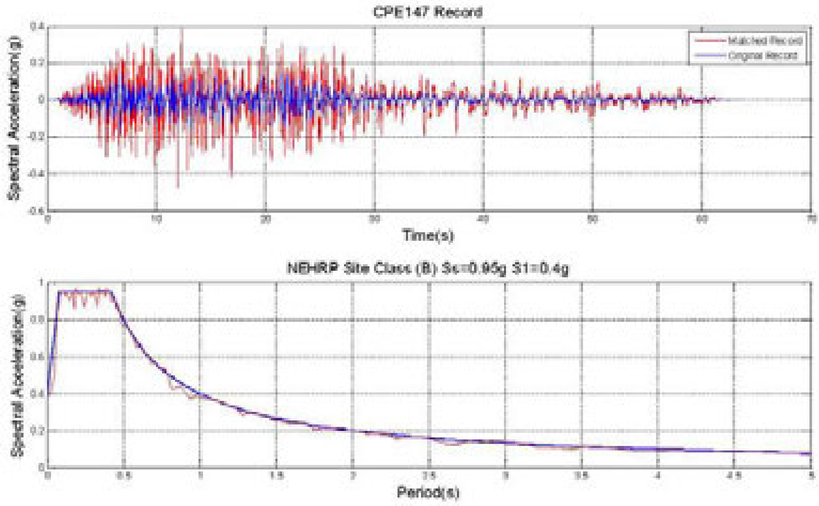

Figure 22. Spectrum compatible generated CPE147 record of Imperial Valley earthquake for OBE level

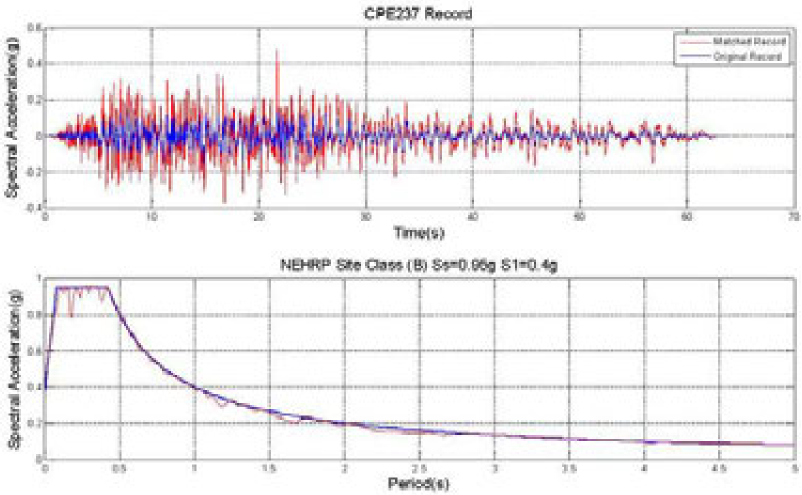

Figure 23. Spectrum compatible generated CPE237 record of Imperial Valley earthquake for OBE level

27

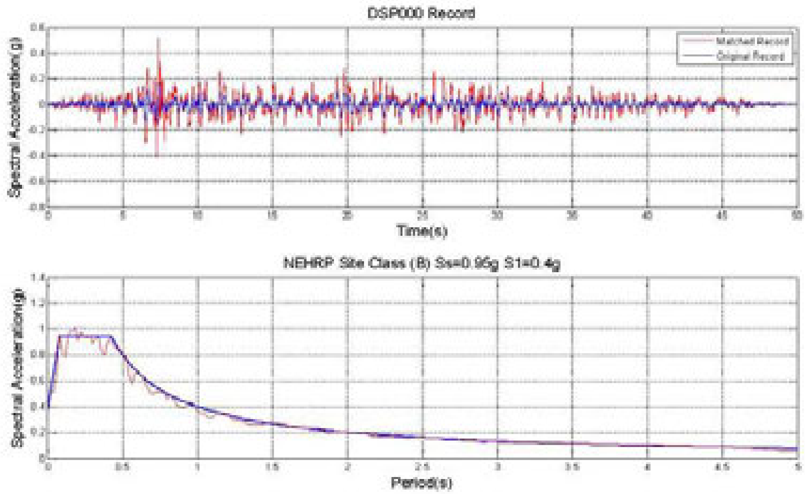

Figure 24. Spectrum compatible generated DSP000 record of Landers earthquake for OBE level

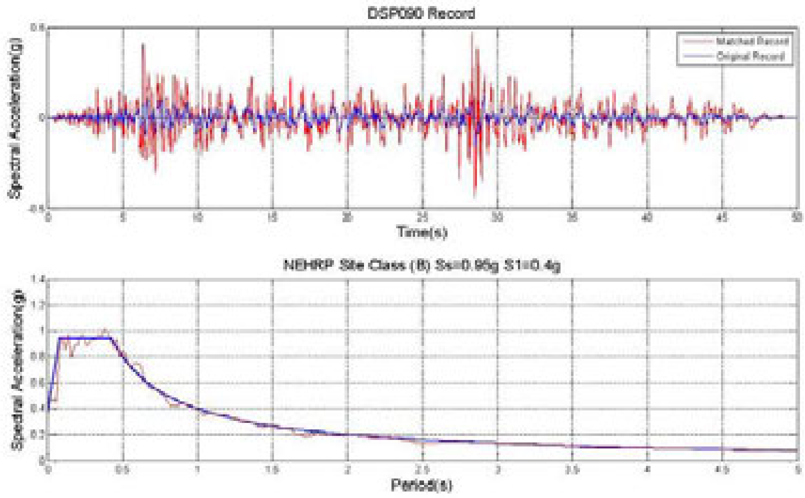

Figure 25. Spectrum compatible generated DSP090 record of Imperial Valley earthquake for OBE level

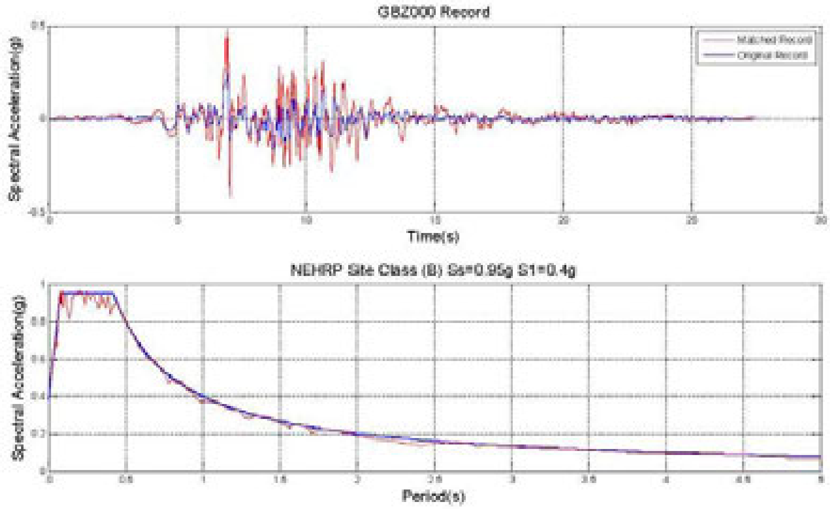

Figure 26. Spectrum compatible generated GBZ000 record of Kocaeli earthquake for OBE level

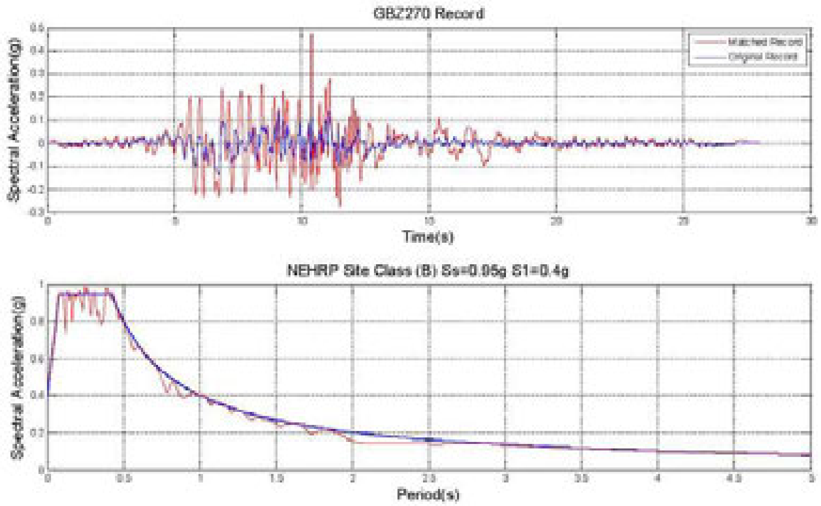

Figure 27. Spectrum compatible generated GBZ270 record of Kocaeli earthquake for OBE level

29

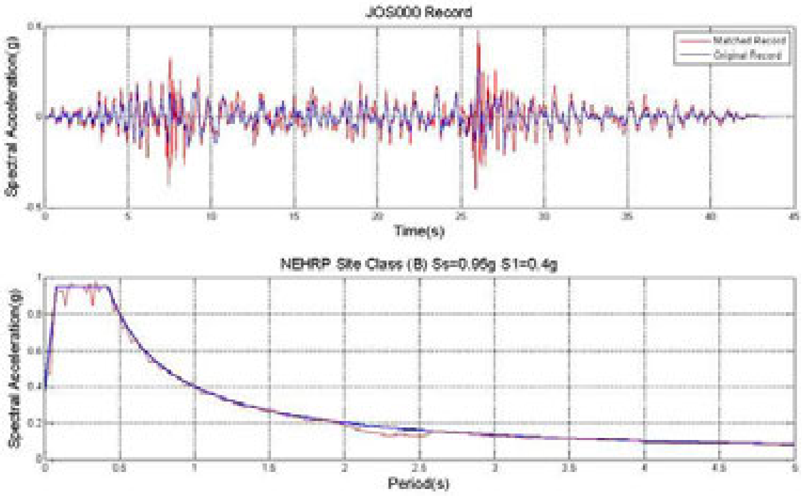

Figure 28. Spectrum compatible generated JOS000 record of Landers earthquake for OBE level

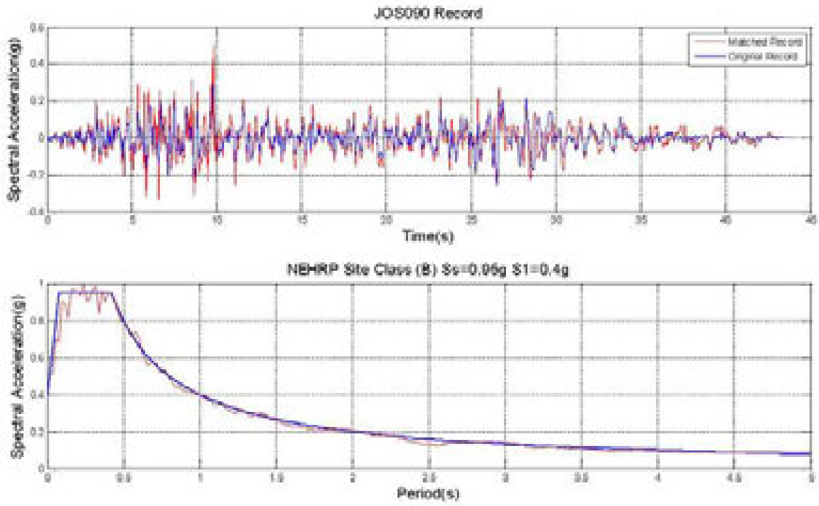

Figure 29. Spectrum compatible generated JOS090 record of Landers earthquake for OBE level

30

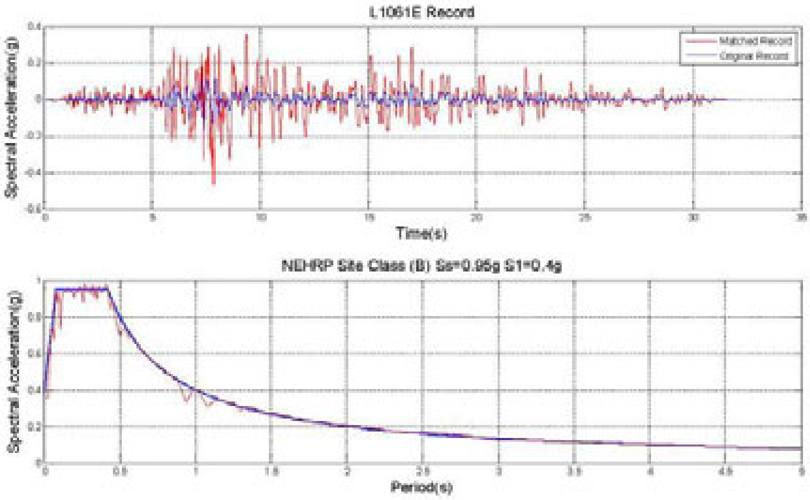

Figure 30. Spectrum compatible generated Lamont1061E component of Duzce-earthquake for OBE level

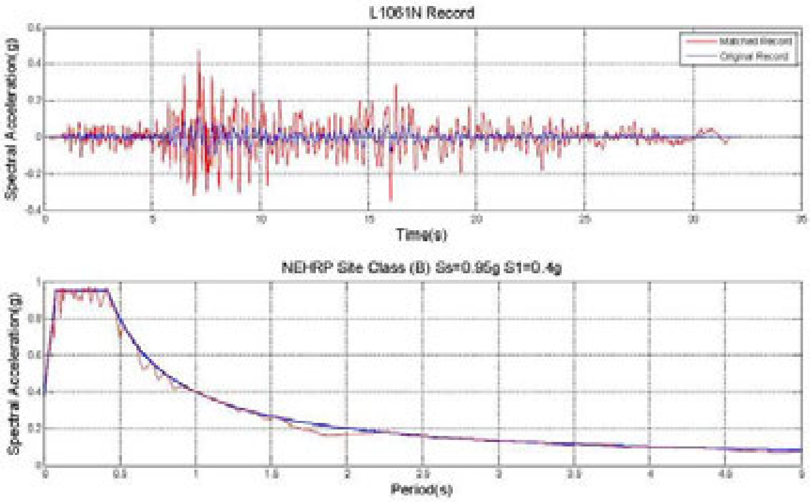

Figure 31. Spectrum compatible generated Lamont1061N component of Duzce-earthquake for OBE level

31

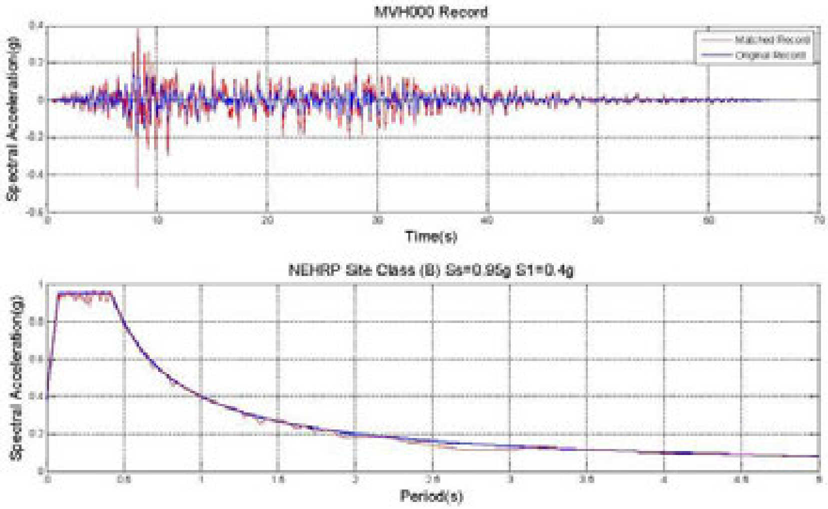

Figure 32. Spectrum compatible generated MVH000 record of Landers-earthquake for OBE level

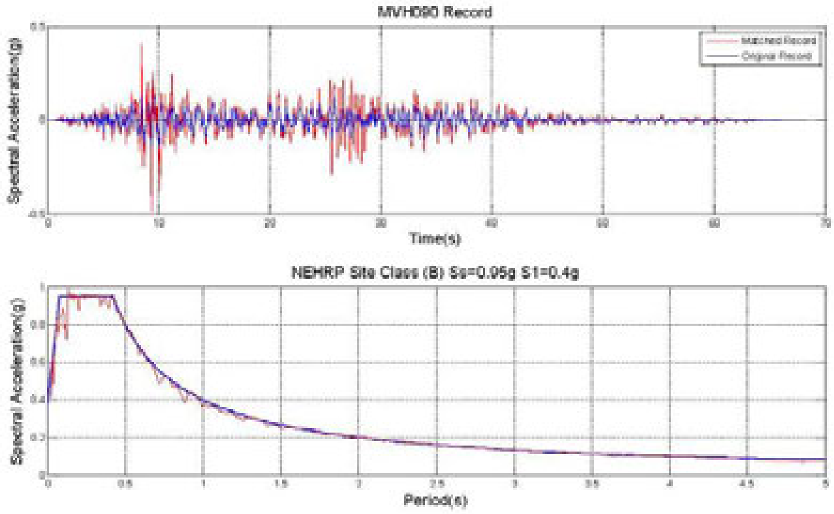

Figure 33. Spectrum compatible generated MVH090 record of Landers-earthquake for OBE level

32

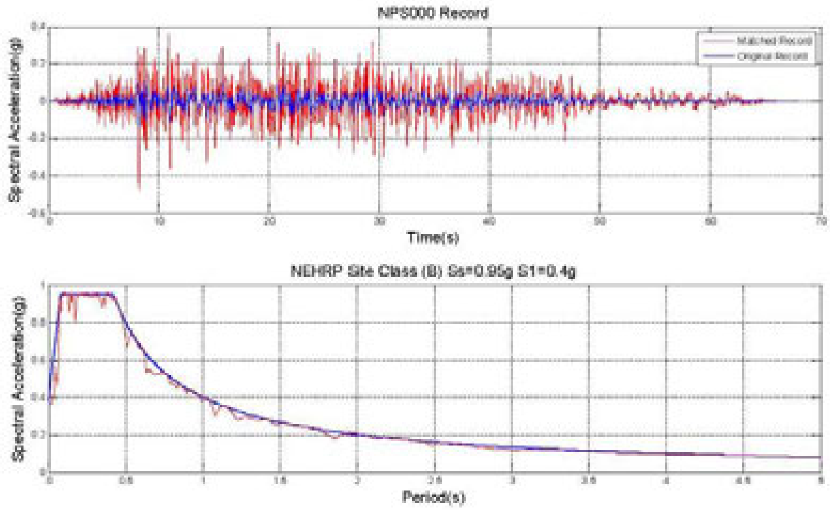

Figure 34. Spectrum compatible generated NPS000 record of Landers-earthquake for OBE level

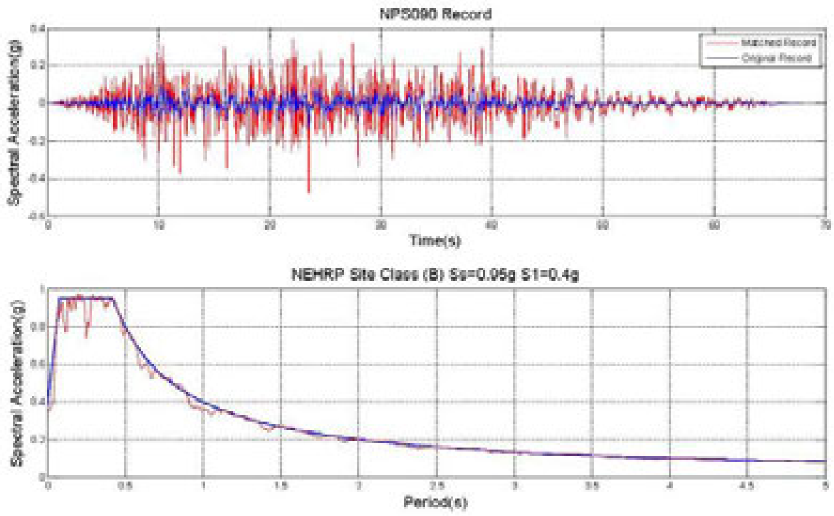

Figure 35. Spectrum compatible generated NPS090 record of Landers-earthquake for OBE level

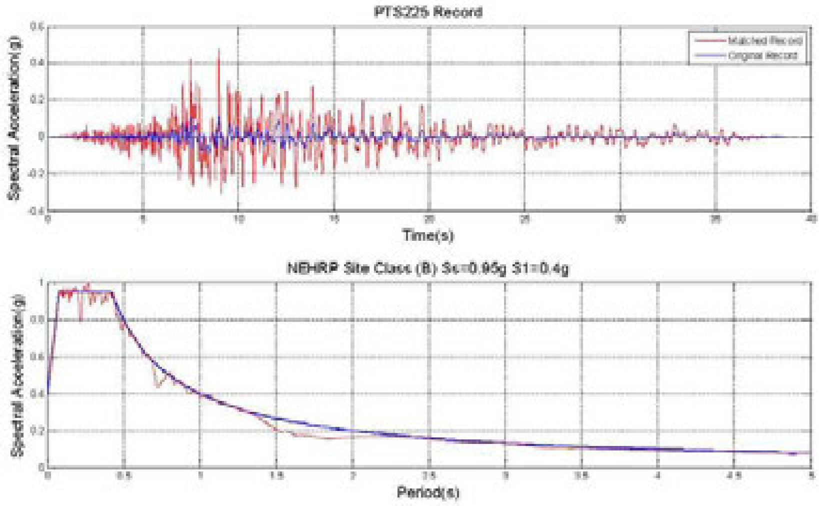

Figure 36. Spectrum compatible generated PTS225 record of Imperial Valley-earthquake for OBE level

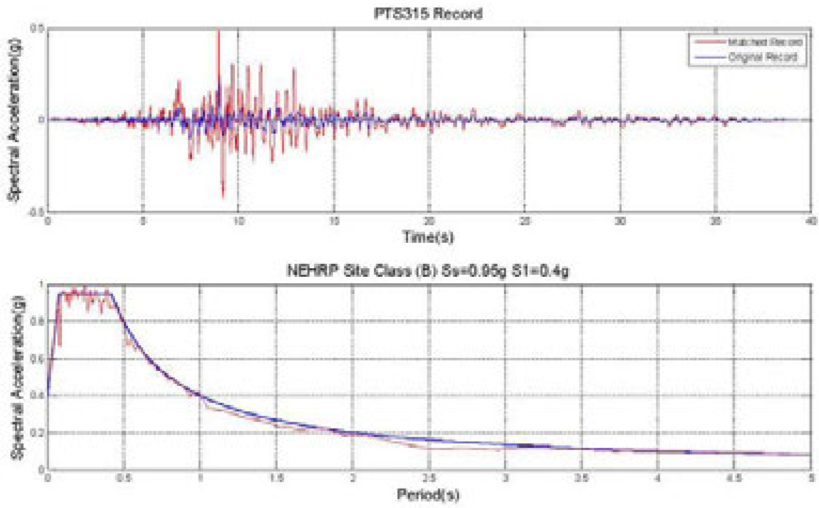

Figure 37. Spectrum compatible generated PTS315 record of Imperial Valley-earthquake for OBE level

34

Spectrum Compatible Vertical Component of Earthquake Records at OBE Level

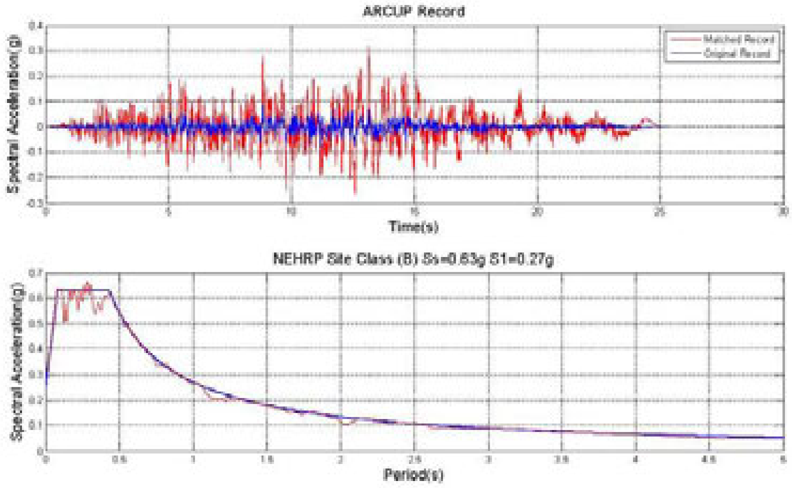

Figure 38. Spectrum compatible generated vertical component of Kocaeli-ARCUP record at OBE level

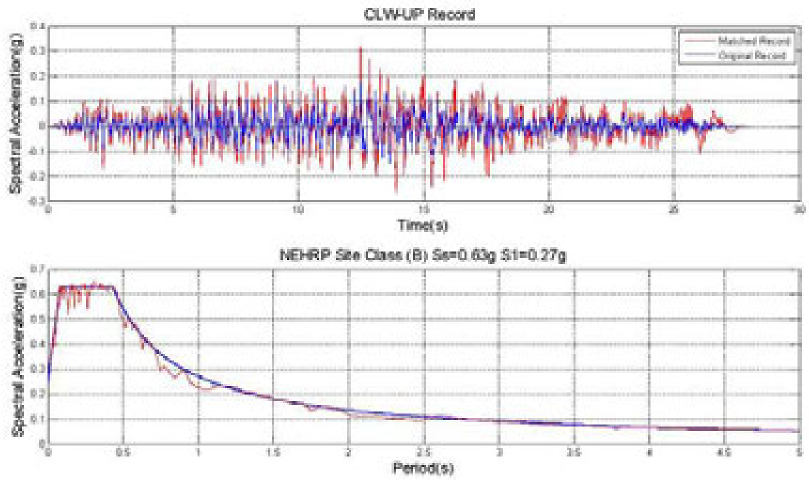

Figure 39. Spectrum compatible generated vertical component of Landers-CLWUP record at OBE level

35

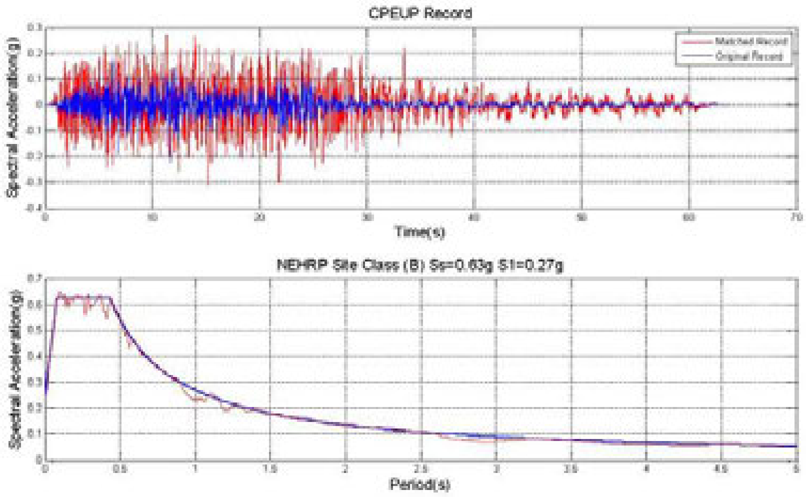

Figure 40. Spectrum compatible generated vertical component of Imperial Valley-CPEUP record at OBE level

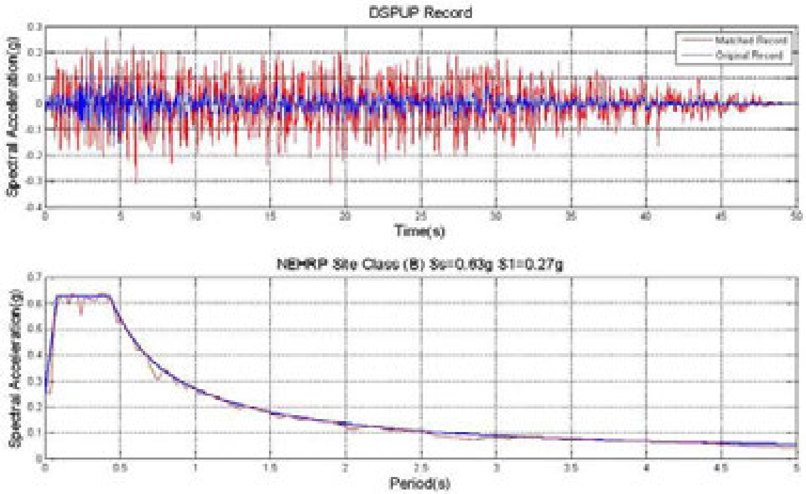

Figure 41. Spectrum compatible generated vertical component of Landers-DSPUP record at OBE level

36

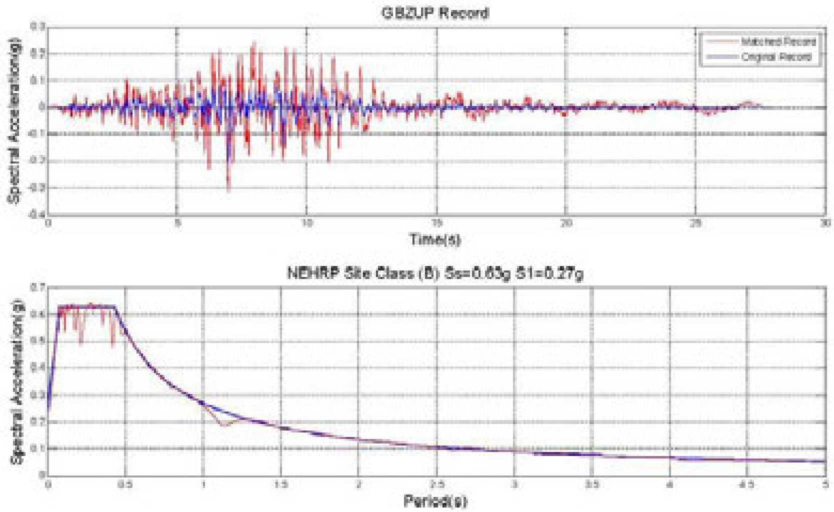

Figure 42. Spectrum compatible generated vertical component of Kocaeli-GBZUP record at OBE level

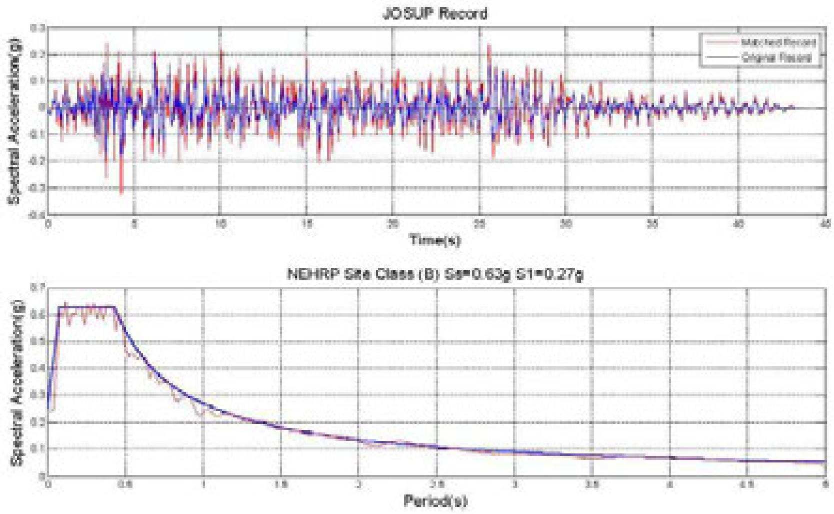

Figure 43. Spectrum compatible generated vertical component of Landers-Josup record at OBE level

37

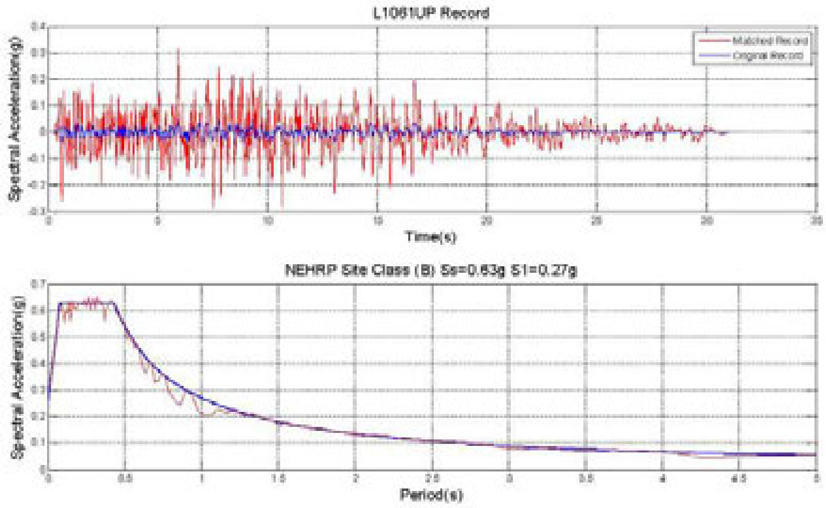

Figure 44. Spectrum compatible generated vertical component of Duzce-Lamont1061 record at OBE level

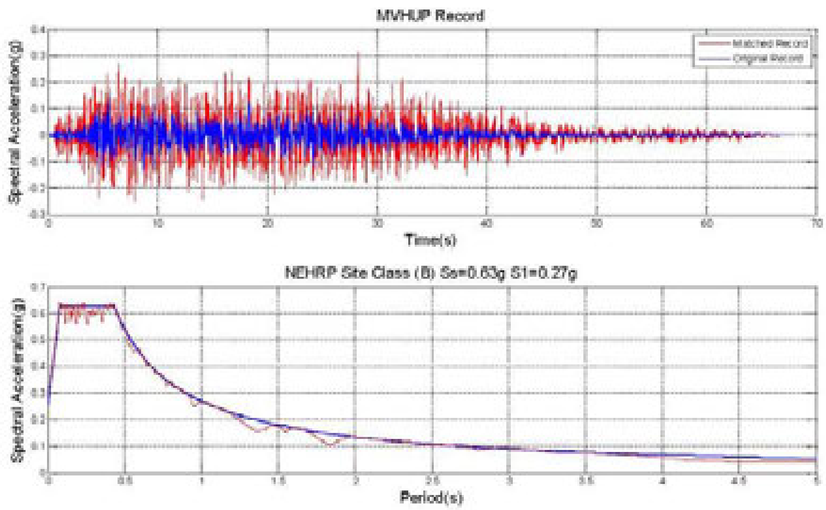

Figure 45. Spectrum compatible generated vertical component of Landers-MVHUP record at OBE level

38

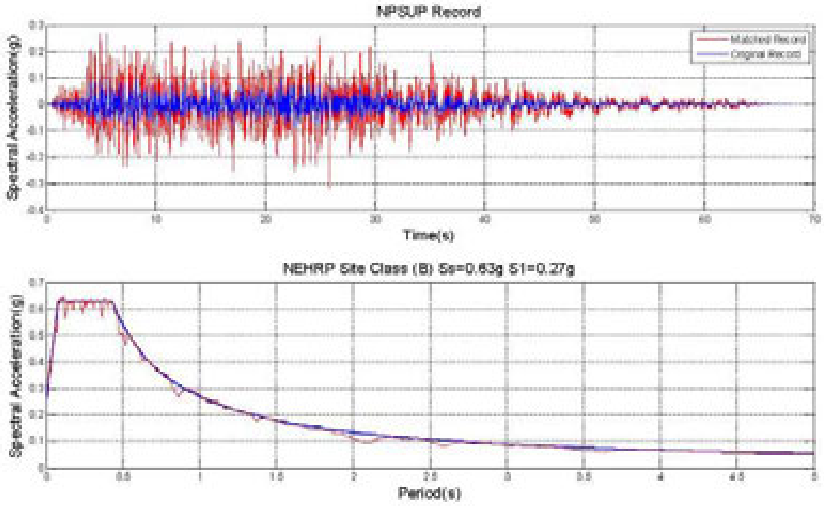

Figure 46. Spectrum compatible generated vertical component of Landers-NPSUP record at OBE level

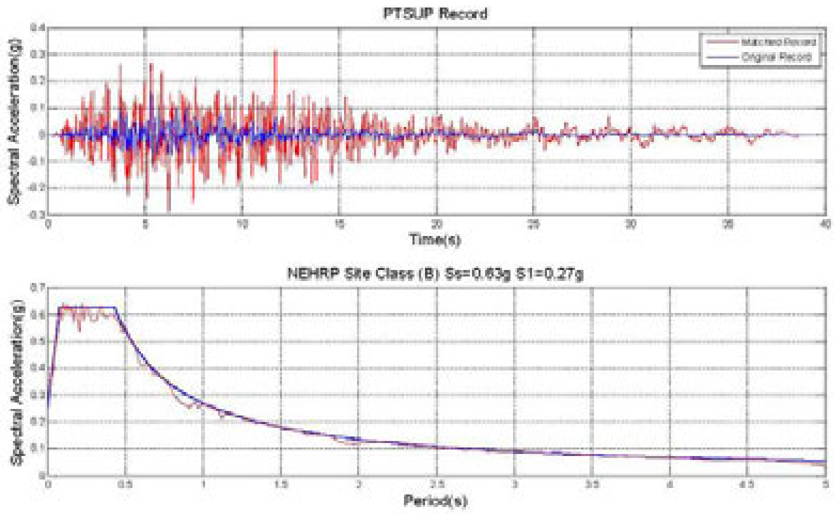

Figure 47. Spectrum compatible generated vertical component of Imperial Valley-PTSUP record at OBE level

Spectrum Compatible Generated Horizontal Records for SEE level

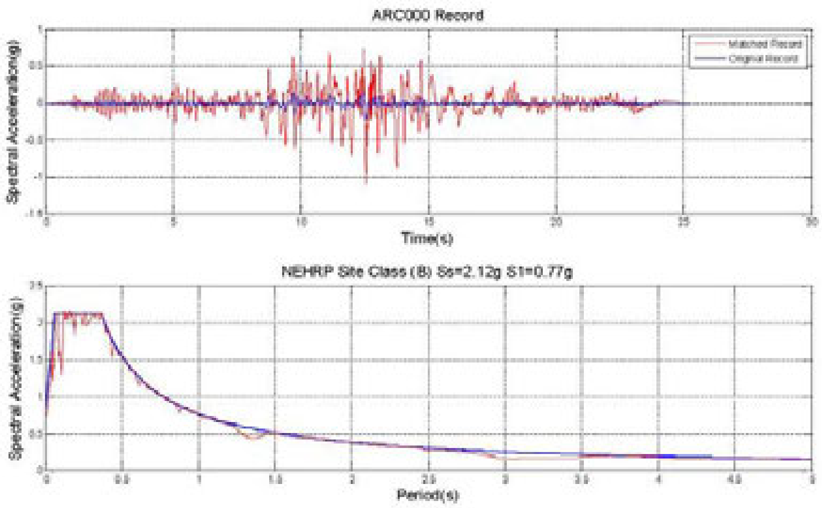

Figure 48. Spectrum compatible generated ARC000 record of Kocaeli earthquake for SEE level

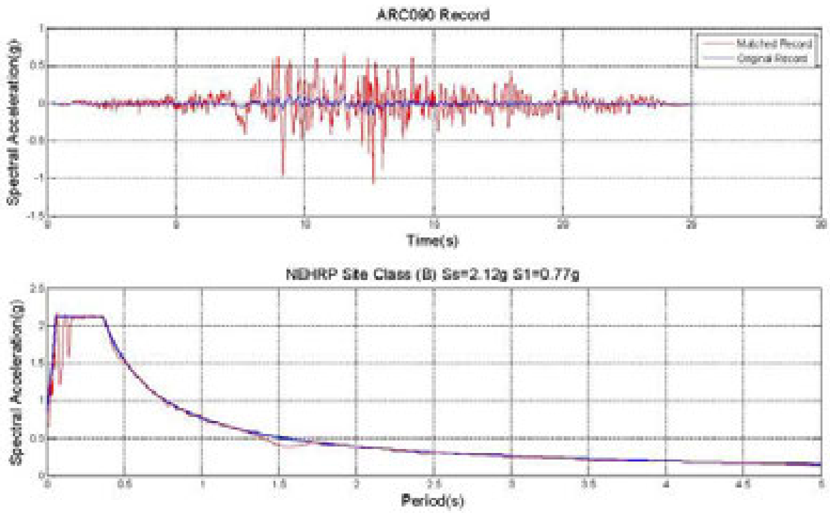

Figure 49. Spectrum compatible generated ARC090 record of Kocaeli earthquake for SEE level

40

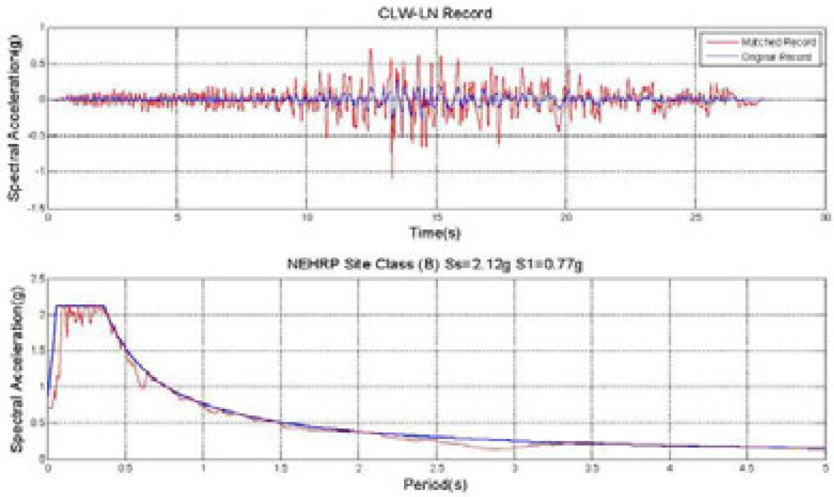

Figure 50. Spectrum compatible generated CLW-LN record of Landers earthquake for SEE level

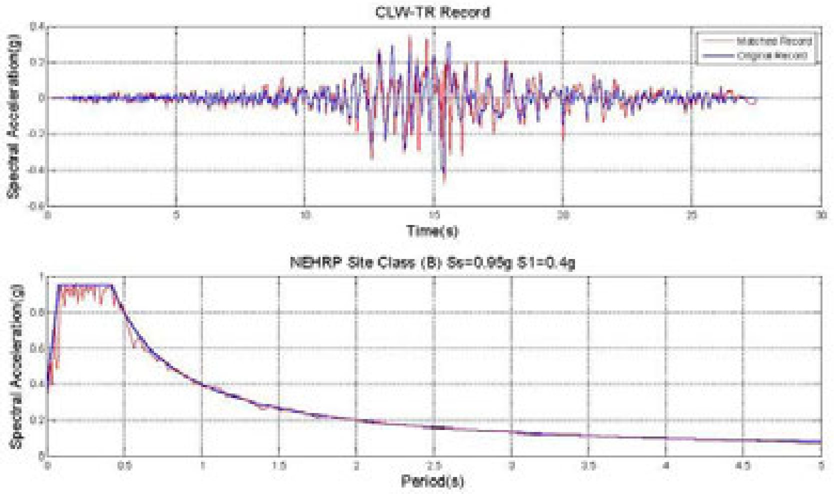

Figure 51. Spectrum compatible generated CLW-TR record of Landers earthquake for SEE level

41

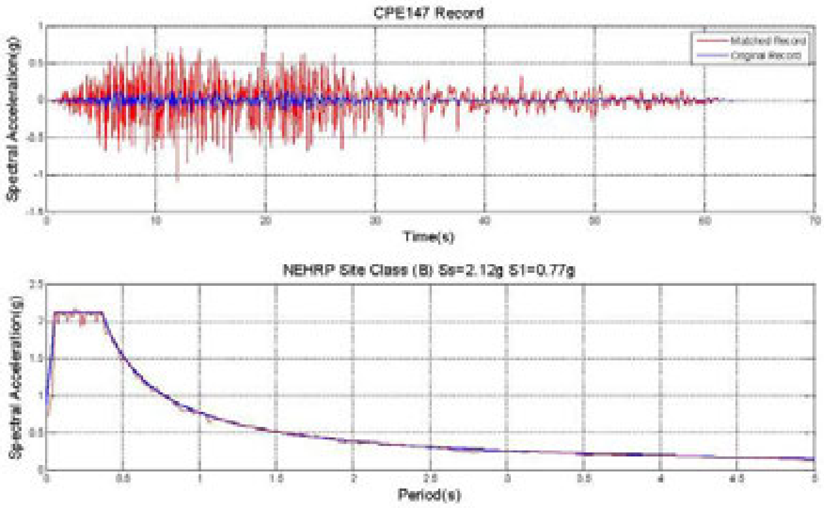

Figure 52. Spectrum compatible generated CPE147 record of Imperial Valley earthquake for SEE level

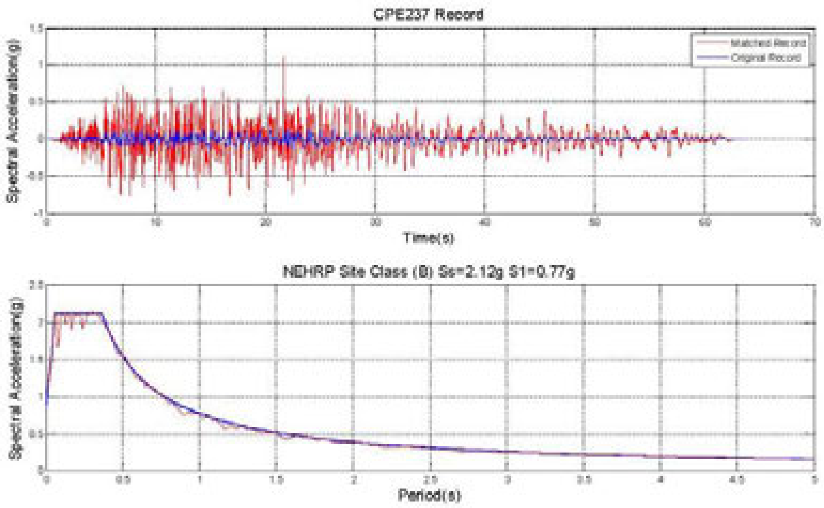

Figure 53. Spectrum compatible generated CPE237 record of Imperial Valley earthquake for SEE level

42

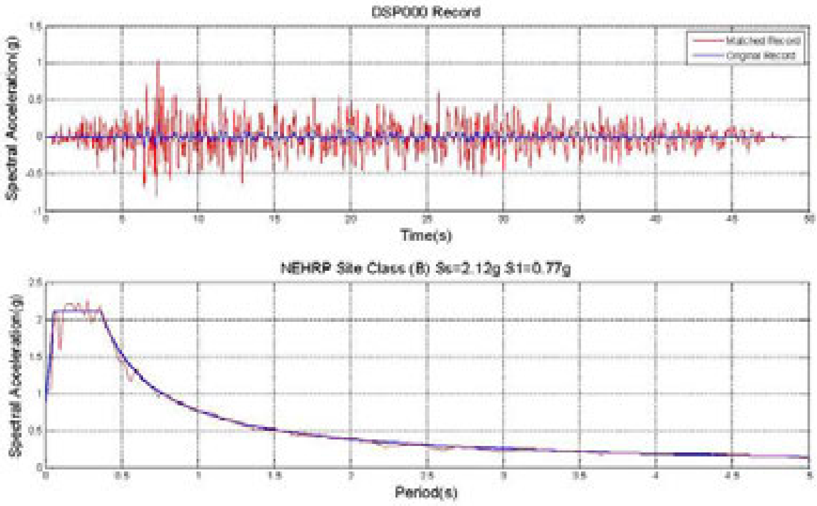

Figure 54. Spectrum compatible generated DSP000 record of Landers earthquake for SEE level

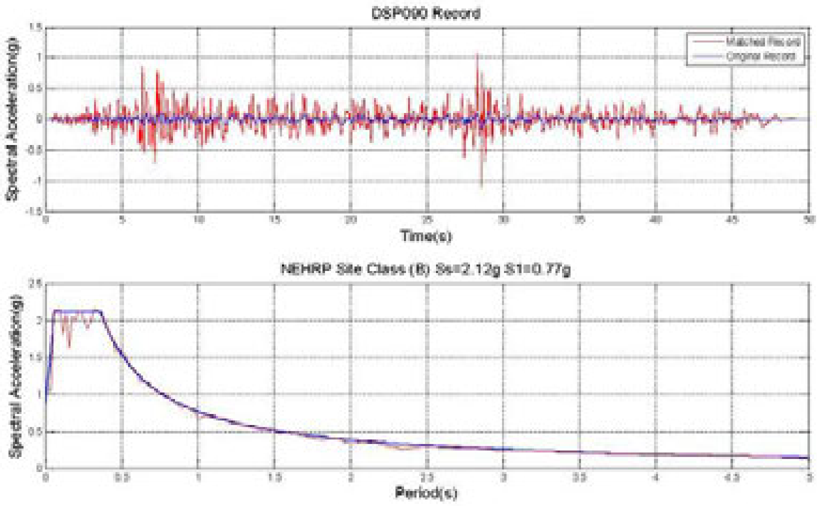

Figure 55. Spectrum compatible generated DSP090 record of Landers earthquake for SEE level

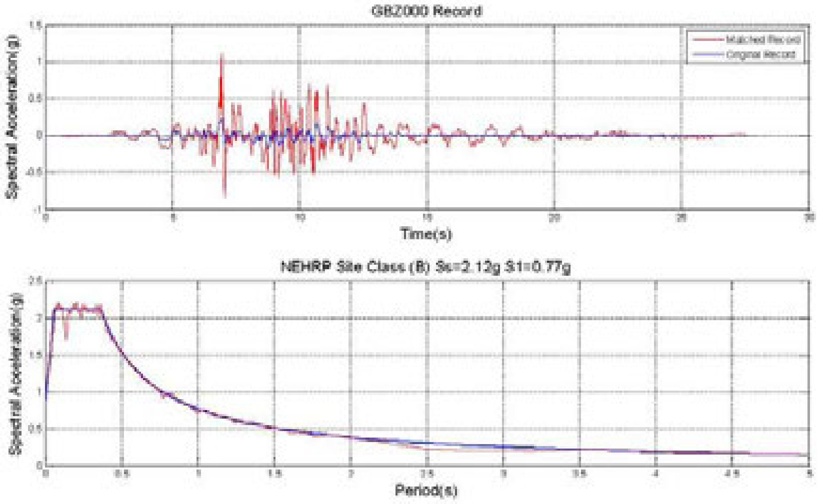

Figure 56. Spectrum compatible generated GBZ000 record of Kocaeli earthquake for SEE level

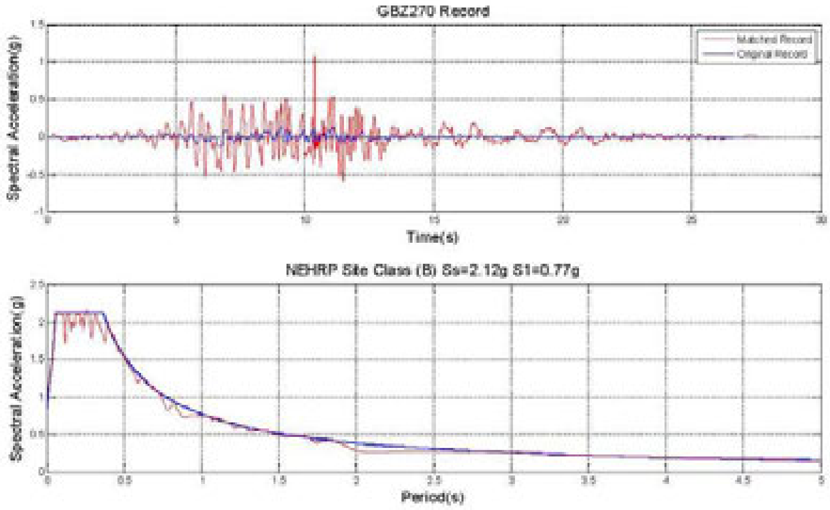

Figure 57. Spectrum compatible generated GBZ270 record of Kocaeli earthquake for SEE level

44

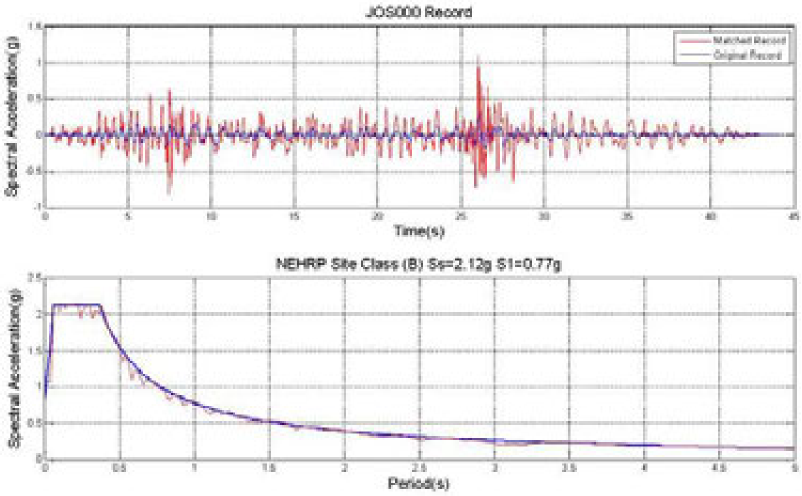

Figure 58. Spectrum compatible generated JOS000 record of Landers earthquake for SEE level

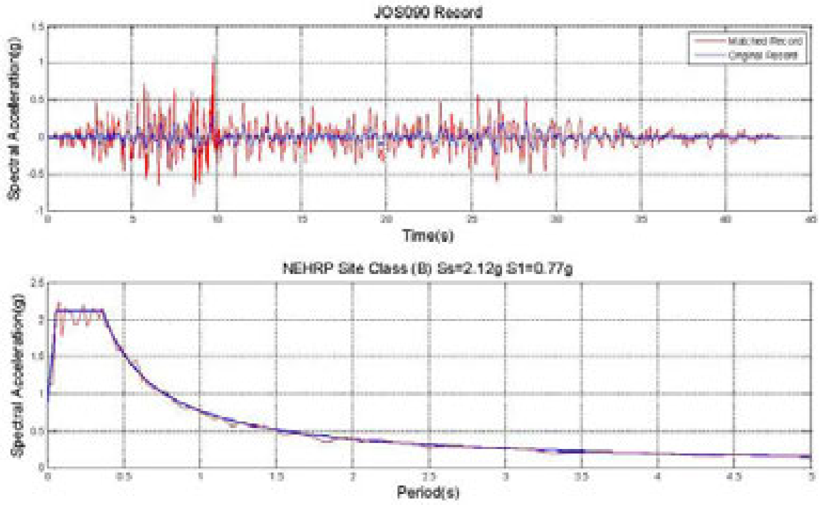

Figure 59. Spectrum compatible generated JOS090 record of Landers earthquake for SEE level

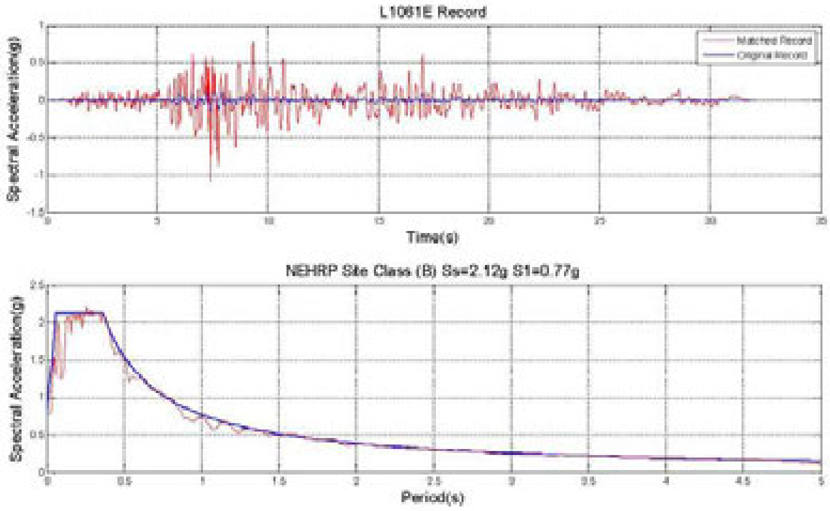

Figure 60. Spectrum compatible generated Lamont1061E component of Duzce-earthquake for SEE level

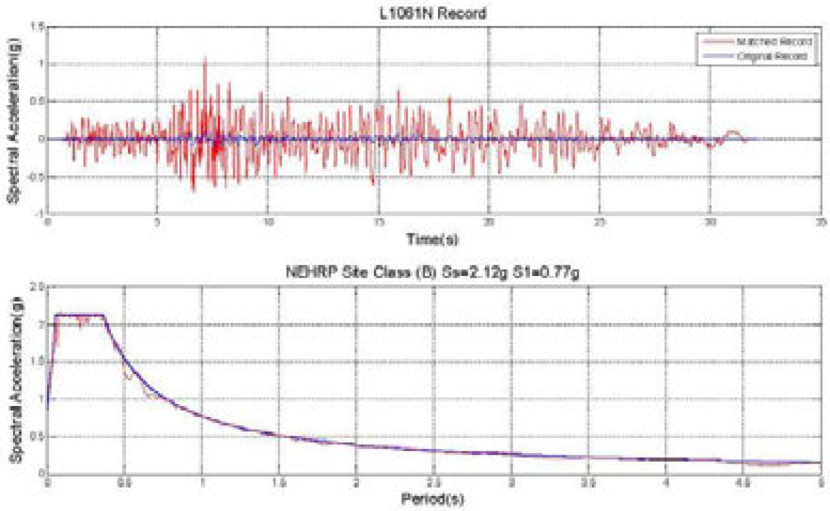

Figure 61. Spectrum compatible generated Lamont1061N component of Duzce-earthquake for SEE level

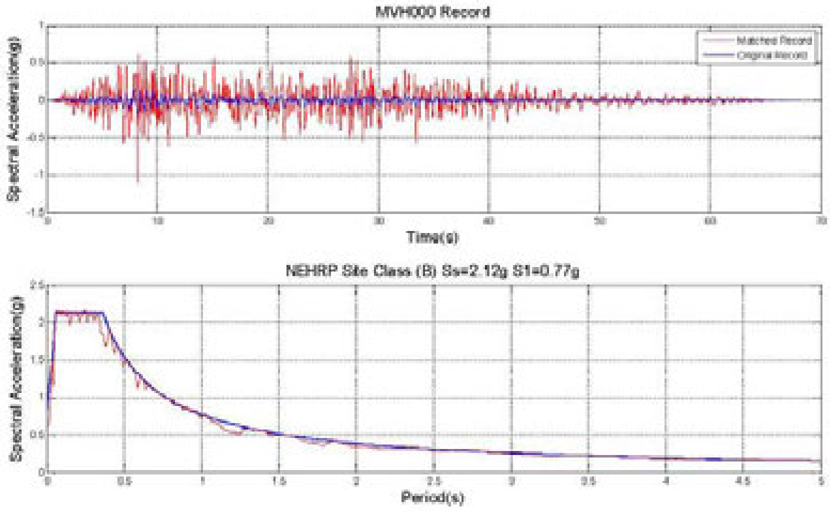

Figure 66. Spectrum compatible generated MVH000 record of Landers-earthquake for SEE level

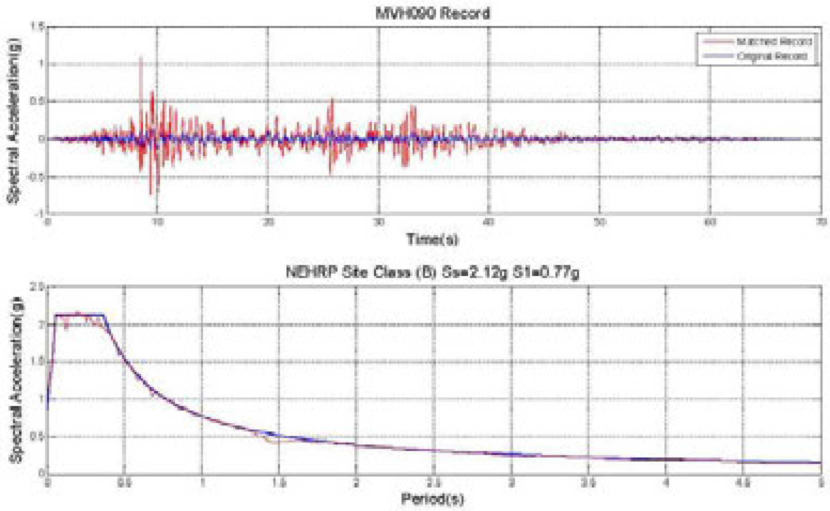

Figure 67. Spectrum compatible generated MVH090 record of Landers-earthquake for SEE level

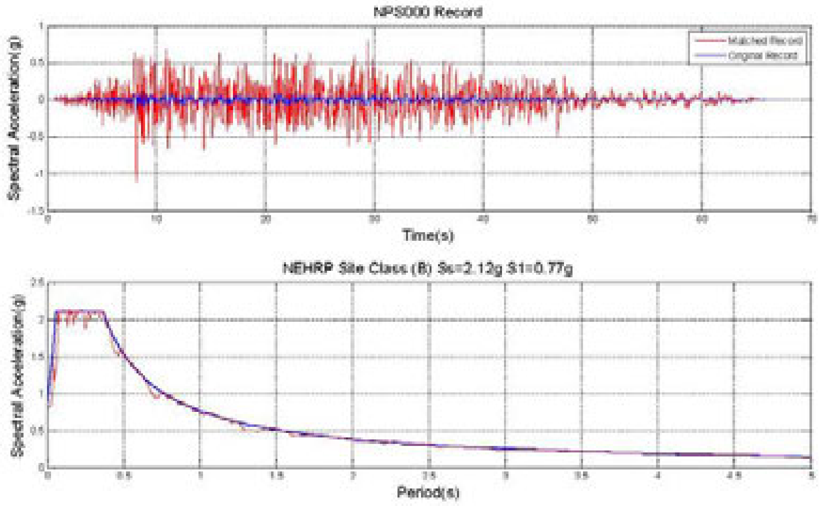

Figure 68. Spectrum compatible generated NPS000 record of Landers-earthquake for SEE level

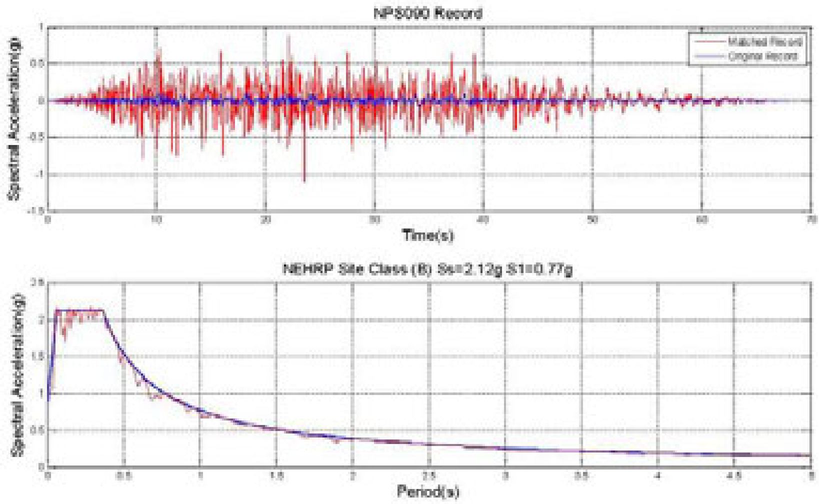

Figure 69. Spectrum compatible generated NPS090 record of Landers-earthquake for SEE level

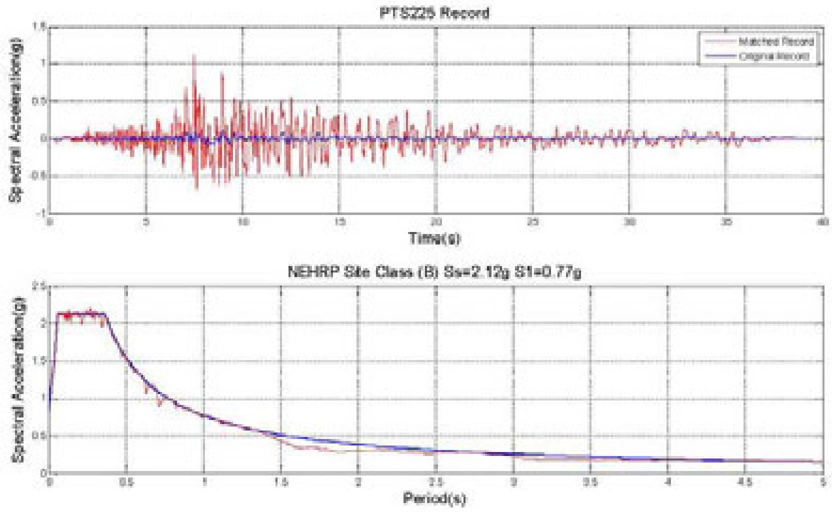

Figure 70. Spectrum compatible generated PTS225 record of Imperial Valley-earthquake for SEE level

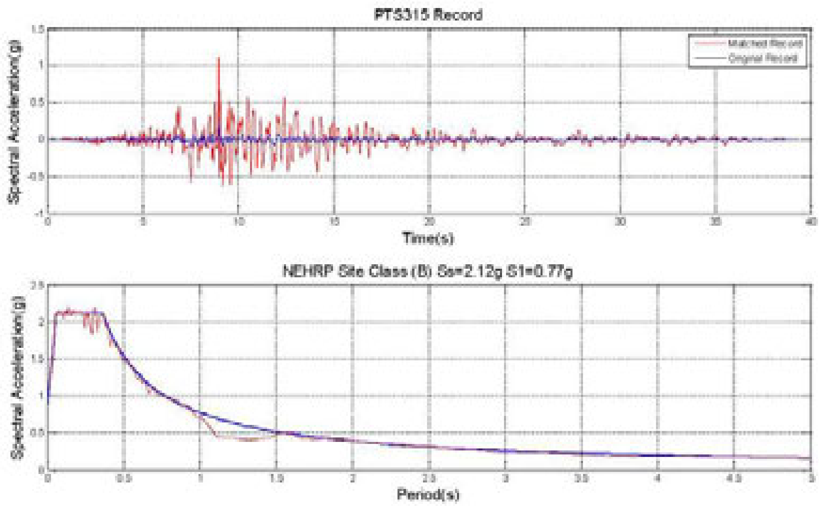

Figure 71. Spectrum compatible generated PTS315 record of Imperial Valley-earthquake for SEE level

49

Spectrum Compatible Vertical Component of Earthquake Records at SEE Level

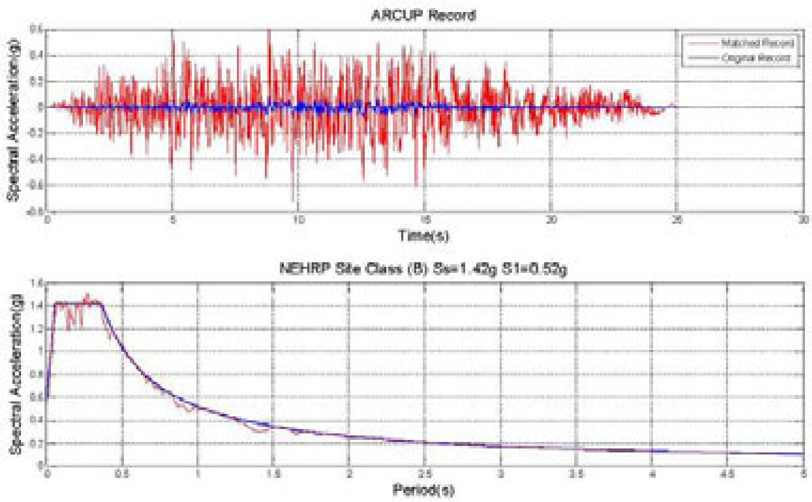

Figure 72. Spectrum compatible generated vertical component of Kocaeli-ARCUP record at SEE level

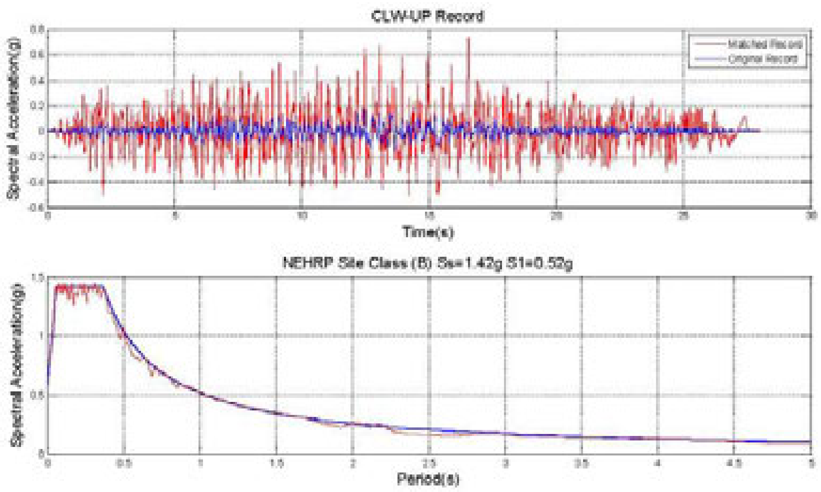

Figure 73. Spectrum compatible generated vertical component of Landers-CLWUP record at SEE level

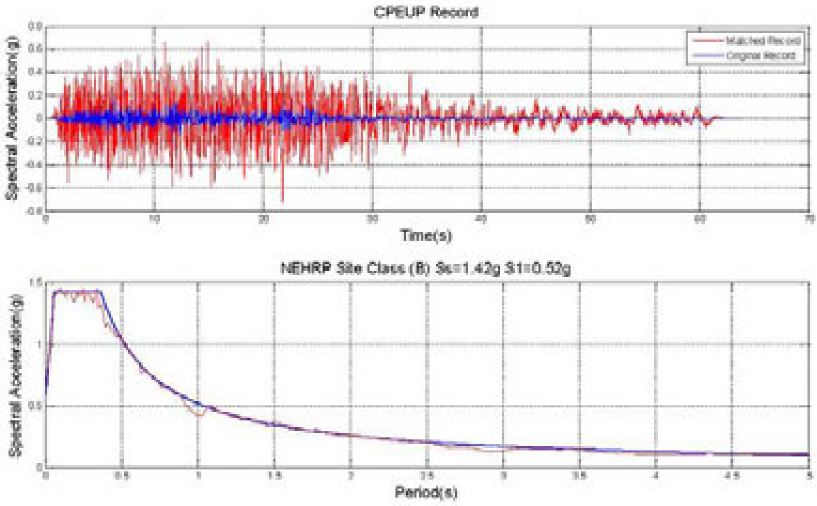

Figure 74. Spectrum compatible generated vertical component of Imperial Valley-CPEUP record at SEE level

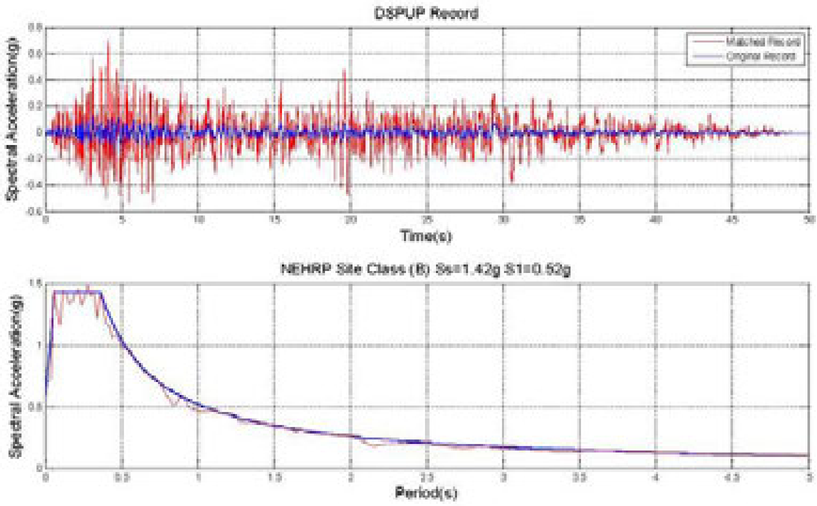

Figure 75. Spectrum compatible generated vertical component of Landers-DSPUP record at SEE level

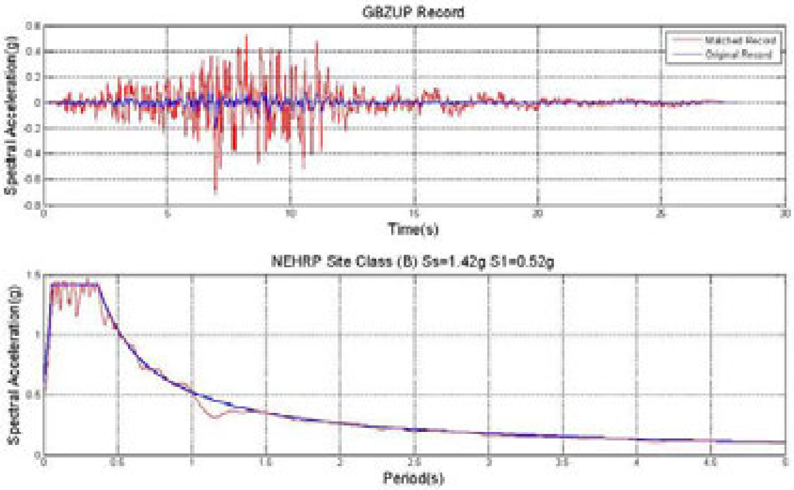

Figure 76. Spectrum compatible generated vertical component of Kocaeli-GBZUP record at SEE level

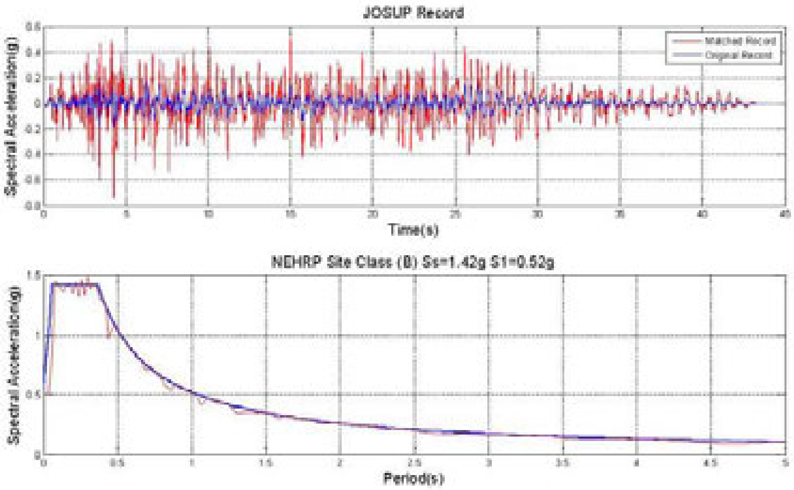

Figure 77. Spectrum compatible generated vertical component of Landers-JOSUP record at SEE level

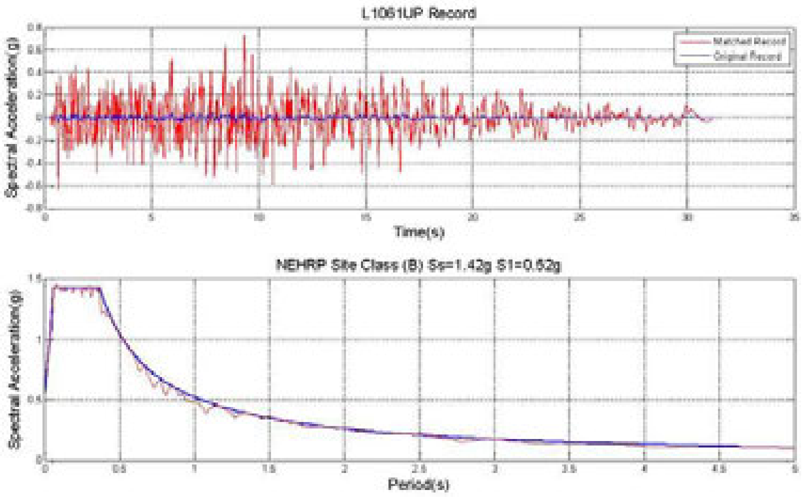

Figure 78. Spectrum compatible generated vertical component of Duzce-Lamont1061UP record at SEE level

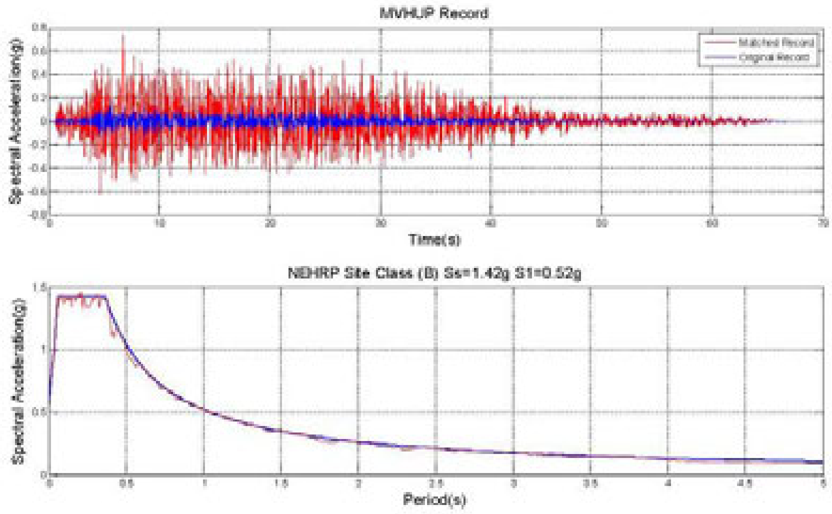

Figure 79. Spectrum compatible generated vertical component of Landers-MVHUP record at SEE level

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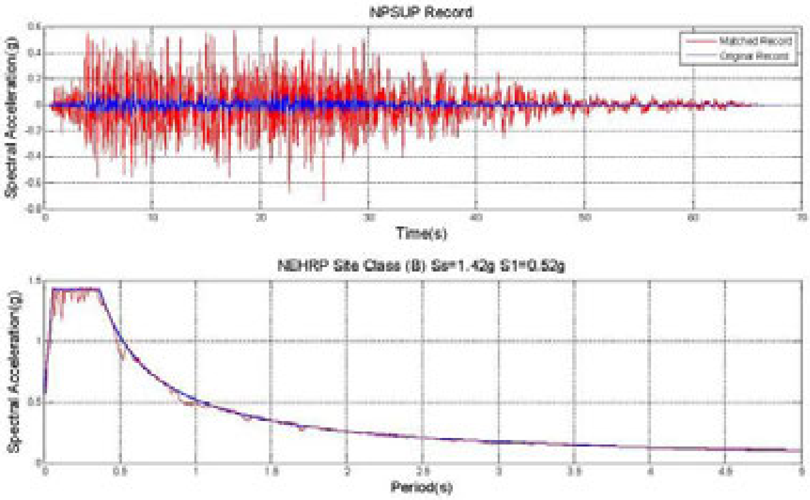

Figure 80. Spectrum compatible generated vertical component of Landers-NPSUP record at SEE level

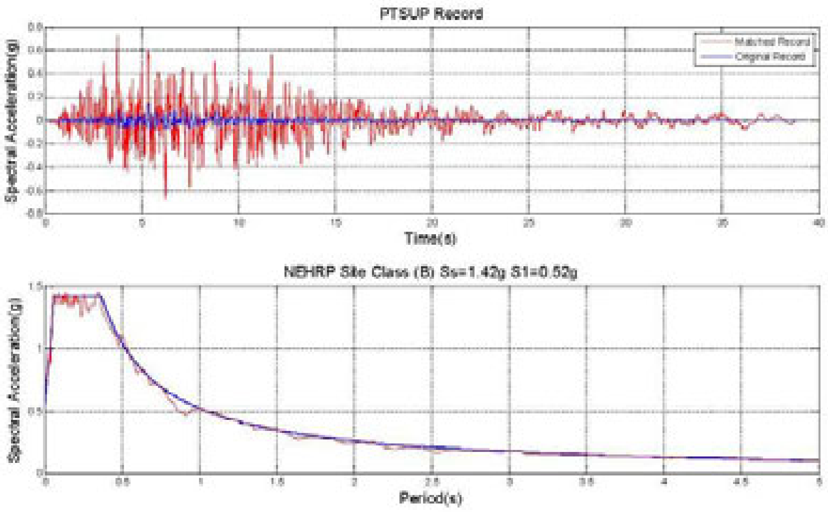

Figure 81. Spectrum compatible generated vertical component of Imperial Valley-PTSUP record at SEE level

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10 CONCLUSIONS

1. The OBE level design basis 5% damped free-field horizontal response spectrum is provided in Table 5a and in Figure 16. This spectrum corresponds to 144 year average return period. The associated vertical spectra can be taken as 2/3 of this horizontal spectrum. The Alpaslan II Dam and the HEPP should be capable of resisting an OBE without sustaining serious damage, so that they remain operational and do not require extensive repair work. All systems and components necessary to maintain the project should be designed to remain operable during and after the OBE. The satisfaction of these performance criteria would requite almost linearly elastic response of the dam body and the HEPP elements under the action of the OBE level ground motion.

2. The SEE level design basis 5% damped free-field horizontal response spectrum is provided in Table 5a and in Figure 17. The associated vertical spectra can be taken as 2/3 of this horizontal spectrum. This spectrum corresponds both to the deterministic MCE ground motion and also to probabilistic ground motion associated with 2,475 year average return period. The Alpaslan II dam and the HEPP should be capable of withstanding the SEE without any failure that would possibly result in a loss of the reservoir. As such, the extent of damage allowed should not impair the ability to quickly and safely draw down the reservoir to alleviate any potential threat to downstream life and property.

3. Ten sets (two horizontal and one vertical) spectrum compatible ground accelerations, associated with the OBE and SEE levels, were generated to enable time domain non-linear analysis. These sets of accelerograms are illustrated in Figures 18 to 81. The associated digital files are separately provided.

4. Reservoir-triggered seismicity may be experienced in connection of the filling of the reservoir. It is believed that it primarily represents the release of pre-existing tectonic strain, with the reservoir being only a perturbing influence. The installation of a strong motion accelerometer array at the dam site is recommended for the monitoring of seismic activity. Such an array will provide data on pre-impounding and post-impounding seismicity for comparison and monitoring the effects of reservoir filling and operation.

REFERENCES

Abrahamson, N. A. 1992, "Non-stationary spectral matching," Seismological Research Letters 63(1), 30.

Abrahamson, N. A. and W. J. Silva, 2008, "Summary of the Abrahamson and Silva NGA Ground Motion Relations", Earthquake Spectra, Vol. 24, pp. 45–66.

ASCE/SEI 7-10 (2011), Minimum Design Loads of Buildings and Other Structures, American Society of Civil Engineers.

Ambraseys, N. N., 1988, "Engineering Seismology", Journal of Earthquake Engineering and Structural Dynamics, Vol. 17, pp. 1-105.

Ambraseys, N.N. and A.Zatopek (1968), The Varto Üstükran (Anatolia) Earthquake of 19 August 1966: Summary of a Field Report, Bulletin of the Seismological Society of America. Vol. 58, pp. 47-102. February, 1968

ASCE (2006), Minimum Design Loads for Buildings and Other Structures, ASCE Standard ASCE-SEI 7-05, American Society of Civil Engineers.

Barka A. A. and K. Kadinsky-Cade, 1988, "Strike-Slip Fault Geometry in Turkey and its Influence on earthquake activity", Tectonics, Vol. 7, No. 3, pp: 663-684.

Barka, A. and R. Reilinger, 1997, "Active Tectonics of Eastern Mediterranean Region: Deduced from GPS, Neotectonic and Seismicity Data", Annali Di Geofisica, Vol.X2, No.3, pp. 587–610.

Bender, B. and D.M. Perkins, 1987, "SEISRISK III: A computer program for seismic hazard Estimation", USGS Bulletin 1772, U.S Government Printing Office.

Boore, D. M., and G. M. Atkinson, 2008, "Ground Motion Prediction Equations for the Average Horizontal Component of PGA, PGV, and 5% - damped PSA at Spectral Periods between 0.01 s and 10.0 s", Earthquake Spectra, Vol. 24, pp. 99 –138.

Campbell, K. W., and Y. Bozorgnia, 2008, "Campbell-Bozorgnia NGA horizontal ground motion model for PGA, PGV, PGD and 5% damped linear elastic response spectra", Earthquake Spectra, Vol. 24, pp.139–171.

Chiou, B., and R. R. Youngs, 2008, "An NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra", Earthquake Spectra, Vol. 24, pp.173–215.
Cornell, A., 1968, "Engineering Seismic Risk Analysis", Bulletin of Seismological Society of America, Vol. 58, No. 5, 1583-1606, October.

Chorowicz, J., D. Dhonta and N. Gundogdu (1999), Neotectonics in the eastern North Anatolian fault region (Turkey) advocates crustal extension: mapping from SAR ERS imagery and Digital Elevation ModelJournal of Structural Geology 21 (1999), 511-532.

Copley, A. and J. Jackson (2006), Active tectonics of the Turkish-Iranian Plateau, TECTONICS, VOL. 25, TC6006, doi:10.1029/2005TC001906, 2006

Dewey, J.F., Hempton, M.R., Kidd, W.S.F., Saroglu, F. & Sengör, A.M.C. 1986. Shortening of continental lithosphere: the neotectonics of eastern Anatolia-A young collision Zone. In: Coward, M.P. & Ries, A.C. (eds.) Collision Tectonics. Geological Society of London, Special Publication, 19,3-36.

Dhont, D. and J.Chorowicz (2006), Review of the neotectonics of the Eastern Turkish–Armenian by geomorphic analysis of digital elevation model imagery, Int J Earth Sci (Geol Rundsch) (2006) 95: 34–49.

DLH, 2007, Ulaştırma Bakanlığı Demiryolları, Limanlar Ve Havameydanları İnşaatı Genel Müdürlüğü Kıyı Yapıları, Demiryolları Ve Havameydanları İnşaatları Deprem Teknik Yönetmeliği İçin Deprem Tehlikesi Belirlemesi, Report prepared by Bogazici University, Kandilli Observatory and Earthquake Research Institute, Department of Earthquake Engineering.

Erdik M., Y. Biro, T. Onur, K. Sesetyan, and G. Birgoren, 1999, "Assessment of Earthquake Hazard in Turkey and Neighboring Regions - GSHAP", Annali di Geofisica, Vol. 42, No.6.
ESC- SESAME, 2002, "Unified Hazard Model for the European- Mediterranean Region", http://www.seismo.ethz.ch/gshap/sesame/.

Erdik, M., Demircioglu, M., Sesetyan, K., Durukal, E. and Siyahi, B. (2004) Earthquake hazard in Marmara region, Turkey. Soil Dynamics and Earthquake Engineering 24, 605–631.

Erdik, M., M.B.Demircioglu, K.Sesetyan and U.Hancılar (2011), Deprem Risk Belirlemesi, 7.Ulusal Deprem Mühendisliği Konferansı, İMO, Mayıs 2011, Istanbul.

Eyidoğan H., S. Nalbant, A. Barka and G. C. P. King, 1999, "Static stress changes induced by the 1924 Pasinler (M=6.8) and 1983 Horasan-Narman (M=6.8) earthquakes", Northwestern Turkey, Terra Nova, 11, 38-44.

FEMA (2005). Federal Guidelines for Dam Safety: Earthquake Analyses and Design of Dams. NDSRB.

Gutenberg, B. and C. F. Richter, 1954, Seismicity of the Earth and Associated Phenomena, Princeton University Press, 2nd edition.

Hubert-Ferrari, A, King, G., van der Woerd, J., Villa I., Altunel E. and Armijo R. (2009). Long-term evolution of the North Anatolian Fault: new constraints from its eastern termination. In van Hinsbergen D.J.J., Edwards M.A. and Govers R.. Collision and collapse at the Africa-Arabia-Eurasia subduction zone. Special Publications. 311. London: Geological Society. pp. 133–154.

ICOLD (1989). International Commission on Large Dams - Guidelines for selecting seismic parameters for large dams. Paris.

ICOLD-CIGB (2010), SELECTING SEISMIC PARAMETERS FOR LARGE DAMS Guidelines, Bulletin 72, 2010 Revision

Idriss, I. M., 2008, "A NGA Empirical Model for Estimating the Horizontal Spectral Values Generated by Shallow Crustal Earthquakes", Earthquake Spectra, Vol. 24, pp. 217 – 242.
Kaptan, C. (2009), Artvin Yusufeli Baraji ve HES Yeri Deprem Risk Analizi Raporu, DSİ, Ankara.

INSITU (2010), Alpaslan II Baraji ve HES Projesi 2nd Stage Geological & Geotechnical Information and Summary Geotechnical Report, prepared by İNSİTU Geology, Geotechnics and Drilling Co. Ltd., November 2010

McGuire, R.K., 1993, "Computations of Seismic Hazard", Annali di Geofisica, Vol.36, pp.181-200.

McKenzie, D. P., 1970, "Plate Tectonics of the Mediterranean Region", Nature, 226, pp. 239-243.

NEHRP97, 1997, "Recommended Provisions for Seismic Regulations For New Buildings and Other Structures, FEMA-303", Prepared by the Building Seismic Safety Council for the Federal Emergency Management Agency, Washington, DC.

Pearce,J.A, J.F. Bender, S.E. De Long, W.S.F. Kidd, P.J. Low, Y. Guner, F. Saroglu, Y.Yilmaz, S. Moorbat and J.G. Mitchell (1990), Genesis of collision volcanism in Eastern Anatolia, Turkey, Journal of Volcanology and Geothermal Research, 44 (1990) 189-229 Elsevier Sicence Publishers B.V., Amsterdam

Reilinger, R., S. McClusky, P. Vernant, S. Lawrence, S. Ergintav, R. Cakmak, H. Ozener, F. Kadirov, I. Guliev, R. Stepanyan, M. Nadariya, G. Hahubia,.S. Mahmoud, K. Sakr, A. ArRajehi, D. Paradissis, A. Al-Aydrus, M. Prilepin, T. Guseva, E. Evren, A. Dmitrotsa, S. V. Filikov, F. Gomez, R. Al-Ghazzi,17 and G. Karam, 2006, "GPS constraints on continental deformation in the Africa-Arabia-Eurasia continental collision zone and implications for the dynamics of plate interactions", Journal Of Geophysical Research, Vol. 111, B05411, Doi:10.1029/2005jb004051.

Sançar, T., C. Zabcı and H. S.Akyüz (2011), Quaternary Activity of Varto Fault Zone (Eastern Anatolia) and New Ideas About 1966 Varto Earthquake, Geophysical Research Abstracts, Vol. 13, EGU2011-9498-1, 2011

Saroglu F, Güner Y (1981) Dogu Anadolunun jeomorfolojik gelisimine etki eden ögeler, jeomorfoloji, tektonik, volkanizma iliskileri (in Turkish). Türkiye Jeol Kur Bült 24:267–282
Saroğlu, F., O. Emre and I. Kuscu (1992), "Active Fault Map of Turkey", Mineral Res. Explor. Inst. Turkey.

Segall, P. and J. L. Davis, 1997, "GPS application for geodynamics and earthquake studies", Annual Rev. Earth Planet. Sci., Vol. 25, pp. 301–336.

Sengör, A.M.C., Görür, N. & Saroglu F. 1985. Strike-slip faulting and related basin formation in zones of tectonic escape: Turkey as a case study. In: Biddle, K.T. & Christie-Blick, N. (eds) Strike-slip faulting and Basin formation. Society of Economic Paleontologists and Mineralogist, Special Publication, 227-267.

Stafford, P.J., Strasser, F.O. and Bommer J.J. (2008), An evaluation of the applicability of the NGA models to ground-motion prediction in the Euro-Mediterranean region, Bulletin of Earthquake Engineering, 6(2): 149-177.

Stepp, J. C., 1973, Analysis of Completeness of the Earthquake Sample in the Puget Sound Area, In: S.T. Handing (Editor), Contributions to Seismic Zoning. NOAA Tech. Report., ERL 267-ESL 30, U.S. Dep. of Commerce, USA.

Taymaz, T., Yilmaz, Y. & Dilek, Y. (2007) The Geodynamics of the Aegean and Anatolia, Geological Society, London, Special Publications, 291, 1–16.

TEFER (Turkey Emergency Flood and Earthquake Recovery), 2000, A Probabilistic Seismic Hazard Assessment For Turkey, Report prepared in connection with the Improvement Of Natural Hazard Insurance And Disaster Funding Strategy Project, Başbakanlık Hazine ve Dış ticaret Müsteşarlığı - Sigortacılık Genel Müdürlüğü.

USACE (1995). Engineering Manual-Response Spectra and Seismic Analysis for Concrete Hydraulic Structures, EC 1110-2-6050. Washington, D.C.: Chief of Engineers.

USACE (2007). Engineering and Design - Earthquake Design and Evaluation of Concrete Hydraulic Structures EM 1110-2-6053. Washington, D.C.: Chief of Engineers.

Wallace, R.E. (1968), Earthquake of August 19, 1966, Varto Area, Eastern Turkey, Bulletin'of the Seismological Society of America. Vol. 58, No. 1, pp. 11-45. February, 1968

Wells, D. and Coppersmith, K.J. (1994). "New empirical relationships among magnitude, rupture length, rupture width, rupture area, and surface displacement," Bulletin of the Seismological Society of America, 84(4): 974-1002.
Wieland, M. (2003), Seismic Aspects of Dams, General Report, Q.83, Proc. of the 21st International Congress on Large Dams, ICOLD, Montreal, Canada.

Wielend, M. (2007) EARTHQUAKE SAFETY OF DAMS AND THE IMPORTANCE OF EMERGENCY PLANNING1st National Symposium and Exposition on Dam Safety Ankara May 28-30, 2007

Wieland M. (2005), Review of seismic design criteria of large concrete and embankment dams, Proc.Workshop on Seismic Aspects of Dams, Paper No. 012-W4, 73rd Annual Meeting of ICOLD,Tehran, Iran.

Wieland M. (2006), Earthquake safety of existing dams, keynote lecture, Proc. First European Conference on Earthquake Engineering and Seismology, 1ECEES, (a joint event of the 13th ECEE & 30th General Assembly of the ESC), Geneva, Switzerland, 3-8 September 2006

Wieland, M. (2010) Dam safety and earthquakes 20 September 2010, International Water Power and Dam Construction

APP 10

ACTIVE FAULT INVESTIGATION REPORT

ALPASLAN II DAM AND HPP PROJECT

ACTIVE FAULT INVESTIGATION REPORT

FOR

ZOROVA DAM AXIS AND SURROUNDING AREA

JULY 2010

CONTENTS

1. INTRODUCTION

This report covers the study for the existance of the active faults which may effect the Alpaslan II dam proposed over Murat River. An area with North-South trend covering 6 km zone in width extending from the confluence of Bingöl stream and Murat River in the north down to the South of Dumlusu Village, leaving the Murat River in the middle were mapped in a scale of 1/25 000 (App-1). Geological units existing in the area were distinguished, their lateral extensions, lower and upper contact relations were described, older, active and potential landslide areas in dam site and surroundings were observed in the field. The positions, extensions and effects of active faults remaining out site the study area and possible effects of earthquakes likely to occur on the dam site were studied.

2. REGIONAL GEOLOGY

Late Oligocene and recent Miocene Adilcevaz Formation is the oldest rock unit covered uncon formably with Pliocene Zırnak and Solhan Formations. The Quaternary river deposits and alluviums are the youngest deposits of the region (App-1).

2.1. Adilcevaz Formation (Tma)

In this local study, the unit extends towards WNW from Talanyaylası Hill occurring in the north of Dumlusu in the east of Murat River. The lithologic units of the sequence forming the geological unit in this area can not be observed clearly due to the cover and extensive landslides in the region. But lithologic properties of some part of sequence at the crown section of landslide occurring at the west of Kaş Tepe (hill) in the North east of Dumlusu are clearly seen. The lower section exposed at here is formed of coarse sandstone lenced laterally siltstone interbedded with sandstone, cross bedded sandstone and siltstone lenced in lateral direction and the upper section is formed of resifal limestone (Figure 1).

On the other hand, the similar situation occurs in the area remaining at the west bank of Murat River, the lower section of the subject geological unit is observed on the road cuts starting from Akpınar Village down to the Suduragı and its upper section is observed at Ziyaret Ridge at the west of Akpınar. The lower section of the sequence is formed of blocky weathered limestone comprising carbonate cemented sandstone, siltstone interbeddings; middle section is formed of siltstone comprising coarse sandstone, small gravel stone, rough small gravel stone and carbonate cemented sandstone intercallations lensed laterally (Figure 2 a-b). The upper section is formed of greyish brown siltstone comprising 20-80 cm thick carbonated sandstone interlayers lenced in lateral direction. The resifal limestone forming the upper section of Ziyaret Ridge is brownish grey, thickly layered-masif, densely textured, excessively jointed and blocky weathered.

Lower contact of formation can not be observed within study area. It is most probably discordant with Yazla Formation outside the study area. Upper contact is covered with angular unconformity by Zırnak and Solhan Formation. The thickness of unit changes depending on erosion occurred.

There is no data for the age of Formation. According to the samples collected by Akay (1989) from the bottom of unit around Muş, outside the area under study, the nannoplanktons such as Triquetrorhabdulus carinatus Martini, Helicopontosphaera recta (Haq), Helicopontosphaera intermedia Martini, Helicopontosphaera Euphrates (Bramlette and Wilcoxon), Sphenolithus ciperoensis Bramlette and Wilcoxon gives the age the late Rupclian (Middle Oligocene). The samples collected from the upper section of the unit, the nannoplanktones such as Discoaster druggi Bramlette and Wilcoxon, Sphenolithus belemnos Bramlette and Wilcoxon, Sphenolithus conicus (Burky), Holicopontosphaera kamptneri Hay and Mohler, Helicopontosphaera intermedia Martini gives the age of late Akitanion-early Burdigalian.

According to the ages determined, Adilcevaz Formation is admitted to be latest Rupelion-early Burdigalian. The lower part of unit has been deposited at shallow marinal-continental, upper part at shallow conditions.

2

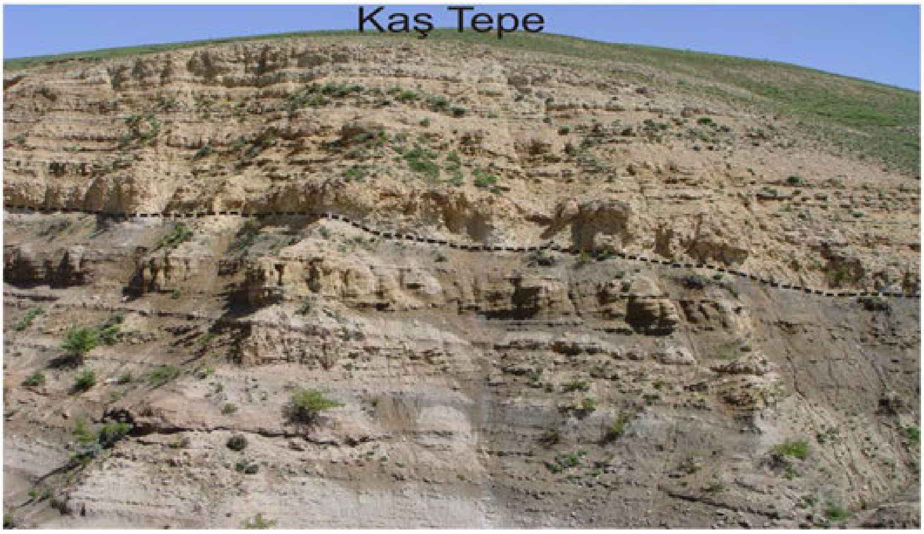

Figure - 1. At 1750 m NE of Dumlusu, at SW of Taç Tepe (Hill), a general appearance of resifal limestone forming the upper part of Adilcevaz Formation, underlying the siltstone and loose textured, cross bedded coarse sandstone interlayer which shows lanse in lateral direction (J47 d4, 21 375-22 675, looking NE).

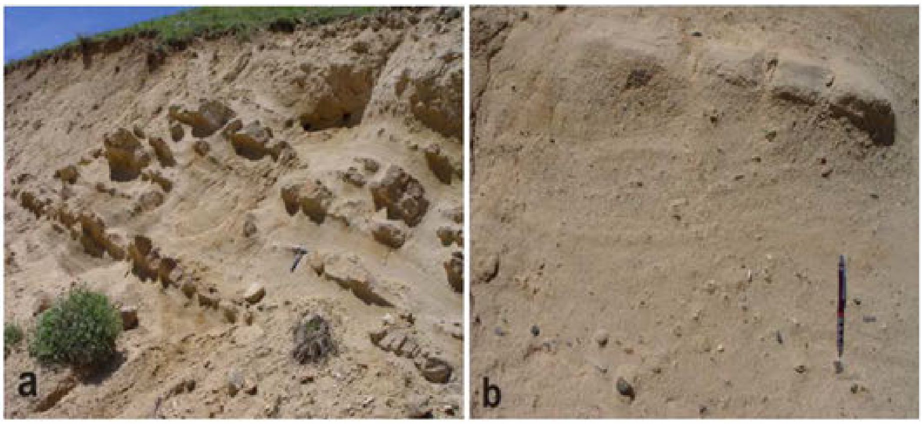

Figure-2a-b. In the north of Akpınar, the lower levels of Adilcevaz Formation exposed along the road cuts leading to Suduragı from Akpınar comprises the siltstone (a) with carbonate cemented sandstone intercallations, rough sandstone, small gravel stone, rough small gravel stone (b) (J47 d4, 16 220-24 025, looking NW).

3

2.2. Zırnak Formation (PLz)

The formation which is exposed in very limited area, was terminated at first by İlker (1967). The conspicuous exposures are encountered at Göller ridge (Figure-3a) at 4 km north of Akpınar and at road cut occurring on Taht ridge and at the crown section of the landslide existing on the ridge of Aliahmet (Figure-3b). The other exposure is in the road cut at the west section of the valley where Murat River flows at about 1 km NE of Akpınar. In all these exposures the lithological features forming the geological unit is not clear. The prominent feature of formation is the existence of basalt blocks reaching up to around 1 m in size in all the exposures.

The unit at the road cut around Taht ridge in the north of Akpınar is formed of light coloured tuffite comprising dark coloured transported volcanic constituents, with rare limestone and oxidised volcanic fragments (Figure-4a). Tuffits showing laterally lenses transmits gradually into fine grained-siltstone with basalt blocks (Figure-4b). The upper levels of the formation exposed at here is formed of excessive basalt blocks, sponge spicules and micritic limestone comprising ostracoda crusts. At the crown portion of landslide developed at the slope looking South ward at Aliahmetçayırı ridge, the formation is comprised of tuffite at lower levels and tuffs at upper levels (Figure-3b). There is no data for the age of formation within the study area. Around Muş, outside of study area the samples collected by Akay (1989), Micromys sp., Arvicolidae gen.et.sp.indet MMF gives the age of early Pliocene, Mimomys hajnackensis. Mimomys stehlini, Mimomys sp. MMF gives the age late Pliocene (MN-16b) and Mimomys Pliocaenicus, Mimomys (Borsodia) sp. Apedumus cf. Sylvaticuc MMF gives the age of the middle of late Pliocene (MN-17). According to the data obtained the age of Formation is Pliocene.

The formation occurs with angular unconformity over Adilcevaz Formation. The upper contact is covered with unconformity by Quaternary deposits. The thickness of formation is not known. According to the topographical data the thickness of formation is approximately 20-150 m. It has lateral transition into Solhan volcanics. The lower levels were deposited under stream and upper levels under lacustrine conditions.

2.3. Solhan Formation (PLs)

The formation which is terminated at first by Yılmaz et.al (1987) is formed of basalt, andesite and pyroclastics. The typical section of the formation exposed in extensive areas between Elazıg-Karlıova, is found at Solhan in the east of Bingöl. The lower levels of the formation are formed of lacustrine deposits, middle levels of lacustrine deposits with pyroclast intercallations and the upper levels of volcanics. At the bottom contact it overlies the older units with angular unconformity, at upper contact it is covered unconformably by Quaternary deposits.

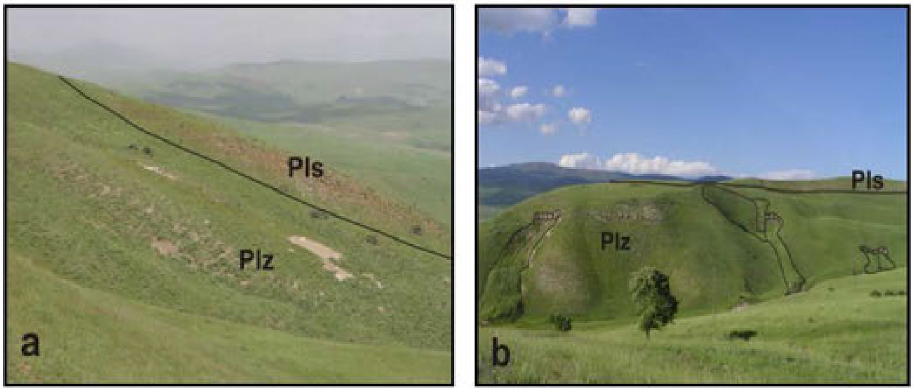

Figure-3a-b. Two different locations where Zırnak and Solhan formations show conspicious relations, the first one (a) is Göller ridge occurring at the west of Murat River, 4 km north of Akpınar (J47 d4, 17 500-26 900, looking towards NW). The other location (b) is found at the east of Murat River, at Aliahmetçayırı ridge at 1750 m NE of Göçmenler District. (J47 d4, 17 500-26 900, looking NW) 19 875-25 650 looking North).

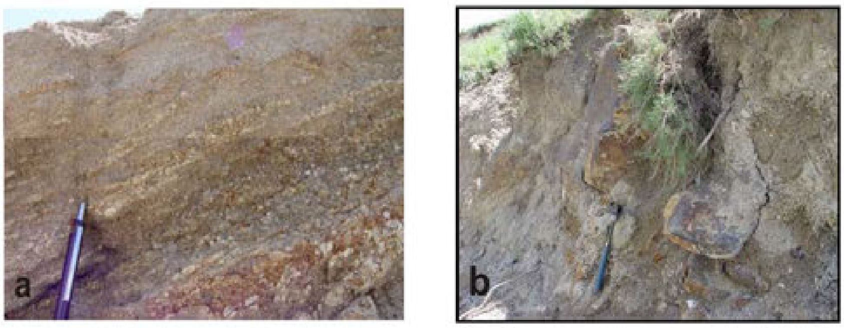

Figure-4a-b. A general view of lithologic features of Zırnak Formation exposed locally at road cut (a). At lower section of exposure, gravel Stone with lacustrine limestone concretions, and the coarse sandstone with the grain size getting smaller upward. Basalt blocks take place in gravel stone at the western continuation of same sequence (b). (J47 d4, 17 576-26 674, looking eastward).

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3. QUATERNARY DEPOSITS

These are the deposits along the Murat River, developed at both banks of valley at the mouths of streams reaching to the river from east and west. These deposits are comprised of gravelstone, sandstone and mudstone. In addition to them, old terrace levels at two different locations along Murat River were observed within the study area. The first one of these terraces which are continuation at lateral direction, occurs at the slope looking at Murat River and Geçitdüzü in the South of Göçmenler District in 1 km NE of Akpınar at the west of river (J47 a4, 17 825-23 600) (Figure-5).

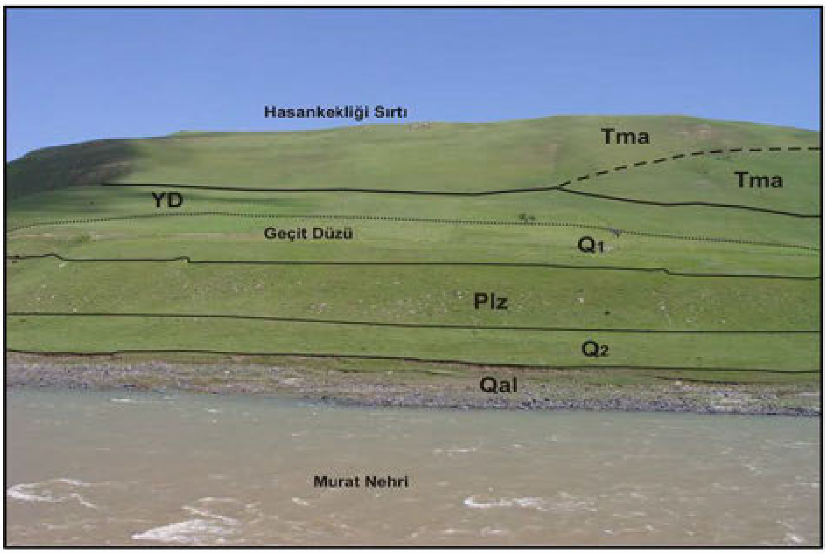

Figure-5. A general view of the terrace levels (Q_1 and Q_2) from oldest to the youngest at the area from Geçitdüzü towards Murat river in the immediate south of Göçmenler and the alluvial deposits (Qal) developed at present day in the river base (J47 d4, 18125-23875, looking east ward).

4. MASS MOVEMENTS

Wide spread landslides are developed in the study area. The most prominent ones of them are the landslides developed along Talanyaylası Tepe and Kaş Tepe towards SW occurring about 1 km NE of Dumlusu (Figure-6). The landsliding in this area is due to the loose textured siltstone, sandstone lithologies forming the lower levels of Adilcevaz Formation and their slope inclinations.

Another landslide is developing in settlement area and nearby area of Göçmenler Didtrict. The landslide developed over Adilcevaz Formation is affecting Zırnak Formation (Figure-7). The landslide developed in the region is due to the high slope angle of Adilcevaz Formation towards Murat River.

The apparent landslide in the area remaining in the west of Murat River has shown development in 1 km NE of Akpınar. The Zırnak Formation containing basalt blocks are also affected from the landslide developed over Adilcevaz Formation (Figure-8).

Figure-6. A general view of wide spread landslides developed from 1 km NE of Dumlusu towards SW (J47 d4, 20 500-22 750, looking North).

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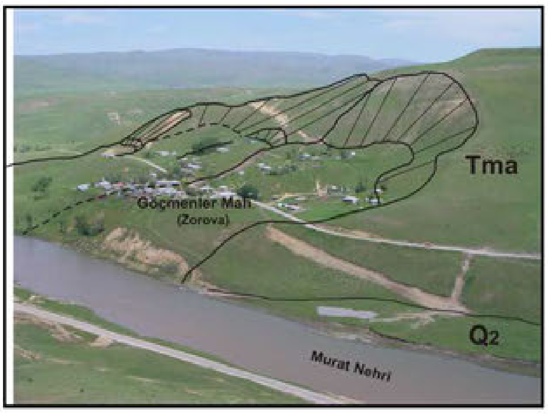

Figure-7. Wide spread landslides developed from high land in the east towards west formed by Adilcevaz Formation in the settlement area of Göçmenler District (J47 d4, 17 700-24 500, looking NE).

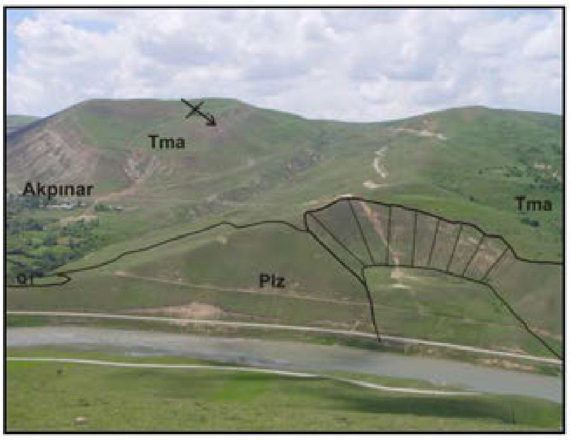

Figure-8. A general view of the landslide occurring 1250 m. NE of Akpınar and developed towards the valley of Murat River (J47 d4, 17 750-24 125, looking west).

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5. ACTIVE TECTONICS OF STUDY AREA

The existence of active faults likely to affect the dam body in the study area has been studied by determining the interruptions of lateral continuity of formations exposed in the region the sections of sequence affected by faulting and the surface features developed by faulting. Adilcevaz Formation trending from Kaş Tepe in the north of Dumlusu towards WNW continues without interruption into the west of Murat River. The same formation taking part in the west of Murat River is continuous without interruption.

But some faults developed depending on the development of basin during deposition in the formation exposed at both banks of river have been determined. The first one of these faults occurs in the east of Murat River at the crown portion of landslide at Kaş Tepe, and the other one has been observed in the road cut at the north of Akpınar. At Kaş Tepe, a faulting occurs with the same age of deposition and effecting rough sandstone intercallation lensing laterally within the lower section of Adilcevaz Formation. Fault plain becomes uncertain towards the upper portion of sequence, covered with younger deposits (Figure-9). Fault plain is nearly vertical, most probably faulting has oblique strike slip and the western compartment has collapsed at the location where Murat River flows. Other faulting is observed at the road cut in the north of Akpınar. At here the fault shows a strike of $320^0/85^0$ SW, the laterally lenticular sandstone layer remaining in the east of fault plain has faller about 65 cm (Figure-10a).

According to the sliding traces and marks observable along fault plane, inclination of fault is 47^0 (Figure-10b), its compartment towards Murat River has fallen down, while the other compartment in the west has moved upward (J47 d4, 16 234-24 049, looking North). On the other hand, the most eastern parts of Zorova opposite to ridge situated in 375-500 m. WNW of Göçmenler District and Göller ridge extending towards Murat River are in the position of triangular surfaces with continuation in N-S direction.

The inclination facture has been considered to be a fault trending N-S direction parallel to the Murat River and the resifal limestone of Adilcevaz Formation in the stream bed where Gümüşhançer spring flows has been observed to continue with an angle of 15^0 eastward without interruption. This situation indicates that the occurrance of the triangular faces in N-S direction with lateral continuation is not due to the tectonical reasons but erosional origin.

There occurs a lake in an oval situation at immediate west of Tavukkıran Tepe (1392m.) in 2250 m north of Göçmenler District. Any data pertaining to the existence of a fault at North, South east and west of the lake have not been found.

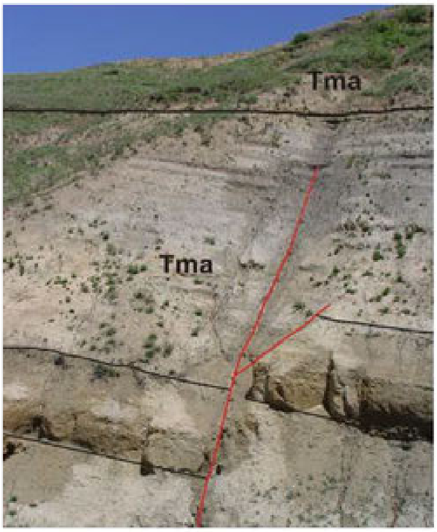

Figure-9. In the north of Dumlusu, at the crown section of landslide developed in Kaş Tepe, occurring within siltstone forming the lower levels of Adilcevaz Formation, affecting the loose textured rough sandstone interlayer with lensing laterally, the normal faulting occurred with the same time of deposition. Fault plane becomes uncertain towards the upper level of sequence and is covered with younger deposits (J47 da, 21 275-22 675, looking north).

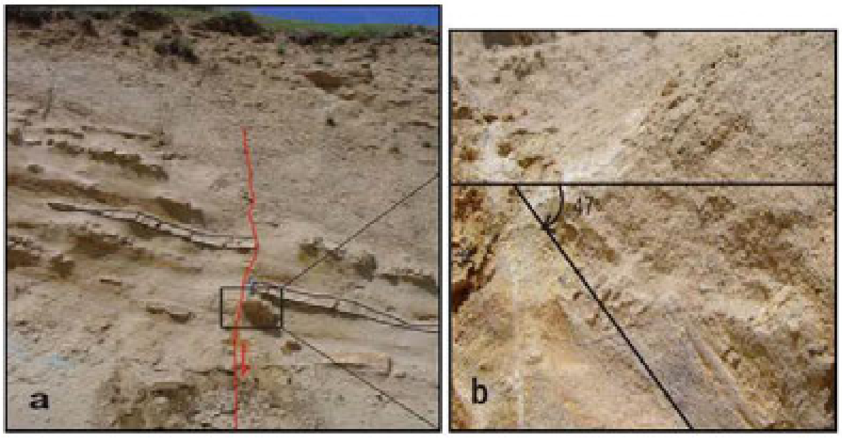

Figure-10 a-b. A general view of fault plane with 320^0/85^0 SW attitude observed at the road cut in the north of Akpınar and sandstone layer showing lensing in lateral direction, subjected to the effect of faulting (a). Sandstone interlayer in the east of fault has fallen down about 65 cm along fault plane observed as normal faulting. According to the friction traces and marks observable along fault plane, the inclination of fault is 47^0, the block remaining in the west of fault has moved upward (J47 d4, 16 234-24 049, looking North).

6. ACTIVE TECTONICS OF REGION

In the region there is there fault systems creating destructive earthquakes (Figure-11). One of them is situated in the west called as Eastern Anatolian Fault (DAF) with NE-SW trend and left-lateral stike slip. The other faults are with NW-SE trend and right-lateral strike slip. In the north. Varto Fault segments and in the south Muş Fault which borders Muş Plain from the north, are taking place. The general properties and know seismicities of these faults are summarized below.

6.1. Eastern Anatolian Fault (DAF)

6.1.1. Göynük Segment

The section extending towards Bingöl from Karlıova where DAF intersects with North Anatolian Fault (KAF) has been called as Göynük segment. This segment is approximately 70 km in length. It is formed of two geometric segments trending each other, Karlıova-Göynük about 30 km and Göynük-Bingöl SW as 40 km in length.

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In the South of fault, an earthquake with M:6.8 occurred between Bingöl SW and Göynük on May 22, 1971. In the field studies made after the earthquake occurance, the effects and observed, features on surface were mapped in detail. Three fracture systems were determined in parallel to the trend of Göynük valley in the east of Bingöl and 5-10 cm left-lateral slips were measured in en echelon arrangement with right step like over thrust components (Arpat, 1971).

In the NE extension of fault of an earthquake procuding a surface rupture about 40 km in length between Çobantaşı and Balık gölü occurred on May 12, 1866 from the historical records (Ambraseys and Jackson, 1998). This section of segment can easily be observed in the field, in the draining system reaching normal to the fault, it is said that left-lateral translation of 350 $\pm$ 10cm occurred during earthquake (Herece, 2008). But, it is not clear whether the section of fault between Çobantaşı-Balık gölü was crushed only or the Göynük segment wholly. The relations between the measured translation value and sliding velocity of fault as 8.3 mm/year, gives the recurrence period of earthquakes as 440 years for the north eastern section of fault.

6.2. Segments Around Varto

In the north of Bahri lake, the DAF confluencing with North Anatolian Fault (KAF) becomes uncertain after 6 km extension in the direction of ESE. In an area from here extending eastward in width of 9 km, there are 3 faults with a trend of NW-SE. These faults which are parallel to each other are Varto, leylakdağ and Çayçatı segments with prominent right-lateral strike slips (Herece, 2008). The nearest one to the study area is Çayçatı segment in the south.

6.2.1. Varto Segment

This segment which has NW-SE trend passing north of Varto, disappears about 2 km north of Kartaldere Village in the NW, its SE extension is not known. The clearly observable segment along surface is measured about 30 km over the map. The segment is expected to produce earthquakes with a magnitude of M> 6.8. creating surface rupture.

6.2.2. **Leylek Dağ Segment**

The segment with linear trend which is nearest to the study area extends between Kartaldere in NW and Aşağı Alagöz in SE having a length of 30 km. This segment which is clearly observable on surface, may generate earthquakes of intermediate magnitudes having surface factures.

6.2.3. **Çayçatı Segment**

This fault extends between Köprücük in the NW bordering Gökçe Dag from south and 2 km NE of Aşağıhacıbey in the SE. The segment has 30 km length. The pressure ridge observable in the field and depression lake. According to formed during earthquakes, the segment is expected to produce surface fracture and to generate earthquake with a magnitude of M≥ 6.8.

Around Varto, an earthquake with a magnitude of M_s = 6.8 causing human losses and destructions occurred on August 9, 1966. Following to the occurrence of earthquake, two different micro-seismic observations were conducted and surface ruptures devoloped were described. (Wallace, 1968; Ambraseys and Zatopec, 1968).

In the field studies made by Wallace (1968), fault scarps reaching from 1 cm up to 30 cm along surface fractures parallel to each other and en echelon fractures with left steps with right lateral displacements were observed.

In the studies made by Ambraseys and Zatopec (1968) and Ambraseys (1988) it is understood that the earthquake has affected the area at 25 km north west and 25 km southeast of Varto, within an area about 15 km in width. In the earthquake, a surface fracture with right-lateral slip with a dip slip component about 30 km in length in 3 fracture zones parallel to each other was developed. This surface fracture has shown an extension about 10-20 km in north west and south east direction during residual earthquake shocks.

In July 12, 1996 an initial earthquake shock and in August 20, 1966 a severe destructive residual shock (M: 6.2.) occurred. Residual shocks with magnitudes of 4.0 ≤ M≥6.2 Migrated from southeast of Varto to the northwest, concentrated in Ilıpınar segment of KAF where Elmalı earthquake occurred in August 17, 1949 (Herece, 2008) (Ambraseys, 1988).

6.3. Muş Fault

It is a fault with right-lateral strike slip, bordering Muş Plain from North in NW-SE trend. The fault with unknown past activities and details is expected to produce an earthquake with a magnitude of M≥ 7.0 creating a surface fracture.

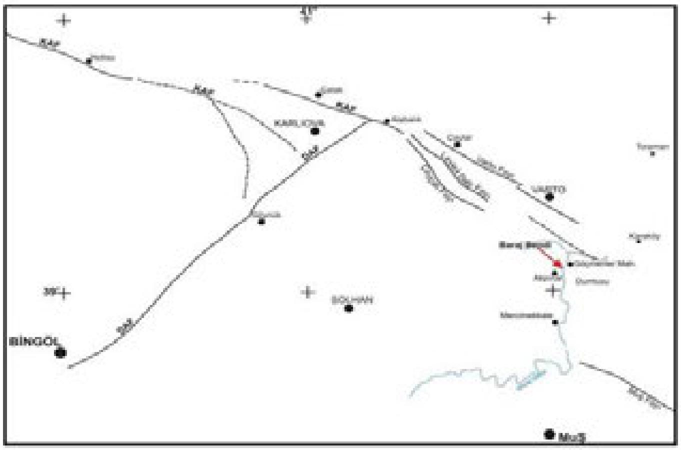

Figure-11. Regional active faults which will affect dam body (red arrow).

7. ACCELERATION TO BE DEVELOPED

For engineering studies the determination of maximum acceleration to be developed in different rock types during earthquake generation is required. While maximum acceleration for high magnitude earthquakes may become higher, the maximum acceleration will be reduced as getting away from energy resource (from fault) for an earthquake in any magnitude. The relation between maximum acceleration and the distance from energy resource is determined with the graphics indicating the reduction found by studies. These studies made with limited data is considered for the same rock type as ground.

These faults effective in the region are with strike slip. The failure along the fault plane during the earthquake (released from friction), it starts from the extreme point towards the other side or starting from a point at the middle of plane extending towards both directions. Fault plane is a energy resource along the whole extension.

The earthquakes effecting dam bodies, they will be produced by means of fracturing of Göynük segment of DAF, the segments belonging to the Varto fault zone or Muş fault. In case these faults are fractured, the earthquake magnitudes and the expected acceleration values around dam site are given below.

The section of eastern Anatolian Fault occurring between Bingöl-Karlıova is called as Göynük segment. This segment clearly visible in field about ~70 km in length is formed of two sub-segments. The SW section between Bingöl-Göynük of fault and NE section between Göynük-Karlıova, both sections are ~ 35 km in length. In case the both segments are fractured, the expected earthquake magnitude; in accordance with the relations of fracture length-earthquake magnitude it is found as M_0=7.2 (Wells and Coppersmith, 1944). In case the both sub segments are fractured, the expected earthquake magnitude is to be M_0=7.0. On the other hand, the earthquakes occurred in SW section of Göynük segment on May 22, 1971 and NE section in 1866. The partial release has occurred in Göynük segments with these earthquakes, but the stress accumulation amount in fault from the time earthquakes occurred up to day is not known.

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In case the whole Göynük segment is ruptured, a surface rupture about 70 km in length and an earthquake with an intensity of M_o= 7.2 is expected. The expected horizontal ground acceleration over the dam body taking part about 65 km away from the fault.

According to Schnabel and Seed (1973)......	g=0.06 cm/sn^2
According to Joyner and Boore (1981).......	g=0.10 cm/sn^2
According to Fukushima and Tanaka (1990)	g=0.11 cm/sn^2

In case the SW section of Göynük segment occurring between Bingöl-Göynük is ruptured, a surface rupture about 35 km in length an earthquake with a magnitude of M_0= 7.0 (Wells and Coppersmith, 1994) is expected. The expected horizontal ground acceleration values over the dam body taking part about 65 km away from the fault are given below.

According to Schnabel and Seed (1973)......	g=0.40 cm/sn^2
According to Joyner and Boore (1981).......	g=0.72 cm/sn^2
According to Fukushima and Tanaka (1990)	g=0.98 cm/sn^2

In case the NE section of Göynük segment occurring between Göynük-Karlıova is ruptured, a surface rupture about 35 km in length and an earthquake of M_o= 7.0 (Wells and Coppersmith, 1994) is expected. The expected average horizontal ground acceleration values over dam body taking part about 48 km away from the fault are;

According to Schnabel and Seed (1973)......	g=0.08 cm/sn^2
According to Joyner and Boore (1981).......	g=0.09 cm/sn^2
According to Fukushima and Tanaka (1990)	g=0.12 cm/sn^2

The 3 segments parallel to each other NW-SE trend taking part around Varto are with right-lateral strike slip, having about 30 km in length. In these faults the intensity of expected earthquake is M≥6.8 depending on the relation between earthquake intensity-rupture length (Well and Coppersmith, 1994).

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Çayçatı segment which is 20 km away from the dam is the most southern section, the faults parallel to each other leylekdağ is 8 km away and Varto fault is 11 km away. These segments during Varto earthquake (M= 6.8) were ruptured together. In case the ground is formed of same type of rock, the average expected horizontal ground acceleration values over dam are given below.

According to Schnabel and Seed (1973)......	g=0.38 cm/sn^2 (for of 8 km distance)
According to Schnabel and Seed (1973)......	g=0.32 cm/sn^2 (for of 11 km distance)
According to Schnabel and Seed (1973)......	g=0.18 cm/sn^2 (for of 20 km distance)
According to Joyner and Boore (1981).......	**g=0.42 cm/sn^2 (for a distance of 8 km)**
According to Joyner and Boore (1981).......	**g=0.38 cm/sn^2 (for a distance of 11 km)**
According to Joyner and Boore (1981).......	**g=0.24 cm/sn^2 (for a distance of 20 km)**
According to Fukushima and Tanaka (1990)	g=0.42 cm/sn^2 (for a distance of 8 km)
According to Fukushima and Tanaka (1990)	g=0.37 cm/sn^2 (for a distance of 11 km)
According to Fukushima and Tanaka (1990)	g=0.26 cm/sn^2 (for a distance of 20 km)

The obtained horizontal ground acceleration values cover the individual ruptures of each fault during earthquake in Varto fault zone. In fact, in Varto earthquake occurred in 1966 all three segments were ruptured together. These segments from South towards north have distances of 20 km, 8 km and 11 km distances to the dam. The expected average horizontal ground acceleration values are given below when considered that these faults will be ruptured together in a future earthquake.

According to Schnabel and Seed (1973)......	g=0.29 cm/sn^2
According to Joyner and Boore (1981).......	g=0.34 cm/sn^2
According to Fukushima and Tanaka (1990)	g=0.35 cm/sn^2

In the region the third fault expected to be effective is Muş fault bordering Muş Plain from the north. Its recent activity is not known, but the expected earthquake intensity M≥ 7.0 (Wells and Coppersmith, 1994), is found depending on the relation rupture length-earthquake intensity along 40 km long fault. The NW extension of this fault has a distance of about 25 km to the dam, the expected average horizontal ground acceleration values are given below.

According to Schnabel and Seed (1973)......	$g=0.18\ cm/sn^2$
According to Joyner and Boore (1981).......	$g=0.20\ cm/sn^2$
According to Fukushima and Tanaka (1990)	$g=0.28\ cm/sn^2$

8. CONCLUSIONS

This study covers the existance of active faults which will be effective on dam structure proposed over Murat River. The geological units were observed in the field, the attitudes, extensions and effectiveness of active faults in the region and the probable effects of faults into dam structure in a future earthquake were studied.

The oldest geological unit in the study area is Adilcevaz Formation. This unit extends from north of Dumlusu in the east of M urat River in the direction of WNW down to the west of Murat River without interruption. During and after deposition, the region has been moved upward at both banks by normal faulting, leaving the Murat River at the middle at most probably during middle-late Miocene and Pliocene Zırnak Formation penetrated into Akpınar along Murat River.

In the study area, no active fault effecting Adilcevaz, Zırnak and Solhan formations and Quaternary deposits have been observed. The active faults of the region are the Çayçatı, Leylekdağ and Varto segments forming the Varto fault zone trending NW-SE direction in the north of study area. Göynük segment occurring between Bingöl-Karlıova of DAF and Muş faults in the South are the other active faults of the region.

9. REFERENCES

Akay.E.,Erkan, E. Ve Ünay, E., 1989 Stratigraphy of Muş Tertiary Basin, MTA Bullettin, 109, 59-76.

Ambraseys. N. N.,, 1988. Engineering Seismology, J.Earthq. Engineering and Struc. Dyn., 17, 1-105.

Ambraseys, N.N. and Jackson, J.A., 1998. Ve Faulting associated with historical and recent earthquakes in the Eastern Mediterranean region, Gophys. J.Int., 133, 390-406.

Ambraseys, N., N., ve Zapotek, A., 1968. The Varto Üstükran (Anatolia) Earthquake of 19 Auğust 1966. Summary of field report, BSSA Bul., 58 (1), 47-102.

Arpat, E., 1971.22 May 1971 Bingöl earthquake (Initial Report) MTA Report no. 4967, Ankara (Unpublished)

Fukushima. Y., and Tanaka, A., 1990. A new attenuation relation for peak horizontal acceleration of strong earthquake ground motion in Japan, Bull. Seis. Soc. Am. Vol. 80 (4), pp. 757-783.

Herece. E., 2008. Eartern Anatolian Fault (DAF) Atlas, MTA General Directorate, Special publication series-13.

İlker. S., 1967. The Erzurum-Muş Region, Karaköse, J48 a4 and J48 d1 sheets in scale of 1:25 000 detailed petroleum study report, MTA Report no. 4177, Ankara (unpublished).

Joyner, W.B., and Boore, D.M., 1981. Peak Horizontal Accelaration and velocity from strong motion records including records from the 1979 Imperial Valley, California, Earthquake, Bull. Seis.Soc. Am.Vol.71 (6), pp. 2011-2038.

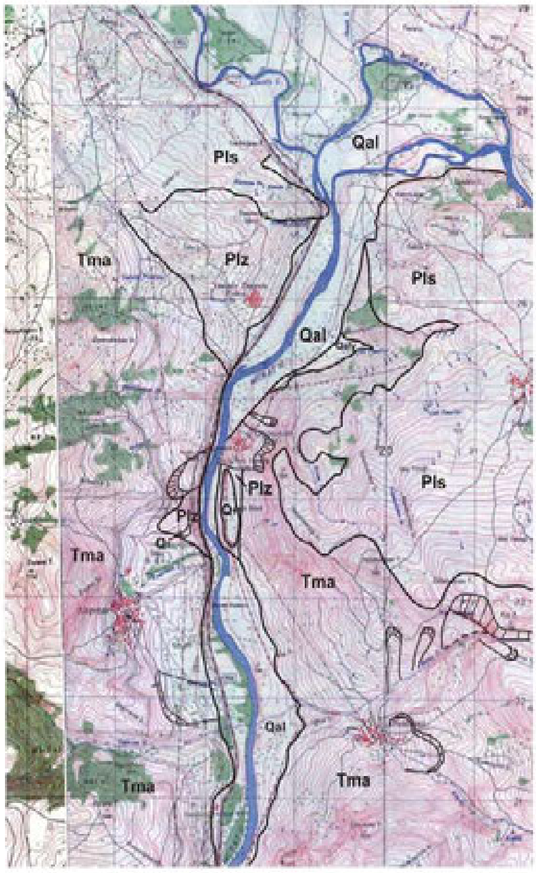
Schnabel, P.B., and Sead, H.B., 1981. Acceleration in rock for earthquake in the Western United States, Bull.Seis.Soc. of Am.Vol., 63 (2), 501-516.

Yılmaz, Y., Şaroğlu, F. And Güner, Y., 1987. Initiation of the neomagmatism in East Anatolia, Tectonophysics, 134.177-199.

Wells. D.L. and Coppersmith, K.J., 1994. New Empirical Relationships among Magnitude, Rupture Length, Rupture Width, Rupture Area, anfd Surface Displacement. Bull.Seis.Soc.of Am.Vol., 84(4), 974-1002.

Wallace, R., 1968. Earthquake of August 19, 1966, Varto Area, eastern Turkey, Bull.Seis.Soc.America, 58, 11-46.

App-1 General Geological Map of Region



Qal	: Alluvium (Holocene)
Qaly	: Alluvium fon (Holocene)
Q1	: Terrace (Quaternary)
Pls	: Solhan Formation (Pliocene)
Plz	: Zırnak Formation (Pliocene)
Tna	: Adilcevaz Formation (Upper oligocene-lower Miocene)

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APP 11

SEISMIC HAZARD ANALYSIS

REPORT

SITE-SPECIFIC DESIGN SPECTRUM OF ALPARSLAN II DAM AND HEP SITES BASED ON PROBABILISTIC SEISMIC HAZARD ANALYSIS

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Consultancy service for Enerjisa Power Generation Company under the contract no. 2010-03-03-2-01-10

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1. Scope

This report is prepared as part of the consultancy service for the Enerjisa Power Generation Company and describes the site-specific design spectra of the Alparslan II Dam and Hydroelectric Plant (HEP) sites that are located in the province of Muş. The design spectra are calculated through probabilistic seismic hazard analysis (PSHA) that is consistent with the guidelines of ICOLD Bulletin No.72 (ICOLD-72) (Bozovic and May, 1989). The probabilistic design spectrum is then compared with the design spectrum proposed by the 2007 Turkish Earthquake Code (TEC07) (Ministry of Public Works, 2007). The general context of the report and the steps followed for developing the site-specific design spectra are summarized in the below items:

(a) The seismic sources that affect the seismic hazard at the Dam and HEP sites are identified by literature survey. The faults that have been active since late-Quaternary (i.e., Holocene and upper Pleistocene) are considered in the hazard calculations provided that their activity is documented by different reliable sources.
(b) Instrumental-period (approximately the last 100 years) earthquakes in the East Anatolia collision zone that cannot be associated with known active faults are considered as random events in the area source (McGuire, 2004).
(c) The recurrence relationships of active faults are determined by considering their estimated slip-rates, and are modeled by employing the characteristic earthquake recurrence density function proposed by Schwartz and Coppersmith (1984). The background seismicity is modeled by using truncated exponential distribution, such that the model parameters are determined from the statistics of historical and instrumental-period catalog information.
(d) A set of recent attenuation relationships (ground-motion prediction equations) published in the literature is employed to describe the ground-motion modeling uncertainty in the seismic hazard analysis. The chosen attenuation relationships are consistent with the seismotectonic settings of the region considered in the PSHA calculations.
(e) The site-specific design spectra and peak ground-motion parameters that are calculated according to ICOLD-72 are compared with the design spectra defined by the 2007 Turkish Earthquake Code.
(f) The provisions of FEMA-P750 (BSSC, 2009) that are used for seismic design of structural systems in the U.S. are implemented to account for the specific site conditions at the Dam and HEP sites.

The Client provided 3 different coordinates for the Dam and HEP sites for PSHA studies: [718699, 4323901], [718654, 4323783], and [718304, 4323471]. The given coordinates are very close to each other and there is practically no difference between the seismic hazards computed at these points. In order to prevent duplications in the presentation of hazard results the PSHA studies are carried out considering the 2nd point given above (i.e., [718654, 4323783]). The site-specific spectra and peak ground motions computed from these analyses are valid for the entire Alparslan II Dam and HEP structures.

2. Seismotectonics and Seismic Sources

The scatter of instrumental-period earthquakes around Muş depicts the existence of significant seismic activity around the Dam and HEP sites (*Figure 1*). Major faults in the region are shown in *Figure 2*. The tectonic environment around the Dam and HEP sites are determined through a literature survey and by considering the document entitled *Report on the Active Faults near Zorova Line for Alpaslan II and HEP Project (*2010, *in Turkish*) that is provided by the Client. Consequently, Göynük segment of East Anatolian Fault, Varto segment of North Anatolian Fault (parallel with Leylekdağ and Çayçatı segments), and Muş Fault are considered for the calculation of seismic hazard. The information on regional seismotectonics compiled from literature is used for the justification of seismic activity of these faults as well as their source characteristics. The summary of findings from relevant literature is presented in the following sections.

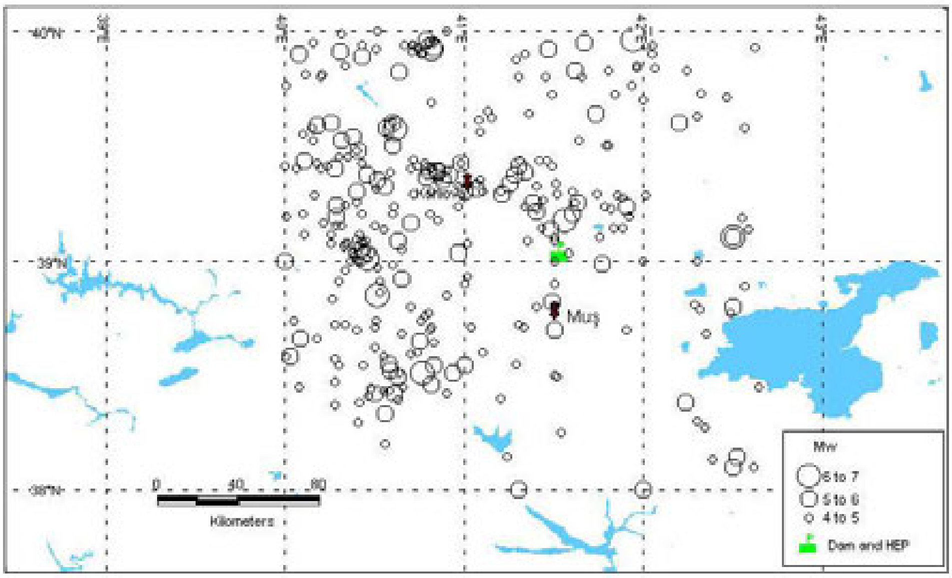

Figure 1. Events around Muş, recorded during the instrumental period (UDİM, 2010).

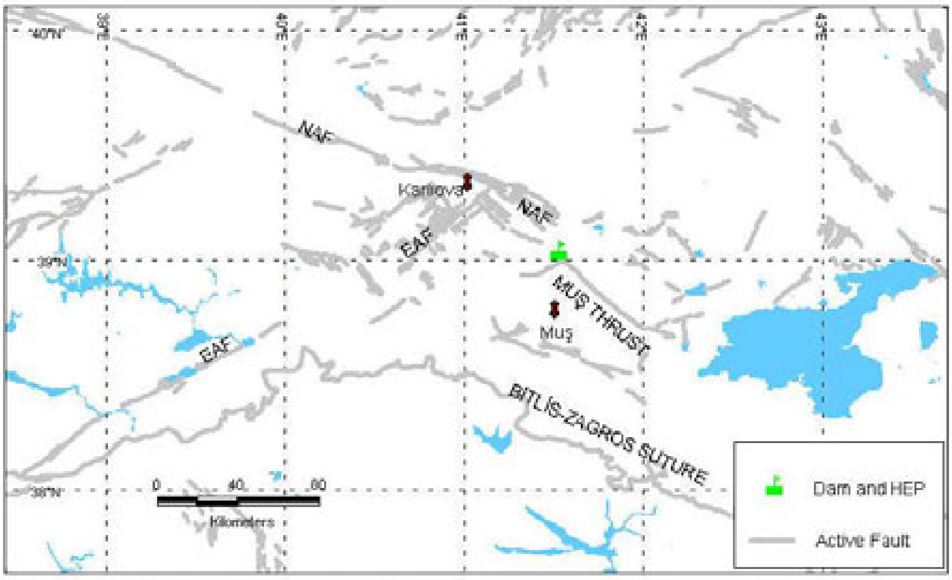

Figure 2. Active faults around Muş (Şaroğlu et al., 1992).

2.1 Historical Earthquakes

The events recorded during the instrumental period that date back to the beginning of 20th century may not always provide sufficient information for a reliable description of seismicity in the region of interest. Therefore, historical events are particularly important for the critical assessment of recurrence relationships proposed for seismic sources in the probabilistic seismic hazard analysis (McGuire, 2004). The major events occurred on faults near Muş during the last three centuries are shown in *Figure 3*. The majority of significant historical earthquakes ruptured a segment either on North Anatolian Fault or East Anatolian Fault. The 1966 Varto and 1971 Bingöl earthquakes are the closest events to the Alparslan II Dam and HEP sites. The absence of any other closer event to the project site suggests the lack of significantly active seismic faults in the vicinity of the Dam. It may also be speculated that the small slip-rates of the close-distance faults to the project site result in very long return periods for the occurrence of large-magnitude earthquakes that might affect the Dam and HEP. A comprehensive understanding of regional seismotectonics will decrease the level of uncertainty introduced due to the limitations of historical data.

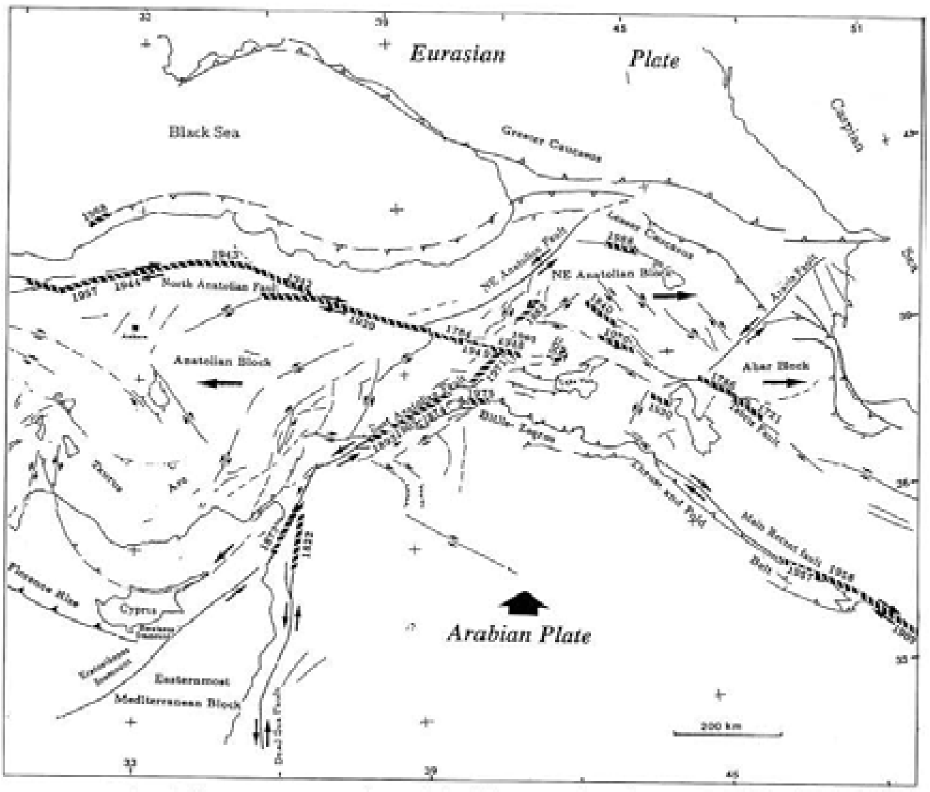

Figure 3. Major faults on East Anatolia and significant earthquakes occurred during the last 3 centuries (Barka ve Reilinger, 1997).

2.2 Active Faults

The Dam site is located on the Eastern Anatolian collision zone between Arabian and Eurasian Plates. The zone is composed of highlands because of shortening between Greater Caucasus and Bitlis-Zagros Suture zone due to relative motion of the two plates. The Anatolian Plate, drifting relatively to west, is located on the west of the site. At approximately 50 km northwest of the Dam site, the Karlıova triple junction between the three plates marks the merging of left-lateral East Anatolian Fault (EAF) to right-lateral North Anatolian Fault (NAF). The two faults respectively delineate the northern and eastern boundaries of Anatolian Plate (Barka and Reilinger, 1997). The tectonic structure of Eastern Anatolia and known major earthquakes during the last 3 centuries are shown in *Figure 3.* The proximity of the Dam site to Karlıova points out that the seismic hazard at the site is predominantly dependent on the seismic activity of EAF and NAF, and on the rather complex structure of faults in the east of Karlıova.

The North Anatolian Fault (NAF, the largest transform fault in Turkey) located on the north – northwest of the Dam site extends from Karlıova towards a northwest direction. The rupture of Erzincan, Mihar-Tümekar, Kelkit Valley and Ezinepazarı segments during the 1939 Erzincan earthquake resulted in the largest earthquake in Anatolia during the last 3 centuries (Barka, 1996; M_w7.6 according to UDİM, 2010). 1966 Varto earthquake (M_w 6.0 according to UDİM, 2010) ruptured the closest known segment of NAF to the Dam site (Wallace, 1968). The GPS velocity measurements show that the right-lateral slip rate on eastern NAF is about 25 mm/yr, which is rather consistent with the geological estimations (Reilinger et al., 2006). Turkelli et al. (2003) showed that NAF extends farther towards the southeast of Karlıova triple junction (possibly to Lake Van) by recording the earthquakes close to Karlıova junction with a local network of seismograms. Türkelli et al. (2003) also stated the existence of several unmapped active faults in the region. The vast majority of recorded well-constrained event depths are less than 20 km. The extension of right-lateral deformation associated with NAF to the east of Karlıova junction is consistent with GPS velocity data from the region. The GPS data also support that the relative NW motion of Arabian plate is largely compensated by the pure right-lateral slip in eastern Turkey and pure thrusting along the Caucasus mountains (McClusky et al. 2000). Hence, NAF may continue all the way down to the Main Recent Fault in the northwestern Iran (Talebian and Jackson 2002; Turkelli et al., 2003).

On the west of the Dam site, EAF, the second largest transform fault of Turkey, delineates the eastern boundary of Anatolian plate. The velocity contrast between Anatolian and Arabian plates requires a transform fault at the boundary, with a slip rate of ~8 mm/yr. Actual GPS velocity estimates are about 10 mm/yr. EAF also links the Dead Sea Fault to NAF. The closest major earthquake on EAF to the Dam site is the 1971 Bingöl earthquake (M_w 7.1) that ruptured a 30-km segment on EAF. Distributed deformation is required in the surroundings of the EAF-NAF intersection near Karlıova. Therefore, several mapped and unmapped faults exist in the deforming zone. Consequently, the rupture of Bingol earthquake of 1 May 2003 did not activate a segment of the EAF, but it took place along an unknown right-lateral fault that is striking in an N-NW direction and located in the angle between EAF and NAF. The depth distribution of aftershocks indicated that the 2003 rupture did not reach the surface (Westaway, 2003; Milkereit et al., 2004; Reilinger et al., 2006).

In Eastern Anatolian collision zone, the type of active faults is generally strike slip. Large number of NE and NW trending strike-slip faults of limited size, and several normal faults form a complex pattern in Eastern Anatolia. The thrust faults were primary structures during the early stages of continental collision, but today they are less important than the other tectonic structures. Hence, the current seismogenic deformation in the zone is dominated by shear and translation. The GPS data show that the convergence between Arabian and Eurasian Belts is accommodated largely by lateral transport of East Anatolia, and partially by shortening along Greater Caucasus and Bitlis-Zagros mountain belts. No significant shortening occurs between those northern and southern bounds. Possibly, the lithospheric shortening and crustal thickening in East Anatolia has greatly ceased with the development of NAF and its eastward extension into the Lesser Caucasus and Iran. The 1975 Lice (M_w 6.6), 1976 Çaldıran, 1983 Horasan-Norman (M_w 6.8) are the recent major earthquakes of East Anatolia (Barka and Reilinger, 1997; Örgülü et al., 2003; Reilinger et al., 2006).

Based on the above discussions NAF and EAF are modeled as line (fault) sources for seismic hazard analysis. The source model for NAF is extended approximately 50 km from Karlıova to the direction of Varto on southeast of Karlıova as suggested by Westaway (2001). There is no justifying information about the Quaternary activity of Muş thrust (see *Figure 3*) that is located on the south of the Dam site. Therefore, Muş thrust accepted as inactive since late-Quaternary that is consistent with the presented information on the neotectonics of East

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Anatolia. The Bitlis-Zagros suture that delineates the boundary between Arabian-European plates on the further south is considered as the third line (fault) source in seismic hazard analysis. The slip-rate estimations for the 3 line sources are based on the study by Reilinger el al. (2006) using GPS data. The complex tectonic structure around Karlıova and East Anatolia is modeled by an area source; considering the uncertainty in unmapped faults as well as the ambiguous characterization of mapped faults with limited lengths.

2.3 Seismic Sources

The seismotectonic settings of the region presented in Sections 2.1 and 2.2 require the consideration of 3 line (active fault) and 1 area (background seismicity) sources for the execution of PSHA (*Figure 4*). The source characteristics are defined from the recommendations of McGuire (2004). The characteristics of active faults are based on the information presented on Section 2.2, and are further simplified by considering the most prominent features of each source in order to avoid complexity in computations. The zone near Karlıova and part of East Anatolia close to the Dam site is modeled as a 100 km x 100 km-wide area source, due to the complexity of tectonic structures in the zone and uncertainty in their characterization. The instrumental-period events (UDİM, 2010) that cannot be associated with 3 line sources are used for calculating the recurrence relationship of the area source (*Figure 4.b*). Declustering of mainshock and aftershock events is done from Reasenberg (1985). The summary of source parameters used in PSHA is presented in *Table 1*. The estimations of β for line sources in *Table 1* are based on the studies of Öncel and Wilson (2002), and Martirosyan et al. (1999) as well as the catalog data of instrumental period. The UDİM (2010) catalog events located (have epicenters) within the boundaries of area source that are not associated with the line sources (*Figure 4.b)* are used in the estimation of β *for background seismicity.*

Table 1. Source parameters employed in seismic hazard analyses.

Source	Type	β	$\dot{s}$ (mm/yr)**	M_{min}	M_{max}
NAF	Fault (strike slip)	2.1	25	4.0	7.6
EAF	Fault (strike slip)	2.1	10	4.0	7.6
Bitlis-Zagros	Fault (reverse)	2.1	3	4.0	7.5
East Anatolia	Area*	1.3	-	4.0	6.2

* Considering the neotectonics of the region, all faults in background seismicity are assumed as strike-slip for simplicity in calculations.

** Slip-rate used for the estimation of occurrence rate of events with magnitudes exceeding M_{min}.

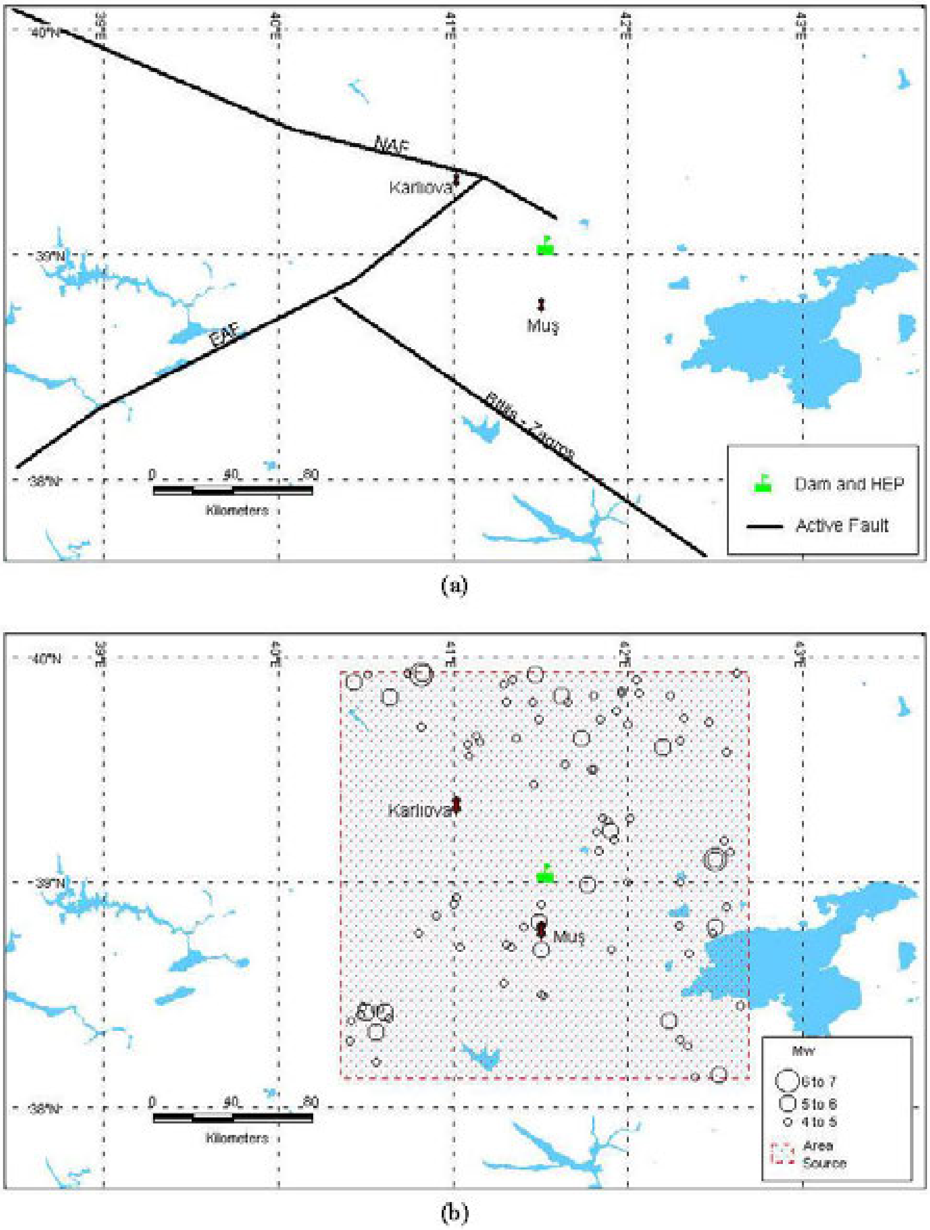

Figure 4. Seismic sources used in the probabilistic hazard analysis: (a) active fault zones, (b) area source.

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The recurrence relationship for line sources (faults) is given by Eq. (1):

$$f_{m}^{YS} = \begin{cases} \left(\frac{1}{1+c}\right)\frac{\beta \exp\left[-\beta(M_{max} - M_{min} - 1.25)\right]}{1 - \exp\left[-\beta(M_{max} - M_{min} - 0.25)\right]} & for\ M_{max} - 0.25 < M \leq M_{max} + 0.25 \\ \left(\frac{1}{1+c}\right)\frac{\beta \exp\left[-\beta(M - M_{min})\right]}{1 - \exp\left[-\beta(M_{max} - M_{min} - 0.25)\right]} & for\ \overline{M}_{min} < M \leq M_{max} - 0.25 \end{cases}$$

(1.a)

$$c = \frac{\beta \exp\left[-\beta(M_{max} - M_{min} - 1.25)\right]}{1 - \exp\left[-\beta(M_{max} - M_{min} - 0.25)\right]} \quad (1.b)$$

where, M_{min} and M_{max} are the minimum and maximum magnitudes considered in the seismic source model. Equation 1 is the characteristic earthquake recurrence law proposed by Schwartz and Coppersmith (1984). The Gutenberg-Richter parameter β indicates the likelihood of larger magnitude events with respect to the small magnitude events. The catalog data of instrumental period as well as the fault lengths (geological data) are interpreted for the estimation of M_{max}: The maximum magnitudes are consistent with the catalog data and with the empirical relationships of Wells and Coppersmith (1994) when it is assumed that the fault source ruptures completely in a single event. The empirical relationships in Wells and Coppersmith (1994) are used for relating the earthquake magnitude, rupture length and rupture width. Hence, M_{min} is chosen as 4.0 for all line sources, since it is the apparent lower bound of the major events concerning the seismic hazard at the site. The chosen values of M_{max} pertaining to each fault source are presented in Table 1. Besides, the upper and lower seismogenic depths are estimated as 5 km and 20 km respectively.

The truncated exponential distribution is employed to formulate the recurrence relationship for background seismicity (McGuire, 2004). Hence, n(M), the annual frequency of earthquakes with magnitudes exceeding M is calculated by

$$n(M) = \nu_{M_{min}}\left[\frac{\exp(\beta M_{min} - \beta M) - \exp(\beta M_{max} - \beta M_{min})}{1 - \exp(\beta M_{max} - \beta M_{min})}\right] \qquad M_{min} \leq M \leq M_{max} \quad (2)$$

where ν_{Mmin} is the annual rate of exceedance of events with magnitude M_{min}, and estimated by using the catalog information associated with background seismicity. c is calculated iteratively using the nonlinear relationship given below:

$$\frac{1}{\beta} = M_{mean} - M_{min} + \frac{(M_{max} - M_{min})e^{-\beta(M_{max} - M_{min})}}{1 - e^{-\beta(M_{max} - M_{min})}} \quad (3)$$

In Eq.(3) M_{mean} is the mean magnitude of events that is estimated by calculating the sample average of the catalog data. The estimated recurrence relationship for the area source is presented in *Figure 5*. *Table 1* presents suggested M_{min} and M_{max}, and estimated β from Eq.(3). The maximum focal depth of earthquakes in the area source is accepted as 20 km.

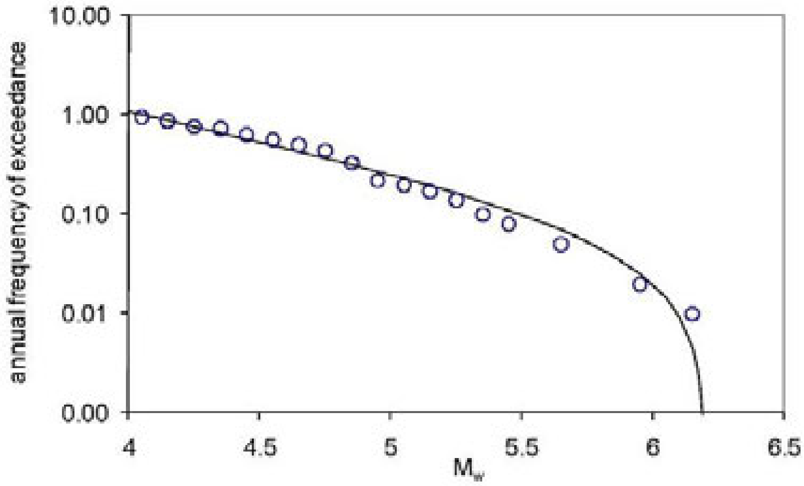

Figure 5. Earthquake recurrence relationship used for modeling the area source, and its comparison with the catalog data.

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3. Probabilistic Seismic Hazard Analysis: Methodology and the selected ground-motion prediction equations

The uncertainties in earthquake recurrence, estimation of ground-motion parameters as well as the location of earthquake events along the seismic sources are considered in the computation of hazard for a given annual exceedance rate. The probability distributions that account for the magnitude recurrence are described in detail in the previous section. The uncertainty in the ground-motion parameters is represented by log-normal distribution that is a common assumption in similar analyses. The likely variation of the earthquake location within the seismic sources is described by uniform distribution. The contribution of seismic activity to total hazard is computed by dividing the 100 km x 100 km source area to cells. Each cell is considered as an individual source and their likely contribution to the total hazard in the area of interest is associated as additional earthquake scenarios in the computations. The earthquakes as well as the ground-motion parameters are assumed to follow Poisson distribution to calculate the exceedance probability of the chosen hazard parameter for a given return period. Detailed descriptions about the Poissonian process are given in the next section.

Five ground-motion prediction equations (GMPEs) are used for the estimation of ground motions. These models are proposed by Boore and Atkinson (2008), Campbell and Bozorgnia (2008), Chiou and Youngs (2008) Abrahamson and Silva (2008), and Idriss (2008). The models represent the seismic hazard variation in shallow active regions that is consistent with the seismotectonic features of the concerned construction site. The chosen GMPEs are based on global strong-motion databases. They are evaluated by Stafford et al. (2008) and Campbell and Bozorgnia (2006) using different statistical methods to ensure their applicability in the pan-European and Middle East region that covers the project site. The GMPEs describe the uncertainty in the direction of incident waves by the horizontal component definition proposed in Boore et al. (2006). The use of 5 models aims to reduce the epistemic uncertainty in the estimated hazard. Therefore, the mean hazard of computed from these GMPEs is used for building the design spectra.

Under the above explanations the hazard curves are calculated for a band of spectral periods for generic rock conditions (described by an average shear-wave velocity of 760 m/s within the first 30 m of the soil/rock profile; V_{S30} = 760 m/s). The hazard curves describe the annual rate of exceedance (or the corresponding earthquake return period, T_R, reciprocal of annual exceedance rate) and they are used in the computation of design spectra for different target return periods. The "rock" design spectra are then modified for different site classes and this is described in the following section.

4. Design Spectrum

The probabilistic seismic hazard analysis provides a relationship between the strong-motion parameter of interest and its return period accepted for design (or, the probability of exceedance for a period of time) on a site. Hence, the choice of design value for a strong-motion parameter depends on the choice of return period. In the following, criteria for selection of a return period for design, proposed by several seismic design documents, and the design spectra built for different site conditions and return periods are presented.

4.1 Criteria Used in the Selection of Design Spectrum

In general two levels of strong ground motion are considered for the seismic performance evaluation of hydraulic structures. The first level is described by OBE, Operating Basis Earthquake (USACE, 1999), such that the probability of a future event exceeding OBE during the service life (generally taken as 50 years) of the structure is 50%. One of the dual aims in the seismic design of a hydraulic structure is to limit the induced damage to a level that does not hinder its operation under OBE level ground motion.

The second level is described by MDE, Maximum Design Earthquake. The other dual aim in the seismic design of hydraulic structures is to prevent any sort of failure with catastrophic consequences (e.g., uncontrolled release of reservoir water), when they are subjected to MDE. On the other hand, economic losses to a certain extent are acceptable for MDE. The maximum limit for MDE is the MCE-Maximum Credible Earthquake, which is the largest reasonably conceivable earthquake in the tectonic environment surrounding the hydraulic structure (USACE, 1999). According to ICOLD-72, MCE is defined as a rare earthquake with a non-exceedance probability of 50% in a very large number of years (no clear discussion is given about the "large number of years" term). It is noted that some researchers do not recommend the use of MCE level in engineering practice due to its ambiguity (Committee on Seismic Risk, 1984). A deterministic approach for estimating the ground motion amplitudes representing MCE or MDE is sensitive to the assumptions (e.g. seismic sources and attenuation relationship). On the other hand, a realistic seismic hazard analysis that aims to determine the worst earthquake scenario is possible in case the results are supported by the probabilistic analyses and deaggregation methods (McGuire, 2001; Bommer, 2002). Therefore, a comprehensive PSHA is sufficient for the determination of seismic demand that represents MDE, since it incorporates the uncertainty in seismic activity, path and source effects as well as the empirical models employed in the analysis (ICOLD, 1972; FEMA, 2005). The level of conservatism in seismic design can be increased by considering a longer return period for strong motion parameters.

Assuming that the earthquake processes and ground motion distributions in time are Poissonian, the return period (T_R) of an event for a given exceedance probability P_R in service life (T_L) is calculated using the following expression (see Eurocode 8, clause 2.1.1 - CEN, 2004):

$$T_R = -\frac{T_L}{\ln(1-P_R)} \qquad (4)$$

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A service life of 50 years is assumed in design of most structures. This general practice is also valid for the dams in Turkey: the rate of sedimentation generally limits the service life of apertures for power plants to 50 years. In some cases, the service life can be as long as 100 years if the rate of sedimentation is low. Hence, the exceedance probabilities (P_R) are suggested as following:

i) 50% for all structures under OBE level ground motions , according to the definition given by USACE (1999),
ii) 10% for all industrial buildings and all non-building type structures covered by the clause 2.12 of TEC07, according to the clause 1.2.2 of the same code,
iii) %2 for all buildings used for power generation and transmission, which are classified as buildings with importance factor of 1.5 in Table 6.3 of TEC07,
iv) %2 for all non-building type structures under MDE level ground motions, such as dams, tunnels, pipelines and power lines which are not covered by TEC07.

In this study, P_R is selected according to the above classification. In clause *iii*, the relationship between P_R and building importance factor (I) is accepted as $P_R \approx 10\% / I^3$ (Eurocode 8-1, clause 2.1.4 –CEN, 2004). For I=1.5, P_R is approximately calculated as 3%. However, this can be accepted as $P_R \approx 2\%$ by considering other uncertainties that effectively increase the vulnerability of structures against seismic action. Table 2 lists the earthquake return periods for each structural type that are calculated by Eq. (4).

Provided that catastrophic consequences of large-dam break are of no concern in design, it may not be feasible to consider extremely long return periods to define the seismic design parameters of HEPs and their service units (USACE, 1999; ICOLD-72 -Bozovic and May, 1989; Eurocode-8 -CEN, 2004). The hydraulic structures that satisfy this requirement can be included in group *ii* (T_R = 475 yr) in *Table 2*. The appropriate return periods for OBE are T_R=72 yr and T_R=144 yr for the cases where service life of the dam is considered as 50 years and 100 years, respectively. Therefore, two design spectra for OBE level (i.e., T_R=72 yr and T_R=144 yr) are presented in the following text. The final OBE design spectrum should be determined by the Client considering the specific purposes of the Dam and HEP under consideration.

Table 2. The suggested return periods for design of various types of structures.

Type	Explanation	T_R(yıl)
i	All buildings – Operating Basis Earthquake	72 or 144
ii	Industrial buildings	475
iii	Buildings of power generation and transmission	2475
iv	Structures as dams, tunnels, pipelines and powerlines	2475

The clause 7.8.1 of TEC07 modifies the code spectrum by certain factors to assess the seismic performance of engineered structures under different hazard levels. According to TEC07 the "as is" code spectrum corresponds to a hazard level of T_R = 475 years. When code spectrum is halved the hazard level corresponds to T_R = 72 years and increasing the code spectrum by 50% results in a hazard level of T_R = 2475 years. Based on the seismic activity in Turkey a return period of T_R=2475 years defines a rare event with possible catastrophic consequences. Therefore, ground-motion corresponding to T_R=2475 years can represent the MCE level hazard for the Dam and HEP sites. In section 4.2, the site-specific design spectra will be compared with the design spectra defined in TEC07 by considering different site conditions.

4.2 Proposed Spectral Values for the Design of the Dam and HEP

PSHA based site-specific spectrum for generic rock conditions (V_{S30} = 760 m/s) is given in *Figure 6. Table 3* lists the corresponding spectral values. TEC07 provides Eq.(5) for the calculation of design spectral values (S_{ae}):

$$S_{ae}(T) = A_0 I S(T) \qquad (5.a)$$

$$S(T) = 1 + 1.5\frac{T}{T_A} \;\; 0 \leq T \leq T_A; \;\; S(T) = 2.5 \; T_A \leq T \leq T_B; \;\; S(T) = 2.5\left(\frac{T_B}{T}\right)^{0.8} \;\; T > T_B \qquad (5.b)$$

In Eq. (5.a) A_0 refers to the effective peak ground acceleration that changes between 0.1g and 0.4g according to the seismic zones in Turkey. The project site is located in Seismic Zone 1. The corresponding A_0 coefficient attains the value of 0.4g (Table 2.2 in TEC07). The corner periods T_A and T_B vary between 0.10s – 0.20s and 0.30s – 0.90s respectively to account for the site effects on spectrum (Table 2.4 in TEC07).

The three site classes; Z1, Z2, and Z3 according to TEC07 (grossly defined as rock, stiff clay and alluvium respectively) roughly correspond to V_{S30} (average shear-wave velocity of uppermost 30 m of soil/rock profile) ranges of 760 m/s ≤ V_{S30} < 1500 m/s, 360 m/s ≤ V_{S30} < 760 m/s and 180 m/s ≤ V_{S30} < 360 m/s respectively. These ranges correspond to NEHRP site classes B, C, and D, respectively that are described in the FEMA-P750 document (BSSC, 2009).

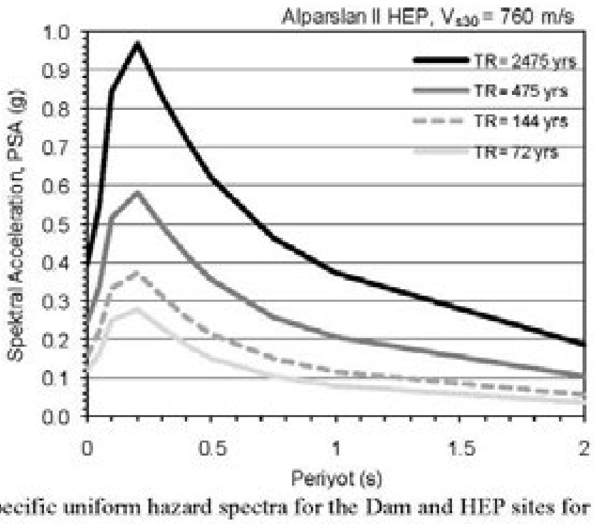

Figure 6. Site-specific uniform hazard spectra for the Dam and HEP sites for return periods ranging from 72 to 2475 yr. The spectra are given for a generic rock site that is classified as Z1 by TEC07.

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In this study, the PSHA based site-specific design spectra corresponding to the site classes presented above are computed in accordance with the Section 3.2 of FEMA-P750 report. These spectra are then compared with the corresponding TEC07-based design spectra, enforced for seismic design of structures in Turkey.

Table 3. Spectral ordinates of the curves in *Figure 6.*

Period (s)	T_R = 2475 yr	T_R = 475 yr	T_R = 144 yr	T_R = 72 yr
PGA	3.94E-01	2.44E-01	1.59E-01	1.20E-01
0.05	5.48E-01	3.37E-01	2.20E-01	1.63E-01
0.10	8.42E-01	5.16E-01	3.34E-01	2.49E-01
0.20	9.67E-01	5.81E-01	3.73E-01	2.77E-01
0.30	8.32E-01	4.94E-01	3.11E-01	2.28E-01
0.40	7.20E-01	4.18E-01	2.57E-01	1.86E-01
0.50	6.20E-01	3.54E-01	2.15E-01	1.51E-01
0.75	4.65E-01	2.57E-01	1.49E-01	1.05E-01
1.00	3.73E-01	2.04E-01	1.16E-01	7.97E-02
2.00	1.87E-01	1.01E-01	5.63E-02	3.50E-02

As stated above the PSHA based site-specific spectral curves with different return periods (i.e., *Figure 6*) are smoothed by the method presented in FEMA-P750 (BSSC, 2009) to build the corresponding design spectra. These generic rock-site design spectra are then modified for the NEHRP B, C, and D site conditions by using the site amplification factors of the same report (Tables 3.3.1 and 3.3.2). As stated previously the NEHRP site classes B, C and D roughly represent the classes Z1, Z2 and Z3 in TEC07, respectively. *Figure 7* presents comparative plots between the probabilistic site-specific design spectra and corresponding TEC07 spectra. Effective peak ground acceleration of Zone 1 (i.e. A_0=0.4g) is substituted in Eq.(5) in order to construct the TEC07 spectra for T_R=475 years (see *www.deprem.gov.tr/linkhart.htm*). Table 2.4 of TEC07 is used to determine T_A and T_B corresponding to the site classes Z1, Z2 and Z3. Consequently, the spectral ordinates are increased by 50% in order to modify the TEC07 spectra for T_R=2475 years (see Section 4.1, last paragraph). The TEC07 spectral ordinates of T_R=475 years are reduced by 50% to determine the spectral ordinates corresponding to T_R=72 years. The site-specific design spectra of T_R=144 years cannot be compared with the corresponding TEC07 spectra because TEC07 does not provide a design spectrum for this hazard level. The spectral ordinates provided by the site-specific design spectra consider the linear and nonlinear soil behavior in a more realistic manner due to the use of soil amplification factors in the FEMA-P750 (BSSC, 2009) report. This makes the spectral ordinates calculated in this study more realistic since TEC07 does not properly consider the soil effects (no adjustment in the vertical axis) while modifying rock motion for different site conditions. *Tables 4-7* list the spectral ordinates of PSHA based site-specific spectra with return periods of T_R=72, 144, 475, and 2475 years for the design of structures at the Dam and HEP sites.

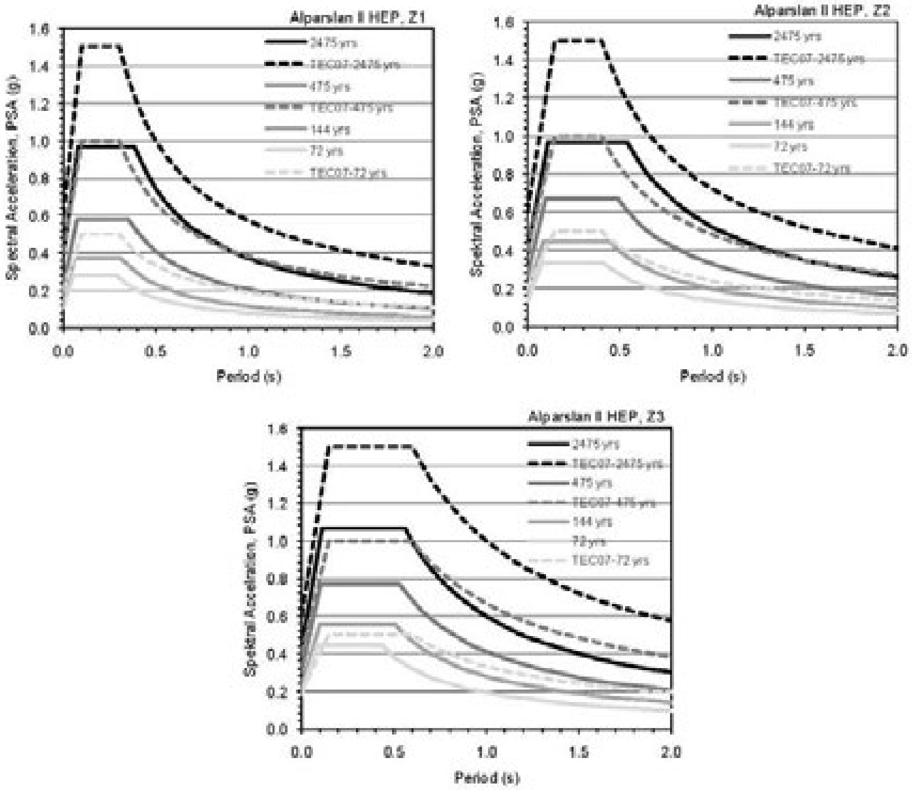

Figure 7. Site-specific uniform hazard spectra for the Dam and HEP sites for return periods of 475, 975 and 2475 years. The spectra are given for a generic rock site that is classified as Z1 by TEC07. The ordinates of 475- years spectra are multiplied by 1.5 and 0.5 in order to determine the ordinates of 2475- and 72-years spectra of TEC07, respectively (see 2007 Turkish Earthquake Code, Clause 7.8.1 – Ministry of Public Works, 2007).

Figure 7 depicts that the ordinates of PSHA based spectra for T_R=72, 475, and 2475 years are lower than those of the TEC07 spectra. This difference can be explained by the variation of distance between the considered seismic sources and the Dam site. TEC07 proposes a single value of effective peak ground acceleration (A_0) for each seismic zone and ignores its spatial variability within a seismic zone. The difference between the site-specific design spectra and TEC07 is less pronounced for Z2 and Z3 class sites. The site amplification terms used by the PSHA-based spectra can reflect the linear and nonlinear soil response that is not fully covered in TEC07 (see discussions in the previous paragraph). This fact plays the main role in the reduced differences between TEC07 and PSHA-based design spectra for Z2 and Z3 site classes. Another source of difference between the site-specific design spectra and TEC07 design spectra is the ground-motion prediction equations used in this study. This study uses the last generation GMPEs that are consistent with the seismotectonic settings of the study region while describing the uncertainty in ground motions. The design spectrum of the Turkish code is a product of an earlier study that uses a relatively old ground-motion model for assessing the variability in ground motions.

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The FEMA-65 report (FEMA, 2005) that sets guidelines for dam safety allows the use of probabilistic hazard maps or site-specific probabilistic/deterministic studies to calculate the design spectra of hydraulic structures. (There are no specific design guidelines in Turkey for seismic design of dams). Under these arguments, specific to the objectives of the client, the PSHA-based design spectra presented in this report or the design spectra of TEC07 should be used for the design of Alparslan II Dam, HEP and surrounding utility structures by considering the local site conditions and the type of structural facility.

Table 4. PSHA- and TEC07-based design spectral ordinates for the Dam and HEP sites (T_R=2475 years).

This study – Z1		TEC07-Z1		This study – Z2		TEC07-Z2		This study – Z3		TEC07-Z3	
Period (s)	PSA (g)	Period (s)	PSA(g)	Period (s)	PSA (g)	Period (s)	PSA(g)	Period (s)	PSA (g)	Period (s)	PSA(g)
0.00	0.3868	0.00	0.6000	0.00	0.3868	0.00	0.6000	0.00	0.4255	0.00	0.6000
0.08	0.9671	0.10	1.5000	0.11	0.9671	0.15	1.5000	0.11	1.0638	0.15	1.5000
0.39	0.9671	0.30	1.5000	0.54	0.9671	0.40	1.5000	0.56	1.0638	0.60	1.5000
0.40	0.9315	0.35	1.3260	0.55	0.9484	0.45	1.3651	0.60	0.9936	0.65	1.4070
0.45	0.8280	0.40	1.1916	0.60	0.8694	0.50	1.2548	0.65	0.9172	0.70	1.3260
0.50	0.7452	0.45	1.0845	0.65	0.8025	0.55	1.1627	0.70	0.8517	0.75	1.2548
0.55	0.6775	0.50	0.9968	0.70	0.7452	0.60	1.0845	0.75	0.7949	0.80	1.1916
0.60	0.6210	0.55	0.9236	0.75	0.6955	0.65	1.0172	0.80	0.7452	0.85	1.1352
0.65	0.5732	0.60	0.8615	0.80	0.6521	0.70	0.9587	0.85	0.7014	0.90	1.0845
0.70	0.5323	0.65	0.8081	0.85	0.6137	0.75	0.9072	0.90	0.6624	0.95	1.0386
0.75	0.4968	0.70	0.7616	0.90	0.5796	0.80	0.8615	0.95	0.6275	1.00	0.9968
0.80	0.4658	0.75	0.7207	0.95	0.5491	0.85	0.8207	1.00	0.5962	1.10	0.9236
0.85	0.4384	0.80	0.6844	1.00	0.5216	0.90	0.7841	1.10	0.5420	1.20	0.8615
0.90	0.4140	0.85	0.6520	1.10	0.4742	0.95	0.7509	1.20	0.4968	1.30	0.8081
0.95	0.3922	0.90	0.6229	1.20	0.4347	1.00	0.7207	1.30	0.4586	1.40	0.7616
1.00	0.3726	0.95	0.5965	1.30	0.4013	1.10	0.6678	1.40	0.4258	1.50	0.7207
1.10	0.3387	1.00	0.5725	1.40	0.3726	1.20	0.6229	1.50	0.3974	1.60	0.6844
1.20	0.3105	1.10	0.5305	1.50	0.3478	1.30	0.5842	1.60	0.3726	1.70	0.6520
1.30	0.2866	1.20	0.4948	1.60	0.3260	1.40	0.5506	1.70	0.3507	1.80	0.6229
1.40	0.2661	1.30	0.4641	1.70	0.3068	1.50	0.5210	1.80	0.3312	1.90	0.5965
1.50	0.2484	1.40	0.4374	1.80	0.2898	1.60	0.4948	1.90	0.3138	2.00	0.5725
1.60	0.2329	1.50	0.4139	1.90	0.2745	1.70	0.4714	2.00	0.2981		
1.70	0.2192	1.60	0.3931	2.00	0.2608	1.80	0.4503				
1.80	0.2070	1.70	0.3745			1.90	0.4313				
1.90	0.1961	1.80	0.3577			2.00	0.4139				
2.00	0.1863	1.90	0.3426								
		2.00	0.3288								

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Table 5. PSHA- and TEC07-based design spectral ordinates for the Dam and HEP sites (T_R=475 years).

This study – Z1		TEC07-Z1		This study – Z2		TEC07-Z2		This study – Z3		TEC07-Z3	
Period (s)	PSA (g)	Period (s)	PSA(g)	Period (s)	PSA (g)	Period (s)	PSA(g)	Period (s)	PSA (g)	Period (s)	PSA(g)
0.00	0.2323	0.00	0.4000	0.00	0.2694	0.00	0.4000	0.00	0.3066	0.00	0.4000
0.07	0.5807	0.10	1.0000	0.10	0.6736	0.15	1.0000	0.11	0.7665	0.15	1.0000
0.35	0.5807	0.30	1.0000	0.49	0.6736	0.40	1.0000	0.53	0.7665	0.60	1.0000
0.40	0.5110	0.35	0.8840	0.50	0.6541	0.45	0.9101	0.55	0.7433	0.65	0.9380
0.45	0.4542	0.40	0.7944	0.55	0.5946	0.50	0.8365	0.60	0.6813	0.70	0.8840
0.50	0.4088	0.45	0.7230	0.60	0.5451	0.55	0.7751	0.65	0.6289	0.75	0.8365
0.55	0.3716	0.50	0.6645	0.65	0.5031	0.60	0.7230	0.70	0.5840	0.80	0.7944
0.60	0.3407	0.55	0.6158	0.70	0.4672	0.65	0.6781	0.75	0.5451	0.85	0.7568
0.65	0.3145	0.60	0.5743	0.75	0.4361	0.70	0.6391	0.80	0.5110	0.90	0.7230
0.70	0.2920	0.65	0.5387	0.80	0.4088	0.75	0.6048	0.85	0.4809	0.95	0.6924
0.75	0.2725	0.70	0.5077	0.85	0.3848	0.80	0.5743	0.90	0.4542	1.00	0.6645
0.80	0.2555	0.75	0.4804	0.90	0.3634	0.85	0.5472	0.95	0.4303	1.10	0.6158
0.85	0.2405	0.80	0.4563	0.95	0.3443	0.90	0.5227	1.00	0.4088	1.20	0.5743
0.90	0.2271	0.85	0.4347	1.00	0.3270	0.95	0.5006	1.10	0.3716	1.30	0.5387
0.95	0.2152	0.90	0.4152	1.10	0.2973	1.00	0.4804	1.20	0.3407	1.40	0.5077
1.00	0.2044	0.95	0.3977	1.20	0.2725	1.10	0.4452	1.30	0.3145	1.50	0.4804
1.10	0.1858	1.00	0.3817	1.30	0.2516	1.20	0.4152	1.40	0.2920	1.60	0.4563
1.20	0.1703	1.10	0.3537	1.40	0.2336	1.30	0.3895	1.50	0.2725	1.70	0.4347
1.30	0.1572	1.20	0.3299	1.50	0.2180	1.40	0.3671	1.60	0.2555	1.80	0.4152
1.40	0.1460	1.30	0.3094	1.60	0.2044	1.50	0.3474	1.70	0.2405	1.90	0.3977
1.50	0.1363	1.40	0.2916	1.70	0.1924	1.60	0.3299	1.80	0.2271	2.00	0.3817

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1.60	0.1278	1.50	0.2759	1.80	0.1817	1.70	0.3143	1.90	0.2152	1.80	0.1680
1.70	0.1202	1.60	0.2621	1.90	0.1721	1.80	0.3002	2.00	0.2044	1.90	0.1592
1.80	0.1136	1.70	0.2497	2.00	0.1635	1.90	0.2875			2.00	0.1512
1.90	0.1076	1.80	0.2385			2.00	0.2759				
2.00	0.1022	1.90	0.2284								
		2.00	0.2192								

Table 6. PSHA- and TEC07-based design spectral ordinates for the Dam and HEP sites (T_R=72 years).

Bu study – Z1		TEC07-Z1		Bu study – Z2		TEC07-Z2		Bu study – Z3		TEC07-Z3	
Period (s)	PSA (g)	Period (s)	PSA(g)	Period (s)	PSA (g)	Period (s)	PSA(g)	Period (s)	PSA (g)	Period (s)	PSA(g)
0.00	0.1109	0.00	0.2000	0.00	0.1331	0.00	0.2000	0.00	0.1774	0.00	0.2000
0.06	0.2772	0.10	0.5000	0.08	0.3326	0.15	0.5000	0.09	0.4435	0.15	0.5000
0.29	0.2772	0.30	0.5000	0.41	0.3326	0.40	0.5000	0.43	0.4435	0.60	0.5000
0.30	0.2658	0.35	0.4420	0.45	0.3012	0.45	0.4550	0.45	0.4253	0.65	0.4690
0.35	0.2278	0.40	0.3972	0.50	0.2711	0.50	0.4183	0.50	0.3828	0.70	0.4420
0.40	0.1994	0.45	0.3615	0.55	0.2465	0.55	0.3876	0.55	0.3480	0.75	0.4183
0.45	0.1772	0.50	0.3323	0.60	0.2259	0.60	0.3615	0.60	0.3190	0.80	0.3972
0.50	0.1595	0.55	0.3079	0.65	0.2086	0.65	0.3391	0.65	0.2944	0.85	0.3784
0.55	0.1450	0.60	0.2872	0.70	0.1937	0.70	0.3196	0.70	0.2734	0.90	0.3615
0.60	0.1329	0.65	0.2694	0.75	0.1807	0.75	0.3024	0.75	0.2552	0.95	0.3462
0.65	0.1227	0.70	0.2539	0.80	0.1694	0.80	0.2872	0.80	0.2392	1.00	0.3323
0.70	0.1139	0.75	0.2402	0.85	0.1595	0.85	0.2736	0.85	0.2251	1.10	0.3079
0.75	0.1063	0.80	0.2281	0.90	0.1506	0.90	0.2614	0.90	0.2126	1.20	0.2872
0.80	0.0997	0.85	0.2173	0.95	0.1427	0.95	0.2503	0.95	0.2014	1.30	0.2694
0.85	0.0938	0.90	0.2076	1.00	0.1356	1.00	0.2402	1.00	0.1914	1.40	0.2539
0.90	0.0886	0.95	0.1988	1.10	0.1232	1.10	0.2226	1.10	0.1740	1.50	0.2402
0.95	0.0839	1.00	0.1908	1.20	0.1130	1.20	0.2076	1.20	0.1595	1.60	0.2281

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1.00	0.0797	1.10	0.1768	1.30	0.1043	1.30	0.1947	1.30	0.1472	1.70	0.2173
1.10	0.0725	1.20	0.1649	1.40	0.0968	1.40	0.1835	1.40	0.1367	1.80	0.2076
1.20	0.0665	1.30	0.1547	1.50	0.0904	1.50	0.1737	1.50	0.1276	1.90	0.1988
1.30	0.0613	1.40	0.1458	1.60	0.0847	1.60	0.1649	1.60	0.1196	2.00	0.1908
1.40	0.0570	1.50	0.1380	1.70	0.0797	1.70	0.1571	1.70	0.1126		
1.50	0.0532	1.60	0.1310	1.80	0.0753	1.80	0.1501	1.80	0.1063		
1.60	0.0498	1.70	0.1248	1.90	0.0713	1.90	0.1438	1.90	0.1007		
1.70	0.0469	1.80	0.1192	2.00	0.0678	2.00	0.1380	2.00	0.0957		
1.80	0.0443	1.90	0.1142								
1.90	0.0420	2.00	0.1096								
2.00	0.0399										

Table 7. PSHA-based design spectral ordinates for the Dam and HEP sites(T_R=144 years).

Bu study – Z1		Bu study – Z2		Bu study – Z3	
Period (s)	PSA (g)	Period (s)	PSA(g)	Period (s)	PSA (g)
0.00	0.1494	0.00	0.1792	0.00	0.2211
0.06	0.3734	0.09	0.4481	0.10	0.5526
0.31	0.3734	0.44	0.4481	0.50	0.5526
0.35	0.3320	0.45	0.4390	0.55	0.5071
0.40	0.2905	0.50	0.3951	0.60	0.4648
0.45	0.2582	0.55	0.3592	0.65	0.4290
0.50	0.2324	0.60	0.3292	0.70	0.3984
0.55	0.2113	0.65	0.3039	0.75	0.3718
0.60	0.1937	0.70	0.2822	0.80	0.3486
0.65	0.1788	0.75	0.2634	0.85	0.3281
0.70	0.1660	0.80	0.2469	0.90	0.3099
0.75	0.1549	0.85	0.2324	0.95	0.2936
0.80	0.1453	0.90	0.2195	1.00	0.2789

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0.85	0.1367	0.95	0.2079	1.10	0.2535
0.90	0.1291	1.00	0.1975	1.20	0.2324
0.95	0.1223	1.10	0.1796	1.30	0.2145
1.00	0.1162	1.20	0.1646	1.40	0.1992
1.10	0.1056	1.30	0.1520	1.50	0.1859
1.20	0.0968	1.40	0.1411	1.60	0.1743
1.30	0.0894	1.50	0.1317	1.70	0.1640
1.40	0.0830	1.60	0.1235	1.80	0.1549
1.50	0.0775	1.70	0.1162	1.90	0.1468
1.60	0.0726	1.80	0.1097	2.00	0.1394
1.70	0.0684	1.90	0.1040		
1.80	0.0646	2.00	0.0988		
1.90	0.0612				
2.00	0.0581				

5. Conclusion

The site-specific design spectra for the Alparslan II Dam and Hydroelectric Plant sites are calculated using PSHA. The construction sites subject to this report are located in Seismic Zone 1 according to the seismic zonation map of Turkey. The PSHA conducted in this study is consistent with the ICOLD 72 guidelines. Site-specific design spectra of OBE, MDE, and MCE levels are less than the corresponding TEC07 spectra for the considered site classes (Z1, Z2 and Z3 in TEC07 or B, C and D sites in NEHRP, respectively). The relevant details of these calculations are presented in Section 4.2. Following the guidelines in the FEMA-65 document (FEMA, 2005), the spectrum to be used for the design of Dam, HEP and utility structures should be chosen among those presented in *Figure 7* provided its consistency with the structural type, site-condition and return period listed in *Table 2*.

Dr. Sinan Akkar
15/10/2010

Tolga Yılmaz

Dr. M. Tolga Yılmaz
15/10/2010

Referecences

Abrahamson N, and Silva W (2008). "Summary of the Abrahamson & Silva NGA ground-motion relations", *Earthquake Spectra*, 24(1): 67-97.

Barka A, (1996) "Slip distribution along the North Anatolian Fault Associated with the large Earthquakes of the Period 1939 to 1967," *Bulletin of the Seismological Society of America*, 86: 1238-1254.

Barka A, and Reilinger R (1997). "Active tectonics of the Eastern Mediterranean region: deduced from GPS, neotectonic and seismicity data," *Annali di Geofisica*, XL(3): 587-610.

Bommer JJ (2002). "Deterministic vs. probabilistic seismic hazard assessment: an exaggerated and obstructive dichotomy," *Journal of Earthquake Engineering*, 6(S1): 43-73.

Boore DM, and Atkinson GM (2008). "Ground-motion prediction equations for the average horizontal component of PGA, PGV, and 5%-damped PSA at spectral periods between 0.01 s and 10.0 s," *Earthquake Spectra* 24(1): 99-138.

Boore DM, Watson-Lamprey J, andAbrahamson NA (2006)."Orientation-independent measures of ground motion," Bulletin of Seismological Society of America, 96: 1502-1511.

Bozovic A, and May YL (1989). *Selecting Seismic Parameters for Large Dams - Guidelines*, ICOLD Bulletin 72, Commission Internationale des Grands Barrages, Paris.

BSSC, Building Seismic Safety Council (2009). *NEHRP Recommended Provisions for Seismic Regulations for New Buildings- Part: 1 Provisions*, FEMA-P750, Washington.

Campbell, K.W. and Y. Bozorgnia (2006). "Next Generation Attenuation (NGA) empirical ground motion models: can they be used in Europe? " *Proceedings of the First European Conference on Earthquake Engineering and Seismology*, Geneva, Switzerland, Paper No. 458.

Campbell KW, and Bozorgnia Y (2008). "NGA ground motion model for the geometric mean horizontal component of PGA, PGV, PGD and 5% damped linear elastic response spectra for periods ranging from 0.01 to 10 s," *Earthquake Spectra*, 24(1): 139-171.

CEN (2004). Eurocode 8, Design of Structures for Earthquake Resistance – Part 1: general rules, seismic actions, and rules for buildings. *EN 1998-1:2004*. Comité Européen de Normalisation, Brussels.

Chiou B, and Youngs RR (2008). "An NGA model for the average horizontal component of peak ground motion and response spectra," *Earthquake Spectra*, 24(1): 173-215.

Committee on Seismic Risk (1984). "Glossary of terms for probabilistic seismic-risk and hazard analysis," *Earthquake Spectra*, 1: 33-40.

FEMA, Federal Emergency Management Agency (2005). *Federal Guidelines for Dam Safey-Earthquake Analyses and Design of Dams*, NDSP-National Dam Safety Program, FEMA-65, *http://www.fema.gov/library*

Idriss IM (2008). "An NGA empirical model for estimating the horizontal spectral values generated by shallow crustal earthquakes," *Earthquake Spectra*, 24: 217-242.

Martirosyan A, Balassanian S, Simonian R, and Asatryan L (1999). "Computation of seismic hazard for GSHAP test area 'Carcasus'," *Natural Hazards*, 20: 1-20.

McClusky S, Balassanian A, Barka A, Demir C, Ergintav S, Georgiev I, Gurkan O, Hamburger M, Hurst K, Kahle H, and diğ. (2000). "Global Positioning System constraints on plate kinematics and dynamics in the eastern Mediterranean and Caucasus," *Journal of Geopyhsical Research*, 105: 5695-5719.

McGuire RK (2001). "Deterministic vs. probabilistic earthquake hazards and risk," *Soil Dynamics and Earthquake Engineering*, 21: 377-384.

McGuire RK (2004). *Seismic Hazard and Risk Analysis*, Earthquake Engineering Research Institute Monograph, MNO-10, CA, 221p.

Milkereit C, Grosser H, Wang R, Wetzel H-U, Woith H, Karakisa S, and dig. (2004). "Implications of the 2003 Bingöl Earthquake for the interaction between the North and East Anatolian Faults," *Bulletin of the Seismological Society of America*, 94: 2400-2406.

Ministry of Public Works (2007). *Turkish Earthquake Code*, T.C. Bayındırlık ve İskan Bakanlığı, Afet İşleri Genel Müdürlüğü, Ankara.

Öncel AO, and Wilson TH (2002). "Space-time correlations of seismotectonic parmeters: examples from Turkey preceeding the İzmit Earthquake," *Bulletin of the Seismological Society of America*, 92: 339-349.

Örgülü G, Aktar M, Türkelli N, Sandvol E, and Barazangi M (2003). "Contribution to the seismotectonics of the eastern Anatolian Plateau from moderate and small size events", *Geophysical Research Letters*,30(24), No. 8040.

Reasenberg, P (1985). "Second-order moment of central California seismicity,1969–1982," *Journal of Geophysical Research*, 90. 5479–5495.

Reilinger R, McClusky S, Vernant P, Lawrence S, Ergintav S, Cakmak R, and dig. (2006). "GPS constraints on continental deformation in the Africa-Arabia-Eurasia continental collision zone and implications for the dynamics of plate interactions," *Journal of Geophysical Research*, 111: B05411.

Stafford PJ, Strasser FO, and Bommer JJ (2008). "An evaluation of the applicability of the NGA models to ground-motion prediction in the Euro-Mediterranean region," *Bulletin of Earthquake Engineering*, 6(2): 149-177.

Schwartz, DP and Coppersmith KJ (1984). "Fault behavior and characteristic earthquakes: examples from the Wasatch and San Andreas faults. *Journal of Geophysical Research*, 89: 5681-5698.

Şaroğlu F, Emre Ö, and Kuşçu I (1992). *Active Fault Map of Turkey*, Republic of Turkey, General Directorate of Mineral Research and Exploration, Ankara.

Talebian M, and Jackson J (2002). "Offset on the Main Recent Fault on NW Iran and implications for the late Cenozoic tectonics of the Arabia-Eurasia collision zone," *Geophysical Journal International*, 150: 422-439.

Turkelli N, Sandvol E, Zor E, Gok R, Bekler T, Al-Lazki A, Karabulut H, Kuleli S, Eken T, Gurbuz C, et al. (2003). "Seismogenic zones in Eastern Turkey," *Geophysical Research Letters*, 30: No.8039.

UDİM, B.Ü. Kandilli Observatory and Earthquake Research Institute, Ulusal Deprem İzleme Merkezi (2010). *http://www.koeri.boun.edu.tr/sismo*, last access: 30.09.2010.

USACE, U.S. Army Corps of Engineers (1999). *Response Spectra and Seismic Analysis for Concrete Hydraulic Structures*, Regulation No. 1110-2-6050, Washington DC.

Wallace RE (1968). "Earthquake of August 19, 1966, Varto Area, eastern Turkey," *Bulletin of Seismological Society of America*, 58: 11-45.

Wells D, and Coppersmith KJ (1994). "New emprical relationships among magnitude, rupture length, rupture width, rupture area, and surface displacement," *Bulletin of the Seismological Society of America*, 84(4): 974-1002.

Westaway R, and Arger J (2001). "Kinematics of the Malatya-Ovacık Fault Zone," *Geodinamica Acta*, 14, 103-131.

Westaway R (2003). "Kinematics of the Middle East and Eastern Mediterranean Updated," *Turkish Journal of Earth Sciences*, 12: 5-46.

APP 12

WATER USAGE RIGHTS REPORT

REPUBLIC OF TURKEY
MINISTRY OF FORESTRY AND WATER AFFAIRS
General Directorate of State Hydraulic Works 17th Regional Directorate

Number : B.23.1.DSİ.1.17.02.00.0-113.02-**391570** Oct. 18, 2011
Subject : Alpaslan II Dam and HEPP Water Usage Rights

ALPASLAN II ENERJI URETIM SANAYI VE TICARET A.S.
(Ehlibeyt Mah. Ceyhun Atıf Kansu Cd. Baskent Plaza No: 106 K:7-8 06520)
Balgat / ANKARA

REF.: Your letter dated September 14, 2011.

The downstream water usage rights report enclosed to the reference letter and issued for **ALPASLAN II DAM AND HEPP PROJECT** with an installed capacity of 280,00 MW planned to be constructed by the company of Alpaslan II Enerji Üretim ve Madencilik San. Tic. A.Ş. over Murat River between the City Center and Varto districts of the Province of Mus has been approved as a result of the studies and examinations performed in relation thereof.

For your information and required action.

(Signature)
Mevlut PEHLIVAN
Regional Director

ANNEX/ANNEXES:
Water Usage Rights Report (1 Set)

DISTRIBUTION:

For Action:	For Information:
Alpaslan II Enerji Uretim Sanayi ve Ticaret A.S. (Ehlibeyt Mah. Ceyhun Atıf Kansu Cd. Başkent Plaza No:106 K:7-8 06520 Balgat / Ankara)	State Hydraulic Works, Investigation and Planning Department

Address: DSI 17. Bolge Mudurlugu Ipekyolu uzeri Havaalani yani 65040 VAN
For Detailed Information: C. AVCI Engineer Phone: Fax:
e-mail: cengiza@dsi.gov.tr Electronic Network: www.dsi.gov.tr

ALPASLAN II DAM AND HEPP

REPUBLIC OF TURKEY
MINISTRY OF FORESTRY AND WATER AFFAIRS
GENERAL DIRECTORATE OF STATE HYDRAULIC WORKS
17TH REGIONAL DIRECTORATE VAN

REGION : 17TH REGIONAL DIRECTORATE VAN

BASIN : FIRAT

PROJECT TITLE : ALPASLAN II DAM AND HEPP

PROJECT CODE :

STAGE : PLANNING

TYPE : WATER USAGE RIGHTS

Checked and Inspected by the Division Management.

CONTROL ENG.	CHIEF CONTROL ENG.	DIVISION MANAGER
(Signature)	(Signature)	(Signature)
Cengiz AVCI	Cengiz AVCI	…..ARSLAN
Agricultural Eng.	Agricultural Eng.	Division Manager
18/10/2011	18/10/2011	18/10/2011

CERTIFIED
(Seal and Signature)
Mevlut PEHLIVAN
Regional Director
20/10/2011

NOT: The reports that are not used in the control year and that are changed for any reason (project variation or revision, etc.) may be used upon prior notice to our department management.

REPUBLIC OF TURKEY
MINISTRY OF FORESTRY AND WATER AFFAIRS
GENERAL DIRECTORATE OF STATE HYDRAULIC WORKS
17TH REGIONAL DIRECTORATE VAN

ALPASLAN II DAM AND HEPP

WATER USAGE RIGHTS

REPORT

ENERJISA

ENERJI ÜRETIM A.S.

REPORT ISSUED BY

HATICE AKER

(Signature)

ANKARA, 2011

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1. INTRODUCTION

Alpaslan II Dam and HEPP project will make significant contributions to the energy supply that will be provided for our national economy; and it will also make an indirect contribution to a certain extent in relation to unemployment which has become an economic and social issue. The said project is located in Fırat Basin and over Murat River between the City Center and Varto districts of the province of Mus in the Eastern Anatolian Region. The project site is located at a distance of 34 km from the city center of Mus and extends in the direction of Mus-Varto-Erzurum State Highway. This asphalt road is always accessible every season of the year.

Alpaslan II Dam and HEPP Project located over Murat River has been designed at a thalweg elevation of 1,272.00 m and is located on 4 323 850 northern and 718 000 eastern coordinates. Alpaslan II Dam and HEPP projects that can be characterized as a toe plant were shown on the same map. Alpaslan II Dam intended for irrigation, energy generation and flood protection purposes has been designed at nearly 3.00 km downstream from the point of confluence where Bingöl Creek and Murat River join together. In the planning report dated September 1994 issued by the 17th Regional Directorate of SHW (State Hydraulic Works), it was determined as a result of the surveys that 78,210.00 ha of agricultural fields could be irrigated in Mus Plain upon commissioning of the project. 10,160.00 ha of the said agricultural fields is still irrigated by gravity from Arıncık weir. However, it was demonstrated that there was no problem in the trial operation studies performed for irrigation of Mus Plain project site, the area of which is 78,210.00 ha in total, and no problem would be experienced in irrigation of the irrigation area since Alpaslan II Dam is designed as a toe plant and no water retention would be performed.

Alpaslan I Dam intended for energy generation is located at upstream of Alpaslan II Dam. Mus Plain irrigation project which is still under construction is located at downstream of it. In respect of the irrigation water requirement for Mus Plain Irrigation, it was warranted that adequate amount of water would be released as per the agreement signed with the 17th Regional Directorate of the State Hydraulic Works. However, water retention is not applicable since Alpaslan II Dam is designed as a toe plant and it would not pose a problem in respect of irrigation since the waters in the reservoir area caught outside the irrigation season would be discharged with continuous outflow.

In the planning report, it was proposed that **(i)** 714.00 GWh of energy per year would be produced on average including 520.28 GWh of firm energy at Alpaslan II HEP with an installed capacity of 200.00 MW to be constructed at the toe of the dam through the outflows that will be regulated at the dam reservoir subject to such flood control volume; and **(ii)** through such turbine outflows, 78,210.00 ha of agricultural areas would be irrigated including 10,150 ha of area to be irrigated by gravity at downstream of Arıncık weir. Of this area, 10,150.00 ha of area to be irrigated by gravity is currently irrigated by the waters discharged from Arıncık weir.

In the surveys conducted in the areas where the dam and HEPP facilities are located, it was observed that agricultural irrigation is performed using the waters collected from Murat River with motor-pump sets at a distance of nearly 3.00 km at downstream of Alpaslan II Dam. However, it was specified that such type of irrigations were not preferred due to the high cost of irrigation. Arıncık Weir is located at 5.00 km downstream of the dam center line location. Currently, 10,150.00 ha of agricultural lands are irrigated by gravity from Arıncık Weir; however, it is planned to ensure irrigation of 78,210.00 ha of lands with Mus Plain Irrigation project.

The life water values required to be released for preservation of natural life are given below.

The natural life and the agricultural fields will not be adversely affected since the water required for maintenance of natural life is released in the project site and Murat River is recharged by the tributary rivers and there will be plenty amount of water in the riverbed in every season.

Table:1 The Water Rights originating from Alpaslan II Dam and required for Natural Life by Months (m^3/s)

MONTHS	Water Rights Originated	Water Rights required for Natural Life
JANUARY		13.00
FEBRUARY		13.00
MARCH		13.00
APRIL		13.00
MAY		13.00
JUNE		13.00
JULY		13.00
AUGUST		13.00
SEPTEMBER		13.00
OCTOBER		13.00
NOVEMBER		13.00
DECEMBER		13.00

With this water usage rights report, it is aimed to determine the facilities such as drinking and industrial water, fish farming facilities, mills and weirs, etc. and to examine, if any, the potential impacts of the project on them.

The areas remaining within the project site that are subject to water usage rights were examined; studies were performed to determine mills, ditches, fish farming facilities and drinking water facilities; and if any, the existing areas were plotted on the map. If there is any agricultural irrigation, crop water consumption requirements are calculated according to Blanney-Criddle method. However, since Alpaslan II Dam is a toe plant and no water retention will be performed (except for water catchment in the reservoir area only outside the irrigation season), there will be no trouble that might be experienced in respect of water amounts required for irrigation areas.

Table:2 Characteristics of Alpaslan II Dam

Crest Elevation	: 1371.00 m
Thalweg Elevation	: 1272.00 m
Max. Water Level	: 1368.00 m

Normal Water Level	: 1368.00 m
Minimum Water Level	: 1340.00 m
Firm Energy	: 606.35 GWh
Secondary Energy	: 255.92 GWh
Total Energy	: 862.27 GWh
Installed Capacity	: 280.00 MW

1.1 DESCRIPTION OF THE PROJECT SITE

The Project site has been designed in Fırat Basin over Murat River, one the main branches of Fırat River, in the province of Mus in the Eastern Anatolian Region with a thalweg elevation of 1269.00 m and at a distance of 34.00 km from the province of Mus.

Mus province and its surroundings are located in a high and mountainous region. The mountains covering 34.90 percent of the provincial area are the extensions of the South-Eastern Taurides. These mountains are young mountains formed with Alpine-Himalayan fold system. The elevation is generally above 1,250 meters.

The plains covered with young and fertile alluvium cover 27.20% of the provincial surface area. Murat valley divides the provincial lands into two sections extending in the east-west direction. In this context, the plateaus up to 1,500.00 m – 1,700.00 m cover 37.90% of the provincial area.

Harsh continental climate prevails in the province of Mus. The temperatures vary from –29ºC to +37ºC. Temperature are recorded above +30ºC for 120 days and below 0ºC for 120 days of the year. There is heavy snowfall in winters. The annual precipitation is between 1000 mm and 350 mm. Winters are very cold and long and summers are short, hot and dry.

Mus province is listed in the bottom lines among the provinces of Turkey in respect of education and literacy. The literacy rate is below 50 percent. However, Alpaslan University located in the province has allowed mobility in respect of trade and tourism in the city.

The healthcare services are insufficient throughout the province. The issued such as communicable diseases, mother and child care, etc. are considered among the major healthcare issues of the city. The lack of hygiene and the insufficiency of the water and sewerage networks and the sanitary installations of the houses in the rural areas are the factors aggravating the healthcare problems.

The provincial economy is based on agriculture and stockbreeding. However, agriculture has not developed to a satisfactory level. The provincial surface area is 819 600 ha in total and 342,198 ha of this total area is comprised of agricultural lands. Such agricultural lands are composed of 335,049 ha of field areas and 7,149 ha of vineyard and orchard areas.

Stockbreeding is the most important sub-sector of the agriculture segment in Mus; and it is completely based on pastures and grasslands. There are 1,479,707 ovine and 245,487 bovine animals in the city.

The bovine livestock is comprised of native race by 77 %, crossbreeds by 18%, and culture race by 5%.

The ovine livestock is comprised of sheep by 86% and goats by 14%. According to the data for 2001, the ovine animals in Mus correspond to 4.20% of the total ovine livestock and the bovine animals correspond to 20% of the total bovine livestock of Turkey.

Since the majority of bovine animals in the province is of native race, the meat and milk productivity per unit is low. It is of great importance to increase the number of the animals bred of culture race, which provide high productivity among the current livestock, in order to achieve higher productivity and income from stockbreeding.

The province of Mus is underdeveloped in respect of industrialization. The main factors of poor industrialization include the lack of capital accumulation, adverse climate conditions and very limited amount of raw materials.

Currently, there are 58 incorporated companies, 553 limited liability companies, and 23 unlimited companies operating in the province.

Mus Sugar Factory, the largest industrial plant of the province, has been in operation since 1982. This factory has a production capacity of 3,352 tons/day. The factory is operated with full capacity in the campaign period and makes important contribution in the provincial economy.

The construction of Mus Organized Industrial Zone that will make important contributions in the industrial development of the province was started in 2002. Planned with a capacity for

56 plants over an area of 90 ha, the Organized Industrial Zone is physically completed by 80%.

There is a small industrial area with a capacity for 100 workplaces providing services in Merkez (Center) District since 1995. The superstructure works (workplaces) are completed for two small industrial areas, one with a capacity for 70 and the other for 43 workplaces, located in the Center district, one small industrial area with a capacity for 66 workplaces located in Bulanık District and one small industrial area with a capacity for 82 workplaces in Malazgirt District. The infrastructure works are completed for Malazgirt Small Industrial Estate; and the infrastructure works for Bulanık Small Industrial Estate are still ongoing.

There are various historical places located within the boundaries of Mus province having a huge potential for tourism. Kale Şehri (Ancient Castle City) outstandingly reflecting the history considering the historical background of the region plays an important role in the tourism of Mus. There are various mosques, churches, monasteries and bathhouses considered among the tourism values in the province of Mus. The traditional Houses of Mus reflect the best the history and values of the province.

1.2 PURPOSE OF THE STUDY

The purposes of the arrangement of the Water Usage Rights Report for Alpaslan II Dam and HEPP project are listed as follows.

a) To enter into and execute a Water Agreement with the General Directorate of DSI (State Hydraulic Works) as per the provisions of the Regulation on Principles and Procedures regarding Conclusion of Water Usage Rights Agreement for Performing Power Generation Activities in the Electricity Market” enforced upon its publication in the Official Gazette no. 25120 dated June 26, 2003;

b) To determine the land areas currently irrigated from Alpaslan II Dam and HEPP project over Murat River constituting the water source of the project and the canals watering such areas;

c) Determine the crop pattern in the currently irrigated land areas and to determine the water amounts required in such areas by months;

d) To determine total water requirements of the lands that will be affected by the project site and to determine the required discharges by months;

e) To determine whether there are any existing mills, drinking and industrial water and fish farming facilities in the project site and to determine the required water amounts;

f) To produce the results related with the project and to present recommendations.

1.3 THE MAPS STUDIED and DRAWN UP

1/25000-scaled map numbered Erzurum J47-d4 on which the facilities currently existing in the project site were plotted was used during the report preparation stage; the studies were performed using this map, and the currently irrigated lands and the canals and flumes watering such lands and, if any, the mills and the fish farming facilities were plotted on the map.

1.4 IRRIGATION WATER DETERMINATION, CANALS and FLUMES

Currently, Arıncık Weir irrigation canals that may serve for irrigation were determined in the project site. The project site is a flat bottom land; and 10,150.00 ha of agricultural lands are irrigated by gravity from such weir canals. It was determined during the surveys that nearly 2000 da of agricultural lands were irrigated from Murat River using motor-pump sets in Akpınar and Kıyıbaşı villages at downstream of Alpaslan II Dam in the project site. However, construction of Alpaslan II Dam will not adversely affect such irrigations. In fact, Alpaslan II Dam is a toe plant and water will not be retained and after generation of energy, the incoming water will be released into the riverbed. Therefore, there will not be any irrigation water trouble in respect of Mus Plain irrigation planned to be performed.

1.5 MILLS and OTHER FACILITIES

It was determined that there was not any mill over Murat River in the project site. Alpaslan I dam and HEPP project is located at upstream of Alpaslan II Dam. Arıncık Weir irrigation and the planned Mus Plain irrigation project are located at downstream of it.

2. LAND AMOUNTS BY PROJECT UNITS, PRODUCT DISTRIBUTIONS AND WATER CONSUMPTION AMOUNTS REQUIRED BY MONTHS

Arıncık Weir is located at downstream of Alpaslan II Dam and HEPP project in the project site; however, no water will be retained in the reservoir since Alpaslan II Dam is a toe plant, and therefore, there will be no problem in respect of irrigation water amount and the company has also warranted to release the required irrigation water.

The current flumes in the Project site, the water amounts used in such flumes and the distribution of the water by months are calculated according to Blanney-Criddle method accepted by the General Directorate of DSI and the values found are used as water consumption amounts. However, currently, there is not any irrigation water problem related with agricultural irrigations in the project site.

This Water Usage Rights Report has been arranged according to the standards accepted by the General Directorate of DSI, Investigation and Planning Department, Agricultural Economy Division.

3. CONCLUSION

- Alpaslan II Dam and HEPP Project over Murat River covers Merkez (Center) and Varto districts of Mus.
- The facilities intended to be constructed in the project site are located over Murat River.
- The Water Usage Rights Report has been arranged according to the standards of the General Directorate of DSI.
- Water requirements are calculated using Blanney-Criddle method accepted by the General Directorate of DSI.
- The classical system, irrigation by gravity method is used in calculation of water requirements.
- A separate irrigation water calculation was not performed for Arıncık Weir irrigation located at downstream of Alpaslan II Dam and HEPP project since the dam is a toe plant and water retention will not be performed.
- The Water Usage Rights Reports prepared does not cover the life water required to be released to the riverbed for maintenance of natural life.

4. RECOMMENDATIONS

As per the 2nd paragraph of the article 4 specified in the ANNEX-1 to the Regulation published under the scope of the Energy Market Law No. 4628 and the “Electricity Market Licensing Regulation” issued by the Energy Market Regulatory Board, no calculation was performed for the irrigation water amount originating at downstream excluding the region between the water intake structure and the tailwater outlet. In fact, the dam is designed as a toe plant and water retention will not be performed. In case of any issues regarding irrigation or water rights which might have escaped from out attention during the surveys, the related responsibility is on the account of our company and the required water will be released.

The water amount to be released into the riverbed for maintenance of natural life should be separately calculated and incorporated into the report according to the applicable law and regulation and the water usage agreement.

5. ANNEXES

- 1/25000-scaled map showing the Agricultural Lands, Canals and the current status
- CV

Hatice AKER

Personal Information	1● Marital status: Married 2● Nationality: Turkish 3● Date of birth: 1959 4● Place of birth: Eregli/KONYA
Education	1981 – 1985 Ankara University, Faculty of Agriculture, Department of Agricultural Economy – Agricultural Engineer ANKARA
Language	English
Work experience	1● Retired 2● 2008 – 1998 DSI V. Regional Directorate, Planning Division (Conducting agricultural economy, expropriation and water rights studies related with irrigation, energy, and drinking water projects)- ANKARA 3● 1988 – 1986 General Directorate of DSI, 5th Region Çankırı Department – Ankara
Courses attended	1● General Directorate of DSI, Language School (9 months) 2● Sediment Transport Technology Course (supported by UNESCO) 3● General Directorate of DSI, Computer Training course MS Office (word, excel)
Tel. no. and electronic mail address	Mobile: 0 542 202 48 48 - Home: 0 312 286 44 88 akerhatice@yahoo.com

ALPASLAN II ENERJI URETIM

REF.	ALPASLAN II ENERJI URETIM VE MADENCILIK SANAYI TIC. A.S.	EHLIBEYT MAH. CEYHUN ATUF KANSU CAD BASKENT PLAZA NO 106, 06520 BALGAT ANKARA TEL : (0 312) 583 40 00 FAX : (0 312) 473 85 46

PDIR-ANK-ALP2/11-1062 **Sept. 23, 2011**

DSI XVII. Regional Directorate,
Ipekyolu Uzeri, Havaalanı Kavsagi,
65040, VAN.
Tel: (0432) 217 50 30

Subject: Task Assignment Letter

The Downstream Water Usage Rights report shall be arranged under the scope of Alpaslan-II Dam and HEPP Project for which our Company has received the Generation License.

As it is specified in the related regulation, the said report should be prepared by an agricultural engineer having at least 5 years of experience in water resources development projects. Therefore, the Agricultural Engineer, HATİCE AKER with her curriculum vitae enclosed hereby has been assigned for issuance of “Alpaslan-II Dam and HEPP Project Downstream Water Usage Rights Report”.

For your information and approval.

Yours sincerely,

(Signature)
Veli BALAT
Member of the Board of Directors

(Signature)
Fuat OKSUZ
Chairman of the Board of Directors

Annex: Curriculum Vitae (Hatice AKER – 1 Page)

APP 13

FOREST REVIEW FORM

Official Letter of the "EIA Positive Decision" from the General Directorate of Forestry

T.C.
ORMAN VE SU İŞLERİ BAKANLIĞI
Orman Genel Müdürlüğü Elazığ Orman Bölge Müdürlüğü

APS

Sayı : B 18 OGM 1 12 00.255. 03/ / 7390

03 -10- 2011

Konu : ÇED

ENCON ÇEVRE.DANŞ.LTD.ŞTİ
(Reşit Galip Cad.NO:120)

Gaziosmanpaşa / ANKARA

Alpaslan II Enerji Üretim Mad.Tic.San.AŞ. tarafından yapılması planlanan Alpaslan II barajı ve HES projesi ile ilgili alan ÇED Yönetmeliği kapsamında incelenmiş olup inceleme sonucunda tanzim edilen İnceleme ve Değerlendirme Formu ilişikte gönderilmiştir.

Ormanlık alanlara isabet eden yerler için kurumumuzdan izin alınması kaydı ile ÇED olumlu belgesi verilmesinde kurumumuzca bir sakınca olmadığı,

Ormanlık alanlara isabet eden kısımlar için müracaat halinde 22 Mart 2007 tarih ve 25470 sayılı Resmi Gazetede yayımlanarak yürürlüğe giren " Orman Sayılan Alanlarda Verilecek İzinler Hakkında Yönetmelik " gereği izin verilebileceği hususunu bilgilerinize rica ederim.

EKİ:
2 Tk.Rap.

M.Zeki TEMUR
Bölge Müdürü

Elazığ Orman Bölge Müdürlüğü Kadastro ve Mülkiyet Şube Müdürlüğü

İrtibat:
TEL : 0424 241 11 13 -15
FAX : 0424 241 11 19
E-Mail: - zekibayici@ogm.gov.tr hamitgulbay@ogm.gov.tr

Forest Inspection and Survey Form from General Directorate of Forestry

1

İNCELEME VE DEĞERLENDİRME FORMU

İli : Muş

İlçesi : Merkez,Varto

Köyü : Merkez ve Varto'ya Bağlı Köyler

Mevkii : Merkez,Varto

ORMAN BÖLGE MÜDÜRLÜĞÜ : Elazığ

ORMAN İŞLETME MÜDÜRLÜĞÜ : Bitlis

ORMAN İŞLETME ŞEFLİĞİ : Muş

1. Müracaat Sahibinin
   - Adı-Soyadı : Alpaslan II Enerji Üretim ve Madencilik San.Tic..A.Ş
   - Adresi : Ehlibeyt Mah. Ceyhun Atıf Kensu Cad. Başkent Plaza No:106 06520 Balgat/ANKARA
2. Madenin Cinsi ve Hangi Kanuna Tabi Olduğu : Alpaslan II barajı, Malzeme Ocakları ve HES projesi, 6831 sayılı orman kanunun 17.md.
3. Seri Adı : Varto, Aligedik
4. Bölme Numarası : Aligedik:1,2,3,5,6,7,10,11,15,19,20,22,23,24,25,26,27,30, 31,32,53,54
   Varto: 277
5. Meşçerenin
   - a) İşletme Şekli : Baltalık
   - b) Mevcut Ağaç Cinsleri : Meşe
   - c) Meşçere Tipleri : OT-ÇBMBt,ÇBMBt,ÇBMBt-OT
6. 1/25.000 Ölçekli Meşçere Haritası Üzerinde ÇED Raporuna Konu Sahanın Sınır Noktalarının Koordinatları : **Ekte sunulmuştur.**

	1. Nokta	2.Nokta	3.Nokta	4.Nokta	5.Nokta
Sağa (y)					
Yukarı (x)					

	6. Nokta	7.Nokta	8.Nokta	9.Nokta	10.Nokta
Sağa (y)					
Yukarı (x)					

7. 1/1000 Ölçekli Meşçere Haritası Üzerinde İşletme İçin İzin İstenen Sahanın Noktalarının Koordinatları : **Ekte sunulmuştur.**

	1. Nokta	2.Nokta	3.Nokta	4.Nokta	5.Nokta
Sağa (y)					
Yukarı (x)					

	6. Nokta	7.Nokta	8.Nokta	9.Nokta	10.Nokta
Sağa (y)					
Yukarı (x)					

8. Orman Tahdit ve Kadastro Durumu:
   - İşletme Sahasının Genel Alanı : 5009,32 (Ha)
   - a) Orman Sayılan Alan : 832,50 (Ha) (Yaklaşık)

2

	b) Orman Sayılmayan Alan	: 4176,82 (Ha)
9.	İzin Verilecek Sahanın Alanı	: 832,50 (Ha) (Yaklaşık)
10.	Talebin Amacı	: Alpaslan II Barajı, Malzeme ocakları ve HES yapımı
11.	Talep Sahasına Başka bir Müracaat Yapılıp Yapılmadığı	: Yapılmadı
12.	Talep sahası yerin 6831 sayılı Orman Kanunu'nun 18.nci maddesindeki; Yangın görmüş orman alanı, gençleştirmeye ayrılmış veya Ağaçlandırılan sahalarla baraj havzalarında kalıp kalmadığı	: Kalmıyor
13.	Talep sahasının Tohum meşceresi, Milli park, Av yaban hayatı, Av üretme sahası, Turizm alanı, Özel çevre koruma bölgesi, Askeri yasak bölge ve Sit alanı içerisinde kalıp kalmadığı	: Kalmıyor
14.	Ormancılık çalışmaları ve Orman-Halk münasebetleri açısından mahsuru olup olmadığı	: Mahsuru yoktur.
15.	Orman yangınları açısından hassasiyet derecesi ve alınması gerekli tedbirler neler olmalıdır	: 5.derece ve gerekli yangın ekipmanları bulundurulacaktır.
16.	Orman Emvallerinin nasıl değerlendirileceği	: İlgili işletme Şefliğince değerlendirilecektir

İNCELEME ve DEĞERLENDİRME FORMUNU TANZİM EDENLER

Serhat Cihan KESKİN
Muş Orman İşletme Şefi

Ümit KILIMCI
Kızılağaç Orman İşletme Şefi

İŞLETME MÜDÜRLÜĞÜNÜN GÖRÜŞ ve MÜTALASI : Ormanlık Sahalarda; 6831 Sayılı Orman Kanununa göre ayrıca İzin almak ve yangına karşı önlem almak kaydıyla sakınca bulunmamaktadır.

19 / 9 / 2011
M.Şakir GÜNERİ
İŞLETME MÜDÜRÜ

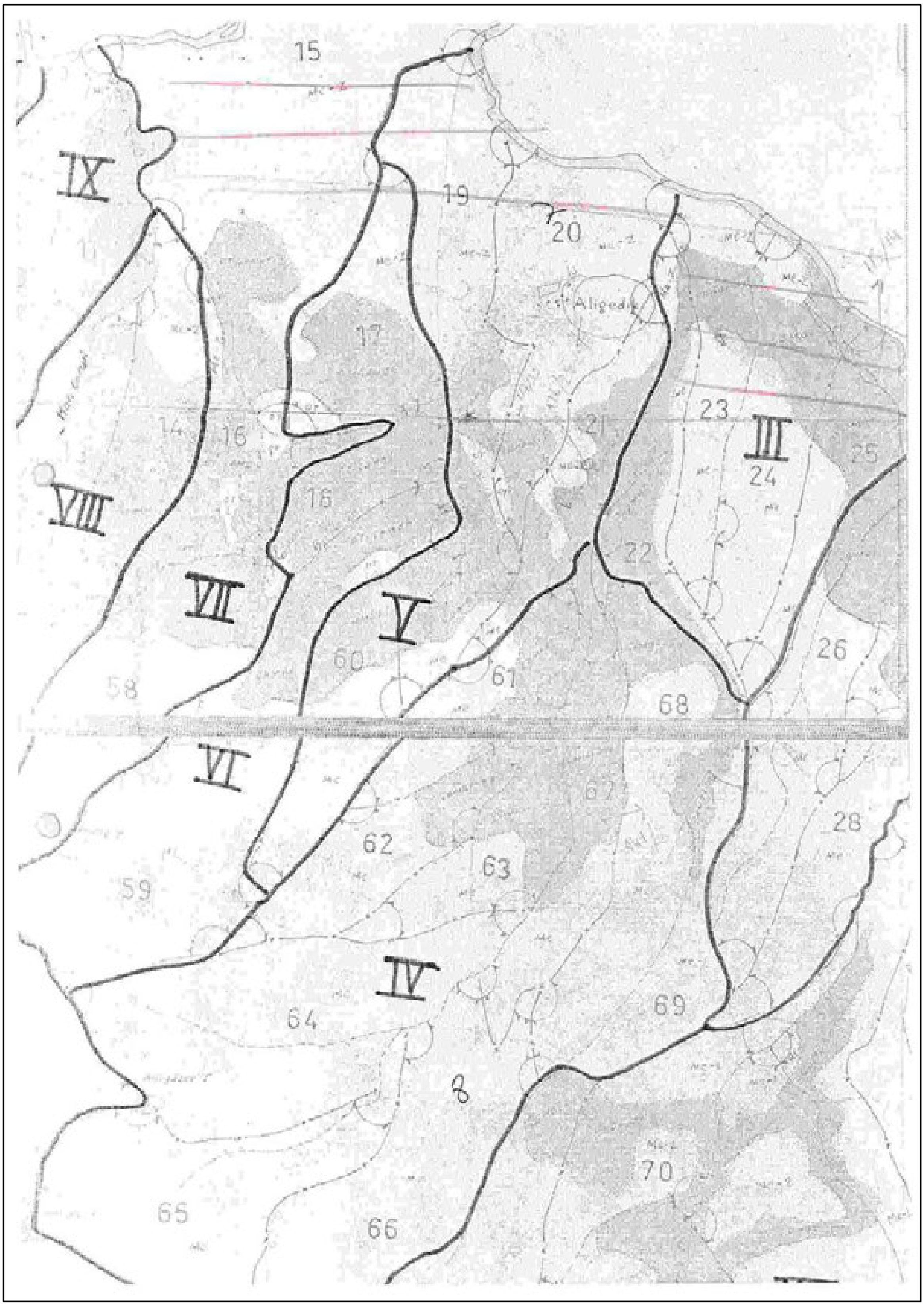
Baraj Aksı, Malzeme Sahaları, Depo Sahaları, Yıkama Eleme Kırma Tesisi, Beton Santralları, Şantiye Sahaları Dış Koordinatları

PROJE ÜNİTELERİ	KOORDİNATLAR			
	ED50 UTM Zon 37		COĞRAFİK WGS84	
	X	Y	X	Y
Baraj Aksı	717738	4323877	41,515400	39,035301
	718560	4323795	41,524799	39,034302
Şantiye Tesisleri - 1	718193	4327920	41,521900	39,071602
	718314	4328010	41,523300	39,072300
	718548	4327680	41,525902	39,069302
	718427	4327600	41,524502	39,068600
Şantiye Tesisleri - 2	717756	4324460	41,515800	39,040501
	717901	4324420	41,517399	39,040199
	717799	4324040	41,516102	39,036701
	717654	4324080	41,514400	39,037102
Şantiye Tesisleri - 3	718776	4321700	41,526600	39,015400
	718921	4321660	41,528301	39,014999
	718819	4321280	41,527000	39,011600
	718674	4321310	41,525299	39,012001
Beton Tesisleri - 1	718285	4324320	41,521801	39,039101
	718375	4324440	41,522900	39,040100
	718415	4324410	41,523300	39,039902
	718324	4324290	41,522301	39,038799
Beton Tesisleri - 2	718434	4324190	41,523499	39,037899
	718474	4324220	41,523998	39,038101
	718563	4324090	41,524899	39,036999
	718523	4324070	41,524502	39,036800
Beton Tesisleri - 3	718340	4323270	41,522099	39,029701
	718349	4323420	41,522301	39,030998
	718399	4323420	41,522800	39,030996
	718389	4323270	41,522701	39,029598
Kırma – Eleme - Yıkama Tesisi	719910	4327110	41,541500	39,063900
	720006	4327080	41,542599	39,063599
	719904	4326750	41,541302	39,060600
	719808	4326780	41,540199	39,060902
A Geçirimsiz Malzeme Sahası	718333	4323210	41,521999	39,029099
	718238	4323610	41,521000	39,032700
	718119	4323700	41,519699	39,033600
	718126	4324090	41,519901	39,037102
	718479	4324030	41,523998	39,036400
	718636	4323250	41,525501	39,029400
	718747	4323200	41,526798	39,028900
	718806	4322890	41,527401	39,026100
	718594	4322650	41,524799	39,023998
	719060	4321780	41,529900	39,016102
	718862	4321710	41,527599	39,015499
	718619	4322040	41,524899	39,018501
	718241	4322890	41,520802	39,026199
	718218	4323100	41,520599	39,028198
B Geçirimsiz Malzeme Sahası	718313	4325160	41,522400	39,046600
	718674	4325320	41,526600	39,048000
	718788	4325110	41,527901	39,046101
	718603	4324790	41,525600	39,043301
	718310	4324760	41,522202	39,043098

PROJE ÜNİTELERİ	KOORDİNATLAR			
	ED50 UTM Zon 37		COĞRAFİK WGS84	
	X	Y	X	Y
D3 Depo Sahası	718834	4325030	41,528400	39,045399
	719647	4326170	41,538101	39,055401
	719860	4326120	41,540600	39,054901
	719714	4325700	41,538700	39,051102
	719958	4325650	41,541599	39,050701
	720265	4325460	41,544998	39,048901
	719723	4325270	41,538700	39,047298
	719527	4325050	41,536400	39,045399
	719074	4324850	41,531101	39,043701
	719038	4324940	41,530701	39,044601
D4 Depo Sahası	718207	4325560	41,521301	39,050301
	718028	4325690	41,519299	39,051498
	717980	4326040	41,518799	39,054699
	718355	4326040	41,523201	39,054501
	718769	4326600	41,528099	39,059502
	718984	4326520	41,530602	39,058701
	718657	4325870	41,526600	39,053001
	718319	4325780	41,522701	39,052200
D5 Depo Sahası	717463	4327390	41,513302	39,066898
	717828	4327800	41,517700	39,070599
	718241	4327490	41,522301	39,067600
	718047	4327250	41,520000	39,065498
D6 Depo Sahası	720870	4327030	41,552502	39,062901
	720466	4326940	41,547798	39,062199
	720377	4326880	41,546799	39,061600
	720363	4326930	41,546600	39,062099
	720331	4327200	41,546398	39,064602
	720663	4327260	41,550201	39,064999
	720771	4327100	41,551399	39,063599
Relokasyon Yolu	718290	4321743	41,521000	39,015900
	718252	4321877	41,520599	39,017101
	718208	4321977	41,520199	39,018101
	718139	4322062	41,519402	39,018799
	717754	4322418	41,515099	39,022099
	717693	4322496	41,514400	39,022900
	717661	4322589	41,514099	39,023701
	717614	4322872	41,513599	39,026299
	717579	4322965	41,513199	39,027100
	717611	4323036	41,512501	39,027802
	717448	4323081	41,511700	39,028198
	717384	4323126	41,511002	39,028599
	717336	4323170	41,510502	39,028999
	717301	4323225	41,510101	39,029499
	717175	4323496	41,508701	39,032001
	717148	4323642	41,508499	39,033298
	717194	4323782	41,508999	39,034599
	717235	4323849	41,509499	39,035099
	717269	4323887	41,509899	39,035500
	717312	4323914	41,510399	39,035702
	717349	4323930	41,510899	39,035900
	717386	4323946	41,511299	39,035999
	717471	4324032	41,512299	39,036701
	717472	4324152	41,512402	39,037800

PROJE ÜNİTELERİ	KOORDİNATLAR			
	ED50 UTM Zon 37		COĞRAFİK WGS84	
	X	Y	X	Y
C Geçirimsiz Malzeme Sahası	719542	4326690	41,537102	39,060200
	719821	4326650	41,540298	39,059700
	719667	4326250	41,538399	39,056198
	719507	4326030	41,536499	39,054199
	719157	4325600	41,532299	39,050400
	718999	4325670	41,530499	39,051102
	719273	4326080	41,533798	39,054798
	719367	4326130	41,534901	39,055199
D Geçirimsiz Malzeme Sahası	719121	4326690	41,532200	39,060299
	719395	4326600	41,535400	39,059299
	718657	4325430	41,526501	39,049000
	718483	4325510	41,524502	39,049801
E Geçirimli Malzeme Sahası	719476	4327280	41,536499	39,065498
	720515	4327490	41,548599	39,067101
	721233	4327550	41,556900	39,067501
	721256	4327410	41,557098	39,066200
	719895	4327130	41,541302	39,063999
	719765	4326710	41,539700	39,060200
	719505	4326720	41,536701	39,060501
F Geçirimli Malzeme Sahası	719323	4327610	41,534901	39,068501
	720305	4327990	41,546299	39,071701
	720519	4327750	41,548698	39,069500
	719955	4327420	41,542099	39,066700
	719449	4327330	41,536201	39,066002
	719421	4327130	41,535801	39,064098
	719388	4327120	41,535400	39,063999
	719273	4327470	41,534199	39,067200
G Geçirimli Malzeme Sahası	718702	4327800	41,527699	39,070400
	719384	4328200	41,535801	39,073799
	719642	4327960	41,538601	39,071602
	719273	4327630	41,534302	39,068699
	719220	4327490	41,533600	39,067402
	719363	4327100	41,535099	39,063900
	719263	4327070	41,534000	39,063599
Röpriz Sahası	718630	4322660	41,525299	39,024101
	718765	4322790	41,526901	39,025200
	718995	4322530	41,529400	39,022900
	718997	4322180	41,529301	39,019699
	718874	4322230	41,527901	39,020100
K1 Kaya Malzeme Sahası	715911	4331817	41,496799	39,107201
	715631	4331822	41,493500	39,107300
	715562	4331972	41,492802	39,108700
	715651	4332067	41,493900	39,109501
	715941	4331856	41,497101	39,107601
K2 Kaya Malzeme Sahası	712633	4333246	41,459400	39,120899
	712908	4333325	41,462601	39,121498
	713065	4333119	41,464298	39,119598
	713214	4333109	41,466000	39,119499
	713312	4333176	41,467201	39,120098
	713591	4333123	41,470402	39,119499
	713519	4332788	41,469398	39,116501
	713066	4332768	41,464199	39,116501
	712643	4333158	41,459400	39,120098

PROJE ÜNİTELERİ	KOORDİNATLAR			
	ED50 UTM Zon 37		COĞRAFİK WGS84	
	X	Y	X	Y
K3A Kaya Malzeme Sahası	720950	4330300	41,554501	39,092300
	720525	4330325	41,549599	39,092602
	720525	4330366	41,549599	39,092999
	721859	4330745	41,565201	39,096100
	722123	4330393	41,568100	39,092800
	722116	4330300	41,568001	39,091999
K5 Kaya Malzeme Sahası	721058	4327285	41,554798	39,065102
	721269	4327382	41,557301	39,065899
	721621	4326963	41,561199	39,062099
	722409	4326688	41,570202	39,059399
	722391	4326119	41,569801	39,054298
	722177	4326133	41,567299	39,054501
	721875	4326564	41,563999	39,058399
	721247	4326809	41,556801	39,060799
K6A Kaya Malzeme Sahası	721974	4321430	41,563499	39,012100
	721373	4322150	41,556801	39,018799
	721583	4322330	41,559200	39,020401
	722565	4321920	41,570400	39,016399
	723363	4322000	41,579700	39,016899
	722892	4321390	41,574001	39,011600
K6B Kaya Malzeme Sahası	723789	4321110	41,584301	39,008801
	722892	4321390	41,574001	39,011600
	723363	4322000	41,579700	39,016899
	723513	4321890	41,581402	39,015900
	723469	4321500	41,580700	39,012501
	724369	4321150	41,591000	39,008999
	725061	4320360	41,598701	39,001701
	724673	4320180	41,594200	39,000198
D1 Depo Sahası	717613	4324970	41,514301	39,045200
	717868	4325000	41,517200	39,045300
	718091	4324940	41,519798	39,044800
	718022	4324580	41,518902	39,041599
	717961	4324470	41,518101	39,040600
	717662	4324520	41,514702	39,041000
	717719	4324760	41,515400	39,043201
	717684	4324830	41,514999	39,043800
	717557	4324970	41,513599	39,045101
D2 Depo Sahası	718008	4325530	41,519001	39,050098
	718241	4325500	41,521702	39,049801
	718287	4325590	41,522202	39,050499
	718315	4325700	41,522598	39,051498
	718345	4325740	41,522999	39,051899
	718586	4325800	41,525799	39,052399
	718408	4325620	41,523602	39,050800
	718418	4325490	41,523701	39,049702
	718191	4325280	41,521000	39,047798
	718099	4325170	41,519901	39,046799
	717904	4325280	41,517700	39,047798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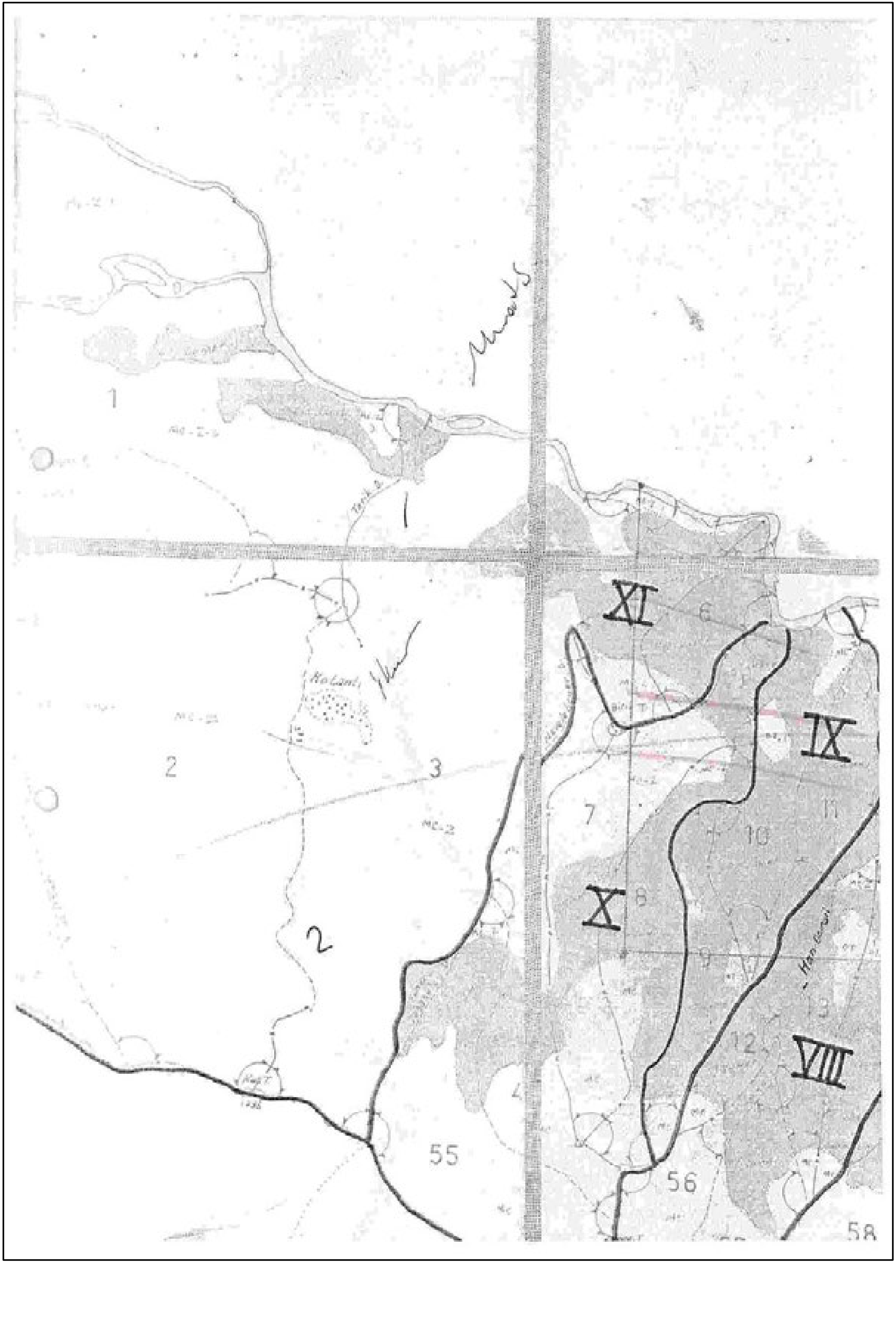
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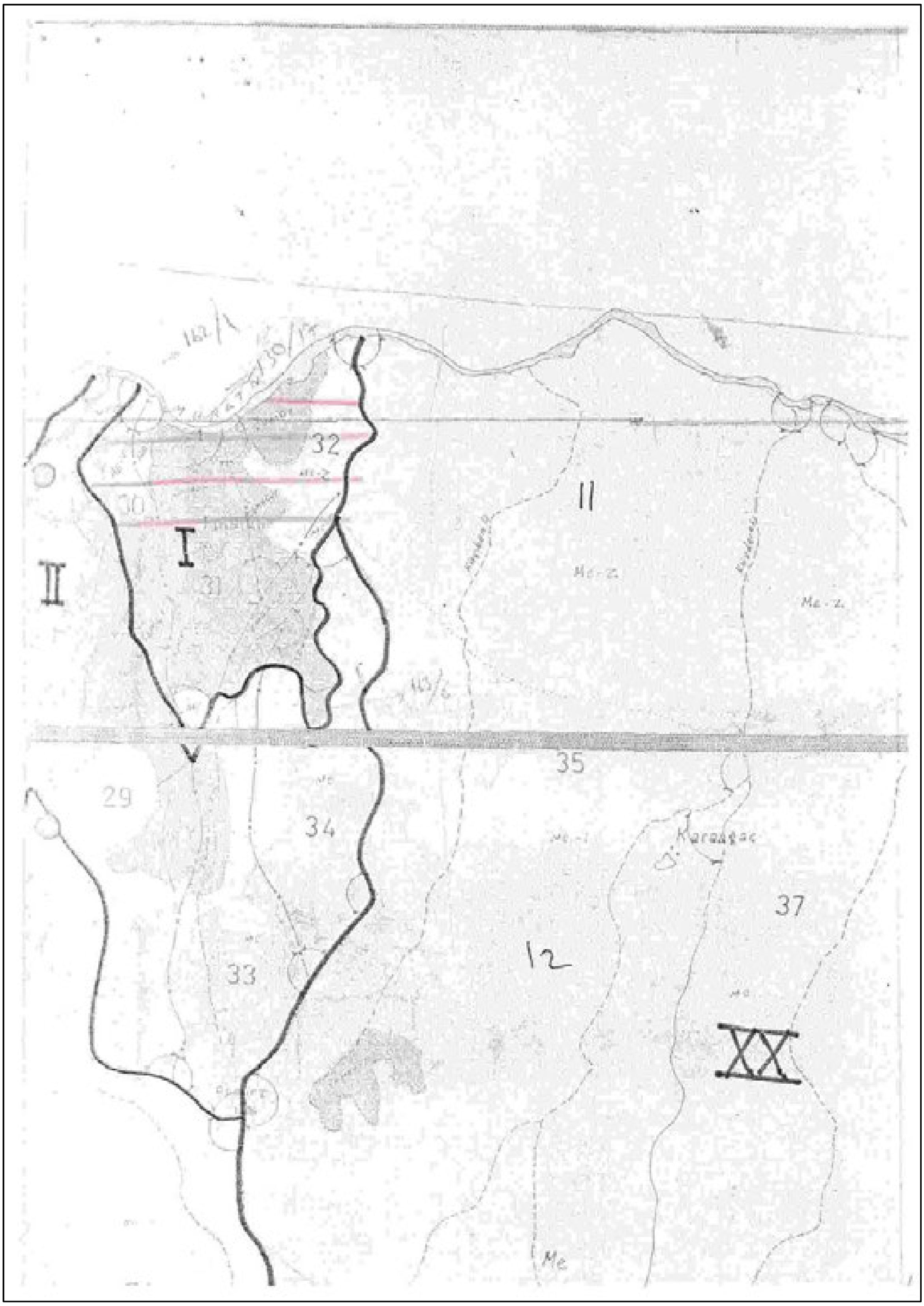
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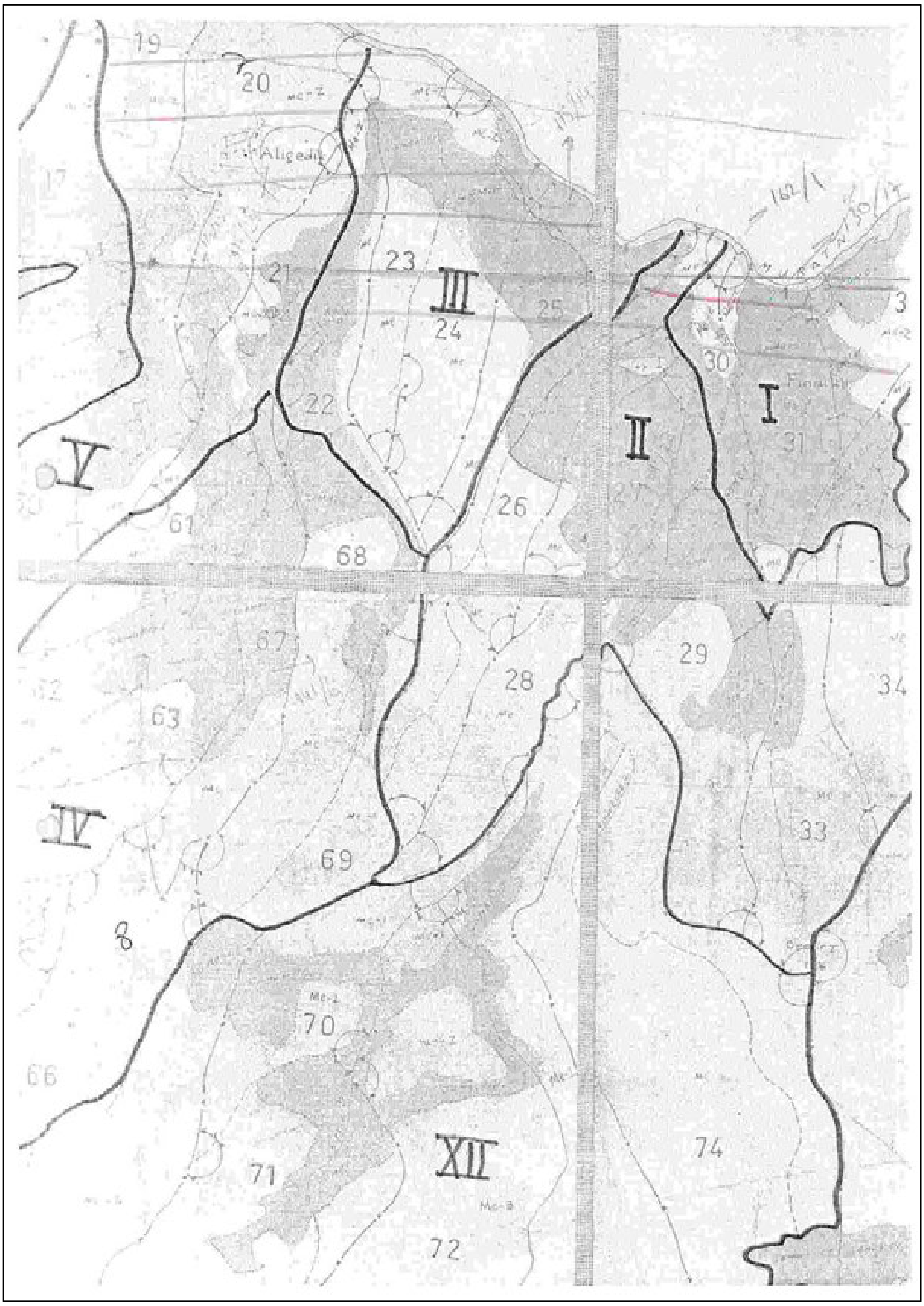
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APP 14

PM_{10} MEASUREMENT REPORT

PM_{10} Measurement Results

T.C.
Çevre ve Orman Bakanlığı

Yeterlik Belge No
Y-06/164/2011

TÜRKAK
TÜRK AKREDİTASYON KURUMU
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ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

Gazi Mah. Silahtar Cad. No:134/I
Yenimahalle / ANKARA

TÜRKAK
Test
TS EN ISO IEC 17025
AB-0286-T

AB-0286-T
R-2011-042-00
09-11

Deney Raporu
Test Report

Müşterinin adı/adresi Customer name/address	**: Encon Çevre Danışmanlık Ltd. Şti.** **(Alpaslan II Barajı ve HES Projesi)**
Teklif Numarası Offer No.	**: T-2011-470-00-01**
Numunenin adı ve tarifi Name and identity of test item	**: Planlanan Faaliyet İçin PM10 Raporu**
Numunenin kabul tarihi The date of receipt of Offer	**: __**
Açıklamalar Remarks	**: 3 Nüsha**
Ölçümün yapıldığı tarih Date of measurement	**:25.26.08.2011**
Raporun Sayfa Sayısı Number of pages of The Report	**: Ekler dahil 30 Sayfa.**

Deney ve /veya ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri (olması halinde) ve deney metodları bu sertifikanın tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.

The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.

MÜHÜR	TARİH	RAPOR SORUMLUSU	ÖLÇÜM SORUMLUSU	LABORATUVAR MÜDÜRÜ
	12.09.2011	Filiz ÜLGER	H.Mehmet YİĞİT	H.Mehmet YİĞİT

ÇEVRE ANALİZ LABORATUVARI
ÇANKAYA

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ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

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RAPORU HAZIRLANAN KURUM / KURULUŞ BİLGİLERİ

Adı	**: Encon Çevre Danışmanlık Ltd. Şti.**
Adresi	**: Reşit Galip Caddesi 120 Gaziosmanpaşa / ANKARA**
Telefonu/Faksı	: 0 312 447 71 22 / 0 312 447 69 88
Ölçümün Yapıldığı Tarih	: 25-26.08.2011
Rapor Tarihi	: 12.09.2011
Rapor Numarası	: R-2011-041-00
Rapor Sayfa Sayısı	: 30
Rapor Ekleri Sayısı	: 3
Rapor Nüsha Sayısı	: 3

RAPORU HAZIRLAYAN KURULUŞ BİLGİLERİ

Adı	: ÇANKAYA Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt.Mat.Yay.Turz.Tic. Ltd.Şti.
Adresi	: Gazi Mah. Silahtar Cad. No:134/1 **Yenimahalle / ANKARA**
Telefonu /Faksı	: (0312) 211 16 80-81-82 / (0312) 211 16 83
Web Sayfası / e-mail adresi	: www. cankayasaglik.com.tr / cevre@cankayasaglik.com.tr
Vergi Dairesi /Numarası	: MALTEPE / 229 038 6895

-YAPILMASI PLANLANAN FAALİYETLER İÇİN PM10 RAPORU-

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İÇİNDEKİLER

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GİRİŞ

2872 sayılı Çevre Kanunu'nun ilgili hükümleri gereğince **03.07.2009 tarih** ve **27277 sayılı** Resmi Gazete'de yayınlanan **"Sanayi Kaynaklı Hava Kirliliğinin Kontrolü Yönetmeliği" (S.K.H.K.K.Y.)**, her türlü sanayi ve enerji üretim tesislerinden kaynaklanan hava kirliliği seviyelerine sınırlamalar getirmekte ve bu kirletici kaynakları 'Tesis' olarak tanımlayarak çevresindeki hava kirliliğinin ölçüm ve denetimini zorunlu kılmaktadır.

2872 sayılı Çevre Kanununa göre alınması gereken izin ve lisanslar gereğince **29.04.2009 tarih** ve **27214 sayılı** Resmi Gazete 'de yayınlanan **"Çevre Kanununca Alınması Gereken İzin Ve Lisanslar Hakkında Yönetmeliği (Ç.K.A.G.İ.L.Y.)"** ,Ek-1 ve Ek-2 listesinde yer alan faaliyet ve tesisler tarafından 2872 sayılı Çevre Kanununa göre alınması gereken izin ve lisanslara ilişkin tüm iş ve işlemler ile bu iş ve işlemlere ilişkin yetkili mercilerin, çevre yönetim birimlerinin ve çevre görevlilerinin görev ve sorumlulukları ile Bakanlıkça yetkilendirilmiş çevre danışmanlık firmalarının, işletmelerin ve işletmecilerin yükümlülüklerini belirlemektir.

Encon Çevre Danışmanlık Ltd. Şti. 'nin talebi üzerine Muş İlinde yapılması planlanan **Alpaslan II Barajı ve HES Projesi** için 25-26.08.2011 tarihlerinde **Kuşluk (Yeni Yerleşim) ve Akpınar Köylerinde** gidilen günün şartlarında imisyon (PM10) ölçümleri yapılmış ve Encon Çevre Danışmanlık Ltd. Şti' nin **Çevresel Etki Değerlendirme Yönetmeliği (ÇED)** kapsamında yaptığı çalışmalarda kullanılmak üzere bu **Teknik Rapor** hazırlanmıştır.

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
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A. GENEL BİLGİLER

A.1 Tesis/işletmenin ticari unvanı

Alpaslan II Enerji Üretim ve Mad. San. Tic. A.ş.

A.2 Tesis/işletmenin adresi

Alpaslan II Enerji Üretim Ve Mad. San. Tic. A.Ş.'nin merkez adresi Ceyhun Atıf Kansu Cad. Başkent Plaza No: 106 Kat: 8 Balgat / Ankara'dır. Alpaslan II Enerji Üretim Ve Mad. San. Tic. A.Ş. tarafından yapılması planlanan Alpaslan II Barajı, Fırat Nehri Havzası'nın alt havzası olan Murat Nehri üzerinde kurulacaktır.

A.3 Tesis/işletmenin üretimi/hizmet konusu

Alpaslan II Enerji Üretim ve Mad. San. Tic. A.Ş. tarafından gerçekleştirilmesi planlanan baraj ve HES projesiyle, enerji üretilmesi planlanmaktadır. Aynı zamanda Muş Ovası'nın sulanması da sağlanacaktır.

A.4 Tesis/işletmenin Çevre Kanununca Alınması Gereken İzin Ve Lisanslar Hakkında Yönetmeliğindeki yeri

Yapılacak olan Alpaslan II Barajı ve HES Projesi Çevre Kanununca Alınması Gereken İzin Ve Lisanslar Hakkında Yönetmeliğin Ek-1 ve Ek-2'sinde yer almamaktadır.

A.5 Tesise en yakın yapının mesafesi (m olarak)

Alpaslan II Barajı ve HES' in İnşaat aşamasında kullanılacak olan alanlara yapılması planlanan Tesislerden (Taş Ocağı ,Kırma-Eleme,Beton Santrali, vs.) kaynaklanacak toz emisyonundan (PM10) etkilenecek en yakın yerleşim yerleri olan Kuşluk (Yeni Yerleşim) ve Akpınar Köyleridir. Bu yerleşim alanlarına kurulması planlanan tesisler ve mesafeleri Tablo 1'de verilmiştir.

Tablo A.1. Yapılması Planlanan Tesislerin yerleşim yerlerine olan mesafesi

Tesisler	Mesafe (m)	En yakın yerleşim yeri
K-3A Kaya Malzeme Ocağı	700	Kuşluk Köyü/Yeni Yerleşim
B Geçirimsiz Malzeme Sahası	1860	Akpınar Köyü
Beton Santrali-1	1650	Akpınar Köyü
Beton Santrali -2	1560	Akpınar Köyü
Beton Santrali -3	1150	Akpınar Köyü

A.6 Tesis/işletmenin kurulacağı alanın özellikleri (arazi yapısı, hakim rüzgar yönü, bağıl nem)

Proje alanı kırsal kesimde, yer yer düz, yer yer dağlık, mera, tarım alanları, boş alanlar ve dağınık yerleşim şeklinde köylerin bulunduğu bir alandır.Proje alanına en yakın meteoroloji istasyonu Hürriyet Mah. Çaylar Cad. No:40'da bulunan Varto Meteoroloji İstasyonudur. Aşağıda verilen tüm meteorolojik veriler, projenin yapılacağı bölgenin meteorolojik özelliklerini en iyi karakterize edeceği düşünülen Varto Meteoroloji İstasyonunun verileridir.

Tablo 2 Meteorolojik Veriler

Ortalama sıcaklık	7,6 °C
Hakim rüzgar yönü	Güneybatı (SW)
Ortalama rüzgar hızı	1,3 m/sn
Ortalama nem	% 63

A.7 Tesis/işletmenin kullanım sahası (m^2 veya km^2 olarak)

Toplam proje alanı 54,69 km^2'dir.

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B. ÖLÇÜMDE KULLANILAN CİHAZ VE ÖLÇÜM YÖNTEMLERİ

Ortamda toz konsantrasyonu ölçümleri Micro PNS-LVS1 PM 10 Örnekleme Cihazı ile yapılmıştır. Ölçüm yöntemi olarak Gravimetrik Metot kullanılmış ve yapılan imisyon ölçümü TS EN 12341:2002 standardına uygun olarak yapılmıştır. PNS-LVS1 PM 10 Örnekleme Cihazına ait bilgiler, rapor ekinde mevcuttur (Ek-2 Cihaz Kalibrasyon Belgeleri)

Kurulması Planlanan tesislerin toz emisyonundan en çok etkilenecek yerleşim yeri olan Kuşluk (Yeni Yerleşim) ve Akpınar Köylerinden olmak üzere toplam 2 (iki) noktadan toz (PM10) ölçümü yapılmıştır.

Tablo 4.1 Ölçüm Yöntemleri ve Standartlar

Parametreler	Ölçüm Yöntemleri	Standartlar	Ölçüm Cihazları	Cihaz Seri No
PM 10 (TOZ)	Gravimetrik Metot	TS EN 12341:2002	Micro PNS-LVS1 PM 10 Örnekleme Cihazı	0607-079

1

Kullanılan Cihaz ve aksesuarları: Micro PNS-LVS1:

I. Örnekleme pompası ve işlemci ünitesi
II. PM10 Başlığı

Kullanılan sarf malzemeleri:

I. Filtre kağıdı (Ø 25,37 ve 47mm)
II. Koruyucu Filtre

Montaj İslemleri:

Cihazın montajı yapılarak ölçüme hazırlanır. Cihazda bağlantılar dahili olduğu için hareketli parçaların montajına azami derecede dikkat edilmelidir. Cihazın hareketli olan parçaları, elektrik kablosu ve PM 10 başlığından oluşmaktadır.

Şekil 1: PM 10 Başlığı ve Filtre

ÇEVRE ÖLÇÜM ANALİZ LABORATUVARI ÇANKAYA

Örnekleme başlığının filtre kısmı 5 bölümden oluşmaktadır.

1) Filtre
2) O-ring halka
3) İki adet PTFE conta
4) Filtre tutucu
5) Klipsler

Filtre kağıdının filtre yuvasına yerleştirilmesi ve montajı:

Filtre tutucuya gereken miktarda filtre yerleştirilir. O-ring ve PTFE contaları dikkatlice yerleştirilip, filtre tutucunun üst tarafından ana baş kısımdaki klipslerle sabitlenir

Montaj aşamasında dikkat edilecek hususlar:

a) Bağlantı elemanlarının tam oturması,
b) Filtre kağıdının yuva içine cımbızla tam olarak oturtulması,
c) Bütün bağlantı elemanlarının iyice sıkılması,
d) Contaların sıyırmaması için yuvalarına tam olarak oturtulması işlemleri yapılmaktadır.

Cihazın elektrik bağlantısı için topraklı fiş belirlenmeli ve çıkış 220 V (50 Hz) olmalıdır.

B.1 Ölçüm Prensipleri

Emisyon sonuçlarının doğru ve hatasız olması, doğru bir ölçüm tekniği kullanılmasına bağlı olduğu kadar, ölçüm işleminin genel prensiplerine de bağlıdır.

Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. olarak, emisyon ölçüm raporlarının hazırlanmasında sahada yaptığımız ölçüm kadar laboratuardaki ön hazırlık ve ölçüm öncesi kontrollerle de doğru ve güvenilir sonuçlara ulaşmayı sağlamaktayız. Bu amaçla emisyon ölçümleri üç aşamalı olarak yapılmaktadır.

B.2 Ölçüm noktalarının proje alanına mesafesi

Tablo 4.2 Ölçüm noktalarının proje alanına mesafesi

Ölçüm noktalarının proje alanına mesafesi (m)	Yerleşim Yerleri
700	Kuşlu (Yeni Yerleşim) Köyü
1150	Akpınar Köyü

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B.3 Ön Hazırlık

➢ Ölçümde kullanılacak cihaz ve ekipmanlar laboratuardan ayrılmadan önce kontrolleri (şarj durumu, temizliği, bakımı vs.) yapılarak ölçüm ekibine teslim edilir.

➢ Çalışmalara başlamadan önce, tesiste yürütülen iş güvenliği ve işçi sağlığı uygulamaları ile varsa patlayıcı, yanıcı, parlayıcı maddeler hakkında bilgi alınır. Bir kaza anında hemen ulaşabilmek açısından, tesisin varsa iş güvenliği sorumlusunun ismi ve irtibat numaraları tedarik edilir.

➢ Tesis, ölçümler sırasında tam kapasite ile çalışmalıdır. Aksi durumlar, kayıt altına alınarak raporda belirtilir.

➢ Deneyler sırasında çevresel faktörlerde gözlenerek, ölçüm sonuçları üzerinde etkisi olabilecek durumlarda kayıt altına alınır. Ölçüme etkisi olabilecek alanlar içerisinde, her türlü insan ve makine faaliyetlerine engel olunur.

➢ Ölçüm öncesi, daha önceden belirlenen ölçüm yapılacak noktalar gezilerek, ölçüm noktalarının hazır ve uygun olup olmadığı ve emisyon kaynakları kontrol edilir.

B.4 Ölçüme Başlama

Ölçümü yapacak olan görevli personelimiz, daha önceden belirlemiş oldukları ölçüm yapacakları noktaları gezerek, ölçüm noktalarının uygunluğunu kontrol eder.

B.5 Ölçüm İşlemi

Ölçüm öncesi bütün şartların hazır olduğundan emin olunduktan sonra ölçüm için görevli personelimiz ölçüme başlar.

B.6 Hesaplamalar:

PM10 Hesaplaması:

C (mg/Nm^3) : Normal şartlarda (0 ^{0}C ve 1 atm) kütle konsantrasyonu
V : Birim zamanda çekilen volüme (m^3)
M: filtre üzerinde biriktirilen toz ağırlığı (mg)

$$\boxed{C\ mg/Nm^3 = M\ (mg)\ /\ V\ (m^3)}$$

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C. ÖLÇÜM SONUÇLARI

C.1 Ölçüm Sonuçları ve Kütlesel Debi Hesaplanması:

Encon Çevre Danışmanlık Ltd. Şti. 'nin talebi üzerine Muş İlinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde Kuşluk (Yeni Yerleşim) ve Akpınar Köylerinde; anında partikül madde izleme cihazı ile havada asılı partikül madde (PM 10) mertebesinin tayini için; Micro PNS-LVS1 PM 10 Örnekleme Cihazı ile toplam 2(iki) noktadan ölçüm yapılmıştır.

Gerçekleştirilen ölçüm sonuçları aşağıda **Tablo C.1:** 'de verilmiştir.

Değerler mg/Nm^3 olarak verilmiştir.

Tablo C.1: Ölçüm Sonuçları

Sıra no	Ölçüm yeri	Ölçüm Sonucu (mg/Nm^3)
1	Kuşluk (Yeni Yerleşim) Köyü	0,0893
2	Akpınar Köyü	0,1232

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D. ÖLÇÜMÜ YAPAN VE RAPORU HAZIRLAYANLARIN İMZALADIĞI ONAY SAYFASI

Ölçümü Yapanlar	Unvanı	İletişim Bilgileri	İmza
H. Mehmet YİĞİT	Çevre Mühendisi (Ölçüm Sorumlusu)	0312 211 16 80 / 22	
Filiz ÜLGER	Çevre Mühendisi (Rapor Sorumlusu)	0312 211 16 80 / 23	
H. Mehmet YİĞİT	Çevre Mühendisi (Laboratuvar Müdürü)	0312 211 16 80 / 22	

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RAPOR EKLERİ

encon

Encon Çevre Danışmanlık Ltd. Şti
(Alpaslan II Barajı ve HES Projesi)

Alpaslan Barajı Merkez ve Varto İlçeleri MUŞ

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Gazi Mah. Silahtar Cad. 134 /1
Yenimahalle / ANKARA

— 2011 —

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EKLER

EK-1 ÖLÇÜMÜ YAPAN KURULUŞUN YETERLİK BELGESİ

EK-2 CİHAZ KALİBRASYON BELGELERİ

EK-3 ÖLÇÜM FOTOĞRAFLARI

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Çevre Yönetimi Genel Müdürlüğü

ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ

Belge No : Y-06/164/2011

Kapsam : Emisyon, İmisyon, Gürültü, Çevresel Titreşim

Düzenleme Tarihi : 30.03.2011

Laboratuvar Adı : ÇANKAYA ÇEVRE ÖLÇÜM İŞ SAĞLIĞI VE İŞ GÜVENLİĞİ MÜH. MÜŞ. EĞİT. VE SAĞLIK HİZM.MATBAACILIK YAYINCILIK VE TURİZM TİC.LTD.ŞTİ.

Adres : Gazi Mahallesi Silahtar Cad. No:134 / 1 Yenimahalle/ANKARA

4856 Sayılı Çevre ve Orman Bakanlığı Kuruluş ve Görevleri Hakkında Kanun gereği yukarıda açık adı ve adresi belirtilen kuruluş/kurum Ek Liste'de belirtilen kapsamda 5 Eylül 2008 tarih ve 26988 sayılı R.G.'de yayımlanan Çevre Ölçüm ve Analiz Laboratuvarları Yeterlik Yönetmeliği'ne göre ölçüm ve/veya analiz yapmaya ve bu çerçevede rapor hazırlamaya yetkilidir.

BELGENİN

BAŞLANGIÇ TARİHİ : 30/03/2011

BİTİŞ TARİHİ : 30/03/2015

EK: PARAMETRE LİSTESİ (3 sayfa)

Prof.Dr.Cumali KINACI
Bakan a.
Genel Müdür

Revizyon Tarihi/No: --/--
Yenileme Tarihi/No: --/--

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ
EK LİSTE-3/3

Belge No	:	Y-06/164/2011
Düzenleme tarihi	:	30.03.2011
Ek Liste		
Başlangıç tarihi	:	30.03.2011
Bitiş tarihi	:	30.03.2015
Revizyon Tarihi/No		-/-
Laboratuvar Adı	:	Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğit. Ve Sağlık Hizm.Matbaacılık Yayıncılık ve Turizm Tic.Ltd.Şti.

ÖLÇÜM VE /VEYA ANALİZ İLE İLGİLİ;

Kapsam	Parametre	Metot adı	Metot Numarası
Gürültü Ölçümleri(1)	Çevresel Gürültü	• Çevre Gürültüsünün Tarifi, Ölçülmesi ve Değerlendirilmesi - Bölüm 1: Temel Büyüklükler ve Değerlendirme İşlemleri	• TS 9315 ISO 1996 - 1: 2005
		• Çevre Gürültüsünün Tarifi, Ölçülmesi ve Değerlendirilmesi - Bölüm 2: Çevre Gürültü Seviyelerinin Tayini	• TS ISO 1996 - 2: 2009
		• Akustik Sesin Dışarıda Yayılırken Azalması-Bölüm 2 : Genel Hesaplama Yöntemi	• TS ISO 9613-2:2006
		• Akustik- Ses Basıncı Mühendislik Yöntemi Kullanarak Yansıtıcı Bir Düzlem Üzerindeki Tamamen Açık Bir Alanda ses Gücü Düzeylerinin Belirlenmesi	• TS EN ISO 3746: 2010
		• Çoklu Gürültü Kaynağına Sahip Sanayi Tesislerinde Çevredeki Ses Basınç Seviyelerinin Değerlendirilmesi İçin Ses Güç Seviyelerinin Tayini -Mühendislik Metodu	• TS ISO 8297: 2006
		• Gürültü Kaynaklarının Ses Gücü Seviyelerinin Ses Basıncı Kullanılarak Tayini Bir Yansıtma Düzlemi Boyunca, Esas Olarak Serbest Bir Alan İçinde Uygulanan Mühendislik Metodu	• TS EN ISO 3744: 2010
Çevresel Titreşim Ölçümleri(1)	Çevresel Titreşim	• El tipi titreşim seviyesi ölçme cihazı ile titreşim hızının ölçülmesi	• TS 10354: 1992

Prof.Dr. Cumali KINACI
Bakan a.
Genel Müdür

(1) 04.06.2010 R.G.No: 27601 "Çevresel Gürültünün Değerlendirilmesi ve Yönetimi Yönetmeliği" kapsamında

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizi. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ
EK LİSTE-2/3

Belge No : Y-06/164/2011
Düzenleme tarihi : 30.03.2011
Ek Liste
Başlangıç tarihi : 30.03.2011
Bitiş tarihi : 30.03.2015
Revizyon Tarihi/No : -/-
Laboratuvar Adı : Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğit. Ve Sağlık Hizm.Matbaacılık Yayıncılık ve Turizm Tic.Ltd.Şti.

ÖLÇÜM VE /VEYA ANALİZ İLE İLGİLİ;

Kapsam	Parametre	Metot adı	Metot Numarası
Emisyon Ölçümleri (1)	O_2 Tayini	• Elektrokimyasal Hücre Metodu	• TS ISO 12039:2005
	İslilik	• Renk Karşılaştırılması (Bacharach Skalası)	• TS 9503: 1991
	Hız ve Debi Tayini	• Pitot Tüpü Metodu	• TS ISO 10780:1998
	Nem Tayini	• Gravimetrik Metot	• EPA Metot 4: 2000
İmisyon Ölçümleri (2)	(2) Partikül Madde (PM10)	• Gravimetrik Metot	• TS EN 12341: 2002
	Çöken Toz Tayini	• Gravimetrik Metot	• TS 2341: 1976
	Uçucu Organik Bileşikler Numune Alma	• Adsorblama Yöntemi ile Numune Alma	• TS EN 13649: 2003

Prof.Dr. Cumali KINACI
Bakan a.
Genel Müdür

(1) 03.07.2009 R.G. No. 27277 "Sanayi Kaynaklı Hava Kirliliğinin Kontrolü Yönetmeliği" kapsamında
(2) (1)03.07.2009 R.G. No. 27277 "Sanayi Kaynaklı Hava Kirliliğinin Kontrolü Yönetmeliği" Ek 2-ş kriteri

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ
EK LİSTE-1/3

Belge No : Y-06/164/2011
Düzenleme tarihi : 30.03.2011
Ek Liste
Başlangıç tarihi : 30.03.2011
Bitiş tarihi : 30.03.2015
Revizyon Tarihi/No : yoktur
Laboratuvar Adı : Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğit. Ve Sağlık Hizm.Matbaacılık Yayıncılık ve Turizm Tic.Ltd.Şti.

ÖLÇÜM VE /VEYA ANALİZ İLE İLGİLİ;

Kapsam	Parametre	Metot adı	Metot Numarası
Emisyon Ölçümleri[1]	CO Tayini	• Elektrokimyasal Hücre Metodu	• TS ISO 12039:2005
	CO_2 Tayini	• Elektrokimyasal Hücre Metodu, • Hesaplama	• TS ISO 12039:2005
	SO_2 Tayini	• Elektrokimyasal Hücre Metodu	• TS ISO 7935: 1999
	Partikül Madde	• Gravimetrik Metot	• TS ISO 9096:2004 (20 mg/m3 üstündeki toz konsantrasyonları için uygun) • TS EN 13284-1 (0-50 mg/m3 arasındaki toz konsantrasyonları için uygun) • EPA Metot 17: 2000
	NO NO_x, NO_2 Tayini	• Elektrokimyasal Hücre Metodu • Elektrokimyasal Hücre Metodu (Hesaplama)	• EPA CTM -022: 1998

Prof.Dr. Cumali KINACI
Bakan a.
Genel Müdür

(1) 03.07.2009 R.G. No: 27277 "Sanayi Kaynaklı Hava Kirliliğinin Kontrolü Yönetmeliği" Kapsamında

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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TÜRKAK

TÜRK AKREDİTASYON KURUMU

AKREDİTASYON SERTİFİKASI

Deney Laboratuvarı olarak faaliyet gösteren,

ÇANKAYA ÇEVRE ÖLÇÜM
İş Sağ. Ve İş Güv. Müh. Müş. Eğt. Ve Sağ. Hizm. Mat. Yay. Tur.
Gazi Mahallesi Silahtar Caddesi No:134/1 Yenimahalle
06170 ANKARA / TÜRKİYE

TÜRKAK tarafından yapılan denetim sonucunda TS EN ISO/IEC 17025:2005 Standardına göre Ek'te yer alan kapsamlarda akredite edilmiştir.

Akreditasyon No : AB-0286-T

Akreditasyon Tarihi : 26-Ocak-2010

Revizyon Tarihi / No : 10-Şubat-2011 / 01

Bu Sertifika, yukarıda açık adı ve adresi yazılı Kuruluşun TS EN ISO/IEC 17025:2005 Standardına, ilgili Yönetmelik ve Tebliğlere uygunluğunu sürdürmesi halinde 25-Ocak-2014, tarihine kadar geçerlidir.

TÜRK AKREDİTASYON KURUMU
TÜRKAK
1999

Ali BOĞA
Yönetim Kurulu Başkanı

Atakan BAŞTÜRK
Genel Sekreter

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizm. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen değil kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sınırındaki çevre koşullarıyla ilgilidir.

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Akreditasyon Sertifikası Eki (Sayfa 1/2)

Akreditasyon Kapsamı

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İş Sağ. Ve İş Güv. Müh. Müş. Eğt. Ve Sağ. Hizm. Mat. Yay. Tur. Tic. Ltd. Şti.

Akreditasyon No: AB-0286-T
Revizyon No: 01 Tarih: 10-Şubat-2011

TÜRKAK
Test
TS EN ISO/IEC 17025
AB-0286-T

Deney Laboratuvarının

Adres : Gazi Mahallesi Silahtar Caddesi No:134/1 Yenimahalle 06170 ANKARA / TÜRKİYE

Tel : 0 312 211 16 80
Faks : 0 312 211 16 83
E-Posta : cevre@cankayasaglik.com.tr
Website : www.cankayasaglik.com.tr/cevre

Deneyi Yapılan Malzemeler / Ürünler	**Deney Adı**	**Deney Metodu (Ulusal, Uluslararası standardlar, işletme içi metodları)**
BACA GAZI	SO2 Tayini	TS ISO 7935:1999
	NO, NO2 ve NOx Tayini	EPA-CTM 022:1998
	CO, O2 ve CO2 (Hesaplama) Tayini	TS ISO 12039:2003
	Islılık Tayini	TS 9583:1991
	Hız Tayini	TS ISO 10780:1999
	İzokinetik Numune Alma ve Partikül Madde Tayini	TS ISO 9096:2004 EPA Metot 17:2000 TS EN 13284-1:2003
	Nem Tayini	EPA Metot 4:2000
ÇEVRE HAVASI	Partikül Madde Tayini (PM10)	TS EN 12341:2002
	Çöken Toz Tayini	TS 2341:1976
İŞ YERİ ORTAMI	İşyeri Ortam Havasında Kimyasal Madde Ölçümü	TS EN 1231:2000
	Aydınlatma Düzeyi Ölçümü	ISO/CIE 8995:2002
	İş Yeri Ortam Havasında Toz ve Kişisel Toz Maruziyeti Ölçümü	TS 2361:1976
TİTREŞİM	Kişisel Titreşim Maruziyeti Ölçümü (El-Kol- Tüm Vücut)	TS 2374:1975 TS 2735:1977 TS ENV 5349-1:2005
	Çevresel Titreşim (Madencilik - Hava Şoku ve Yer Titreşimi Ölçümü)	TS 10354: 1992
GÜRÜLTÜ	Kişisel Gürültü Ölçümü	TS 2673: 1977 TS 2607 ISO 1999: 2005
	İş Ortam Gürültü Ölçümü	TS 2673: 1977

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
ÇANKAYA

ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11

Akreditasyon Sertifikası Eki (Sayfa 2/2)
Akreditasyon Kapsamı

TÜRKAK

ÇANKAYA ÇEVRE ÖLÇÜM
İş Sağ. Ve İş Güv. Müh. Müş. Eğt. Ve Sağ. Hizm. Mat. Yay. Tur. Tic. Ltd. Şti.

Akreditasyon No: AB-0286-T
Revizyon No: 01 Tarih: 10-Şubat-2011

Deneyi Yapılan Malzemeler / Ürünler	Deney Adı	Deney Metodu (Ulusal, Uluslararası standardlar, işletme içi metodlar)
(GÜRÜLTÜ Devam)	Çevresel ve Akustik Gürültü Ölçümü	TS 9315 ISO 1996-1 2005 TS ISO 1996-2 2009 TS ISO 8297 2008 TS ISO 9613-2 2008 TS EN ISO 3744 2010 TS 8988 EN ISO 3746 2010

KAPSAM SONU

Ali BOĞA
Yönetim Kurulu Başkanı

TÜRK AKREDİTASYON KURUMU
TÜRKAK
1999

Alakan BAŞTÜRK
Genel Sekreter

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadığı kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
ÇANKAYA

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ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11

EK-2 CİHAZ KALİBRASYON BELGELERİ

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
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TÜRKAK
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PROTOS KALİBRASYON ÖLÇÜM EĞİTİM VE DANIŞMANLIK HİZMETLERİ TİCARET LTD. ŞTİ.
KALİBRASYON LABORATUVARI

AB-0078-K
39/2011
01-11

Kalibrasyon Sertifikası
Calibration Certificate

Cihazın Sahibi/ adresi Customer / address	: Cankaya Cevre Ölçüm İş Sağlığı Ve İş Güvenliği Müh. Müş. Eğitim Ve Sağlık Hiz. Mat. Yay. Tur. Tic. Ltd. Şti. Gazi Mah. Silahtar Cad. 134/1 Yenimahalle/ANKARA
Talep Numarası Order Number	: 21/2011
Makine/Cihaz Instrument/Device	: Toz Örnekleme Cihazı
İmalatçı Manufacturer	: MCZ
Tip Type	: PNS LVS-I
Seri Numarası Serial Number	: 0607-079
Kalibrasyon Tarihi Date of Calibration	: 27.01.2011
Sertifikanın Sayfa Sayısı Number of pages of the Certificate	: 3

Bu kalibrasyon sertifikası, Uluslararası Birimler Sisteminde (SI) tanımlanmış birimleri realize eden ulusal ölçüm standardlarına izlenebilirliği belgeler.
This calibration certificate documents the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).

Türk Akreditasyon Kurumu (TÜRKAK) kalibrasyon sertifikalarının tanınması konusunda Avrupa Akreditasyon Birliği (EA) ve Uluslararası Laboratuvar Akreditasyon Birliği (ILAC) ile karşılıklı tanınma antlaşmasını imzalamıştır.
The Turkish Accreditation Agency (TURKAK) is signatory to the multilateral agreements of the European co-operation for the Accreditation (EA) and of the International Laboratory Accreditation (ILAC) for the Mutual recognition of calibration certificates.

Ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri ve kalibrasyon metodları bu sertifikanın tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.
The measurements, the uncertainties with confidence probability and calibration methods are given on the following pages which are part of this certificate.

Mühür *Seal*	Tarih *Date*	Kalibrasyonu Yapan *Calibrated by*	Laboratuvar Müdürü V. *Head of Calibration Laboratory*
	27.01.2011	Onur YILDIRIM	Murat KUŞLU

Bu sertifika, laboratuvarın yazılı izni olmadan kısmen kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz sertifikalar geçersizdir.
This certificate shall not be reproduced other than in full except with the permission of the laboratory. Calibration certificates without signature and seal are not valid.

Sayfa 1/3

FR.510.02

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
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ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11

TÜRKAK
TÜRK AKREDİTASYON KURUMU

UZMANLAR METROLOJİ SERVİSİ
ANKARA KALİBRASYON LABORATUVARI

KALİBRASYON SERTİFİKASI
Calibration Certificate

AB-0012-K
E10T20211
11.10

Cihazın Sahibi Customer	ÇANKAYA Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh.Müş.Eğ.ve Sağ.Hizm.Tic.ltd.şti. GAZİ MAH. SİLAHTAR CAD. NO:134/1 Yenimahalle/ANKARA
İstek Numarası Order No.	TA 2991 F01
Makine/Cihaz Instrument/Device	A.Terazi
İmalatçı Manufacturer	AND
Tip Type	GR-200 / Dijital göstergeli
Seri Numarası Serial Number	- / 14220846
Kalibrasyon Tarihi Date Of Calibration	22.11.2010
Sertifikanın Sayfa Sayısı Number of pages of the Certificate	3

22.11.2010 — Gola CAN — İlkmet TERZİ

KALİBRASYON UMS

Nº 016101

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hiz. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

ÇANKAYA ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

Sayfa 25 / 30
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ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11

TÜRKAK
TÜRK AKREDİTASYON KURUMU

UMS
UZMANLAR METROLOJİ SERVİSİ
ANKARA KALİBRASYON LABORATUVARI

AB-0012-K
M10S22594
12.10

KALİBRASYON SERTİFİKASI
Calibration Certificate

Cihazın Sahibi Customer	ÇANKAYA ÇEVRE ÖLÇÜM İŞ SAĞLIĞI VE İŞ GÜVENLİĞİ MÜH.MÜŞ.EĞ.VE SAĞ.HİZM.TİC.LTD.ŞTİ. Gazi Mah. Silahtar Cad.No:134/1 Yenimahalle / ANKARA
İstek Numarası Order No.	1A 3325-L01
Makina/Cihaz Instrument/Device	TERMO - HYGROMETRE
İmalatçı Manufacturer	TFA
Tip Type	Data Logger / Dijital
Seri Numarası Serial Number	4233L01
Kalibrasyon Tarihi Date of Calibration	17.12.2010
Sertifikanın Sayfa Sayısı Number of pages of the Certificate	3

20.12.2010

Gamze YILDIRIM

Hikmet TERZİ

No 018840

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup; Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizm. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

ÇANKAYA ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

Sayfa 26 / 30
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ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11

TÜRKAK
TÜRK AKREDİTASYON KURUMU
TURKISH ACCREDITATION AGENCY

UMS
UZMANLAR METROLOJİ SERVİSİ
ANKARA KALİBRASYON LABORATUVARI

AB-0012-K

KALİBRASYON SERTİFİKASI
Calibration Certificate

Bu rapor , Muş İlinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

ÇANKAYA

Sayfa 27 / 30
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ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11

TÜRKAK
TÜRK AKREDİTASYON KURUMU

UMS
UZMANLAR METROLOJİ SERVİSİ
ANKARA KALİBRASYON LABORATUVARI

TÜRKAK

B10K22764
12.2010

KALİBRASYON SERTİFİKASI
Calibration Certificate

Cihazın Sahibi Customer	ÇANKAYA ÇEVRE ÖLÇÜM İŞ SAĞLIĞI VE İŞ GÜVENLİĞİ MÜH MÜŞ EĞ VE SAĞ HİZM TİC LTD ŞTİ Gazi Mah. Silahtar Cad. No.134/1 Yenimahalle / ANKARA
İsrek Numarası Order No.	TA. 3329 - L02
Makine/Cihaz Instrument/Device	Kütle / 1 Adet
İmalatçı Manufacturer	Kern
Tip Type	E2
Seri Numarası Serial Number	G08 11221
Kalibrasyon Tarihi Date of Calibration	13.12.2010
Sertifikanın Sayfa Sayısı Number of pages of the Certificate	3

KALİBRASYON UMS MERKEZİ

13.12.2010

Ahmet DEVECİ

Hamdi TEKZİ

Nº 118209

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hiz. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA

ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

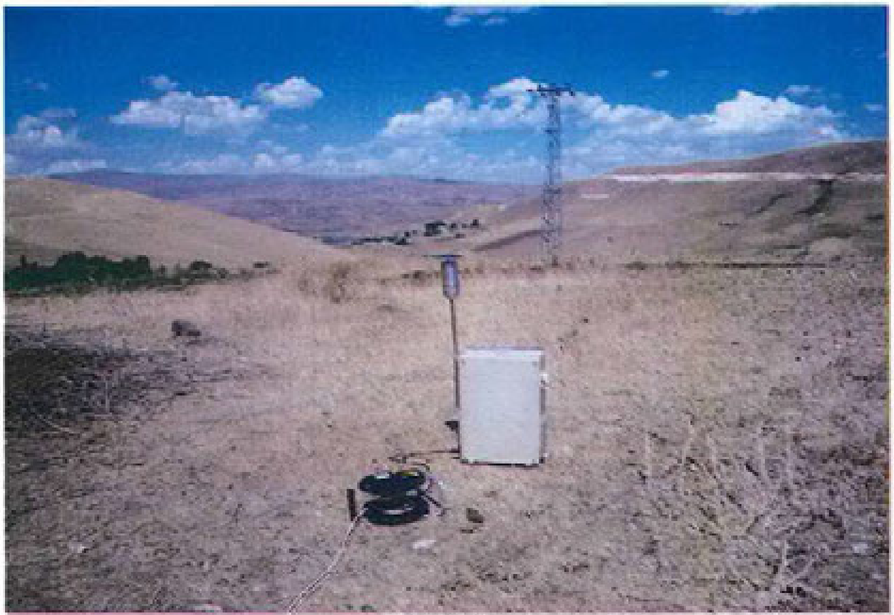
AB-0286-T
R-2011-042-00
09-11

EK-3 ÖLÇÜM FOTOĞRAFLARI

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
ÇANKAYA

ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11



Akpınar Köyü

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
ÇANKAYA

ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

AB-0286-T
R-2011-042-00
09-11

Kuşluk (Yeni Yerleşim) Köyü

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

APP 15

WATER ANALYSIS REPORT

Results of Water Analysis

encon

LABORATUVAR SONUÇ RAPORU FORMU

TÜRKAK Test TS EN ISO/IEC 17025 AB-0168-T

T.C. Çevre ve Orman Bakanlığı

Tarih:01.09.2010
Rapor No: LR10.079

LABORATUVAR BİLGİLERİ	
LABORATUVAR ADI	ENCON ÇEVRE VE DANIŞMANLIK LTD. ŞTİ
LABORATUVAR ADRESİ	Reşit Galip Cad. 120 GOP/ANKARA
MÜŞTERİ BİLGİLERİ	
MÜŞTERİ ADI	ENCON ÇEVRE VE DANIŞMANLIK LTD. ŞTİ
MÜŞTERİ ADRESİ	Reşit Galip Cad. 120 GOP/ANKARA

NUMUNE BİLGİLERİ			
NUMUNE ALINAN YER	: Muş	PROJE ADI	: Alparslan II
NUMUNE ALINMA TARİHİ	: 30.07.2010	NUMUNE ALMA YÖNTEMİ/TALİMATI	: Anlık
NUMUNE ALIMINDA ÇEVRE ŞARTLARI	: -	NUMUNE TÜRÜ	: Nehir Suyu
NUMUNE KABUL TARİHİ	: 02.08.2010		
İSTENİLEN ÖLÇÜMLER	: AKM, BOİ, Çözünmüş Oksijen, KOİ, pH, Toplam Azot, Toplam Fosfor, Toplam Koliform	DENEY TARİHİ	: 02-06.08.2010
DENEYDE UYGULANACAK STANDARD VE KAYNAKLAR	1. Gravimetrik metot ile AKM tayini (SM 2540) 2. Titrimetrik metot ile BOD ve KOİ analizi (SM 5210 B, SM 5220 B) 3. Spektrofotometrik metot ile nitrat, nitrit tayini (EPA 352.1, SM 4500-NO_2- B) 4. Suda Makro-Kjeldahl metodu ile toplam kjeldahl azotu analizi (SM 4500- Norg B) 5. Spektrofotometrik metot ile toplam fosfor analizi (SM 4500 P E) 6. Membran filtrasyonu ile mikrobiyolojik analizler (SM 9222 B)		
DENEY METOTLARININ ÖLÇÜ BİRİMLERİ	mg/L, sayı/100 mL		

DENEYDE KULLANILACAK CİHAZLAR VE CİHAZ BİLGİLERİ	CİHAZ ADI	CİHAZ MARKASI / KODU
	KOİ Cihazı	Şimşek
	Spektrofotometre	T60 S
	Vakum Pompası	Millipore
	Kjeldahl Cihazı	Şimşek
	Mikrobiyolojik Kabin	Esco

DENEYDE KULLANILACAK MALZEME	Çeşitli Cam Malzemeler
DENEYİN YAPILDIĞI ORTAM VE ÇEVRE ŞARTLARI	Sıcaklık: 26.3 °C, Nem: % 45.5
DENEYİ YAPAN PERSONELİN ADI / SOYADI	Dr. Pınar ÇEKİRDEK
LABORATUVAR MÜDÜRÜ AD / SOYAD KAŞE / İMZA	Hüseyin TEKİN

encon Çevre Danışmanlık Ltd. Şti. Reşit Galip Caddesi No:120 06700 Ankara Tel: 312 447 71 22 - Fax: 312 447 69 88 SEĞMENLER V.D. 334 006 3189

NOTLAR: 1- Laboratuvar Sonuç Raporlarını dijital ortamda yazınız.
2- Laboratuvar Sonuç Raporu ENCON Laboratuvarının yazılı izni olmadan çoğaltılamaz.
3- İmzasız ve kaşesiz raporlar geçersizdir.
4- Sonuçlar deneyi yapılan numune ile ilgilidir.
5- Su, Mikrobiyolojik, Hava, Toprak deneylerinin sonuçlarını yazmak için doldurulur.

Döküman Adı : LABORATUVAR SONUÇ RAPORU FORMU — Sayfa 1 / 2
Döküman Kodu : ENC – LABFR –RAP– 67 - A
Revizyon : 07 *Tarih :* 19.02.2009

encon

LABORATUVAR SONUÇ RAPORU FORMU

TÜRKAK
TS EN ISO/IEC 17025
AB-0168-T

T.C.
Çevre ve Orman Bakanlığı

Tarih:01.09.2010
Rapor No: LR10.079

ANALİZ SONUÇLARI VE AÇIKLAMALAR				
ÖLÇÜM SONUÇLARI				
	Numune Kodları			
*Parametre	Birim	Num10.0167 (Sample 1)	Num10.0168 (Sample 2)	Num10.0169 (Sample 3)
Askıda Katı Madde	mg/L	10	45	<5.172
Biyokimyasal oksijen ihtiyacı	mg/L	<4.894	14.05	13.55
Çözünmüş oksijen	mg/L	7.4	7.2	6.8
Kimyasal oksijen ihtiyacı	mg/L	6.80	29.60	23.20
pH	-	7.98	8.11	8.37
Nitrat	mg/L	<1.473	<1.473	<1.473
Nitrit	mg/L	<0.030	<0.030	<0.030
Toplam kjeldahl azotu	mg/L	0.538	0.762	0.493
Toplam azot	mg/L	0.538	0.762	0.493
Toplam fosfor	mg/L	<0.090	<0.090	<0.090
Toplam koliform	Sayı/100 ml	>500	>500	>500

*Tüm parametreler Çevre ve Orman Bakanlığı ve TÜRKAK kapsamı içerisinde gerçekleştirilmiştir.

P.Ç.

NOTLAR: 1- Laboratuvar Sonuç Raporlarını dijital ortamda yazınız.
2- Laboratuvar Sonuç Raporu ENCON Laboratuvarının yazılı izni olmadan çoğaltılamaz.
3- İmzasız ve kaşesiz raporlar geçersizdir.
4- Sonuçlar deneyi yapılan numune ile ilgilidir.
5- Su, Mikrobiyolojik, Hava, Toprak deneylerinin sonuçlarını yazmak için doldurulur.

Döküman Adı : LABORATUVAR SONUÇ RAPORU FORMU
Döküman Kodu : ENC – LABFR –RAP– 67 - A
Revizyon : 07 *Tarih :* 19.02.2009

Sayfa 2 / 2

APP 16

ACOUSTICS REPORT

Results of Acoustics Measurements

T.C.
Çevre ve Orman Bakanlığı

Yeterlik Belge No
Y-06/164/2011

TÜRKAK
TÜRK AKREDİTASYON KURUMU
TURKISH ACCREDITAION AGENCY
Tarafından akredite edilmiş

TÜRKAK
Test
TS EN ISO/IEC 17025
AB-0286-T

AB-0286-T
R-2011-041-02
09-11

ÇANKAYA
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
Gazi Mah. Silahtar Cad. No:134/1
Yenimahalle / ANKARA

Deney Raporu
Test Report

Müşterinin adı/adresi Customer name/address	**: Encon Çevre Danışmanlık Ltd. Şti. (Alpaslan II Barajı ve HES Projesi)**
Teklif Numarası Offer No.	**: T-2011-470-00-01**
Numunenin adı ve tarifi Name and identity of test item	**: Planlanan Faaliyet İçin Akustik Rapor**
Numunenin kabul tarihi The date of receipt of Offer	**: —**
Açıklamalar Remarks	**: 3 Nüsha**
Ölçümün yapıldığı tarih Date of measurement	**:25.26.08.2011**
Raporun Sayfa Sayısı Number of pages of The Report	**: Ekler dahil 55 Sayfa.**

Deney ve /veya ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri (olması halinde) ve deney metodları bu sertifikanın tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.

The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages which are part of this report.

MÜHÜR	TARİH	RAPOR SORUMLUSU	ÖLÇÜM SORUMLUSU	LABORATUVAR MÜDÜRÜ
ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA	26.12.2011	Eliz ÜLGER	H.Mehmet YİĞİT	H.Mehmet YİĞİT

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RAPORU HAZIRLANAN KURUM / KURULUŞ BİLGİLERİ

Adı	**: Encon Çevre Danışmanlık Ltd. Şti.**
Adresi	**: Reşit Galip Caddesi 120 Gaziosmanpaşa Ankara**
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Ölçümün Yapıldığı Tarih	: 25-26.08.2011
Rapor Tarihi	: 26.12.2011
Rapor Numarası	: R-2011-041-02
Rapor Sayfa Sayısı	: 55
Rapor Ekleri Sayısı	: 5
Rapor Nüsha Sayısı	: 3

RAPORU HAZIRLAYAN KURULUŞ BİLGİLERİ

Adı	: ÇANKAYA Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt.Mat.Yay.Turz.Tic. Ltd.Şti.
Adresi	: Gazi Mah. Silahtar Cad.No:134/1 Yenimahalle / ANKARA
Telefonu /Faksı	: (0312) 211 16 80-81-82 / (0312) 211 16 83
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Vergi Dairesi /Numarası	: MALTEPE / 229 038 6895

YAPILMASI PLANLANAN FAALİYETLER İÇİN AKUSTİK RAPOR

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
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İÇİNDEKİLER:

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA

TABLOLAR

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ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA

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GİRİŞ

Bu rapor Encon Çevre Danışmanlık Ltd. Şti'nin Çevresel Etki Değerlendirme Yönetmeliği kapsamında yaptığı çalışmalarda kullanılmak üzere Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için hazırlanmıştır.

A.GENEL BİLGİLER

1. Tesis/işletmenin ticari unvanı

Alpaslan II Enerji Üretim ve Mad. San. Tic. A.ş.

2. Tesis/işletmenin adresi

Alpaslan II Enerji Üretim Ve Mad. San. Tic. A.Ş.'nin merkez adresi Ceyhun Atıf Kansu Cad. Başkent Plaza No: 106 Kat: 8 Balgat / Ankara'dır. Alpaslan II Enerji Üretim Ve Mad. San. Tic. A.Ş. tarafından yapılması planlanan Alpaslan II Barajı, Fırat Nehri Havzası'nın alt havzası olan Murat Nehri üzerinde kurulacaktır.

3. Tesis/işletmenin üretimi/hizmet konusu

Alpaslan II Enerji Üretim ve Mad. San. Tic. A.Ş. tarafından gerçekleştirilmesi planlanan baraj ve HES projesiyle, enerji üretilmesi planlanmaktadır. Aynı zamanda Muş Ovası'nın sulanması da sağlanacaktır.

4. Tesis/işletmenin Çevre Kanununca Alınması Gereken İzin Ve Lisanslar Hakkında Yönetmeliğindeki yeri

Yapılacak olan Alpaslan II Barajı ve HES Projesi Çevre Kanununca Alınması Gereken İzin Ve Lisanslar Hakkında Yönetmeliğin Ek-1 ve Ek-2'sinde yer almamaktadır.

5. İşletmenin bulunduğu alanın imar/uygulama planları dikkate alınarak belirlenmesi (Çevresel Gürültünün Değerlendirilmesi Ve Yönetimi Yönetmeliği göre)

Proje alanı çevresinde gürültüye hassas (konut) kullanımlar,dağ, mera, tarım alanları,boş alanlar bulunmaktadır.

6. Tesise en yakın yapının mesafesi (m olarak)

Alpaslan II Barajı ve HES'in İnşaat aşamasında kullanılacak olan alanların en yakın yerleşim yerlerine mesafeleri Tablo 1'de verilmiştir.

Tesisler	Mesafe (m)	En yakın yerleşim yeri
K-1 Kaya Malzeme Ocağı	770	Doğdap Mah.
K-2 Kaya Malzeme Ocağı	1470	Doğdap mah.
K-3A Kaya Malzeme Ocağı	700	Kuşluk Köyü
K-5 Kaya Malzeme Ocağı	520	Kayalıdere Köyü
K-6A Kaya Malzeme Ocağı	1260	Dumlusu Köyü
K-6B Kaya Malzeme Ocağı	1260	Dumlusu Köyü
A Geçirimsiz Malzeme Sahası	620	Dumlusu Köyü
B Geçirimsiz Malzeme Sahası	1860	Akpınar Köyü
C Geçirimsiz Malzeme Sahası	1900	Akkonak Köyü
D Geçirimsiz Malzeme Sahası	2390	Akkonak Köyü
E Geçirimli Malzeme Sahası	1150	Kayalıdere Köyü
F Geçirimli Malzeme Sahası	1980	Kayalıdere Köyü
G Geçirimli Malzeme Sahası	2860	Kayalıdere Köyü

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Beton Santrali-1	1650	Akpınar Köyü
Beton Santrali -2	1560	Akpınar Köyü
Beton Santrali -3	1150	Akpınar Köyü
Kırma-Eleme-Yıkama Tesisi	2025	Akkonak Köyü
Baraj gövdesi	1100	Akpınar Köyü

Tablo 1. Tesislerin yerleşim yerlerine olan mesafesi

7. Tesis/işletmenin kurulacağı alanın özellikleri (arazi yapısı, hakim rüzgar yönü, bağıl nem)

Proje alanı kırsal kesimde, yer yer düz, yer yer dağlık, mera, tarım alanları, boş alanlar ve dağınık yerleşim şeklinde köylerin bulunduğu bir alandır.Proje alanına en yakın meteoroloji istasyonu Hürriyet Mah.Çaylar Cad.No:40'da bulunan Varto Meteoroloji İstasyonudur. Aşağıda verilen tüm meteorolojik veriler, projenin yapılacağı bölgenin meteorolojik özelliklerini en iyi karakterize edeceği düşünülen Varto Meteoroloji İstasyonunun verileridir.

Ortalama sıcaklık	7,6 ^{0}C
Hakim rüzgar yönü	Güneybatı (SW)
Ortalama rüzgar hızı	1,3 m/sn
Ortalama nem	% 63

Tablo 2. Meteorolojik veriler

8. Tesis/işletmenin kullanım sahası (m^2 veya km^2 olarak)

Toplam proje alanı 54,69 km^2'dir.

B. İNŞAAT AŞAMASI İÇİN GÜRÜLTÜ/TİTREŞİM DÜZEYLERİNE İLİŞKİN BİLGİLER

1. İnşaat faaliyetinin gerçekleştirileceği alan (yeri ve büyüklüğü; m^2 veya km^2 olarak), inşaat süresi (ay ve/veya yıl olarak) ve çalışma zaman dilimleri (gündüz ve/veya aksam ve/veya gece)

Alpaslan II Barajının, Fırat Nehri Havzası'nın alt havzası olan Murat Nehri üzerinde, 1265 talveg kotunda ve Muş kent merkezine 34 km. uzaklıkta olması planlanmıştır. Aşağıda verilen alanlardan elde edilen cevher bu barajda gövde yapımında dolgu malzemesi olarak kullanılacaktır.

Tesis	Yeri	Alanı (m^2)
K-1 Kaya Malzeme Ocağı	Özenç Köyü Varto /Muş	53.100
K-2 Kaya Malzeme Ocağı	Yedikavak Köyü Varto /Muş	150.300
K-3A Kaya Malzeme Ocağı	Kuşluk Köyü Varto /Muş	135.900
K-5 Kaya Malzeme Ocağı	Kayalıdere Köyü Varto /Muş	257.600
K-6A Kaya Malzeme Ocağı	Dumlusu Köyü Varto /Muş	290.800
K-6B Kaya Malzeme Ocağı	Dumlusu Köyü Varto /Muş	226.100
A Geçirimsiz Malzeme Sahası	Dumlusu Köyü Varto /Muş	1.200.000
B Geçirimsiz Malzeme Sahası	Akpınar Köyü Varto /Muş	175.000
C Geçirimsiz Malzeme Sahası	Akkonak Köyü Varto /Muş	325.000
D Geçirimsiz Malzeme Sahası	Akkonak Köyü Varto /Muş	250.000
E Geçirimli Malzeme Sahası	Kayalıdere Köyü Varto /Muş	400.000
F Geçirimli Malzeme Sahası	Kayalıdere Köyü Varto /Muş	375.000
G Geçirimli Malzeme Sahası	Kayalıdere Köyü Varto /Muş	350.000

Tablo 3. Tesislerin alanları

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Tüm malzeme sahaları ve tesislerde gündüz saatlerinde tek vardiya çalışılması öngörülmüştür. Malzeme sahaları 5 yıl süreyle işletilecektir. Yılda 12 ay çalışılması planlanmakla birlikte bölgede kış mevsiminin ağır geçmesi sebebiyle, hava şartlarına bağlı olarak kış aylarında çalışmayacak zamanlar olacaktır.

2. Kullanılacak makine ve ekipmanların sayısı ve türleri

Ünite	Adet
Wagon Drill	1
Kompresör	1
Ekskavatör	1
Loder	1
Kamyon	4

Tablo 4. K-1, K-2, K-3A, K-5, K-6A, K-6B Kaya Malzeme Ocaklarında kullanılacak ekipmanlar

Ünite	Adet
Ekskavatör	1
Loder	1
Kamyon	4

Tablo 5. A,B,C,D,E,F,G Geçirimli ve Geçirimsiz malzeme sahalarında kullanılacak ekipmanlar

Ünite	Adet
Mikser	1

Tablo 6. Beton Tesislerinde (3 adet) kullanılacak ekipmanlar

Ünite	Adet
Kırıcı	3
Elek	3
Konveyör	2

Tablo 7. Kırma-Eleme-Yıkama Tesisinde (1 adet) kullanılacak ekipmanlar

Ünite	Adet
Dozer	2
Ekskavatör	2
Yükleyici	2
Kamyon	3
Arazöz	1

Tablo 8. Baraj gövde inşaatında (1 adet) kullanılacak ekipmanlar

3. Aynı anda çalışma durumları ve konumları

Bütün ekipmanların aynı anda çalışacağı kabul edilmiştir.

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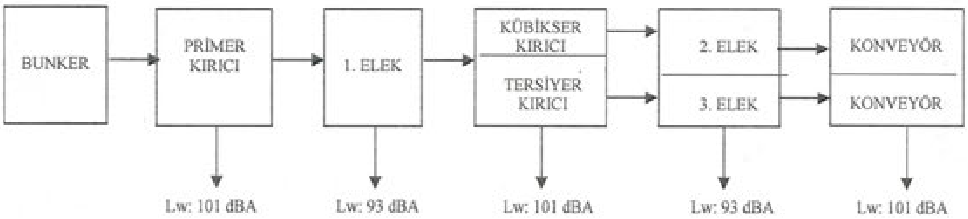
4. Her bir ekipmanın ses gücü düzeyi bilgileri ve bu bilgilerin temin edildiği referans kaynak

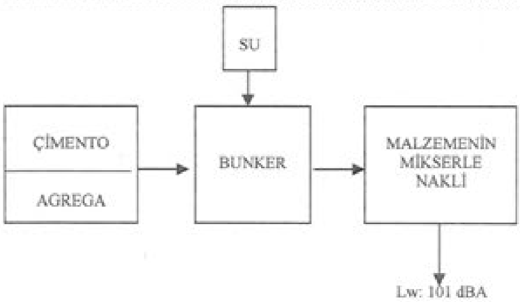
30.12.2006 tarih ve 26392 sayılı Resmi Gazetede yayınlanan "Açık Alanda Kullanılan Teçhizat Tarafından Oluşturulan Çevredeki Gürültü Emisyonu İle İlgili Yönetmelik" hükümleri çerçevesinde makinelerden kaynaklanacak Ses Gücü Seviyeleri ve üretim akım şemaları aşağıda verilmiştir.

Şekil 1. K-1, K-2, K-3A, K-5, K-6A, K-6B Kaya Malzeme Ocakları Üretim Akım Şeması ve Ses Gücü Seviyeleri

Şekil 2. A,B,C,D,E,F,G Geçirimli ve Geçirimsiz Malzeme Sahaları Üretim Akım Şeması ve Ses Gücü Seviyeleri



Şekil 3. Kırma Eleme Yıkama Tesisi Üretim Akım Şeması ve Ses Gücü Seviyeleri



Şekil 4. Beton Tesisleri Üretim Akım Şeması ve Ses Gücü Seviyeleri

Şekil 5. Baraj Gövdesi İnşaatı Akım Şeması ve Ses Gücü Seviyeleri

5. İnşaat faaliyeti sonucu oluşabilecek toplam gürültü düzeyinin hesaplanması, (sesin açık alanda yayılım prensibine göre; mesafe ve atmosferik yutuşun hesaba katılması)

Ortalama ses basınç seviyesi $L_{port} = 10\log \sum 10^{L_{pi}/10}$ dBA

Tesisler	Mesafe (m)	En yakın yerleşim yeri	L_{port}
K-1 Kaya Malzeme Ocağı	770	Doğdap Mah.	113,8
K-2 Kaya Malzeme Ocağı	1470	Doğdap Mah.	
K-3A Kaya Malzeme Ocağı	700	Kuşluk Köyü	110,7
K-6 Kaya Malzeme Ocağı	1260	Dumlusu Köyü	113,1
A Geçirimsiz Malzeme Sahası	620	Dumlusu Köyü	
B Geçirimsiz Malzeme Sahası	1860	Akpınar Köyü	114,2
Beton Santrali-1	1650	Akpınar Köyü	
Beton Santrali -2	1560	Akpınar Köyü	
Beton Santrali -3	1150	Akpınar Köyü	
Baraj gövdesi inşaatı	1100	Akpınar Köyü	
K-5 Kaya Malzeme Ocağı	520	Kayalıdere Köyü	115,7
E Geçirimli Malzeme Sahası	1150	Kayalıdere Köyü	
F Geçirimli Malzeme Sahası	1980	Kayalıdere Köyü	
G Geçirimli Malzeme Sahası	2860	Kayalıdere Köyü	
C Geçirimsiz Malzeme Sahası	1900	Akkonak Köyü	111,8
D Geçirimsiz Malzeme Sahası	2390	Akkonak Köyü	
Kırma-Eleme-Yıkama Tesisi	2025	Akkonak Köyü	

Tablo 9. Yerleşim yerleri için hesaplanmış ses gücü seviyeleri

r mesafedeki ses basıncı (model) $L_{pi} = L_p + 10\log (Q/4\pi r^2)$
Atmosferik yutum $A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q]$

f = Gürültü kaynağının frekansı = 2000 Hz
r = mesafe
Q = Bağıl nem = %63 (Meteorolojik Veriler)
r mesafedeki gerçek ses basıncı, L_{Pg};
ilk 100 metrede, $L_{Pg} = L_{Port}$
100 metreden sonra, $L_{Pg} = L_{Port} - A_{Atm}$
$L_{port} = 10\log \sum 10^{L_{pi}/10}$

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Doğdap Mahallesi İçin Modelleme:

$L_{port} = 113{,}8$ dBA

$L_{pw} = L_{port} + 10 \log (Q/(4\pi r^2))$

Q = Atmosferik İndirgeme Faktörü 1 olarak alınmıştır

r = 10m için; $L_{pi} = L_p + 10\log (Q/4\pi\ r^2)$
$(L_{pi}) = 113{,}8 + 10\log (1/4 \times 3{,}14 \times 10^2) = 82{,}8$ dBA

r = 20m için; $L_{pi} = L_p + 10\log (Q/4\pi\ r^2)$
$(L_{pi}) = 113{,}8 + 10\log (1/4 \times 3{,}14 \times 20^2) = 76{,}8$ dBA

r = 50m için; $L_{pi} = L_p + 10\log (Q/4\pi\ r^2)$
$(L_{pi}) = 113{,}8 + 10\log (1/4 \times 3{,}14 \times 50^2) = 68{,}8$ dBA

r = 100m için; $L_{pi} = L_p + 10\log (Q/4\pi\ r^2)$
$(L_{pi}) = 113{,}8 + 10\log (1/4 \times 3{,}14 \times 100^2) = 62{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10\text{-}8 \times [2000^2 \times 100/63] = 0{,}47$
$L_{Pg} = LP_{ort} - A_{Atm} = 62{,}8 - 0{,}47 = 62{,}3$ dBA

r = 200m için; $L_{pi} = Lw + 10\log (Q/4\pi\ r^2)$
$(L_{pi}) = 113{,}8 + 10\log (1/4 \times 3{,}14 \times 200^2) = 56{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/\ Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 200/63] = 0{,}94$
$L_{Pg} = L_{Port} - A_{Atm} = 56{,}8 - 0{,}94 = 55{,}9$ dBA

r = 500m için; $L_{pi} = Lw + 10\log (Q/4\pi\ r^2)$
$(L_{pi}) = 113{,}8 + 10\log (1/4 \times 3{,}14 \times 500^2) = 48{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 500/63] = 2{,}35$
$L_{Pg} = L_{Port} - A_{Atm} = 48{,}8 - 2{,}35 = 46{,}5$ dBA

r = 720m için; $L_{pi} = Lw + 10\log (Q/4\pi\ r^2)$
$(L_{pi}) = 113{,}8 + 10\log (1/4 \times 3{,}14 \times 720^2) = 45{,}7$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 720/63] = 3{,}38$
$L_{Pg} = L_{Port} - A_{Atm} = 45{,}7 - 3{,}38 = 42{,}3$ dBA

R(m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	113,8	0	113,8
10	82,8	0	82,8
20	76,8	0	76,8
50	68,8	0	68,8
100	62,8	0,47	62,3
200	56,8	0,94	55,9
500	48,8	2,35	46,5
720	45,7	3,38	42,3

Tablo 10. (Doğdap Mahallesi) Gürültü Düzeyinin Mesafeye Göre Dağılımı (dBA)

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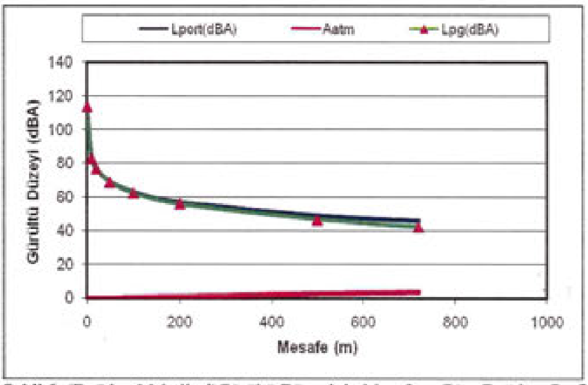

Şekil 6. (Doğdap Mahallesi)Gürültü Düzeyinin Mesafeye Göre Dağılım Grafiği (dBA)

Kuşluk Köyü İçin Modelleme

L_{port} = 110,7 dBA
L_{pw}= L_{port} +10 log $(Q/(4\pi r^2))$

Q = Atmosferik İndirgeme Faktörü 1 olarak alınmıştır

r = 10m için; $L_{pi} = L_p + 10\log(Q/4\pi\, r^2)$
$(L_{pi}) = 110,7 + 10\log(1/4 \times 3,14 \times 10^2) = 79,7$ dBA

r = 20m için; $L_{pi} = L_p + 10\log(Q/4\pi\, r^2)$
$(L_{pi}) = 110,7 + 10\log(1/4 \times 3,14 \times 20^2) = 73,7$ dBA

r = 50m için; $L_{pi} = L_p + 10\log(Q/4\pi\, r^2)$
$(L_{pi}) = 110,7 + 10\log(1/4 \times 3,14 \times 50^2) = 65,7$ dBA

r = 100m için; $L_{pi} = L_p + 10\log(Q/4\pi\, r^2)$
$(L_{pi}) = 110,7 + 10\log(1/4 \times 3,14 \times 100^2) = 59,7$ dBA

$A_{Atm} = 7,4 \times 10^{-8} \times [(f^2) \times r/Q] = 7,4 \times 10^{-8} \times [2000^2 \times 100/63] = 0,47$
$L_{Pg} = L_{Port} - A_{Atm} = 59,7 - 0,47 = 59,2$ dBA

r = 200m için; $L_{pi} = Lw + 10\log(Q/4\pi\, r^2)$
$(L_{pi}) = 110,7 + 10\log(1/4 \times 3,14 \times 200^2) = 53,7$ dBA

$A_{Atm} = 7,4 \times 10^{-8} \times [(f^2) \times r/ Q] = 7,4 \times 10^{-8} \times [2000^2 \times 200/63] = 0,94$
$L_{Pg} = L_{Port} - A_{Atm} = 53,7 - 0,94 = 52,7$ dBA

r = 500m için; $L_{pi} = Lw + 10\log(Q/4\pi\, r^2)$
$(L_{pi}) = 110,7 + 10\log(1/4 \times 3,14 \times 500^2) = 45,7$ dBA

$A_{Atm} = 7,4 \times 10^{-8} \times [(f^2) \times r/Q] = 7,4 \times 10^{-8} \times [2000^2 \times 500/63] = 2,35$
$L_{Pg} = L_{Port} - A_{Atm} = 45,7 - 2,35 = 43,4$ dBA

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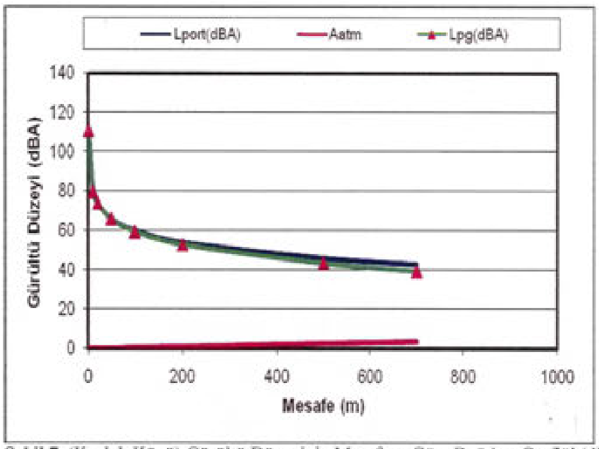
r = 700m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 110,7 + 10\log(1/4 \times 3,14 \times 700^2) = 42,8$ dBA

$A_{Atm} = 7,4 \times 10^{-8} \times [(f^2) \times r/Q] = 7,4 \times 10^{-8} \times [2000^2 \times 700/63] = 3,29$
$L_{Pg} = L_{Port} - A_{Atm} = 42,8 - 3,29 = 39,5$ dBA

R(m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	110,7	0	110,7
10	79,7	0	79,7
20	73,7	0	73,7
50	65,7	0	65,7
100	59,7	0,47	59,2
200	53,7	0,94	52,7
500	45,7	2,35	43,4
700	42,8	3,29	39,5

Tablo 11. (Kuşluk Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılımı (dBA)



Şekil 7. (Kuşluk Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılım Grafiği (dBA)

Dumlusu Köyü İçin Modelleme

$L_{port} = 113,1$ dBA
$L_{pw} = L_{port} + 10\log(Q/(4\pi r^2))$

Q = Atmosferik İndirgeme Faktörü 1 olarak alınmıştır

r = 10m için; $L_{pi} = L_p + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 113,1 + 10\log(1/4 \times 3,14 \times 10^2) = 82,1$ dBA

r = 20m için; $L_{pi} = L_p + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 113,1 + 10\log(1/4 \times 3,14 \times 20^2) = 76,1$ dBA

r = 50m için; $L_{pi} = L_p + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 113,1 + 10\log(1/4 \times 3,14 \times 50^2) = 68,1$ dBA

r = 100m için; $L_{pi} = L_p + 10\log(Q/4\pi r^2)$

$(L_{pi}) = 113{,}1 + 10\log(1/4 \times 3{,}14 \times 100^2) = 62{,}1$ dBA

$A_{Atm} = 7{,}4 \times 10\text{-}8 \times [(f^2) \times r/Q] = 7{,}4 \times 10\text{-}8 \times [2000^2 \times 100/63] = 0{,}47$
$L_{Pg} = L_{Port} - A_{Atm} = 62{,}1 - 0{,}47 = 61{,}6$ dBA

r = 200m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 113{,}1 + 10\log(1/4 \times 3{,}14 \times 200^2) = 56{,}1$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 200/63] = 0{,}94$
$L_{Pg} = L_{Port} - A_{Atm} = 56{,}1 - 0{,}94 = 55{,}1$ dBA

r = 500m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 113{,}1 + 10\log(1/4 \times 3{,}14 \times 500^2) = 48{,}1$ dBA

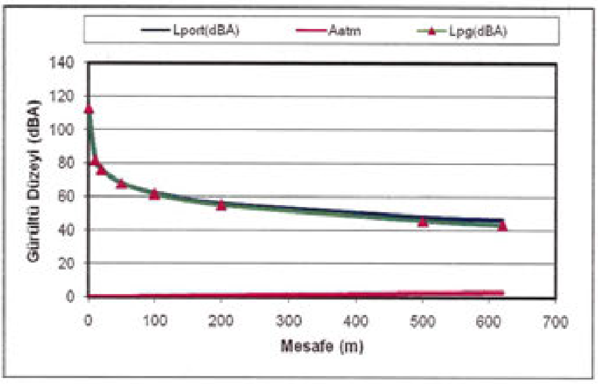
$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 500/63] = 2{,}35$
$L_{Pg} = L_{Port} - A_{Atm} = 48{,}1 - 2{,}35 = 45{,}8$ dBA

r = 620m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 113{,}1 + 10\log(1/4 \times 3{,}14 \times 620^2) = 46{,}3$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 620/63] = 2{,}91$
$L_{Pg} = L_{Port} - A_{Atm} = 46{,}3 - 2{,}91 = 43{,}3$ dBA

R(m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	113,1	0	113,1
10	82,1	0	82,1
20	76,1	0	76,1
50	68,1	0	68,1
100	62,1	0,47	61,6
200	56,1	0,94	55,1
500	48,1	2,35	45,8
620	46,3	2,91	43,3

Tablo 12. (Dumlusu Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılımı (dBA)



Şekil 8. (Dumlusu Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılım Grafiği (dBA)

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Akpınar Köyü İçin Modelleme

L_{port} = 114,2 dBA
$L_{pw}= L_{port} + 10 \log (Q/(4\pi r^2))$

Q = Atmosferik İndirgeme Faktörü 1 olarak alınmıştır

r = 10m için; $L_{pi} = L_p + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 10^2) = 83{,}2$ dBA

r = 20m için; $L_{pi} = L_p + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 20^2) = 77{,}1$ dBA

r = 50m için; $L_{pi} = L_p + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 50^2) = 69{,}0$ dBA

r = 100m için; $L_{pi} = L_p + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 100^2) = 63{,}2$ dBA

$A_{Atm} = 7{,}4 \times 10\text{-}8 \times [(f^2) \times r/Q] = 7{,}4 \times 10\text{-}8 \times [2000^2 \times 100/63] = 0{,}47$
$L_{Pg} = L_{Port} - A_{Atm} = 63{,}2 - 0{,}47 = 62{,}7$ dBA

r = 200m için; $L_{pi} = Lw + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 200^2) = 57{,}2$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/ Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 200/63] = 0{,}94$
$L_{Pg} = L_{Port} - A_{Atm} = 57{,}2 - 0{,}94 = 56{,}2$ dBA

r = 500m için; $L_{pi} = Lw + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 500^2) = 49{,}2$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 500/63] = 2{,}35$
$L_{Pg} = L_{Port} - A_{Atm} = 49{,}2 - 2{,}35 = 46{,}9$ dBA

r = 1000m için; $L_{pi} = Lw + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 1000^2) = 43{,}2$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 1000/63] = 4{,}70$
$L_{Pg} = L_{Port} - A_{Atm} = 43{,}2 - 4{,}70 = 38{,}5$ dBA

r = 1100m için; $L_{pi} = Lw + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 1100^2) = 42{,}4$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 1100/63] = 5{,}17$
$L_{Pg} = L_{Port} - A_{Atm} = 42{,}4 - 5{,}17 = 37{,}2$ dBA

r = 1150m için; $L_{pi} = Lw + 10\log (Q/4\pi\, r^2)$
$(L_{pi}) = 114{,}2 + 10\log (1/4 \times 3{,}14 \times 1150^2) = 42{,}0$ dBA

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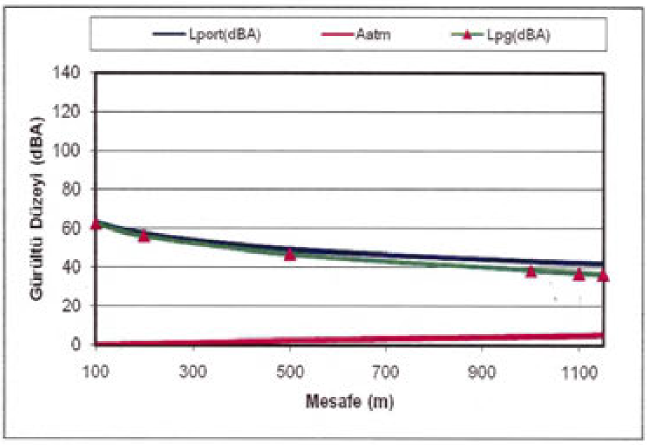
$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 1150/63] = 5{,}40$

$L_{Pg} = L_{Port} - A_{Atm} = 42{,}0 - 5{,}40 = 36{,}6$ dBA

R(m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	114,2	0	114,2
10	83,2	0	83,2
20	77,1	0	77,1
50	69,0	0	69,0
100	63,2	0,47	62,7
200	57,2	0,94	56,2
500	49,2	2,35	46,9
1000	43,2	4,70	38,5
1100	42,4	5,17	37,2

Tablo 13. (Akpınar Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılımı (dBA)



Şekil 9. (Akpınar Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılım Grafiği (dBA)

Kayalıdere Köyü İçin Modelleme

$L_{port} = 115{,}7$ dBA

$L_{pw} = L_{port} + 10 \log (Q/(4\pi r^2))$

Q = Atmosferik İndirgeme Faktörü 1 olarak alınmıştır

r = 10m için; $L_{pi} = L_p + 10\log (Q/4\pi\, r^2)$

$(L_{pi}) = 115{,}7 + 10\log (1/4 \times 3{,}14 \times 10^2) = 84{,}7$ dBA

r = 20m için; $L_{pi} = L_p + 10\log (Q/4\pi\, r^2)$

$(L_{pi}) = 115{,}7 + 10\log (1/4 \times 3{,}14 \times 20^2) = 78{,}7$ dBA

r = 50m için; $L_{pi} = L_p + 10\log (Q/4\pi\, r^2)$

$(L_{pi}) = 115{,}7 + 10\log (1/4 \times 3{,}14 \times 50^2) = 70{,}7$ dBA

r = 100m için; $L_{pi} = L_p + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 115{,}7 + 10\log(1/4 \times 3{,}14 \times 100^2) = 64{,}7$ dBA

$A_{Atm} = 7{,}4 \times 10\text{-}8 \times [(f^2) \times r/Q] = 7{,}4 \times 10\text{-}8 \times [2000^2 \times 100/63] = 0{,}47$
$L_{Pg} = L_{Port} - A_{Atm} = 64{,}7 - 0{,}47 = 64{,}2$ dBA

r = 200m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 115{,}7 + 10\log(1/4 \times 3{,}14 \times 200^2) = 58{,}7$ dBA

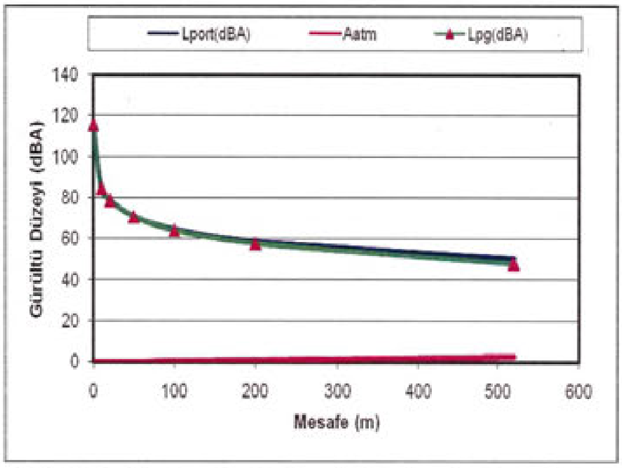
$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 200/63] = 0{,}94$
$L_{Pg} = L_{Port} - A_{Atm} = 58{,}7 - 0{,}94 = 57{,}7$ dBA

r = 520m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 115{,}7 + 10\log(1/4 \times 3{,}14 \times 520^2) = 50{,}4$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 520/63] = 2{,}44$
$L_{Pg} = L_{Port} - A_{Atm} = 50{,}4 - 2{,}44 = 47{,}9$ dBA

R(m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	115,7	0	115,7
10	84,7	0	84,7
20	78,7	0	78,7
50	70,7	0	70,7
100	64,7	0,47	64,2
200	58,7	0,94	57,7
520	50,4	2,44	47,9

Tablo 14. (Kayalıdere Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılımı (dBA)



Şekil 10. (Kayalıdere Köyü)Gürültü Düzeyinin Mesafeye Göre Dağılım Grafiği (dBA)

Akkonak Köyü İçin Modelleme

L_{port} = 111,8 dBA
L_{pw}= L_{port} +10 log $(Q/(4\pi r^2))$

Q = Atmosferik İndirgeme Faktörü 1 olarak alınmıştır

r = 10m için; $L_{pi} = L_p + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 10^2) = 80{,}8$ dBA

r = 20m için; $L_{pi} = L_p + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 20^2) = 74{,}8$ dBA

r = 50m için; $L_{pi} = L_p + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 50^2) = 66{,}8$ dBA

r = 100m için; $L_{pi} = L_p + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 100^2) = 60{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10\text{-}8 \times [(f^2) \times r/Q] = 7{,}4 \times 10\text{-}8 \times [2000^2 \times 100/63] = 0{,}47$
$L_{Pg} = L_{Port} - A_{Atm} = 60{,}8 - 0{,}47 = 60{,}3$ dBA

r = 200m için; $L_{pi} = Lw + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 200^2) = 54{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/\ Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 200/63] = 0{,}94$
$L_{Pg} = L_{Port} - A_{Atm} = 54{,}8 - 0{,}94 = 53{,}8$ dBA

r = 500m için; $L_{pi} = Lw + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 500^2) = 46{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 500/63] = 2{,}35$
$L_{Pg} = L_{Port} - A_{Atm} = 46{,}8 - 2{,}35 = 44{,}5$ dBA

r = 1000m için; $L_{pi} = Lw + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 620^2) = 40{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 620/63] = 2{,}91$
$L_{Pg} = L_{Port} - A_{Atm} = 40{,}8 - 2{,}91 = 36{,}1$ dBA

r = 1900m için; $L_{pi} = Lw + 10\log(Q/4\pi\ r^2)$
$(L_{pi}) = 111{,}8 + 10\log(1/4 \times 3{,}14 \times 1900^2) = 35{,}2$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 620/63] = 8{,}93$
$L_{Pg} = L_{Port} - A_{Atm} = 35{,}2 - 8{,}93 = 26{,}3$ dBA

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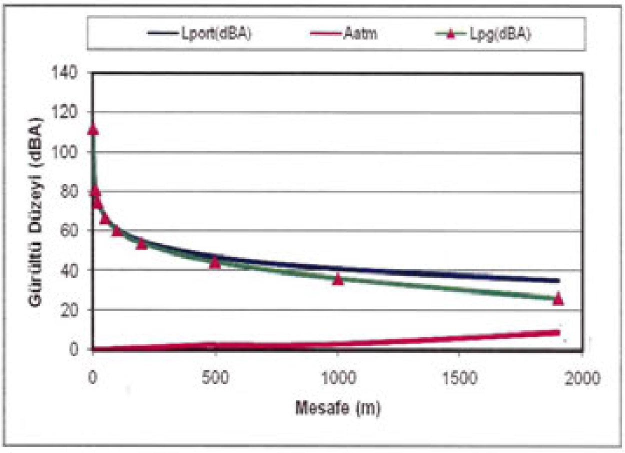
R(m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	111,8	0	111,8
10	80,8	0	80,8
20	74,8	0	74,8
50	66,8	0	66,8
100	60,8	0,47	60,3
200	54,8	0,94	53,8
500	46,8	2,35	44,5
1000	40,8	2,91	36,1
1900	35,2	8,93	26,3

Tablo 15. (Akkonak Köyü) Gürültü Düzeyinin Mesafeye Göre Dağılımı (dBA)



Şekil 11. (Akkonak Köyü)Gürültü Düzeyinin Mesafeye Göre Dağılım Grafiği (dBA)

Patlatma Sırasında Oluşacak Gürültü:

Patlatma yapılırken diğer bütün işlemler durdurulduğundan sadece patlatmadan kaynaklanan gürültü oluşacaktır. Dolayısıyla malzeme çıkarma işlemleri ile ilgili gürültü hesapları ayrı tutulmuştur.

Patlatma sırasında oluşacak gürültü düzeyi : 130 dBA olacaktır.

Ortalama ses basınç seviyesi $L_{port} = 10\log \sum 10^{Lpi/10}$ dBA

r mesafedeki ses basıncı (model) $L_{pi} = L_p + 10\log(Q/4\pi r^2)$

Atmosferik yutum $A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q]$

f = Gürültü kaynağının frekansı = 2000 Hz
Q = Bağıl nem = %63

r mesafedeki gerçek ses basıncı, L_{Pg} ;
ilk 100 metrede, $L_{Pg} = L_{Port}$
100 metreden sonra, $L_{Pg} = L_{Port} - A_{Atm}$

$L_{pw} = L_{Ar,LT} + 10\log(Q/(4\pi r^2))$

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Q = İndirgeme faktörü 1 olarak alınmıştır

r = 10m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 10^2) = 99{,}01$ dBA

r = 50m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 50^2) = 85{,}03$ dBA

r = 100m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 100^2) = 79{,}0$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 100/63] = 0{,}47$
$L_{Pg} = L_{Port} - A_{Atm} = 79{,}0 - 0{,}47 = 78{,}5$ dBA

r = 200m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 200^2) = 73{,}0$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 100/63] = 0{,}94$
$L_{Pg} = L_{Port} - A_{Atm} = 73{,}0 - 0{,}94 = 72{,}0$ dBA

r = 520m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 520^2) = 64{,}7$dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 520/63] = 2{,}44$
$L_{Pg} = L_{Port} - A_{Atm} = 64{,}7 - 2{,}44 = 62{,}2$ dBA (KAYALIDERE KÖYÜ)

r = 700 m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 700^2) = 62{,}1$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 1000/63] = 3{,}29$
$L_{Pg} = L_{Port} - A_{Atm} = 62{,}1 - 3{,}29 = 58{,}8$ Dba(KUŞLUK KÖYÜ)

r = 770 m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 770^2) = 61{,}3$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 770/63] = 3{,}62$
$L_{Pg} = L_{Port} - A_{Atm} = 61{,}3 - 3{,}29 = 57{,}7$ dBA (DOĞDAP KÖYÜ)

r = 1000m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 1000^2) = 59{,}0$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 1000/63] = 4{,}7$
$L_{Pg} = L_{Port} - A_{Atm} = 59{,}0 - 4{,}7 = 54{,}3$ dBA

r = 1150m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 1150^2) = 57{,}8$ dBA

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 1150/63] = 5{,}4$
$L_{Pg} = L_{Port} - A_{Atm} = 57{,}8 - 5{,}4 = 52{,}4$ dBA (AKPINAR KÖYÜ)

r = 1260m için; $L_{pi} = Lw + 10\log(Q/4\pi r^2)$
$(L_{pi}) = 130 + 10\log(1/4 \times 3{,}14 \times 1260^2) = 57{,}0$ Dba

$A_{Atm} = 7{,}4 \times 10^{-8} \times [(f^2) \times r/Q] = 7{,}4 \times 10^{-8} \times [2000^2 \times 1260/63] = 5{,}92$
$L_{Pg} = L_{Port} - A_{Atm} = 57{,}0 - 5{,}92 = 51{,}1$ dBA (DUMLUSU KÖYÜ)

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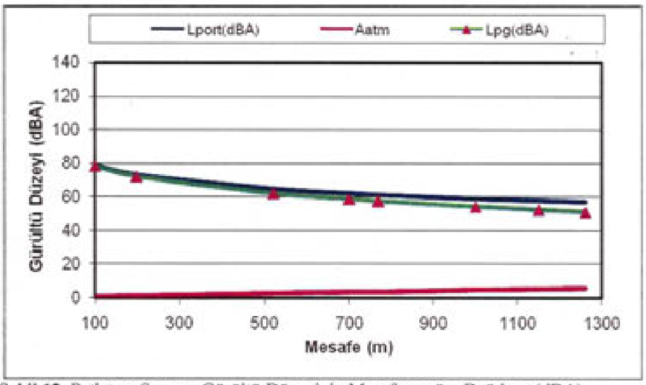
R (m)	L_{port}, dBA	A_{ATM}	L_{pg}, dBA
0	130,00	0	130,00
10	99,1	0	99,1
50	85,03	0	85,03
100	79,0	0,47	78,5
200	73,0	0,94	72,0
520	64,7	2,44	62,1
700	62,1	3,29	58,8
770	61,3	3,62	57,7
1000	59,0	4,7	54,3
1150	57,8	5,4	52,4
1260	57,0	5,92	51,1

Tablo 16. Patlatma Sonucu Gürültün Düzeyinin Mesafeye Göre Dağılımı (dBA)



Şekil 12. Patlatma Sonrası Gürültü Düzeyinin Mesafeye göre Dağılımı (dBA)

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6. Hesaplama sonucu elde edilen değerlerin ÇGDY Yönetmeliği Madde 23 (ç maddesi) çerçevesinde değerlendirilmesi

En yakın yerleşim yerlerinde hissedilecek gürültü seviyeleri Tablo 17'de verilmiştir.

Mesafe (m)	En yakın yerleşim yeri	İNŞAAT Lpg (dB A)	Lgündüz (dB A) (Arka plan gürültüsü)	hissedilecek gürültü seviyeleri (dB A)	PATLATMA Lpg (dB A)	Lgündüz (dB A) (Arka plan gürültüsü)	hissedilecek gürültü seviyeleri (dB A)
770	Doğdap Mah.	42,3	46,88	48,18	57,7	46,88	58,05
620	Dumlusu Köyü	43,3	50,12	50,94	51,1	50,12	53,65
1100	Akpınar Köyü	37,2	46,22	46,73	52,4	46,22	53,34
520	Kayalıdere Köyü	47,9	44,45	49,52	62,2	44,45	62,27
700	Kuşluk Köyü	39,5	43,95	45,28	58,8	43,95	58,94
Mesafe (m)	En yakın yerleşim yeri	İNŞAAT Lpg (dB A)	Lakşam (dB A) (Arka plan gürültüsü)	hissedilecek gürültü seviyeleri (dB A)	PATLATMA Lpg (dB A)	Lakşam (dB A) (Arka plan gürültüsü)	hissedilecek gürültü seviyeleri (dB A))
770	Doğdap Mah.	42,3	42,15	45,24	57,7	42,15	57,82
620	Dumlusu Köyü	43,3	44,86	47,16	51,1	44,86	52,03
1100	Akpınar Köyü	37,2	43,98	44,81	52,4	43,98	52,98
520	Kayalıdere Köyü	47,9	43,28	49,19	62,2	43,28	62,26
700	Kuşluk Köyü	39,5	45,54	46,51	58,8	45,54	59,00
Mesafe (m)	En yakın yerleşim yeri	İNŞAAT Lpg (dB A)	Lgece (dB A) (Arka plan gürültüsü)	hissedilecek gürültü seviyeleri (dB A)	PATLATMA Lpg (dB A)	Lgece (dB A) (Arka plan gürültüsü)	hissedilecek gürültü seviyeleri (dB A)
770	Doğdap Mah.	42,3	41,1	44,75	57,7	41,1	57,79
620	Dumlusu Köyü	43,3	40,68	45,19	51,1	40,68	51,48
1100	Akpınar Köyü	37,2	44,45	45,20	52,4	44,45	53,05
520	Kayalıdere Köyü	47,9	41,85	48,86	62,2	41,85	62,24
700	Kuşluk Köyü	39,5	42,73	44,42	58,8	42,73	58,91

Tablo 17. En Yakın Mesafelerde Hissedilecek Gürültü Düzeyi

04.06.2011 tarih ve 27601 sayılı Resmi Gazetede yayınlanarak yürürlüğe girmiş olan Çevresel Gürültünün Değerlendirilmesi ve Yönetimi Yönetmeliği a bendine göre : Şantiye alanındaki faaliyet türlerinden çevreye yayılan gürültü seviyesi Ek-VII'de yer alan Tablo-5'te verilen sınır değerleri aşamaz.

Tablo–5: Şantiye Alanı İçin Çevresel Gürültü Sınır Değerleri

Faaliyet türü (yapım, yıkım ve onarım)	$L_{gündüz}$ (dBA)
Bina	70
Yol	75
Diğer kaynaklar	70

Hesaplanan gürültü düzeyleri Tablo.5'te belirtilen, Lgündüz sınır değeri olan 70 dBA değerinin **altında** olmasına rağmen söz konusu yönetmeliğin hükümlerine uyulacaktır.

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7. **İnşaat alanı yakınında (en az 50 m'lik mesafede) konut, hastane ve okul bulunması halinde makine ve ekipmanlara göre titreşimin oluşup oluşmayacağının Yönetmeliğin 25 inci maddesi kapsamında değerlendirilmesi ve titreşim oluşması halinde gerekli tedbirlerin alınacağının taahhüt edilmesi**

İnşaat alanı yakınında (en az 50 m'lik mesafede) yerleşim yeri bulunmamaktadır.

C. ARKA PLAN GÜRÜLTÜ DÜZEYİNE İLİŞKİN BİLGİLER

1. **Tesisin kurulacağı alana en yakın hassas yapının dışındaki mevcut gürültü düzeyinin TS 9315 ve TS ISO 1996-2 standartları esas alınarak belirlenmesi ve değerlendirilmesi. (Tesisin kurulacağı alan gürültüye hassas yapılardan 500 m uzakta ise bu durumda isletmeci ileride oluşabilecek şikayetleri önlemek için isterse ölçüm yaptırabilir, onun dışında zorunlu değildir.)**

Tesislerin kurulacağı alan gürültüye hassas yapılardan en az 520 m uzaklıktadır.

2. **Arka plan gürültü düzeyi ölçümü yapılacak noktaların belirlenmesi (tesisin isletmeye geçtikten sonraki olası çevresel gürültü düzeyinin tespitinde hesaplama veya ölçüm noktaları ve değerleri referans alınarak tesis etrafındaki yapılarda (gürültü kaynağının türüne bağlı olarak en az 2 noktada ölçüm yapılması)**

Arka plan gürültü düzeyi ölçümü için proje alanına en yakın köyler belirlenmiş ve ölçümler bu noktalardan gündüz,akşam ve gece zaman dilimlerinde alınmıştır.

3. **Ölçüm noktalarının proje alanına mesafesi**

Ölçüm noktalarının proje alanına mesafesi (m)	Yerleşim Yerleri
770	Doğdap Mah.
620	Dumlusu Köyü
1100	Akpınar Köyü
520	Kayalıdere Köyü
700	Kuşluk Köyü

Tablo 18.Ölçüm noktalarının proje alanına mesafesi

4. **Ölçüm noktaları arasındaki mesafe**

Akpınar Köyü - Dumlusu Köyü ......2,7 km
Dumlusu Köyü - Kayalıdere Köyü... 6,1 km
Kayalıdere Köyü - Kuşluk Köyü........4,6 km
Kuşluk Köyü - Doğdap Mah............5,2 km
Doğdap Mah. - Akpınar Köyü....... 9,2 km

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5. Ölçüm süresi (gürültü türüne bağlı olarak 5-15 dk aralığında), tarihi, ölçülen parametreler ve ölçüm sonuçları (varsa ölçüm kayıtları)

Ölçüm yeri	Ölçüm koordinatları	Ölçüm süresi (dak.)	Ölçüm tarihi	Ölçüm sonuçları (dB A)			
					Leq	L10	L90
Akpınar Köyü	X:717306,42	8 dak.	25.08.2011	Lgündüz	46,22	47,40	37,10
				Lakşam	43,98	39,90	37,10
	Y:4322717,07			Lgece	44,45	43,40	37,10
Doğdap Mah.	X:714694,09	8 dak.	25.08.2011	Lgündüz	46,88	45,40	37,30
				Lakşam	42,15	41,70	37,20
	Y:4331533,75			Lgece	41,10	42,80	37,70
Dumlusu Köyü	X:719693,46	8 dak.	25.08.2011	Lgündüz	50,12	50,70	37,30
				Lakşam	44,86	45,90	37,40
	Y:4321630,31			Lgece	40,68	41,70	37,10
Kayalıdere Köyü	X:722483,19	8 dak.	26.08.2011	Lgündüz	44,45	42,80	37,10
				Lakşam	43,28	44,30	37,10
	Y:4327046,22			Lgece	41,85	44,20	37,10
Kuşluk Köyü	X:719882,03	8 dak.	26.08.2011	Lgündüz	43,95	45,30	37,10
				Lakşam	45,54	42,60	37,10
	Y:433080981			Lgece	42,73	42,60	37,10

Tablo 19.Ölçüm Sonuçları

Ölçümler ile ilgili veriler ölçüm cihazı çıktısı olarak Ek-4'de verilmiştir.

6. Ölçüm yüksekliği

Tripot üzerine ölçüm cihazı konularak 1,5 m yükseklikten ölçümler gerçekleştirilmiştir.

7. Ölçüm metodolojisi

- Gürültü düzeyi ölçümleri sırasında, cihazın ölçümlerini etkileyecek ölçüde herhangi bir gürültü çıkarılmamasına özen gösterilmiştir.
- Her ölçümden önce ölçüm cihazının kalibrasyonu yapılmıştır.
- Ölçümler proje alanına bakan yönlerde en yakın yerleşim yerlerinden, konutlardan 5 m mesafeden yansıtıcı yüzeylerden uzakta alınmıştır.
- Ölçüm fotoğrafları Ek-5'te verilmiştir.

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8. Ölçümlerde kullanılan ölçüm cihazı hakkında bilgi (cihaz seri no'su, tipi, modeli ve üreticisi)

Svantek 958 Tip 1model bir cihaz olup 1/1 ve 1/3 oktav bantlarında ölçümler yapabilmektedir. Ayrıca 20 kHz ve 140 dBA' ya kadar ölçüm yapabilmektedir.

Svantek 958 Gürültü Ölçüm Cihazı Teknik Özellikleri: Cihaz tamamen otomatik ve fonksiyonel özelliğe sahiptir. Gürültü ölçülmesinde anlık akustik parametreler (Lp, Leq ve Lpk) ile geniş bant frekans ölçümüyle bütünleşmiş akustik parametreler (Lpmax, Leqed ve Lpkmax) ve de günlük kişisel korunmasızlık seviyelerini ölçmektedir.Ölçümlerde rüzgar vb. etkileşimlerden korumak amacıyla korugani mevcuttur.

GÜRÜLTÜ ÖLÇÜM CİHAZININ			
Seri Nosu:	**Tipi:**	**Modeli:**	**Üreticisi:**
14294	1	958	SVANTEK

Tablo 20.Gürültü Ölçüm Cihazı Özellikleri

9. Kalibrasyon metodu, kalibrasyon seviyeleri ve ölçüm cihazının kalibrasyon sertifikası

Cihazın harici olan bir kalibrasyon aparatına sahiptir (Kalibratör).

- MENÜ' ye girilir buradan "FUNCTION", "CALIBRATION", "BY MEASUREMENT" menülerine ilerlenir.
- Kalibratör cihaza takılır ve "START" tuşuna basılır. Burada cihaz kalibratörden okuduğu değer koyu bir şekilde ekranda sabitlenir.
- Bu değer girilen değerle cihaz hafızasında kıyaslanır.
- Kalibratör çıkarılır.
- Her ölçümden önce cihaz 1000 Hz (1 kHz) lik frekansta 94 dB de kalibre edilir
- Hesaplanan değer cihazda kalibrasyon faktörü olarak saklanır.
- Daha sonraki yapılan her ölçümde bu kalibrasyon faktörü kadar düzeltmeyi cihaz, diğer değerler üzerinde uygulayacaktır.

10. Ölçüm yapan kurum/kuruluş (adı, ön yeterlilik/yeterlilik belgesi)

Ölçüm yapan kuruluşa ait belgeler Ek-1'de verilmiştir.

D. İSLETME SAFHASINDA OLUŞABİLECEK GÜRÜLTÜ/TİTRESİM DÜZEYİ HAKKINDA BİLGİLER

1. Tesis/isletme içinde yer alacak gürültü kaynakları, yerleri, varsa gürültü kaynaklarının ses gücü düzeyleri ve ses karakteri hakkında bilgi,

Yalnızca projenin inşaat aşamasında gürültü oluşacağından dolayı bu başlık altında değerlendirme yapılmamıştır.

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E. KONTROL TEDBİRLERİ HAKKINDA BİLGİ

1. İnşaat aşaması için hesaplanan çevresel gürültü düzeyinin ÇGDY Yönetmeliğinde verilen sınır değerleri aşması durumunda alınacak kontrol tedbirleri hakkında bilgi

İnşaat aşaması için hesaplanan çevresel gürültü düzeyinin ÇGDY Yönetmeliğinde verilen sınır değerleri **sağlamaktadır.**

2. Çevre iznine tabi bir tesisin isletmeye geçtikten sonra yapılacak çevresel gürültü ve titreşim ölçümleri dikkate alınarak, sınır değerlerin sağlanmaması halinde alınması gereken kontrol tedbirlerinin uygulamaya konulmasının işletmeci tarafından taahhüt edilmesi

Yapılacak olan Alpaslan II Barajı ve HES Projesi Çevre Kanununca Alınması Gereken İzin Ve Lisanslar Hakkında Yönetmeliğin Ek-1 ve Ek-2'sinde yer almamaktadır.

F. ÖLÇÜMÜ YAPAN VE RAPORU HAZIRLAYANLARIN İMZALADIĞI ONAY SAYFASI

Ölçümü Yapanlar	Unvanı	İletişim Bilgileri	İmza
H. Mehmet YİĞİT	Çevre Mühendisi (Ölçüm Sorumlusu)	0312 211 16 80 / 22	
Filiz ÜLGER	Çevre Mühendisi (Rapor Sorumlusu)	0312 211 16 80 / 23	
H. Mehmet YİĞİT	Çevre Mühendisi (Laboratuvar Müdürü)	0312 211 16 80 / 22	

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RAPOR EKLERİ

encon

Encon Çevre Danışmanlık Ltd. Şti
(Alpaslan II Barajı ve HES Projesi)

Alpaslan Barajı Merkez ve Varto İlçeleri MUŞ

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Gazi Mah. Silahtar Cad. 134 /1
Yenimahalle / ANKARA

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EKLER

EK-1 GÜRÜLTÜ ÖLÇÜMÜ YAPAN KURULUŞUN YETERLİK BELGESİ
EK-2 CİHAZ KALİBRASYON BELGELERİ
EK-3 PERSONELE AİT BELGELER
EK-4 ÖLÇÜM CİHAZI ÇIKTISI
EK-5 ÖLÇÜM FOTOĞRAFLARI

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EK-1 GÜRÜLTÜ ÖLÇÜMÜ YAPAN KURULUŞUN YETERLİK BELGESİ

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Çevre Yönetimi Genel Müdürlüğü

T.C.
Çevre ve Orman Bakanlığı

ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ

Belge No	:	**Y–06/164/2011**
Kapsam	:	**Emisyon, İmisyon, Gürültü, Çevresel Titreşim**
Düzenleme Tarihi	:	**30.03.2011**
Laboratuvar Adı	:	ÇANKAYA ÇEVRE ÖLÇÜM İŞ SAĞLIĞI VE İŞ GÜVENLİĞİ MÜH. MÜŞ. EĞİT. VE SAĞLIK HİZM.MATBAACILIK YAYINCILIK VE TURİZM TİC.LTD.ŞTİ.
Adres	:	**Gazi Mahallesi Silahtar Cad. No:134 / 1 Yenimahalle/ANKARA**

4856 Sayılı Çevre ve Orman Bakanlığı Kuruluş ve Görevleri Hakkında Kanun gereği yukarıda açık adı ve adresi belirtilen kurum/kuruluş Ek Liste'de belirtilen kapsamda 5 Eylül 2008 tarih ve 26988 sayılı R.G.de yayımlanan Çevre Ölçüm ve Analiz Laboratuvarları Yeterlik Yönetmeliği'ne göre ölçüm ve/veya analiz yapmaya ve bu çerçevede rapor hazırlamaya yetkilidir.

BELGENİN

BAŞLANGIÇ TARİHİ : **30/03/2011**

BİTİŞ TARİHİ : **30/03/2015**

Prof.Dr.Cumali KINACI
Bakan a.
Genel Müdür

EK: PARAMETRE LİSTESİ (3 sayfa)

Revizyon Tarihi/No: --/--
Yenileme Tarihi/No:--/--

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA

Bu rapor Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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Çevre Yönetimi Genel Müdürlüğü

ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ
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ÖLÇÜM VE /VEYA ANALİZ İLE İLGİLİ;

Kapsam	Parametre	Metot adı	Metot Numarası
Gürültü Ölçümleri (3)	Çevresel Gürültü	• Çevre Gürültüsünün Tarifi, Ölçülmesi ve Değerlendirilmesi – Bölüm 1: Temel Büyüklükler ve Değerlendirme İşlemleri	• TS 9315 ISO 1996 – 1: 2005
		• Çevre Gürültüsünün Tarifi, Ölçülmesi ve Değerlendirilmesi – Bölüm 2: Çevre Gürültü Seviyelerinin Tayini	• TS ISO 1996 – 2: 2009
		• Akustik Sesin Dışarıda Yayılırken Azalması-Bölüm 2 : Genel Hesaplama Yöntemi	• TS ISO 9613-2:2006
		• Akustik: Ses Basıncı Mühendislik Yöntemi Kullanarak Yansıtıcı Bir Düzlem Üzerindeki Tamamen Açık Bir Alanda ses Gücü Düzeylerinin Belirlenmesi.	• TS EN ISO 3746: 2010
		• Çoklu Gürültü Kaynağına Sahip Sanayi Tesislerinde Çevredeki Ses Basınç Seviyelerinin Değerlendirilmesi İçin Ses Güç Seviyelerinin Tayini -Mühendislik Metodu	• TS ISO 8297: 2006
		• Gürültü Kaynaklarının Ses Gücü Seviyelerinin Ses Basıncı Kullanılarak Tayini Bir Yansıtma Düzlemi Boyunca, Esas Olarak Serbest Bir Alan İçinde Uygulanan Mühendislik Metodu	• TS EN ISO 3744: 2010
Çevresel Titreşim Ölçümleri(3)	Çevresel Titreşim	• El tipi titreşim seviyesi ölçme cihazı ile titreşim hızının ölçülmesi	• TS 10354: 1992

Prof.Dr. Cumali KINACI
Bakan a.
Genel Müdür

(3) 04.06.2010 R.G.No. 27601 "Çevresel Gürültünün Değerlendirilmesi ve Yönetimi Yönetmeliği" Kapsamında

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA

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ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ
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Revizyon Tarihi/No --/--
Laboratuvar Adı : Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğit. Ve Sağlık Hizm.Matbaacılık Yayıncılık ve Turizm Tic.Ltd.Şti.

ÖLÇÜM VE /VEYA ANALİZ İLE İLGİLİ;

Kapsam	Parametre	Metot adı	Metot Numarası
Emisyon Ölçümleri (1)	O_2 Tayini	• Elektrokimyasal Hücre Metodu	• TS ISO 12039:2005
	İslilik	• Renk Karşılaştırılması (Bacharach Skalası)	• TS 9503: 1991
	Hız ve Debi Tayini	• Pitot Tüpü Metodu	• TS ISO 10780:1999
	Nem Tayini	• Gravimetrik Metot	• EPA Metot 4: 2000
İmisyon Ölçümleri (1)	(2) Partikül Madde (PM10)	• Gravimetrik Metot	• TS EN 12341: 2002
	Çöken Toz Tayini	• Gravimetrik Metot	• TS 2341: 1976
	Uçucu Organik Bileşikler Numune Alma	• Adsorblama Yöntemi ile Numune Alma	• TS EN 13649: 2003

Prof.Dr. Cumali KINACI
Bakan a.
Genel Müdür

(1) 03.07.2009 R.G. No: 27277 **"Sanayi Kaynaklı Hava Kirliliğinin Kontrolü Yönetmeliği"** Kapsamında
(2) (1) 03.07.2009 R.G. No: 27277 **"Sanayi Kaynaklı Hava Kirliliğinin Kontrolü Yönetmeliği"** Ek 2-g hariç

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA

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ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

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T.C.
ÇEVRE VE ORMAN BAKANLIĞI
Çevre Yönetimi Genel Müdürlüğü

ÇEVRE ÖLÇÜM VE ANALİZLERİ YETERLİK BELGESİ
EK LİSTE-1/3

Belge No : Y-06/164/2011
Düzenleme tarihi : 30.03.2011
Ek Liste
Başlangıç tarihi : 30.03.2011
Bitiş tarihi : 30.03.2015
Revizyon Tarihi/No --/--
Laboratuvar Adı : Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Egit. Ve Sağlık Hizm.Matbaacılık Yayıncılık ve Turizm Tic.Ltd.Şti.

ÖLÇÜM VE /VEYA ANALİZ İLE İLGİLİ;

Kapsam	Parametre	Metot adı	Metot Numarası
Emisyon Ölçümleri (1)	CO Tayini	• Elektrokimyasal Hücre Metodu	• TS ISO 12039:2005
	CO_2 Tayini	• Elektrokimyasal Hücre Metodu, • Hesaplama	• TS ISO 12039:2005
	SO_2 Tayini	• Elektrokimyasal Hücre Metodu	• TS ISO 7935: 1999
	Partikül Madde	• Gravimetrik Metot	• TS ISO 9096:2004 (20 mg/m3 üstündeki toz konsantrasyonları için uygun) • TS EN 13284-1 (0-50 mg/m3 arasındaki toz konsantrasyonları için uygun) • EPA Metot 17: 2000
	NO NOx, NO_2 Tayini	• Elektrokimyasal Hücre Metodu • Elektrokimyasal Hücre Metodu (Hesaplama)	• EPA CTM -022: 1998

Prof.Dr. Cumali KINACI
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Genel Müdür

(1) 03.07.2009 R.G. No: 27277 "Sanayi Kaynaklı Hava Kirliliğinin Kontrolü Yönetmeliği" Kapsamında

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Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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TÜRKAK

TÜRK AKREDİTASYON KURUMU

AKREDİTASYON SERTİFİKASI

Deney Laboratuvarı olarak faaliyet gösteren,

ÇANKAYA ÇEVRE ÖLÇÜM
İş Sağ. Ve İş Güv. Müh. Müş. Eğt. Ve Sağ. Hizm. Mat. Yay. Tur.
Gazi Mahallesi Silahtar Caddesi No:134/1 Yenimahalle
06170 ANKARA / TÜRKİYE

TÜRKAK tarafından yapılan denetim sonucunda TS EN ISO/IEC 17025:2005 Standardına göre Ek'te yer alan kapsamlarda akredite edilmiştir.

Akreditasyon No : **AB-0286-T**

Akreditasyon Tarihi : **26-Ocak-2010**

Revizyon Tarihi / No : **10-Şubat-2011 / 01**

Bu Sertifika, yukarıda açık adı ve adresi yazılı Kuruluşun TS EN ISO/IEC 17025:2005 Standardına, ilgili Yönetmelik ve Tebliğlere uygunluğunu sürdürmesi halinde 25-Ocak-2014, tarihine kadar geçerlidir.

Ali BOĞA
Yönetim Kurulu Başkanı

TÜRK AKREDİTASYON KURUMU
TÜRKAK
1999

Atakan BAŞTÜRK
Genel Sekreter

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Akreditasyon Sertifikası Eki (Sayfa 1/2)

Akreditasyon Kapsamı

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ÇANKAYA ÇEVRE ÖLÇÜM
İş Sağ. Ve İş Güv. Müh. Müş. Eğt. Ve Sağ. Hizm. Mat. Yay. Tur. Tic. Ltd. Şti.

Akreditasyon No: AB-0286-T
Revizyon No: 01 Tarih: 10-Şubat-2011

Deney Laboratuvarının

Adres : Gazi Mahallesi Silahtar Caddesi No:134/1 Yenimahalle 06170 ANKARA / TÜRKİYE
Tel : 0 312 211 16 80
Faks : 0 312 211 16 83
E-Posta : cevre@cankayasaglik.com.tr
Website : www.cankayasaglik.com.tr/cevre

Deneyi Yapılan Malzemeler / Ürünler	Deney Adı	Deney Metodu (Ulusal, Uluslararası standardlar, işletme içi metodlar)
BACA GAZI	SO_2 Tayini	TS ISO 7935:1999
	NO, NO_2 ve NO_x Tayini	EPA-CTM 022:1998
	CO, O_2 ve CO_2 (Hesaplama) Tayini	TS ISO 12039:2005
	İslilik Tayini	TS 9503:1991
	Hız Tayini	TS ISO 10780:1999
	İzokinetik Numune Alma ve Partikül Madde Tayini	TS ISO 9096:2004 EPA Metot 17:2000 TS EN 13284-1:2003
	Nem Tayini	EPA Metot 4:2000
ÇEVRE HAVASI	Partikül Madde Tayini (PM10)	TS EN 12341:2002
	Çöken Toz Tayini	TS 2341:1976
İŞ YERİ ORTAMI	İşyeri Ortam Havasında Kimyasal Madde Ölçümü	TS EN 1231:2000
	Aydınlatma Düzeyi Ölçümü	ISO/CIE 8995:2002
	İş Yeri Ortam Havasında Toz ve Kişisel Toz Maruziyeti Ölçümü	TS 2361:1976
TİTREŞİM	Kişisel Titreşim Maruziyeti Ölçümü (El-Kol-Tüm Vücut)	TS 2774:1977 TS 2775:1977 TS ENV 5349-1:2005
	Çevresel Titreşim (Madencilik - Hava Şoku ve Yer Titreşimi Ölçümü)	TS 10354: 1992
GÜRÜLTÜ	Kişisel Gürültü Ölçümü	TS 2673: 1977 TS 2607 ISO 1999: 2005
	İç Ortam Gürültü Ölçümü	TS 2673: 1977

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Akreditasyon Sertifikası Eki (Sayfa 2/2)
Akreditasyon Kapsamı

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İş Sağ. Ve İş Güv. Müh. Müş. Eğt. Ve Sağ. Hizm. Mat. Yay. Tur. Tic. Ltd. Şti.

Akreditasyon No: AB-0286-T
Revizyon No: 01 Tarih: 10-Şubat-2011

Deneyi Yapılan Malzemeler / Ürünler	Deney Adı	Deney Metodu (Ulusal, Uluslararası standardlar, işletme içi metodlar)
(GÜRÜLTÜ Devam)	Çevresel ve Akustik Gürültü Ölçümü	TS 9315 ISO 1996-1: 2005 TS ISO 1996-2: 2009 TS ISO 8297: 2006 TS ISO 9613-2: 2006 TS EN ISO 3744: 2010 TS 8958 EN ISO 3746:2010

KAPSAM SONU

Ali BOĞA
Yönetim Kurulu Başkanı

Atakan BAŞTÜRK
Genel Sekreter

TÜRK AKREDİTASYON KURUMU
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1999

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI
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Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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EK-2 CİHAZ KALİBRASYON BELGELERİ

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PROTOS

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Telefon: 0216 415 4949 (Pbx), Faks: 0216 415 4950
e-posta: info@protos.com.tr, internet: www.protos.com.tr

AB-0078-K
116/2010
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Kalibrasyon Sertifikası
Calibration Certificate

Cihazın Sahibi/adresi *Customer / address*	**:Çankaya Çevre Ölçüm İş Sağlığı ve İş Güv.Müh. Müş.Eğit. ve Sağlık Hiz.Mat.Yay.Turz.Tic.Ltd.Şti.** Gazi Mah.Şenol Cad. Yavuz Kanat Sok.No:7/2 Yenimahalle/ANKARA
Talep Numarası *Order Number*	**: 87/2010**
Makine/Cihaz *Instrument/Device*	**: Ses Düzeyi Ölçer**
İmalatçı *Manufacturer*	**: SVANTEK**
Tip *Type*	**: SVAN 958**
Seri Numarası *Serial Number*	**: 14294**
Kalibrasyon Tarihi *Date of Calibration*	**: 09.10.2010**
Sertifikanın Sayfa Sayısı *Number of pages of the Certificate*	**: 4**

Bu kalibrasyon sertifikası, Uluslararası Birimler Sisteminde (SI) tanımlanmış birimleri realize eden ulusal ölçüm standardlarına izlenebilirliği belgeler.
This calibration certificate documents the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).

Türk Akreditasyon Kurumu (TÜRKAK) kalibrasyon sertifikalarının tanınması konusunda Avrupa Akreditasyon Birliği (EA) ve Uluslararası Laboratuvar Akreditasyon Birliği (ILAC) ile karşılıklı tanınma antlaşmasını imzalamıştır.
The Turkish Accreditation Acency (TURKAK) is signatory to the multilateral agreements of the European co-operation for the Accreditation(EA) and of the International Laboratory Accreditation(ILAC) for the Mutual recognation of calibration certificates.

Ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri ve kalibrasyon metodları bu sertifikanın tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.
The measurements, the uncertainities with confidence probability and calibration methods are given on the following pages which are part of this certificate.

Mühür *Seal*	**Tarih** *Date*	**Kalibrasyonu Yapan** *Calibrated by*	**Laboratuvar Müdürü V.** *Head of Calibration Laboratory*
PROTOS KALİBRASYON	12.10.2010	Erdem YILDIZ	Murat KUŞLU

Bu sertifika, laboratuvarın yazılı izni olmadan kısmen kopyalanıp çoğaltılamaz.
İmzasız ve mühürsüz sertifikalar geçersizdir.
This certificate shall not be reproduced other than in full except with the permission of the laboratory.
Calibration certificates without signature and seal are not valid.

Sayfa 1/4
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Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümler kapsamında olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI

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PROTOS KALİBRASYON ÖLÇÜM EĞİTİM VE DANIŞMANLIK HİZMETLERİ TİCARET LTD. ŞTİ. KALİBRASYON LABORATUVARI

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1. Test Edilen Cihaz

Adı	Üretici	Model / Tip	Seri No	Ölçme aralığı veya Tanımlama
Ses Düzeyi Ölçer	SVANTEK	SVAN958	14294	Sınıf : 1 Frekans Ağırlığı : A, C, Lin Zaman Ağırlığı : F:Hızlı, S:Yavaş

2. Kalibrasyonun Yapıldığı Yer : Protos Kalibrasyon Laboratuvarı

3. Cihazın Laboratuvara Kabul Tarihi : 08.10.2010

4. Kalibrasyonda Kullanılan Referans Cihazlar :

Adı	Üretici	Model / Tip	Seri No	İzlenebilirlik
Çok Fonksiyonlu Akustik Kalibratör	B&K	4226	2692346	TÜBİTAK UME, G2AK0263-25.11.2009

5. Kalibrasyon Prosedürü : PR504.08 SLM Kalibrasyon Prosedürü

Ses düzeyi ölçerin (SLM) A-Ağırlıklı, C-Ağırlıklı ve Lin filtrelerin 31,5 Hz-16 kHz frekans aralığında tepkileri, doğrusallığı, F:Fast ve S:Slow zaman ağırlıklarının tepkileri, Crest Faktörü CF=3 ve bir saatlik çalışmada kararlılığı kontrol edildi.

Kalibrasyon sırasında referans cihaz tarafından üretilen ses basınç düzeyi değerleri ortam şartlarına göre düzeltilerek dikkate alınmıştır.

6. Çevre Şartları

Sıcaklık: (23 ± 0,5) °C Bağıl Nem:%(45,0±5,0) Basınç: (999±1,0)mbar

7. Kalibrasyon Sonuçları

Tablo 1. SLM A-ağırlıklı filtrenin frekans tepkileri sonuçları

Frekans (Hz)	Nominal SPL (dB)	A-ağırlıklı filtrenin karakteristiği (dB)	Hesaplanan SPL (dB)	Ölçülen SPL (dB)	Tepki Farkı (dB)	Tolerans (dB)
31,5	94,0	-39,4	54,6	54,7	0,1	± 2,0
63	94,0	-26,2	67,8	67,9	0,1	± 1,5
125	94,0	-16,1	77,9	77,9	0,0	± 1,5
250	94,0	-8,6	85,4	85,3	-0,1	± 1,4
500	93,9	-3,2	90,7	90,7	0,0	± 1,4
1000	94,0	0,0	94,0	94,0	0,0	± 1,1
2000	94,0	1,2	95,2	95,2	0,0	± 1,6
4000	94,0	1,0	95,0	94,9	-0,1	± 1,6
8000	93,9	-1,1	92,8	92,2	-0,6	+2,0;-3,1
12500	94,1	-4,3	89,8	87,7	-2,1	+3,0;-6,0
16000	94,1	-6,6	87,5	84,4	-3,1	+3,5;-17,0

Tablodaki değerler SLM A-ağırlıklı filtre ve Fast modunda iken elde edilmiştir.

PROTOS KALİBRASYON

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Tablo 2. SLM C-ağırlıklı filtrenin frekans tepkileri sonuçları

Frekans (Hz)	Nominal SPL (dB)	C-ağırlıklı filtrenin karakteristiği (dB)	Hesaplanan SPL (dB)	Ölçülen SPL (dB)	Tepki Farkı (dB)	Tolerans (dB)
31.5	94,0	-3,0	91,0	91,1	0,1	± 2,0
63	94,0	-0,8	93,2	93,3	0,1	± 1,5
125	94,0	-0,2	93,8	93,8	0,0	± 1,5
250	94,0	0,0	94,0	94,0	0,0	± 1,4
500	93,9	0,0	93,9	94,0	0,1	± 1,4
1000	94,0	0,0	94,0	94,0	0,0	± 1,1
2000	94,0	-0,2	93,8	93,8	0,0	± 1,6
4000	94,0	-0,8	93,2	93,1	-0,1	± 1,6
8000	93,9	-3,0	90,9	90,3	-0,6	+2,0;-3,1
12500	94,1	-6,2	87,9	85,8	-2,1	+3,0;-6,0
16000	94,1	-8,5	85,6	82,6	-3,0	+3,5;-17,0

Tablodaki değerler SLM C-ağırlıklı filtre ve Fast modunda iken elde edilmiştir.

Tablo 3. SLM Lin filtresinin frekans tepkileri sonuçları

Frekans (Hz)	Nominal SPL (dB)	Ölçülen SPL (dB)	Tepki Farkı (dB)	Tolerans (dB)
31.5	94,0	94,2	0,2	± 2,0
63	94,0	94,1	0,1	± 1,5
125	94,0	94,0	0,0	± 1,5
250	94,0	94,0	0,0	± 1,4
500	93,9	93,9	0,0	± 1,4
1000	94,0	94,0	0,0	± 1,1
2000	94,0	94,0	0,0	± 1,6
4000	94,0	93,9	-0,1	± 1,6
8000	93,9	93,2	-0,7	+2,0;-3,1
12500	94,1	92,1	-2,0	+3,0;-6,0
16000	94,1	91,3	-2,8	+3,5;-17,0

Tablodaki değerler SLM Lin -ağırlıklı filtre ve Fast modunda iken elde edilmiştir.

Tablo 4. SLM 1 kHz'deki doğrusallık kontrolü sonuçları

Frekans (Hz)	Uygulanan		Ölçülen		Tepki Farkı (dB)	Tolerans (dB)
	SPL (dB)	Seviye Artışı (dB)	SPL (dB)	Seviye Artışı (dB)		
1000	94,0	0,0	94,0	0,0	0,0	±0,6
	104,0	10,0	104,0	10,0	0,0	
	114,0	20,0	114,0	20,0	0,0	

Tablodaki değerler SLM A-ağırlıklı filtre ve Fast modunda iken elde edilmiştir.

PROTOS KALİBRASYON

Sayfa 3/4
FR510.02

ÇEVRE ÖLÇÜM VE ANALİZ LABORATUVARI ÇANKAYA

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Tablo 5. SLM Zaman Ağırlıklı filtrelerinin Hızlı (Fast) ve Yavaş (Slow) Kontrolü Sonuçları

Frekans (Hz)	Hızlı				Yavaş			
	Nominal SPL (dB)	Ölçülen SPL (dB)	Tepki Farkı (dB)	Tolerans (dB)	Nominal SPL (dB)	Ölçülen SPL (dB)	Tepki Farkı (dB)	Tolerans (dB)
1000	105,0	105,0	0,0	± 0,8	101,9	102,0	0,1	± 0,8
2000	105,0	105,0	0,0		101,9	102,1	0,2	
4000	105,0	105,0	0,0		101,9	102,0	0,1	

Tablodaki değerler SLM A-ağırlıklı filtre modunda iken elde edilmiştir.

Tablo 6. SLM "Crest Factor CF=3" Kontrolü Sonuçları

Frekans (Hz)	Nominal SPL (dB)	Ölçülen SPL (dB)	Tepki Farkı (dB)	Tolerans (dB)
2000	94,0	94,2	0,2	± 0,5
	104,0	104,3	0,3	

Tablodaki değerler SLM A-ağırlıklı filtre ve Fast modunda iken elde edilmiştir.

Tablo 7. SLM Bir saatlik çalışmasında okunan değerdeki en büyük sapma sonuçları

Nominal SPL (dB)	Ölçülen SPL (dB)	En büyük sapma * (dB)	Tolerans (dB)
94,0	94,0	0,0	± 0,5

*En büyük sapma, ölçülen değerdeki bir saatlik okuma süresi boyunca ki değişimdir.
Tablodaki değerler SLM A-ağırlıklı filtre ve Fast modunda iken elde edilmiştir.

8. Ölçüm Belirsizliği

Ses düzeyi ölçerin kalibrasyonundaki belirsizlik 0,2 dB'dir.

Beyan edilen genişletilmiş ölçüm belirsizliği, standart belirsizliğin k=2 olarak alınan genişletme katsayısı ile çarpımı sonucunda bulunan değerdir ve %95 oranında güvenilirlik sağlamaktadır.

9. Görüşler, Açıklamalar ve Uygunluk Beyanı

Ölçüm sonuçları IEC 61672-1 standartında 1.Sınıf Ses Düzeyi Ölçerler için verilen toleranslarla karşılaştırıldı. Cihazın ölçülen özelliklerinin standartta belirtilen şartlara uygun olduğu tespit edilmiştir.

Kalibrasyon sonuçları sadece kalibrasyonu yapılan ses düzeyi ölçer cihazına aittir. Cihazın performansı için gerekli çevre şartlarında kullanımından ve uygun aralıklarla kalibrasyonunun sağlanmasından kullanıcı sorumludur.

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DANIŞMANLIK HİZMETLERİ TİCARET LTD. ŞTİ.
KALİBRASYON LABORATUVARI

Mehmet Akif Mh. Tavukçuyolu Cd. No: 150/1 Ümraniye İSTANBUL
Telefon: 0216 415 4949 (Pbx), Faks: 0216 415 4950
e-posta: info@protos.com.tr, internet: www.protos.com.tr

TÜRKAK Kalibrasyon TS EN ISO/IEC 17025 AB-0078-K

AB-0078-K
179/2011
05-11

Kalibrasyon Sertifikası
Calibration Certificate

Cihazın Sahibi/ adresi *Customer / address*	: Çankaya Çevre Ölçüm İş Sağlığı Ve İş Güvenliği Müh. Müş. Eğitim Ve Sağlık Hiz. Mat. Yay. Turz. Tic. Ltd. Şti. Gazi Mah. Silahtar Cad. 134/1 Yenimahalle/ANKARA
Talep Numarası *Order Number*	: 117/2011
Makine/Cihaz *Instrument/Device*	: Ses Kalibratörü
İmalatçı *Manufacturer*	: -
Tip *Type*	: ND9
Seri Numarası *Serial Number*	: N274726
Kalibrasyon Tarihi *Date of Calibration*	: 12.05.2011
Sertifikanın Sayfa Sayısı *Number of pages of the Certificate*	: 3

Bu kalibrasyon sertifikası, Uluslararası Birimler Sisteminde (SI) tanımlanmış birimleri realize eden ulusal ölçüm standardlarına izlenebilirliği belgeler.
This calibration certificate documents the traceability to national standards, which realize the unit of measurement according to the International System of Units (SI).

Türk Akreditasyon Kurumu (TÜRKAK) kalibrasyon sertifikalarının tanınması konusunda Avrupa Akreditasyon Birliği (EA) ve Uluslararası Laboratuvar Akreditasyon Birliği (ILAC) ile karşılıklı tanınma antlaşmasını imzalamıştır.
The Turkish Accreditation Acency (TURKAK) is signatory to the multilateral agreements of the European co-operation for the Accreditation(EA) and of the International Laboratory Accreditation(ILAC) for the Mutual recognation of calibration certificates.

Ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri ve kalibrasyon metodları bu sertifikanın tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir.
The measurements, the uncertainties with confidence probability and calibration methods are given on the following pages which are part of this certificate.

Mühür *Seal*	Tarih *Date*	Kalibrasyonu Yapan *Calibrated by*	Laboratuvar Müdürü V. *Head of Calibration Laboratory*
PROTOS KALİBRASYON	12.05.2011	Erdem YILDIZ	Murat KUŞLU

Bu sertifika, laboratuvarın yazılı izni olmadan kısmen kopyalanıp çoğaltılamaz.
İmzasız ve mühürsüz sertifikalar geçersizdir.
This certificate shall not be reproduced other than in full except with the permission of the laboratory.
Calibration certificates without signature and seal are not valid.

Sayfa 1/3

FR510.02

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Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamaktadır, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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1. Test Edilen Cihaz

Adı	Üretici	Model / Tip	Seri No	Ölçme aralığı veya Tanımlama
Ses Kalibratörü	-	ND9	N274726	Sınıf : 1 Frekans: 1000 Hz Seviye : 94 dB, 114 dB

2. Kalibrasyonun Yapıldığı Yer : Protos Kalibrasyon Laboratuvarı

3. Cihazın Laboratuvara Kabul Tarihi : 10.05.2011

4. Kalibrasyonda Kullanılan Referans Cihazlar :

Adı	Üretici	Model / Tip	Seri No	İzlenebilirlik
Kapasitif Mikrofon	B&K	4192	2686160	TÜBİTAK UME G2AK-0257, 07.10.2010

5. Kalibrasyon Prosedürü : PR504.09 SLK Kalibrasyon Prosedürü

Ses kalibratörünün (SLK) kalibrasyonu referans mikrofon kullanılarak karşılaştırma yöntemi ile yapılmıştır. Ses Kalibratörün ürettiği ses basınç düzeyleri ve frekansı ile seviye ve frekans kararlılığı kontrol edildi.

Kalibrasyon sırasında referans cihaz tarafından üretilen ses basınç düzeyi değerleri ortam şartlarına göre düzeltilerek dikkate alınmıştır.

6. Çevre Şartları

Sıcaklık: (23±1,0) °C   Bağıl Nem:%(43,0±5,0)   Basınç: (993±1,0)mbar

7. Kalibrasyon Sonuçları

Tablo 1. SLK Seviye Kontrolü Sonuçları

Nominal Değer (dB)	Ölçülen Değer (dB)	Tolerans (dB)	Seviye Kararlılığı (dB)		Tolerans (dB)
			|UL-ML|	|LL-ML|	
94,00	94,03	± 0,4	0,014	0,019	± 0,1
114,00	113,65		0,003	0,001	

|UL-ML| : 20 saniye süresince kalibratörün en yüksek seviyesi ile ortalama seviyesi arasındaki fark
|LL-ML| : 20 saniye süresince kalibratörün en küçük seviyesi ile ortalama seviyesi arasındaki fark

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Tablo 2. SLK Frekans Kontrolü Sonuçları

Nominal Değer (Hz)	Ölçülen Değer (Hz)	Tolerans (%)	Seviye (dB)	Frekans Kararlılığı (%)	
				|UF-MF|	|LF-MF|
1000,00	1000,11	± 1,0	94,0	0,003	0,002
			114,0	0,018	0,011

|UL-ML| : 20 saniye süresince kalibratörün en yüksek frekansı ile ortalama frekansı arasındaki fark
|LL-ML| : 20 saniye süresince kalibratörün en küçük frekansı ile ortalama frekansı arasındaki fark

8. Ölçüm Belirsizliği

Ses kalibratörün seviye belirlenmesindeki belirsizlik 0,13 dB'dir.

Beyan edilen genişletilmiş ölçüm belirsizliği, standart belirsizliğin k=2 olarak alınan genişletme katsayısı ile çarpımı sonucunda bulunan değerdir ve %95 oranında güvenilirlik sağlamaktadır.

9. Görüşler, Açıklamalar ve Uygunluk Beyanı

Ölçüm sonuçları IEC 60942 standartında 1.Sınıf Ses Kalibratörleri için verilen toleranslarla karşılaştırılmıştır. Cihazın ölçülen özelliklerinin IEC 60942 standartında 1.Sınıf Ses Kalibratörleri için belirtilen şartlara uygun olduğu tespit edilmiştir.

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EK-3 PERSONELE AİT BELGELER

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T.C.
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Mühendislik Fakültesi Dekanlığı

SAYI: B.30.2.DEU.0.45.00.01 5219

25/07/2006

GEÇİCİ MEZUNİYET BELGESİ

ÖĞRENCİNİN

T.C. Kimlik Numarası	:	33322268032
Soyadı Adı	:	ÜLGER FİLİZ
Numarası	:	2001501049
Baba Adı	:	ALİ
Anne Adı	:	ZEHRA
Doğum Yeri / Yılı	:	ALACA ÇORUM - 07/06/1983
Bölüm / Program	:	Çevre Mühendisliği
Kesin Kayıt Tarihi	:	17/09/2001
Kayıt Şekli	:	ÖSS-ÖYS yoluyla
Mezuniyet Tarihi ve Derecesi	:	28/06/2006-LİSANS MEZUNU
Mezuniyet Notu	:	2,75

Bu geçici mezuniyet belgesi, adı geçen öğrenciye daha sonra hazırlanacak olan diploması ile değiştirilmek üzere verilmiştir.
Bilgilerinizi arz / rica ederim.

Prof. Dr. [illegible]
Dekan Vekili

Ege Üniversitesi Kampüsü
35100 Bornova - İZMİR

Tel : (232) 388 06 80
Faks : (232) 388 78 64
Santral :

e-posta : muhendislik@deu.edu.tr

ÇANKAYA

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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FİZİK MÜHENDİSLERİ ODASI
BAŞARI BELGESİ

Sayın Filiz ÜLGER

TMMOB Fizik Mühendisleri Odası ile Çevre ve Orman Bakanlığı işbirliği ile 2-5 Nisan 2009 tarihleri arasında Fizik Mühendisleri Odası Genel Merkezi'nde gerçekleştirilen

"A-2 Tipi Mühendislik Akustiği"

Sertifika Programına katılarak "BAŞARILI" olmuştur .

Dr. Abdullah ZARARSIZ
Yönetim Kurulu Başkanı

Belge Kodu: FMO1 Belge No: 13 Veriliş Tarihi: 5 Nisan 2009

İSTANBUL TEKNİK ÜNİVERSİTESİ
SÜREKLİ EĞİTİM MERKEZİ
BAŞARI BELGESİ

Filiz ÜLGER

Mimarlık ve Makine Fakülteleri tarafından düzenlenen

"ÇEVRESEL GÜRÜLTÜNÜN DEĞERLENDİRİLMESİ VE YÖNETİMİ (ÇGDY)"

B-1 Tipi SERTİFİKA Programını başarıyla tamamlamıştır.

Dönem: 2009/01 *Toplam Süre: 36 saat*

Prof. Dr. Taner DERBENTLİ
Makine Fakültesi Dekanı

Prof. Dr. Orhan HACIHASANOĞLU
Mimarlık Fakültesi Dekanı

Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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Türkiye Cumhuriyeti
Atatürk Üniversitesi
Mühendislik Fakültesi
Lisans Diploması

Bölümü : Çevre Mühendisliği

Diploma № 3438
Mezuniyet Tarihi: 09.06.2006

1982 yılı Yeşilhisar doğumlu
Hacı Mehmet YİĞİT
Atatürk Üniversitesi
Mühendislik Fakültesi ' nin
özel kanun ve yönetmelikleri gereğince öğrenimini
başarı ile tamamladığından,
Türkiye Cumhuriyeti kanunlarının verdiği bütün hak ve yetkilerden
faydalanmak üzere kendisine bu diploma verilmiştir.

Prof.Dr. M.Şahin GÜLABOĞLU
Dekan

Prof.Dr. Yaşar SÜTBEYAZ
Rektör

TÜRKİYE CUMHURİYETİ
ORTA DOĞU TEKNİK ÜNİVERSİTESİ
ANKARA

REPUBLIC OF TURKEY
MIDDLE EAST TECHNICAL UNIVERSITY
ANKARA

SEM - CEC

A-2 TİPİ MÜHENDİSLİK AKUSTİĞİ SERTİFİKASI

A-2 TYPE CERTIFICATE ON ENGINEERING ACOUSTICS

H. Mehmet YİĞİT

Yukarıda adı belirtilen kişi, 12 – 16 Eylül 2009 tarihleri arasında ODTÜ Sürekli Eğitim Merkezi tarafından düzenlenen ve aşağıdaki konuları içeren A-2 TİPİ MÜHENDİSLİK AKUSTİĞİ SERTİFİKA PROGRAMI'nı başarı ile tamamlayarak bu sertifikayı almaya hak kazanmıştır.

- Akustik ile İlgili Genel Bilgiler
- Gürültünün Etkileri
- Çevresel Titreşim – Titreşim Tarifi ve Ölçümü
- Gürültü Kontrol İlkeleri
- Çevresel Gürültünün Tarifi
- Gürültü Ölçümleri

H. Mehmet YİĞİT

This is to certify that the above person has diligently pursued and successfully completed the A-2 TYPE CERTIFICATE PROGRAM ON ENGINEERING ACOUSTICS offered by Continuing Education Center organized between September 12th, 2009 and, September 16th 2009, which includes the courses listed below:

- General Information on Acoustics
- Effects of Noise on Man
- Environmental Vibration-Definitions and Vibration Measurements
- Principles of Noise Control
- Environmental Noise-Definitions
- Noise Measurements

Prof. Dr. Ahmet ACAR
Rektör

Prof. Dr. H. Nevzat ÖZGÜVEN
Eğitmen

Prof. Dr. Mehmet ÇALIŞKAN
Eğitmen

Prof. Dr. Hüseyin VURAL
SEM Başkanı

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Bu rapor , Muş ilinde yapılması planlanan Alpaslan II Barajı ve HES Projesi için 25-26.08.2011 tarihlerinde yapılan ölçümleri kapsamakta olup, Çankaya Çevre Ölçüm İş Sağlığı ve İş Güvenliği Müh. Müş. Eğitim ve Sağlık Hizt. Mat. Yay. Tur. Tic. Ltd. Şti.'nin izni olmadan kısmen dahi kopyalanıp çoğaltılamaz. İmzasız ve mühürsüz raporlar geçersizdir. Deney sonuçları, sadece ölçüm sırasındaki çevre koşullarıyla ilgilidir.

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EK-4 ÖLÇÜM CİHAZI ÇIKTISI

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@AKD : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ld	Ltm3	Ltm5
25.08.2011	10:00:06	Ch4	P1	A	00:08:00	0	dB	83,15	66,5	32,31	38,26	46,22	73,03	46,2	54,1	55,3
25.08.2011	10:00:06	Ch4	P2	Lin	00:08:00	0	dB	89,97	82,3	42,97	51,54	65,97	92,78	66	71,6	72,7
25.08.2011	10:00:06	Ch4	P3	C	00:08:00	0	dB	82,59	73,9	39,44	44,02	57,74	84,55	57,7	63,2	64,3

@AKE : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Le	Ltm3	Ltm5
25.08.2011	20:01:18	Ch4	P1	A	00:08:00	0	dB	91,87	69,6	31,95	38,87	43,98	70,79	49	52,8	54,5
25.08.2011	20:01:18	Ch4	P2	Lin	00:08:00	0	dB	91,72	79,3	43	54,48	62,86	89,67	67,9	68,9	70
25.08.2011	20:01:18	Ch4	P3	C	00:08:00	0	dB	91,38	74,8	39,79	50,23	54,79	81,6	59,8	61,4	62,6

@AKN : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ln	Ltm3	Ltm5
25.08.2011	23:30:34	Ch4	P1	A	00:08:00	0	dB	96,12	72,3	32,33	46,41	44,45	71,26	54,5	54,1	56
25.08.2011	23:30:34	Ch4	P2	Lin	00:08:00	0	dB	94,7	84,2	46,13	70,91	69,51	96,32	79,5	74,9	75,9
25.08.2011	23:30:34	Ch4	P3	C	00:08:00	0	dB	94,68	76,7	41,65	66,44	61,7	88,51	71,7	66,9	67,9

@DOD : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ld	Ltm3	Ltm5
25.08.2011	11:17:56	Ch4	P1	A	00:08:00	0	dB	102,3	75,9	33,26	49,89	46,88	73,69	46,9	56,9	58,7
25.08.2011	11:17:56	Ch4	P2	Lin	00:08:00	0	dB	107,9	99,5	39,89	70,42	71,44	98,25	71,4	79,8	81,5
25.08.2011	11:17:56	Ch4	P3	C	00:08:00	0	dB	104,5	95	36,04	62,06	64,63	91,44	64,6	74,4	76,3

@DOE : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Le	Ltm3	Ltm5
25.08.2011	21:30:32	Ch4	P1	A	00:08:00	0	dB	95,01	72,9	32,5	36,67	42,15	68,96	47,2	53,7	54,3
25.08.2011	21:30:32	Ch4	P2	Lin	00:08:00	0	dB	95,09	78	38,93	45,88	54,32	81,13	59,3	62,1	62,7
25.08.2011	21:30:32	Ch4	P3	C	00:08:00	0	dB	95,72	75,9	34,97	41,38	47,7	74,51	52,7	57,4	57,7

@DGN : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ln	Ltm3	Ltm5
26.08.2011	01:31:12	Ch4	P1	A	00:08:00	0	dB	82,9	63,4	34,57	39,71	41,1	67,91	51,1	46	47
26.08.2011	01:31:12	Ch4	P2	Lin	00:08:00	0	dB	88,04	82,7	40,96	73,06	66,15	92,96	76,2	72,1	73,3
26.08.2011	01:31:12	Ch4	P3	C	00:08:00	0	dB	85,13	72,5	36,22	63,53	57,53	84,34	67,5	63,4	64,3

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@DUD : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ld	Ltm3	Ltm5
25.08.2011	13:01:02	Ch4	P1	A	00:08:00		0 dB	94,09	69	33,27	51,14	50,12	76,93	50,1	58,7	60
25.08.2011	13:01:02	Ch4	P2	Lin	00:08:00		0 dB	92,69	75	39,35	63,5	57,1	83,91	57,1	64,3	65,5
25.08.2011	13:01:02	Ch4	P3	C	00:08:00		0 dB	91,63	71,7	35,65	58,87	53,59	80,4	53,6	61,2	62,4

@DUE : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ln	Ltm3	Ltm5
25.08.2011	22:30:46	Ch4	P1	A	00:08:00		0 dB	88,08	70,5	33,37	52,89	44,86	71,67	54,9	53,2	54,8
25.08.2011	22:30:46	Ch4	P2	Lin	00:08:00		0 dB	89,23	80,1	40,89	60,34	56	82,81	66	63,5	65,1
25.08.2011	22:30:46	Ch4	P3	C	00:08:00		0 dB	87,81	75	38,19	58,9	50,42	77,23	60,4	58,3	60,1

@DUN : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ln	Ltm3	Ltm5
26.08.2011	02:30:40	Ch4	P1	A	00:08:00		0 dB	85,16	63,9	32,83	52,13	40,68	67,49	50,7	48,7	50,3
26.08.2011	02:30:40	Ch4	P2	Lin	00:08:00		0 dB	89,64	83,2	39,47	70,34	59,67	86,48	69,7	67	68,7
26.08.2011	02:30:40	Ch4	P3	C	00:08:00		0 dB	85,63	75,2	35,97	60,7	51,43	78,24	61,4	59	60,4

@KAD : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ld	Ltm3	Ltm5
26.08.2011	09:02:36	Ch4	P1	A	00:08:00		0 dB	89,78	70,4	32,08	55,15	44,45	71,26	44,5	54,4	56,1
26.08.2011	09:02:36	Ch4	P2	Lin	00:08:00		0 dB	101,3	94,1	41,46	82,61	77,24	104,1	77,2	84,4	85,6
26.08.2011	09:02:36	Ch4	P3	C	00:08:00		0 dB	93,84	84,7	36,54	71,66	68,73	95,54	68,7	75,8	77

@KAE : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Le	Ltm3	Ltm5
26.08.2011	19:30:48	Ch4	P1	A	00:08:00		0 dB	90,78	68,5	32,52	45,54	43,28	70,09	48,3	52,4	53,6
26.08.2011	19:30:48	Ch4	P2	Lin	00:08:00		0 dB	105,1	98,8	45,36	89,41	82,21	109	87,2	88,7	89,6
26.08.2011	19:30:48	Ch4	P3	C	00:08:00		0 dB	97,02	89,1	38,65	81,44	73,62	100,4	78,6	80,1	80,9

@KAN : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT %	units	Peak	Max	Min	Spl	Leq	Sel	Ln	Ltm3	Ltm5
26.08.2011	23:16:06	Ch4	P1	A	00:08:00		0 dB	86,53	64,2	32,75	35,58	41,85	68,66	51,9	49,9	50,7
26.08.2011	23:16:06	Ch4	P2	Lin	00:08:00		0 dB	110,5	102	45,9	68,85	82,82	109,6	92,8	89,8	91
26.08.2011	23:16:06	Ch4	P3	C	00:08:00		0 dB	102,3	92,8	40,02	58,51	74,12	100,9	84,1	81	82,2

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Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT units %	Peak	Max	Min	Spl	Leq	Sel	Ld	Ltm3	Ltm5
26.08.2011	10:01:58	Ch4	P1	A	00:08:00	0 dB	86,74	65,8	32,05	44,44	43,95	70,76	44	52,9	54,7
26.08.2011	10:01:58	Ch4	P2	Lin	00:08:00	0 dB	94,47	83,7	39,21	73,85	60,5	87,31	60,5	68,7	70
26.08.2011	10:01:58	Ch4	P3	C	00:08:00	0 dB	91	80,1	34,46	64,64	53,14	79,95	53,1	62,2	63,9

@KUE : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT units %	Peak	Max	Min	Spl	Leq	Sel	Le	Ltm3	Ltm5
26.08.2011	20:11:34	Ch4	P1	A	00:08:00	0 dB	89,11	72,1	31,63	35,66	45,54	72,35	50,5	54,7	56,8
26.08.2011	20:11:34	Ch4	P2	Lin	00:08:00	0 dB	96,98	86	37,39	71,13	63,59	90,4	68,6	70,9	72,1
26.08.2011	20:11:34	Ch4	P3	C	00:08:00	0 dB	96,42	84,1	32,53	61,82	56,19	83	61,2	64,8	66,5

@KUN : Main results

Main results for sound

Day dd.MM.yyyy	Hour HH:mm:ss	Channel	Profile	Filter	Time hh:mm:ss	OvlT units %	Peak	Max	Min	Spl	Leq	Sel	Ln	Ltm3	Ltm5
27.08.2011	00:16:36	Ch4	P1	A	00:08:00	0 dB	93,39	73,1	33	55,11	42,73	69,54	52,7	53	54,9
27.08.2011	00:16:36	Ch4	P2	Lin	00:08:00	0 dB	95,49	82,2	38,67	63,22	65,19	92	75,2	71,4	72,2
27.08.2011	00:16:36	Ch4	P3	C	00:08:00	0 dB	95,01	76,3	35,89	54,76	56,8	83,61	66,8	63,5	64,6

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EK-5 ÖLÇÜM FOTOĞRAFLARI

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Akpınar Köyü

Doğdap Mahallesi

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Dumlusu Köyü

Kayalıdere Köyü

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Kuşluk Köyü

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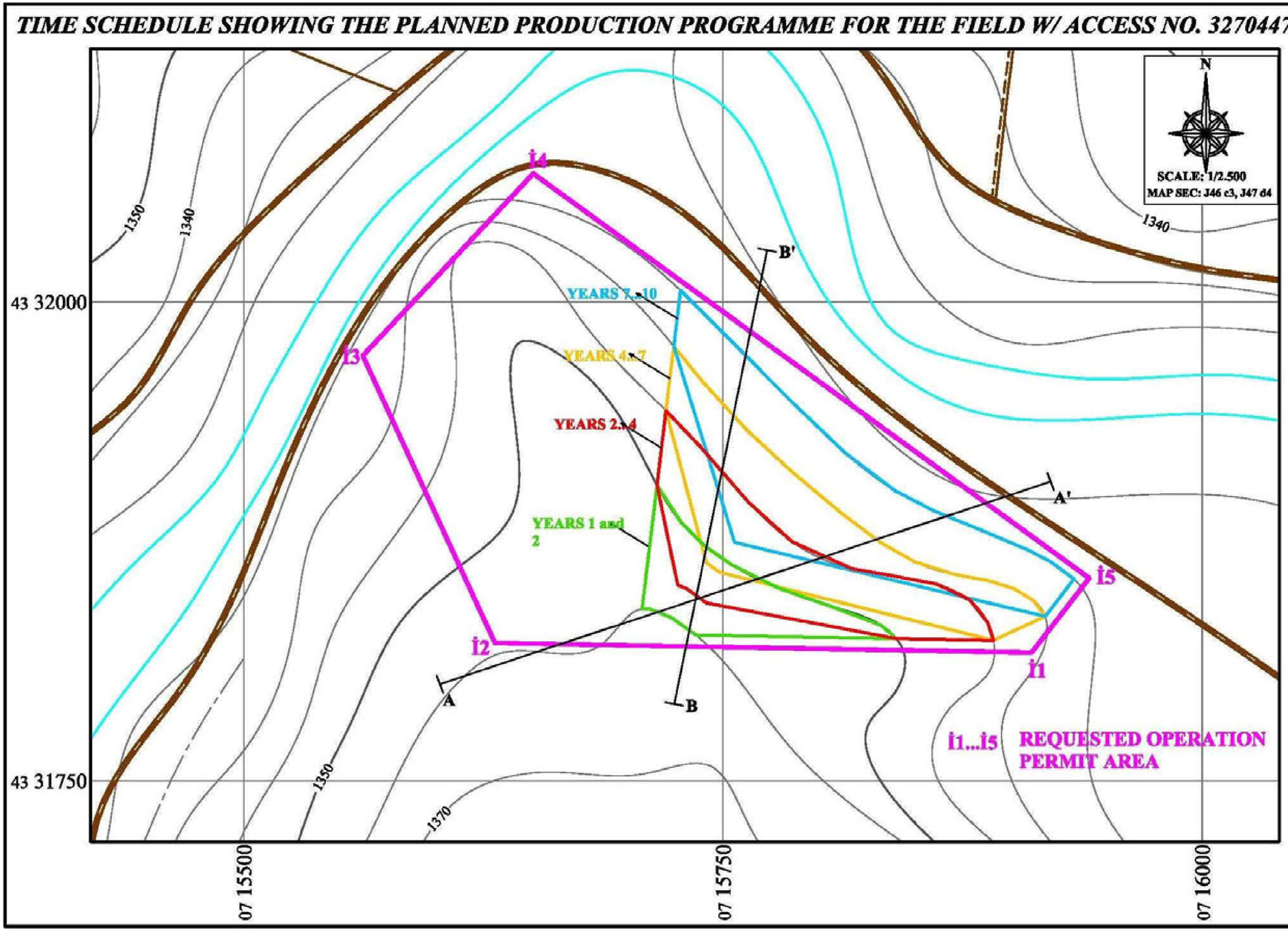
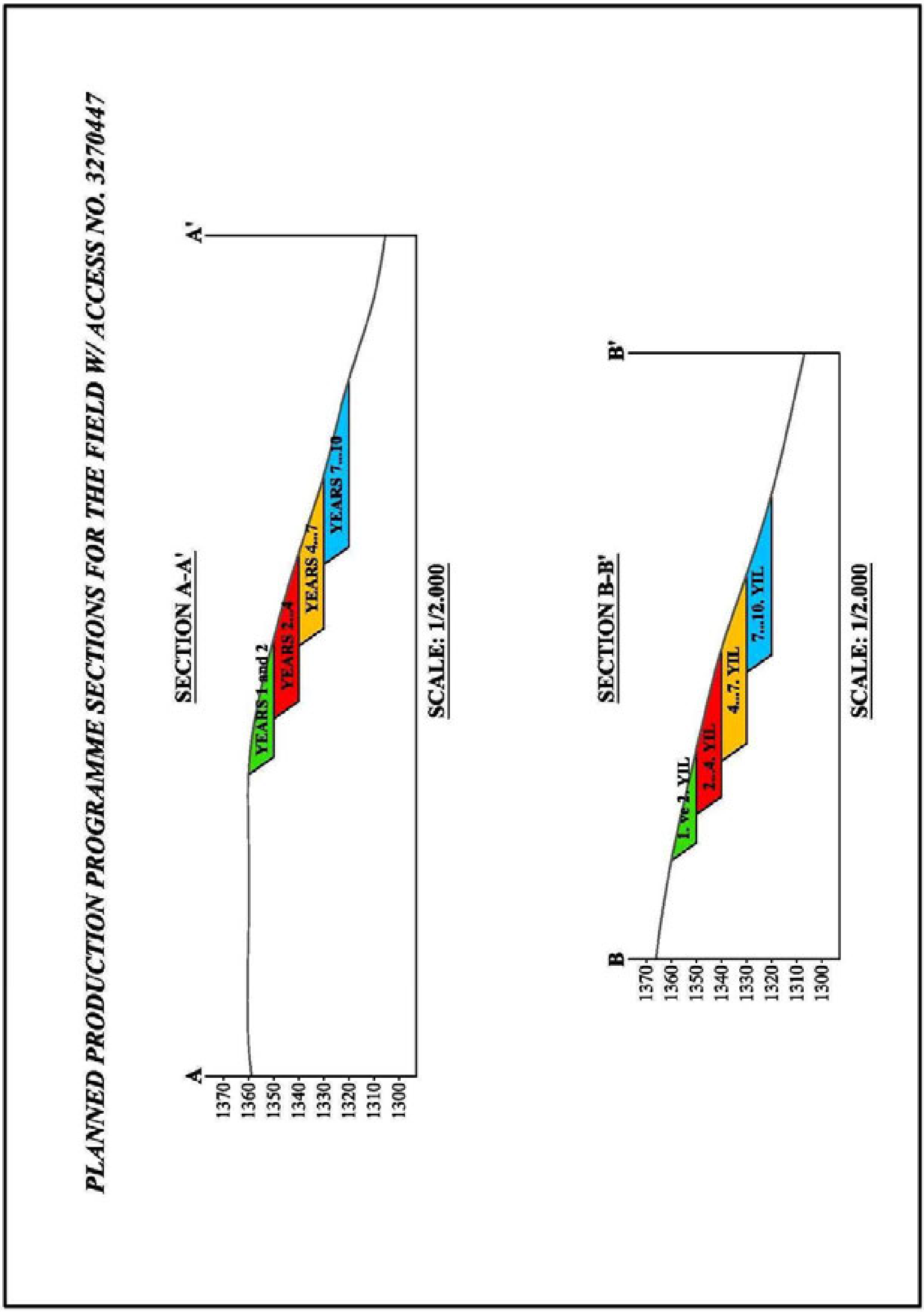
APP 17

MATERIAL BORROW AREAS PROCESS LAYOUTS

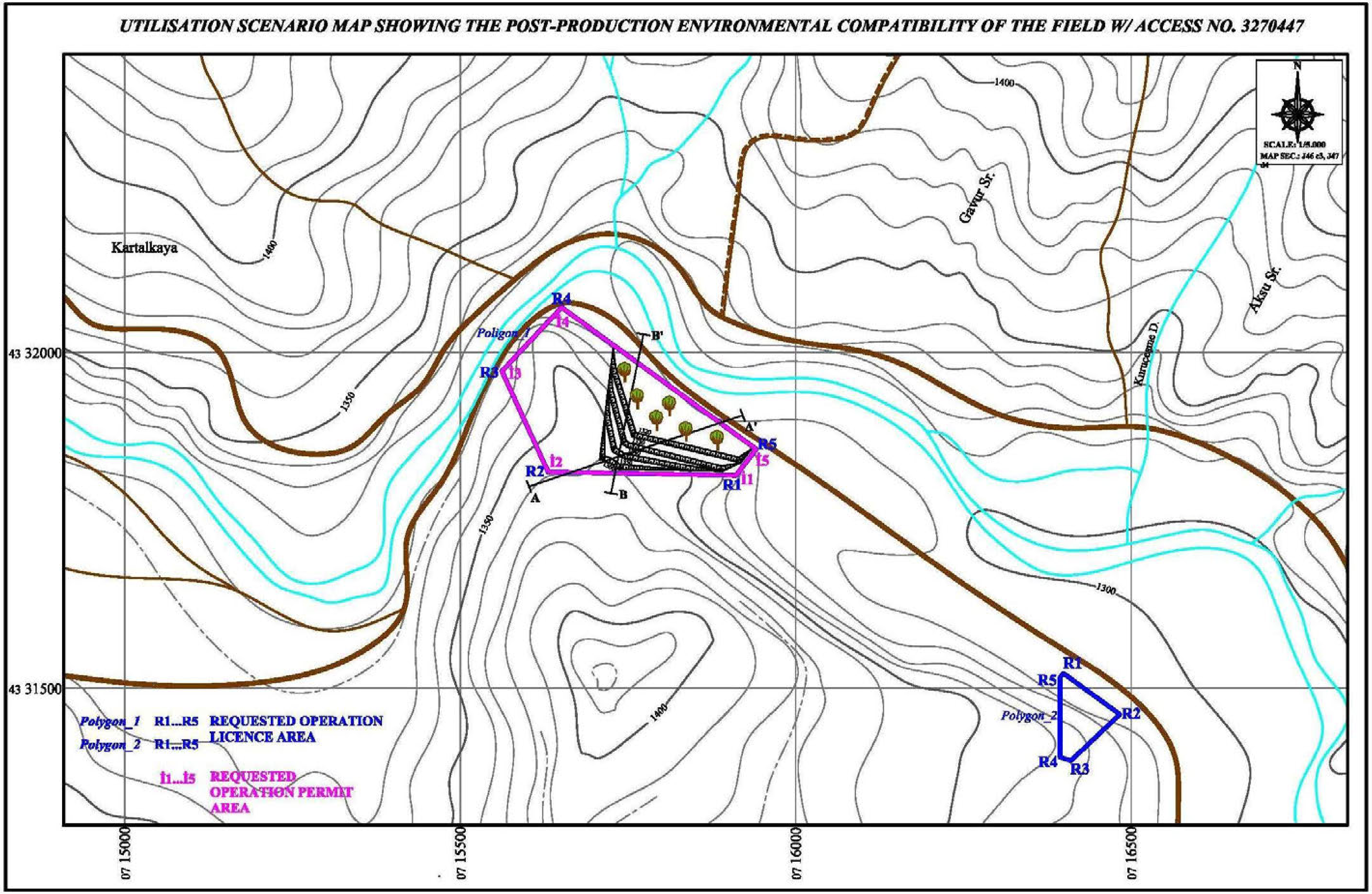
Material Borrow Area K-1



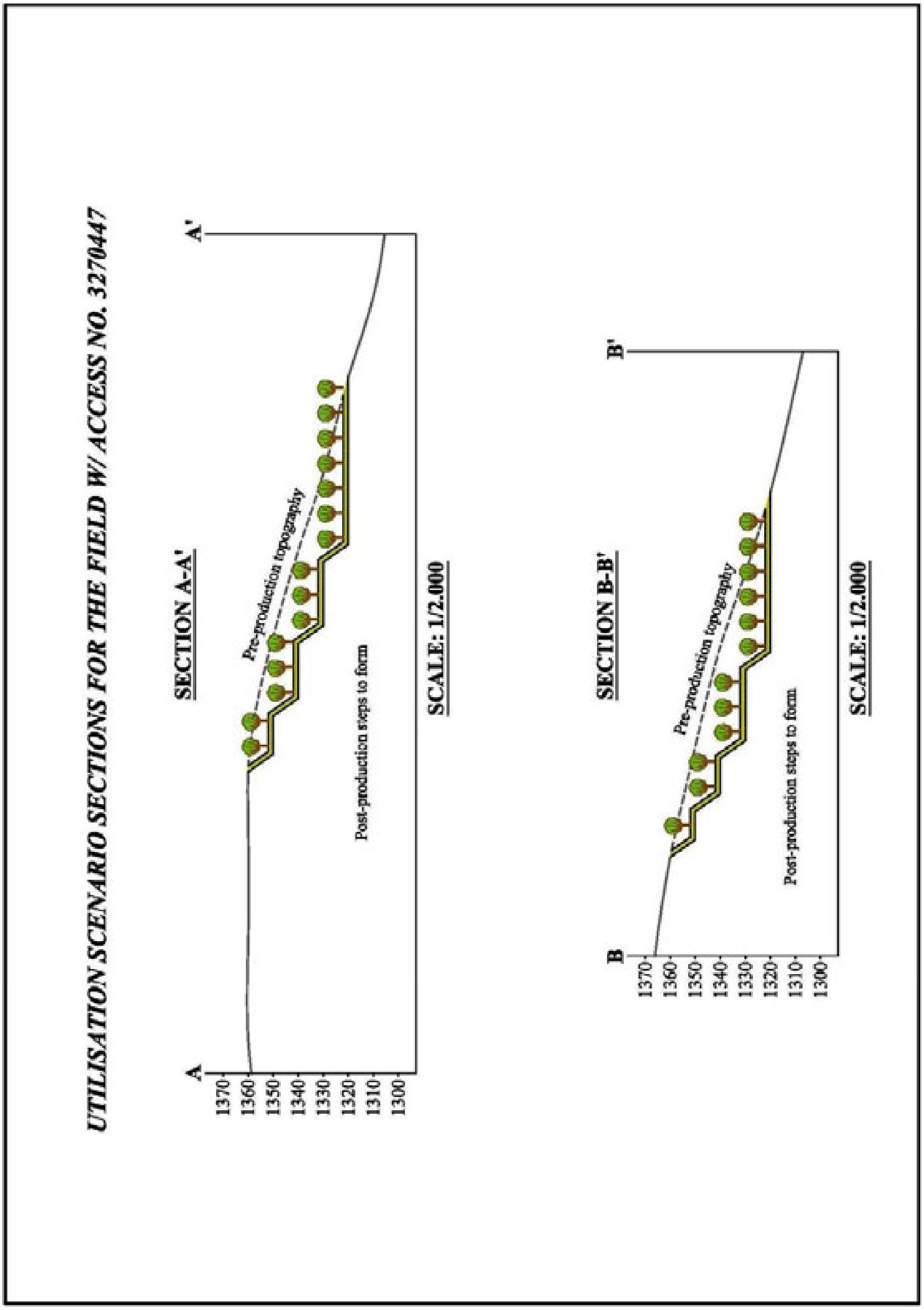
App 17.1. Time Schedule Showing of Material Borrow Area K-1



App 17.2. Production Programme Sections of Material Borrow Area K-1

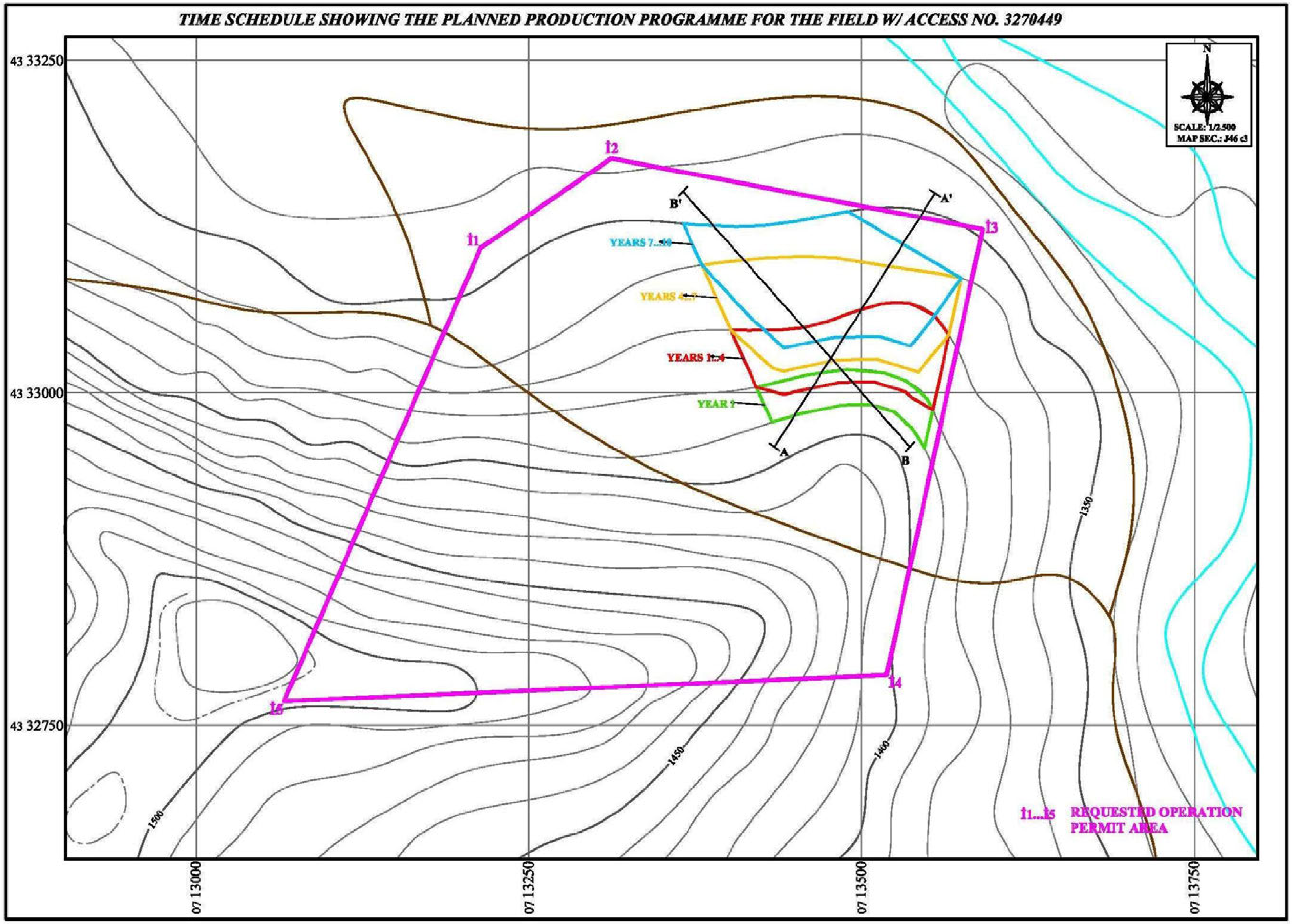


App 17.3. Utilisation Scenario Map Showing of Material Borrow Area K-1

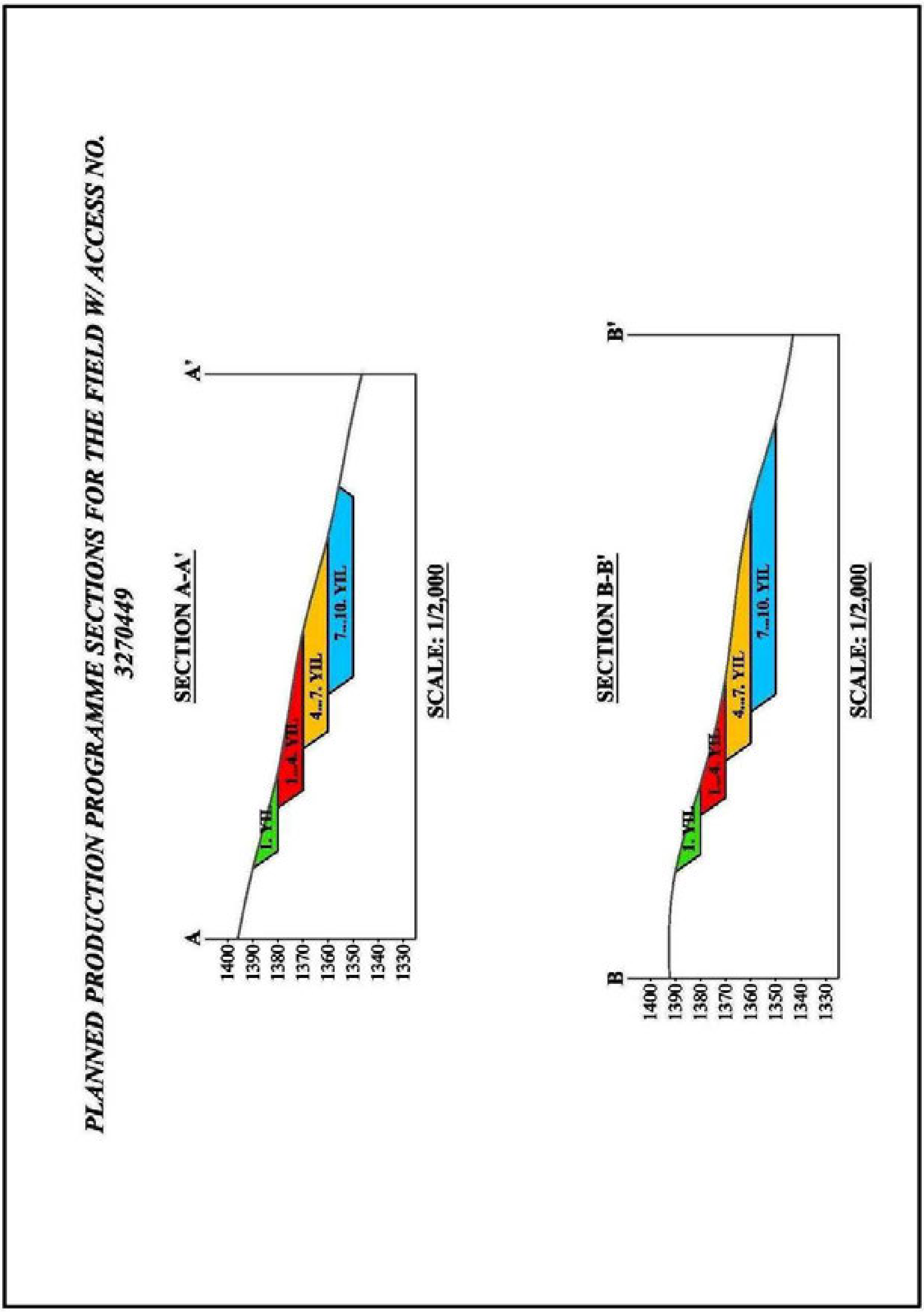


App 17.4. Utilisation Scenario Sections of Material Borrow Area K-1

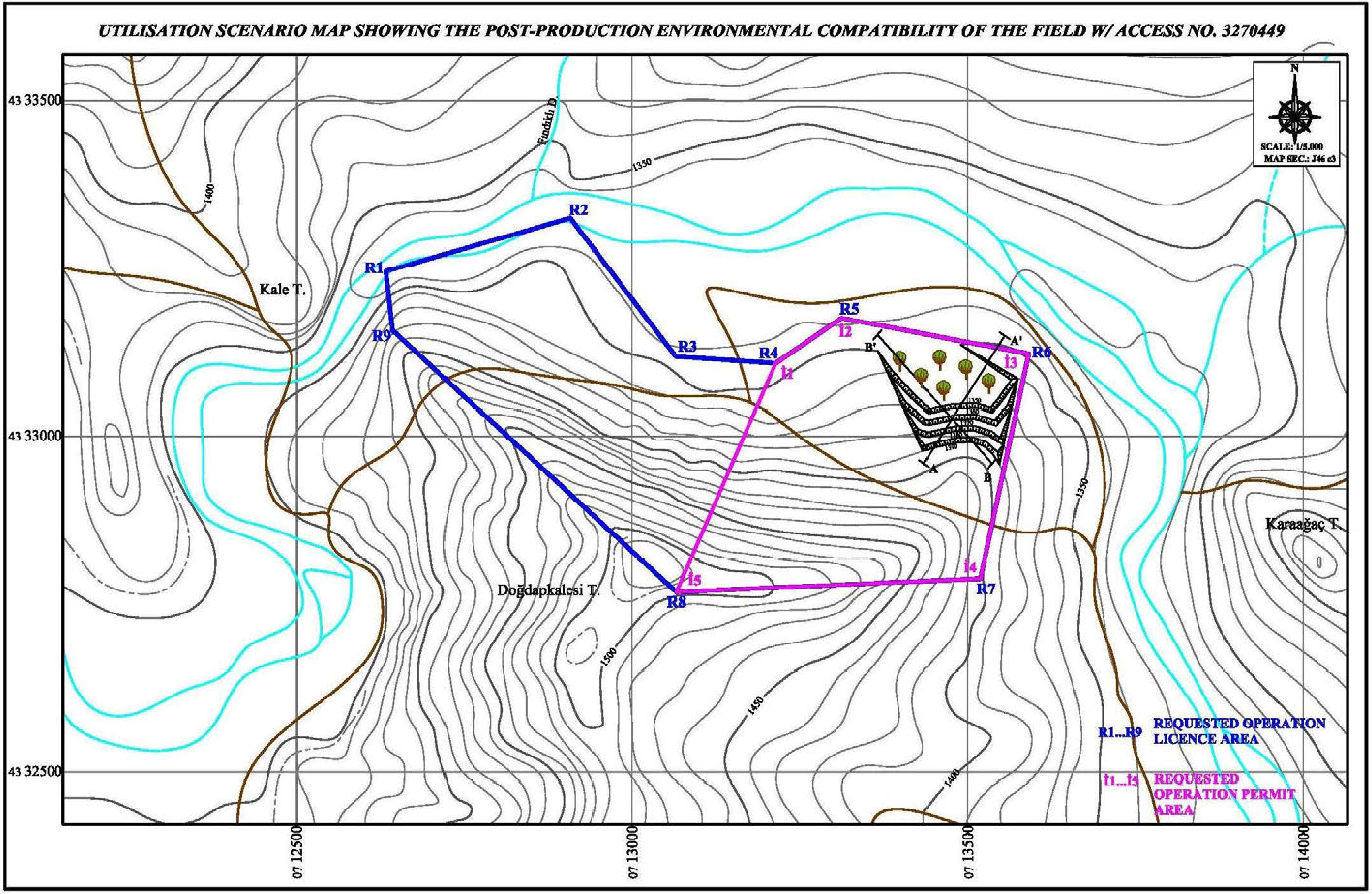
Material Borrow Area K-2



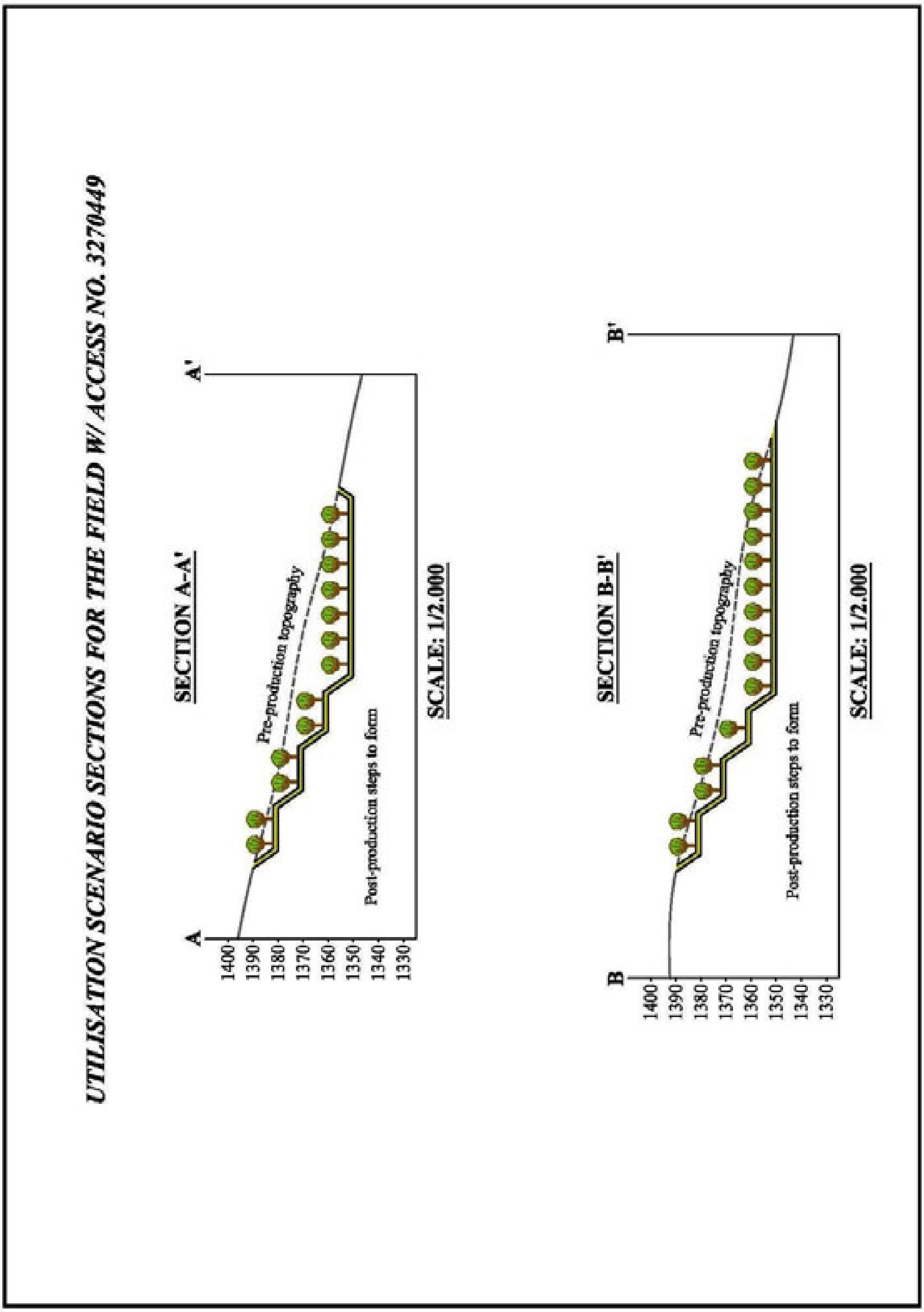
App 17.5. Time Schedule Showing of Material Borrow Area K-2



App 17.6. Production Programme Sections of Material Borrow Area K-2

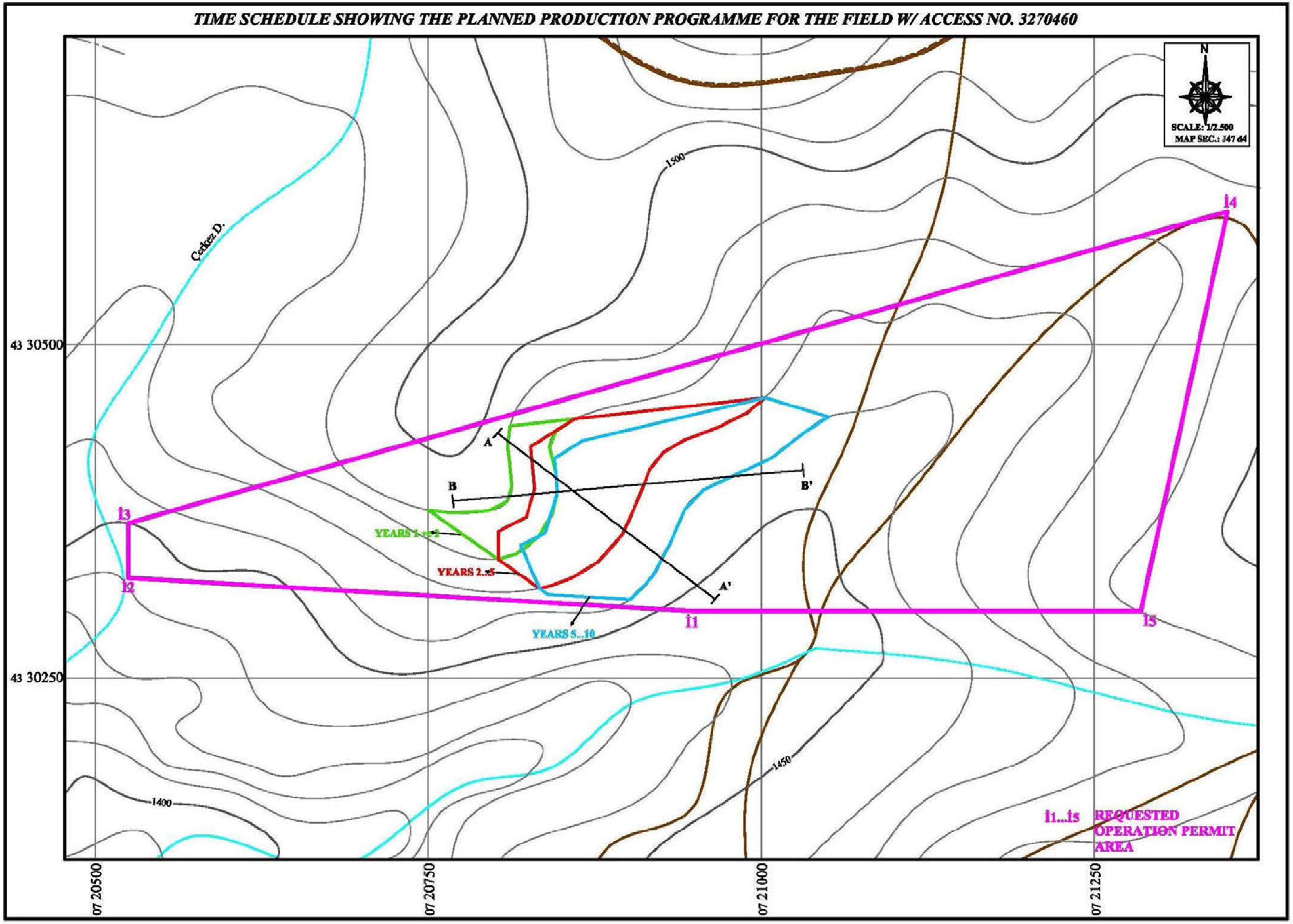


App 17.7. Utilisation Scenario Map Showing of Material Borrow Area K-2

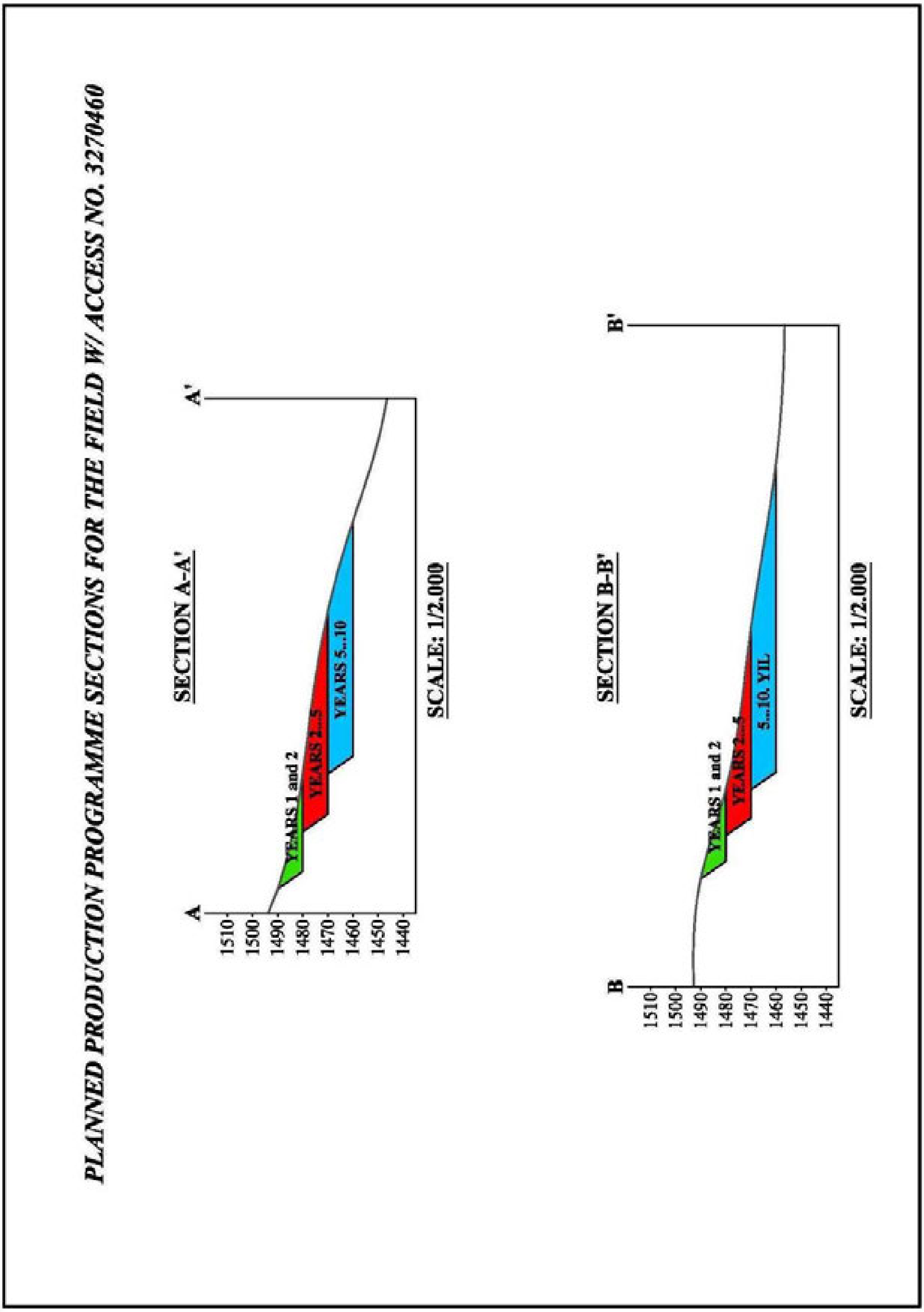


Ek 17.8. Utilisation Scenario Sections of Material Borrow Area K-2

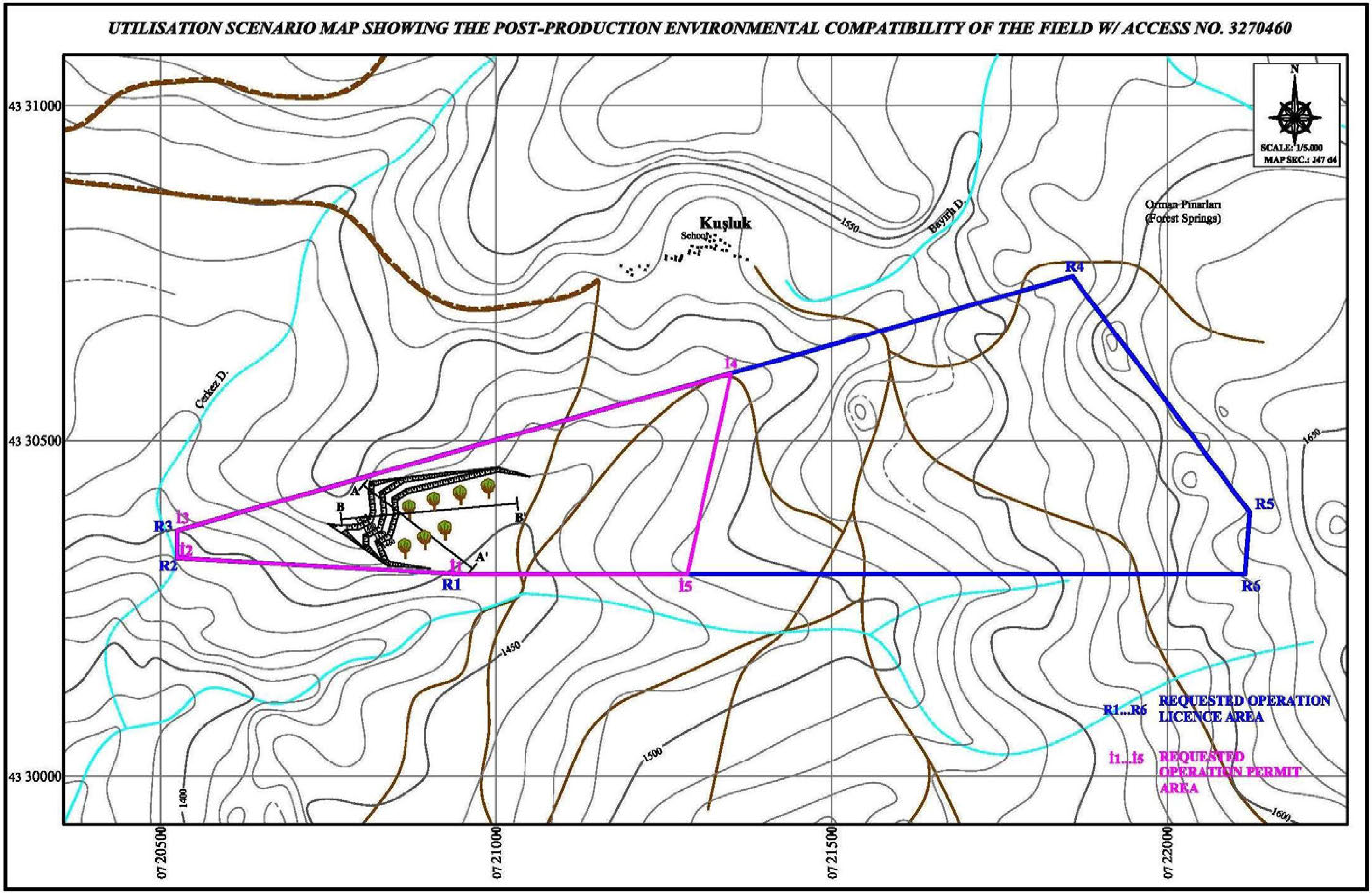
Material Borrow Area K-3



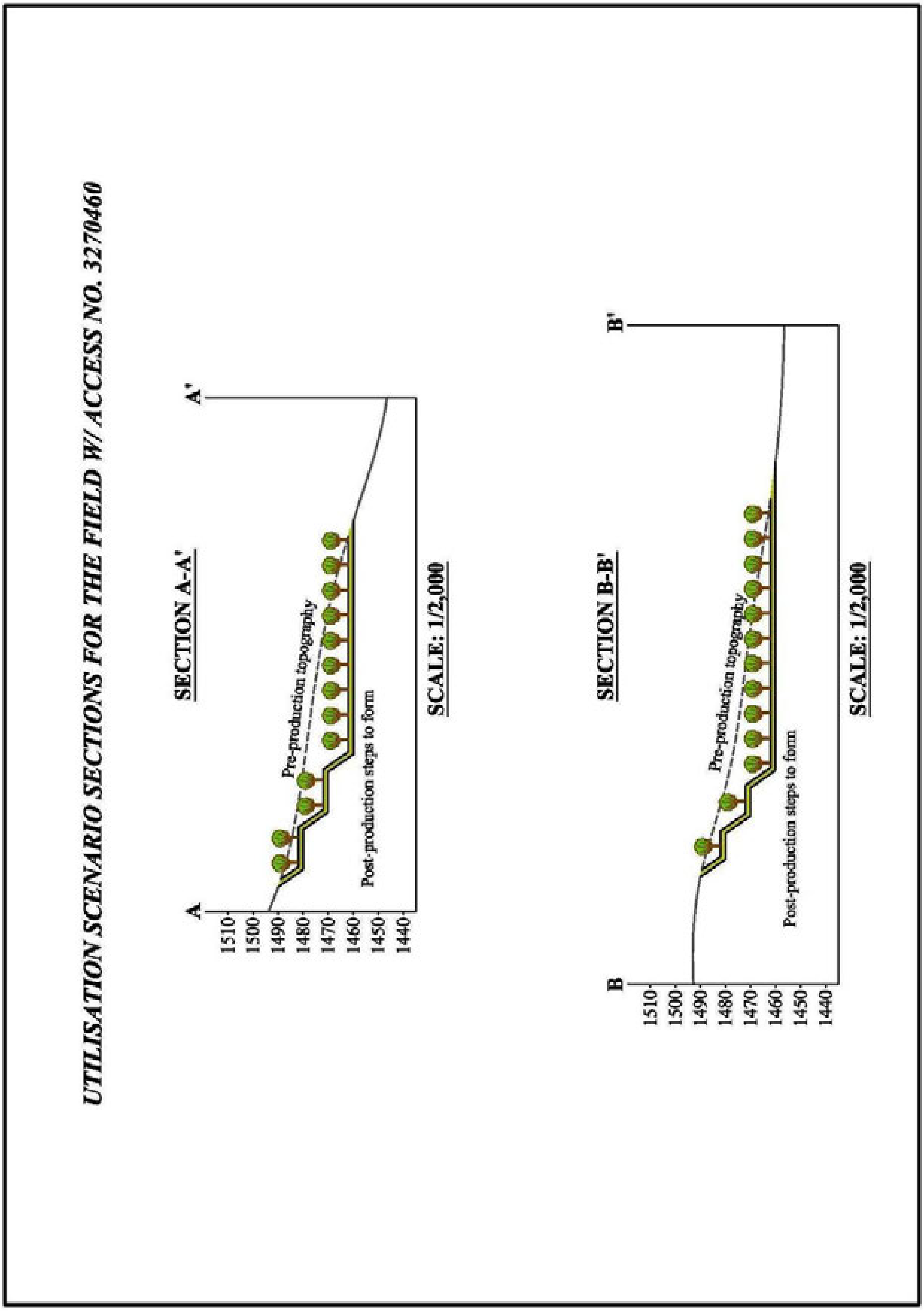
App 17.9. Time Schedule Showing of Material Borrow Area K-3



App 17.10. Production Programme Sections of Material Borrow Area K-3

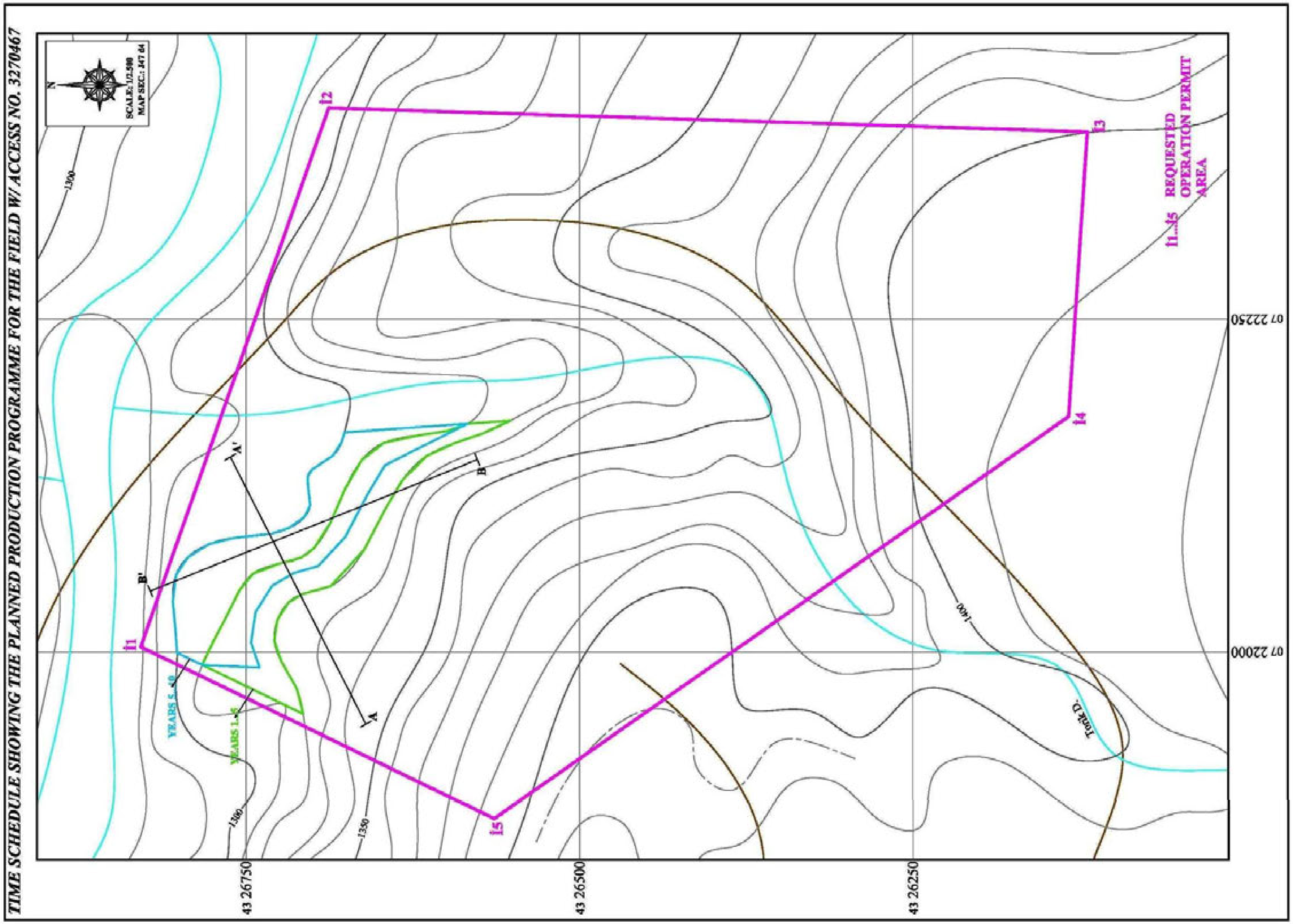


App 17.11. Utilisation Scenario Map Showing of Material Borrow Area K-3

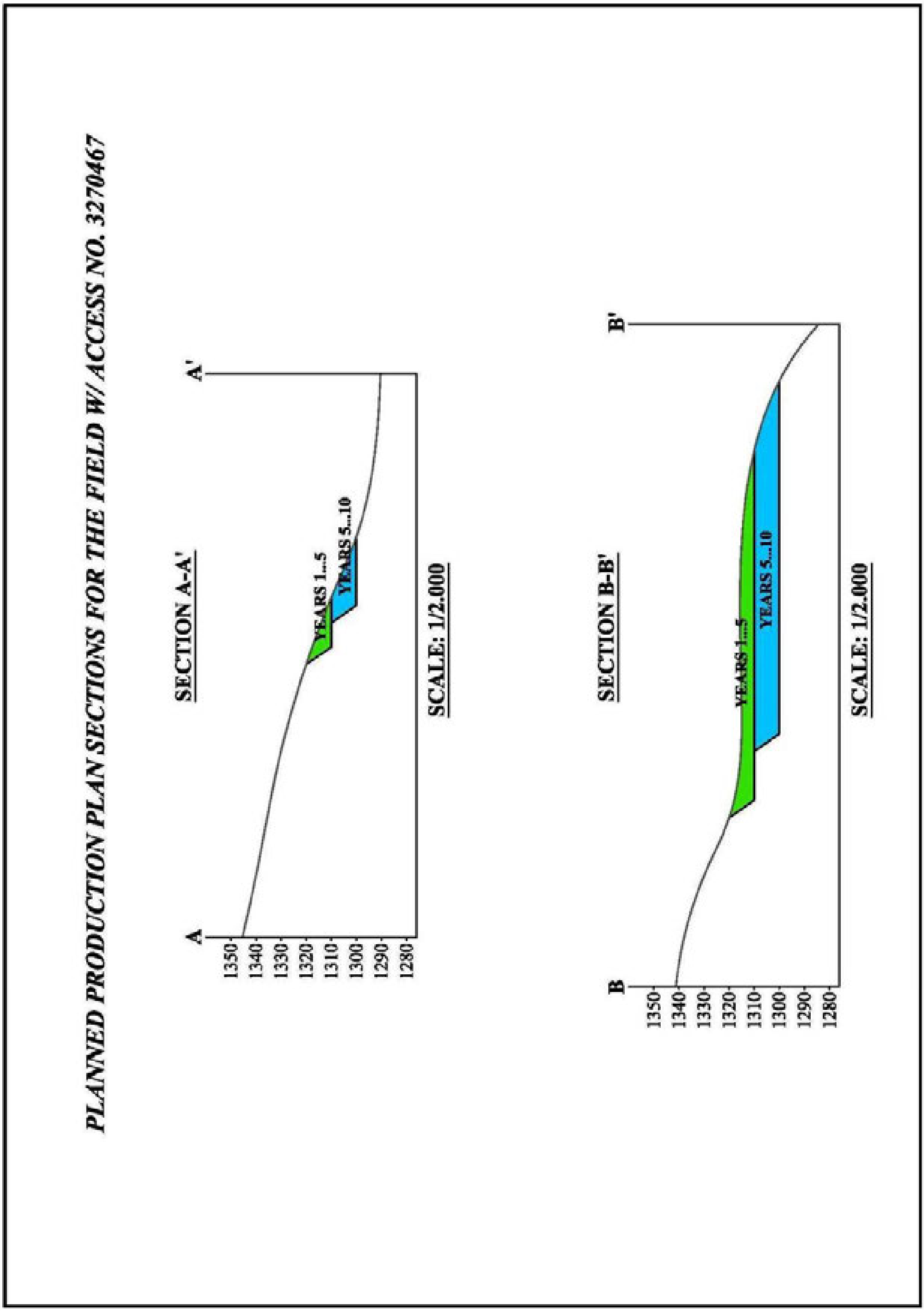


App 17.12. Utilisation Scenario Sections of Material Borrow Area K-3

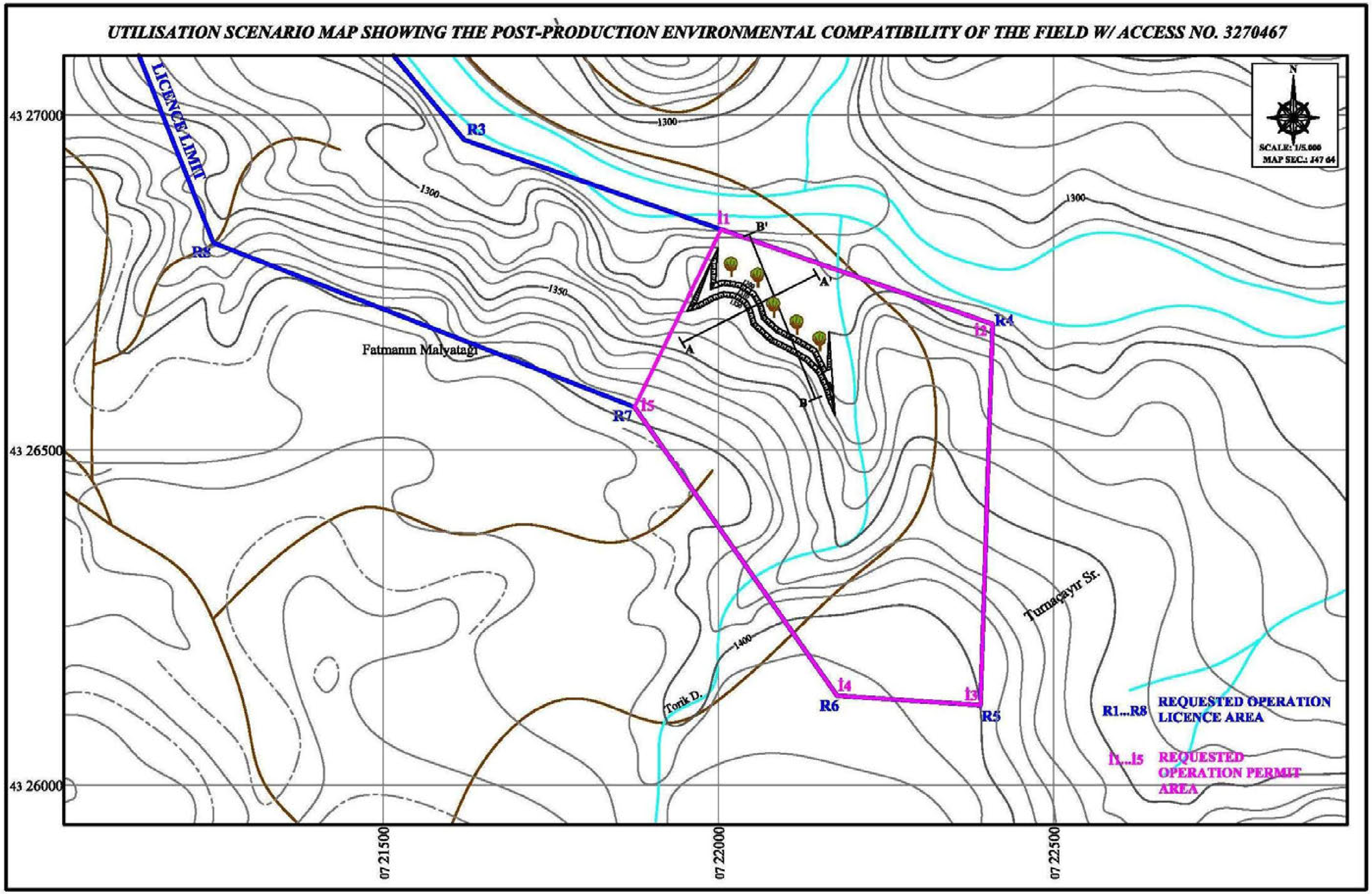
Material Borrow Area K-5



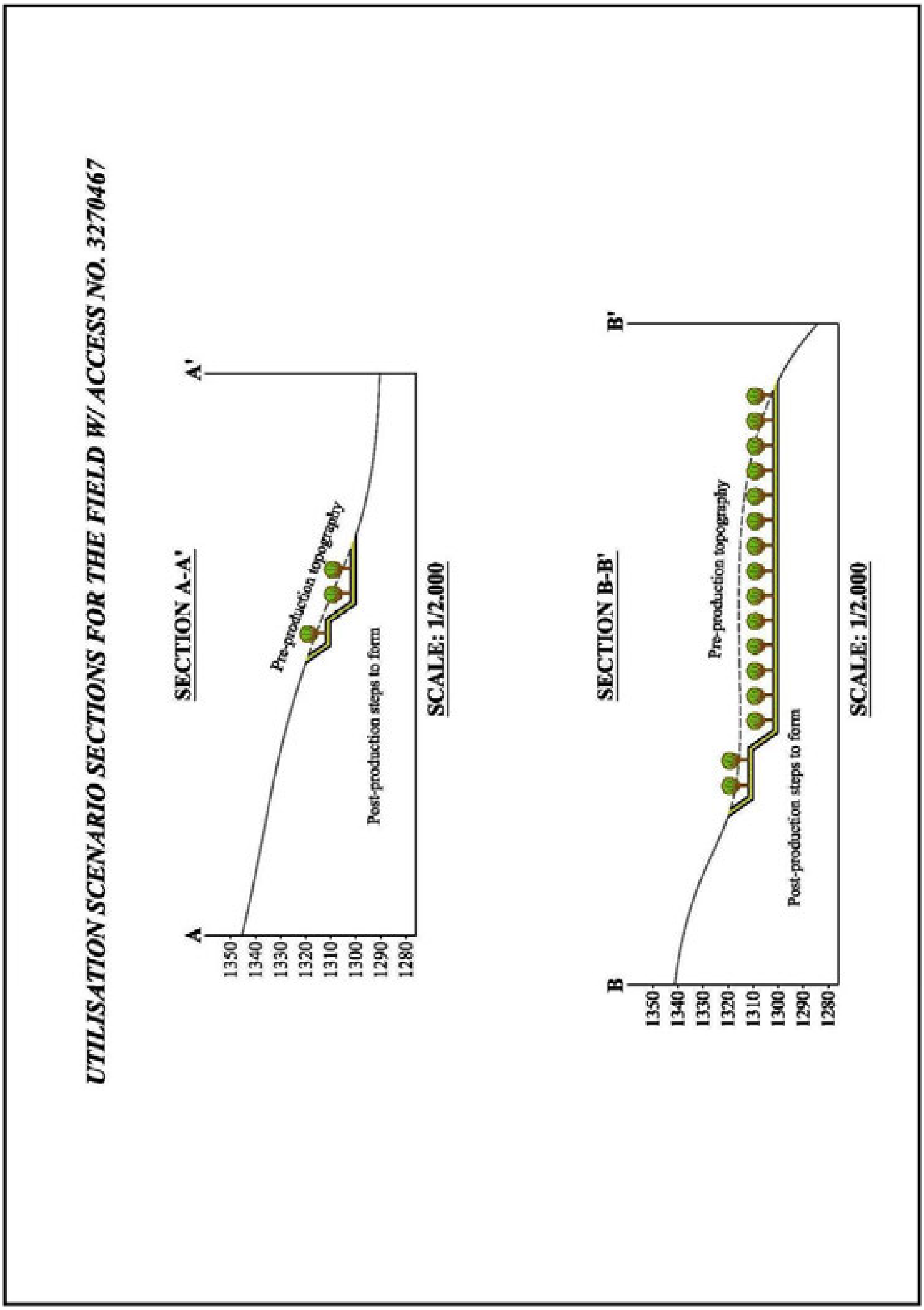
App 17.13. Time Schedule Showing of Material Borrow Area K-5



App. 17.14. Production Programme Sections of Material Borrow Area K-5

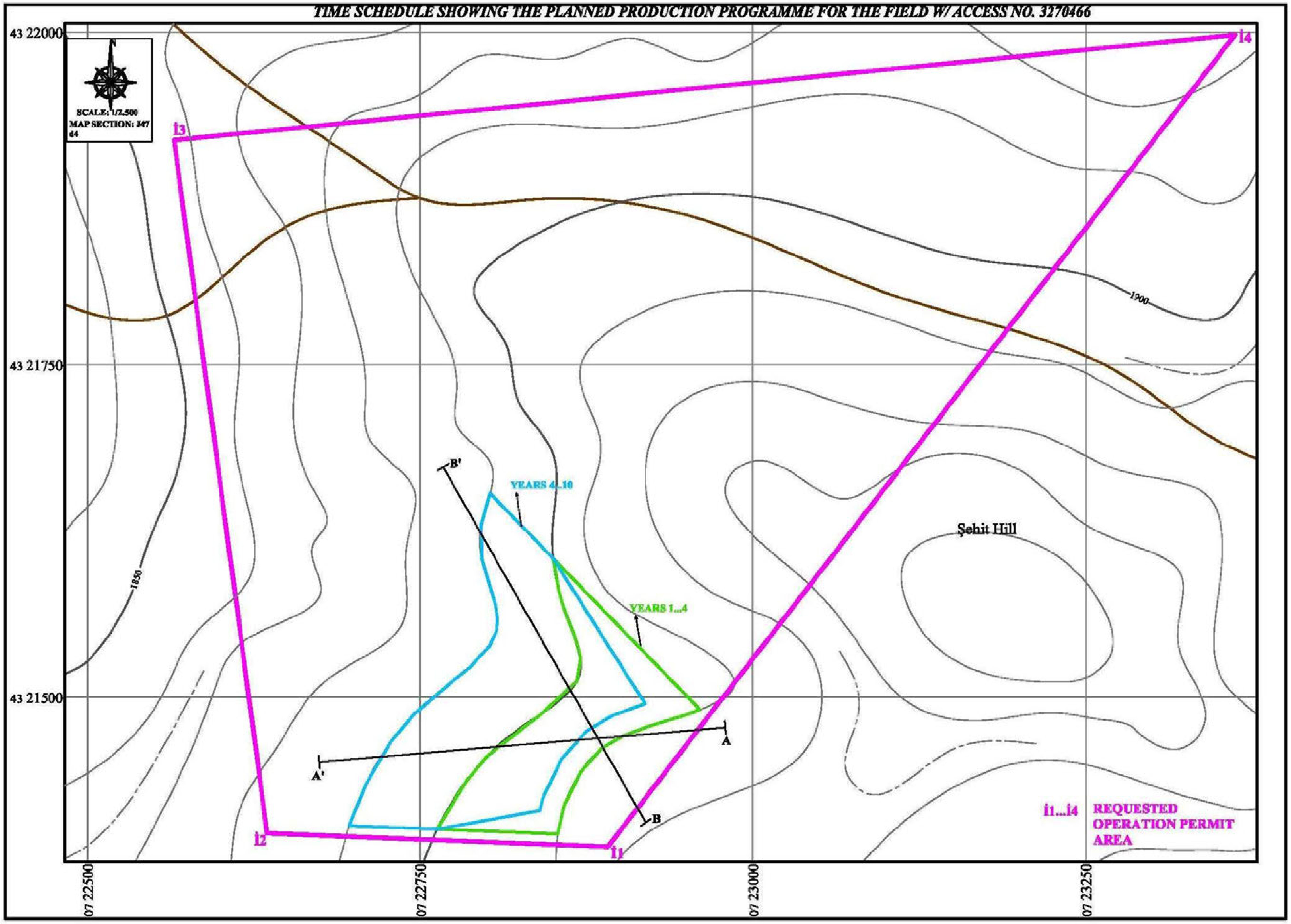


App 17.15. Utilisation Scenario Map Showing of Material Borrow Area K-5

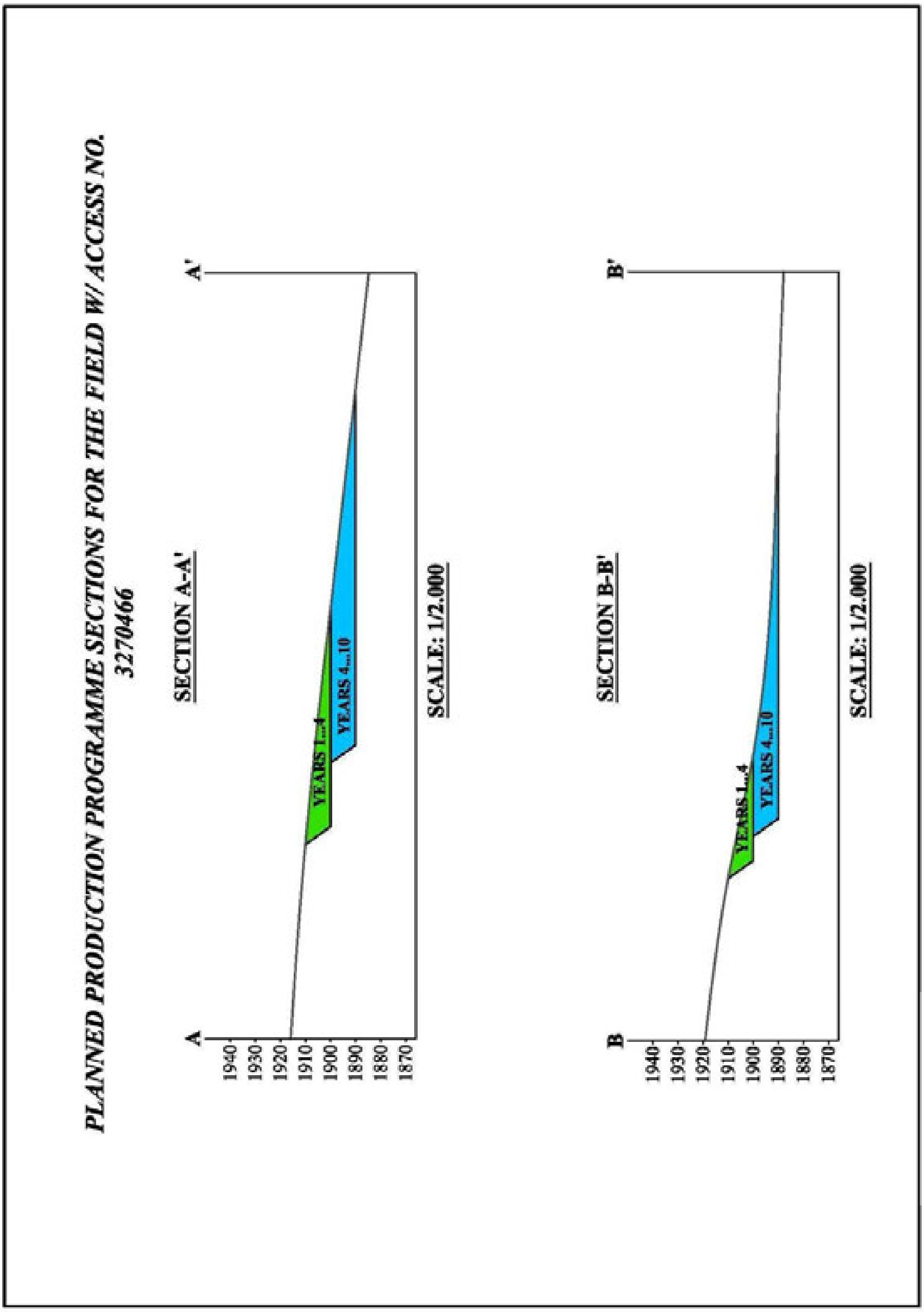


App 17.16. Utilisation Scenario Sections of Material Borrow Area K-5

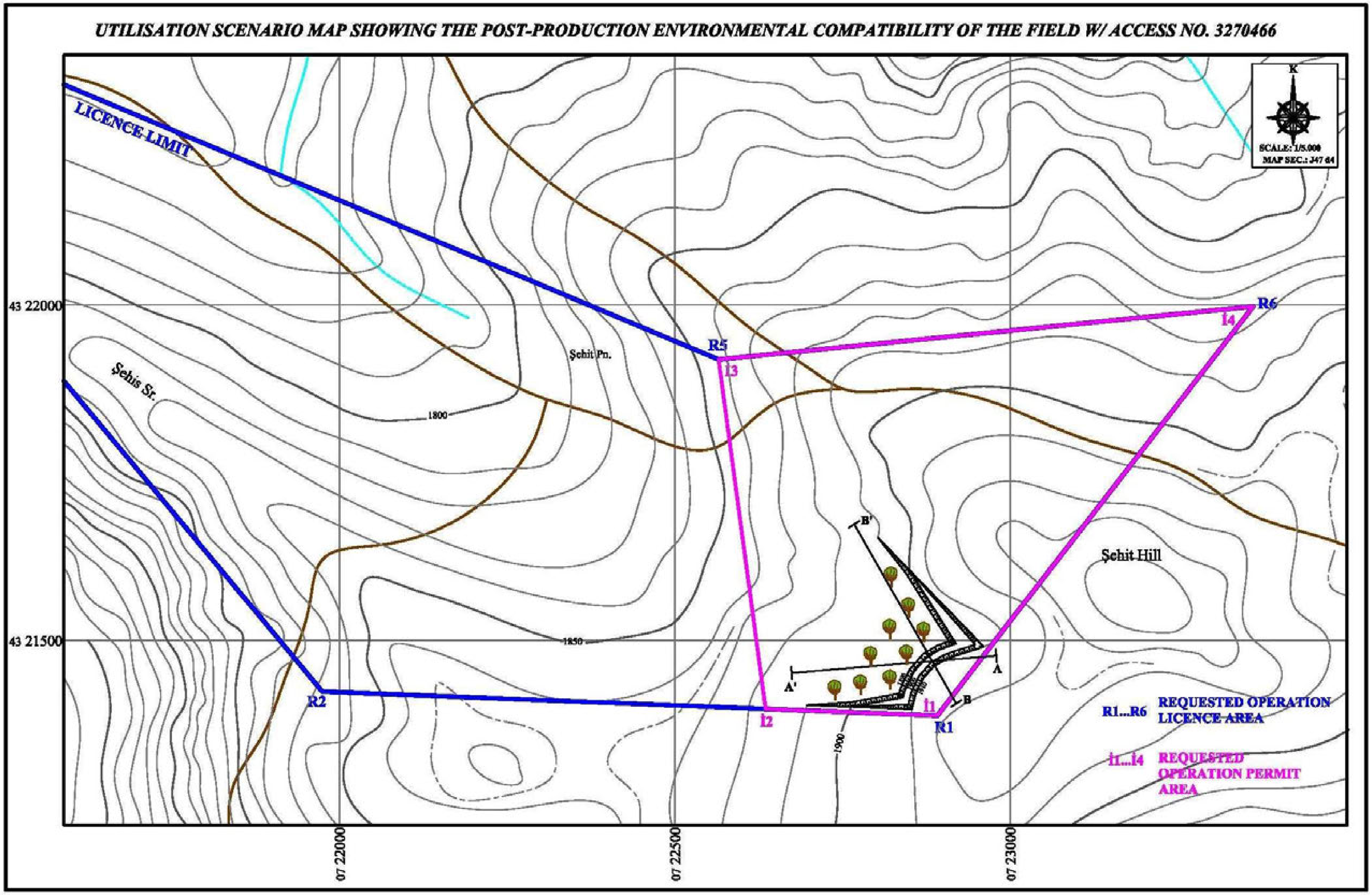
Material Borrow Area K-6A



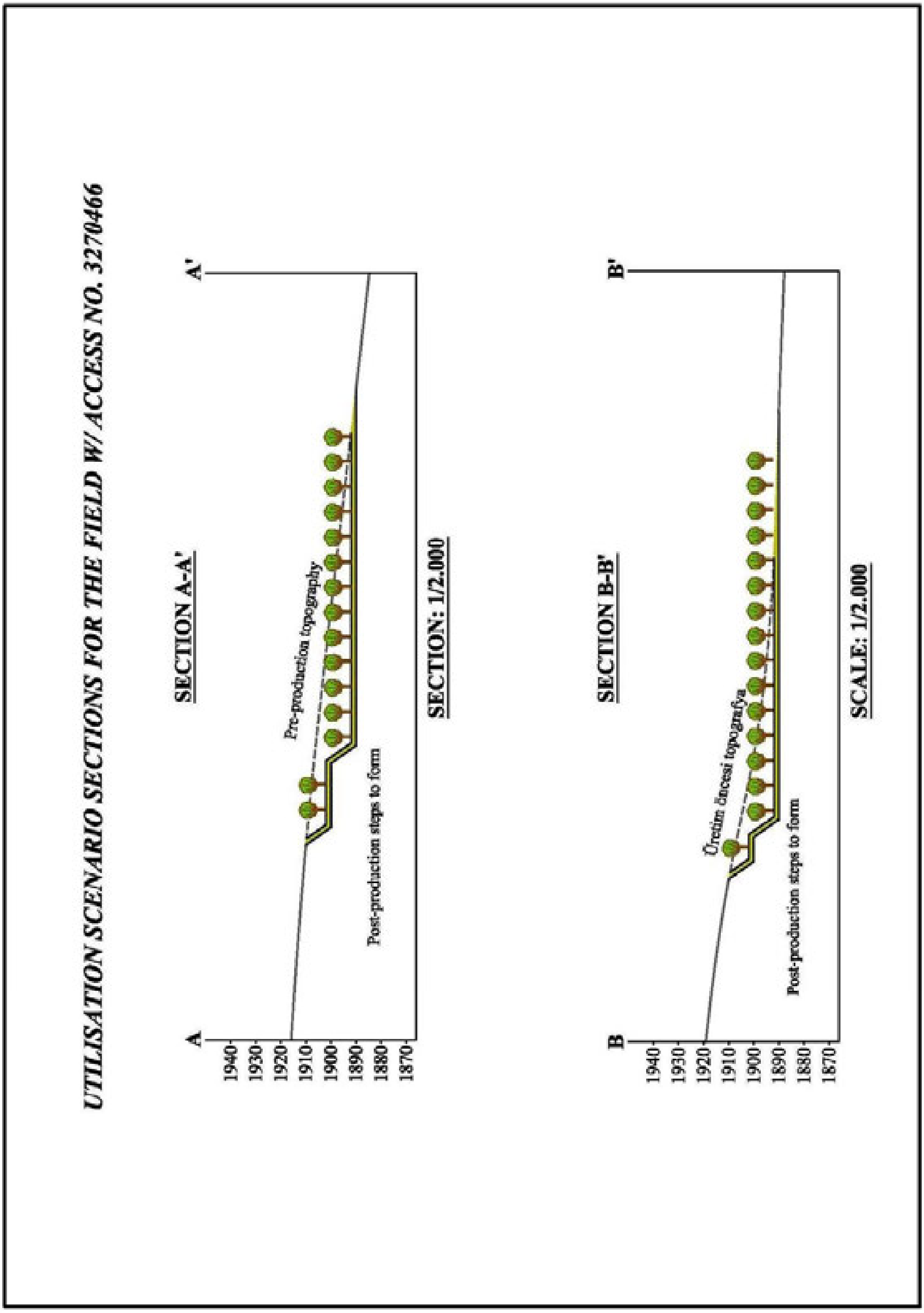
App .17.17 Time Schedule Showing of Material Borrow Area K-6A



App 17.18. Production Programme Sections of Material Borrow Area K-6A

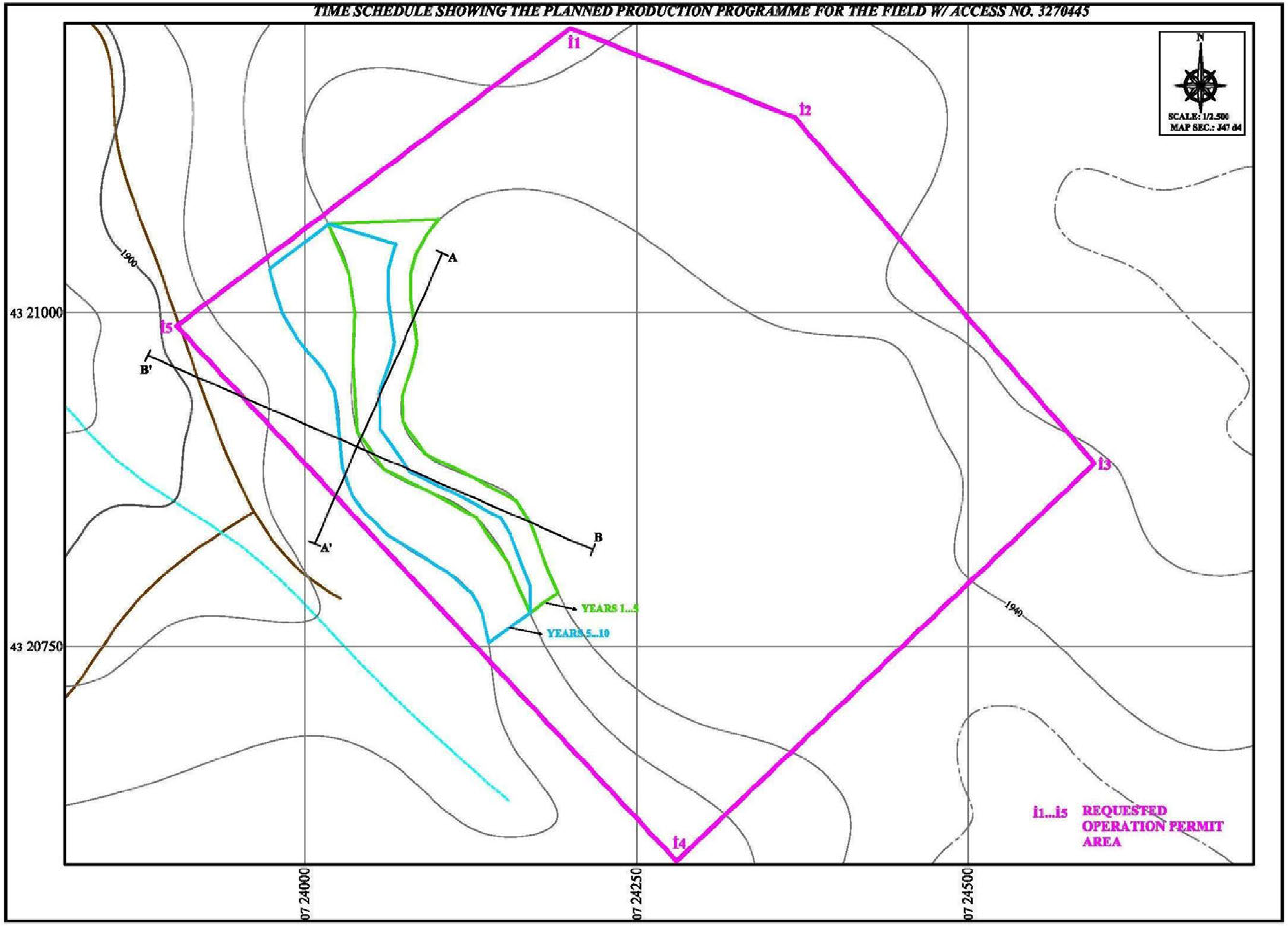


App 17.19. Utilisation Scenario Map Showing of Material Borrow Area K-6A

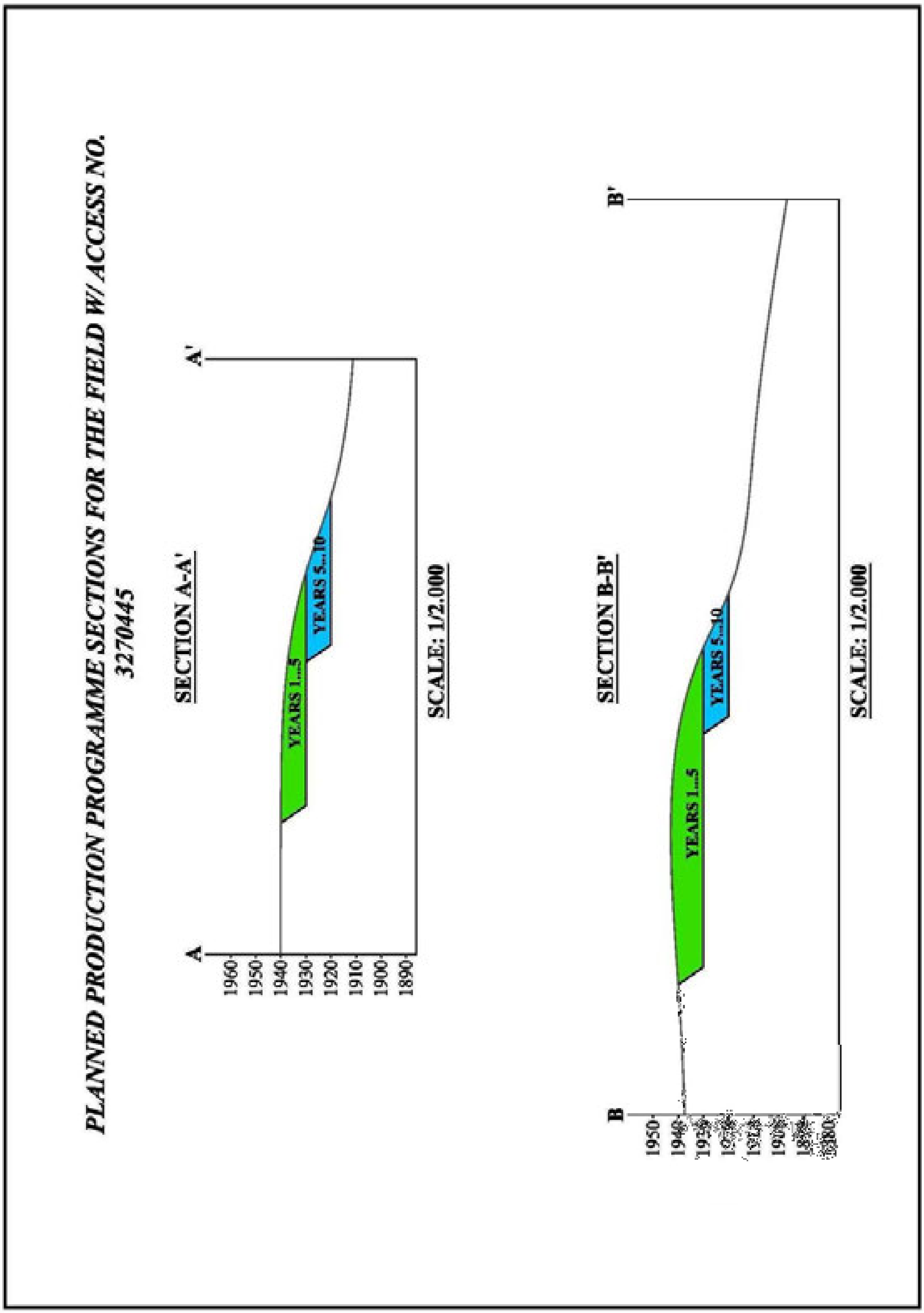


App 17.20. Utilisation Scenario Sections of Material Borrow Area K-6A

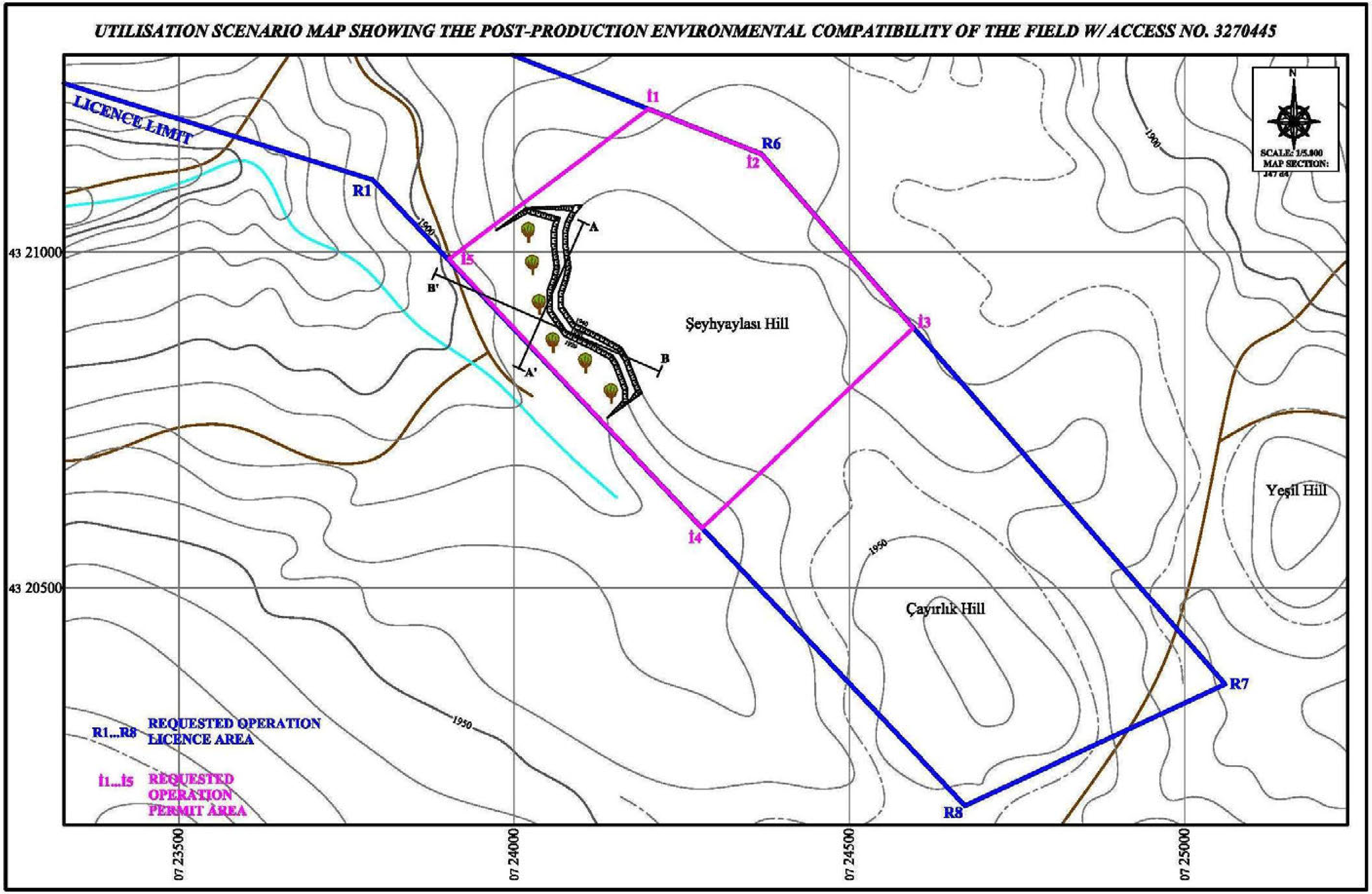
Material Borrow Area K-6B



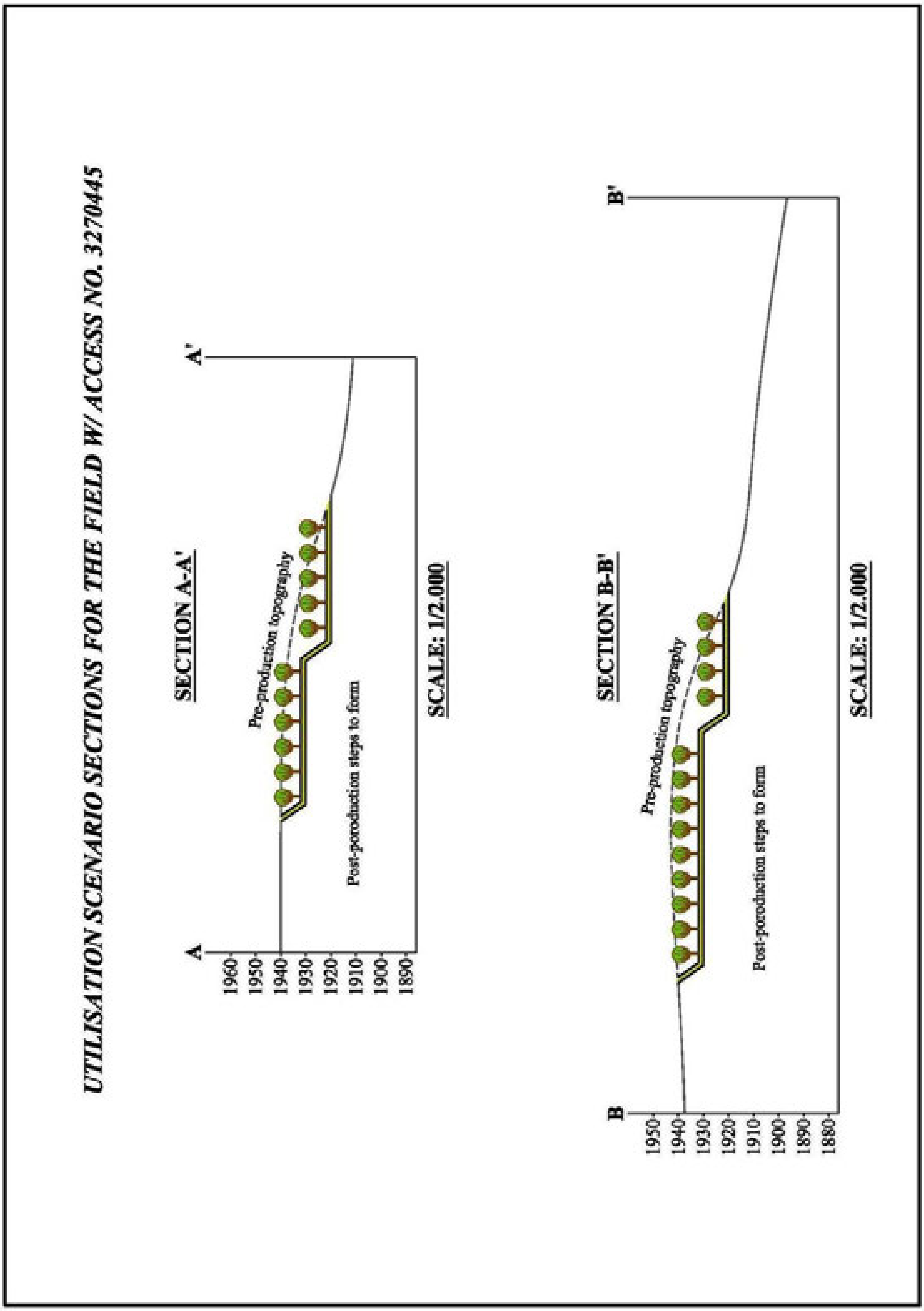
App 17.21. Time Schedule Showing of Material Borrow Area K-6B



App 17.22. Production Programme Sections of Material Borrow Area K-6B



App 17.23. Utilisation Scenario Map Showing of Material Borrow Area K-6B



App 17.24. Utilisation Scenario Sections of Material Borrow Area K-6B

APP 18

ECOSYSTEM ASSESSMENT REPORT

ALPASLAN II DAM AND HEPP PROJECT

ASSESSMENT REPORT FOR HEPP PROJECTS AND OTHER HYDRAULIC ACTIVITIES

(ECOSYSTEM ASSESSMENT REPORT)




ANKARA, JANUARY 2012

ALPASLAN II DAM AND HEPP PROJECT

ECOSYSTEM ASSESSMENT REPORT

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A. DETERMINATION OF GENERAL CHARACTERISTICS AND RELATIONS

Within the scope of the Alpaslan II Dam and HEPP Project Ecosystem Assessment Report, it is targeted to assess the impacts of the Alpaslan II Dam and HEPP Project water structures, planned to be located within the boundaries of Mus province, on the associated riverbed and also the related ecosystem on the basis of hydrobiological, ecological, meteorological, hydrological, hydrogeological and hydraulic data.

Alpaslan II Dam and HEPP will be constructed on Murat River, which is one of the main tributaries of Euphrates River, at a distance of about 34 km to Mus city center and at a talveg elevation of 1,269 m. The dam axis is located at 4323859 North and 718000 East UTM coordinates on the 1/25,000 scale map of Erzurum No.J47-d4.

The main objective of this study is to identify the required conditions and related measures in order to ensure that the existing aquatic environment and surrounding ecosystems continue to exist, there is no adverse interaction between surface and groundwater systems, and environmental flow is maintained, upon implementation of the project. The chapters discussed within the scope of the report can be listed as the following

Alpaslan II Project Zorova axis is located 4 km to the downstream of Alpaslan II (Arincik Regulator) axis whose final project work has been completed as of 2004, to the upstream of Alpaslan I Dam Site, and to the north of Mus city center. The right bank of the Dam Site can be accessed by a road, and the left bank is accessed through the stabilized road of Akcan-Serinova located at the south and east of Murat River.

Alpaslan II Project is based on the “Mus Alpaslan II Project Planning Report”, which was prepared in September of 1994. The objective of the project was foreseen as “Irrigation, Energy Production, and Flood Control and Prevention”. The current feasibility report was prepared within this context (see Hidro Dizayn, 2011). The project components proposed in the Planning Report can be listed as Alpaslan II Dam, Arincik Regulator, Alpaslan II HEPP and Irrigation and Flood Control facilities. Mus Plain is located to the downstream of Alpaslan II Dam. Within this framework, a flood control capacity has been reserved to protect Mus Plain from flooding of Karasu River, which is at the downstream of Murat River. The following were proposed in the planning report:

(i) power generation of 714.00 GWh, 520.28 GWh of which is firm energy, within Alpaslan II HEPP, which will have an installed capacity of 200.00 MW and will be established with flows to be regulated at the dam reservoir, with a condition of adhering to the flood control capacity

(ii) irrigation of a total of 78,210 ha agricultural land at the downstream of Arincik Regulator, 10,150 ha of which will be gravity-fed. 10,150 ha of land is already being irrigated by water from Arincik Regulator.

The project location is provided in Figure A.1 and A.2, and the project characteristics are provided in Table A.1.

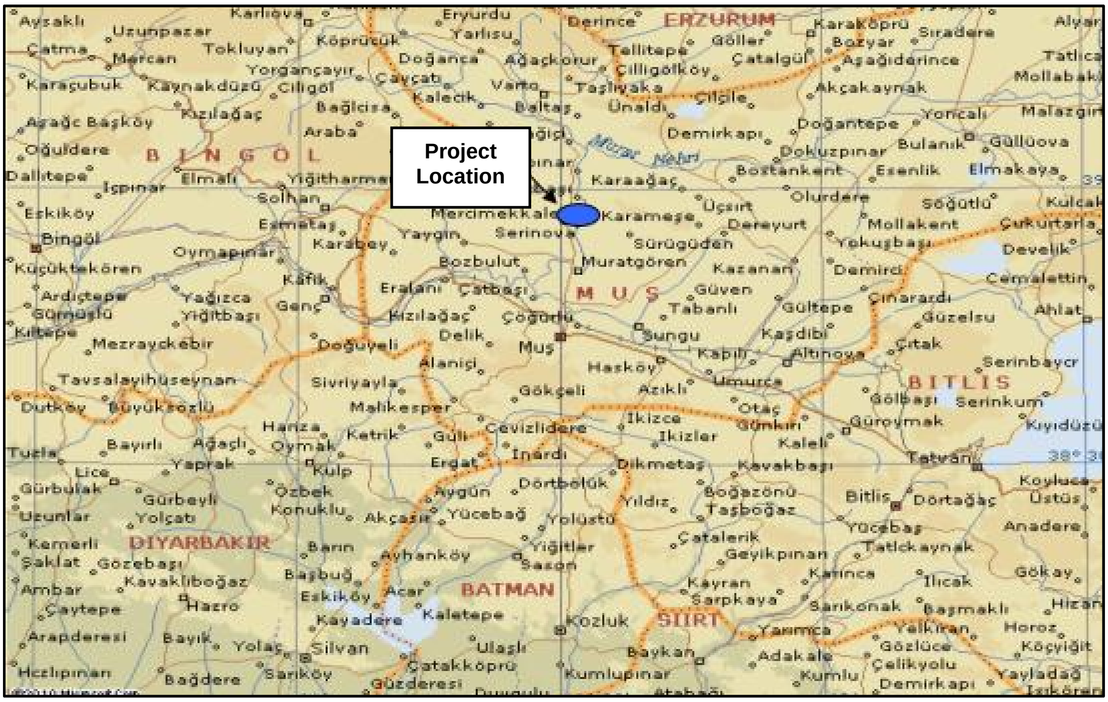

Figure A.1. Location of Alpaslan II Dam and HEPP Project

Figure A.2. Satellite Image of Alpaslan II Dam Axis and Surroundings

Table A.1. Project Characteristics

Alpaslan II Dam (ZOROVA AXIS)	
Drainage Area	: 17 505.00 km^2
Annual Average Flow	
Natural Flow	: 4 297.17 hm^3 (136.26 m^3/s)
Baseline Flow	: 4 030.51 hm^3 (127.81 m^3/s)
Future Flow	: 3 386.99 hm^3 (107.40 m^3/s)
Crest Length	: 844.00 m
(936,00 m including the Spillway)	
Crest Width	: 12.00 m
Type	: Clay seeded rock filled
Thalweg Elevation	: 1 272.00 m
Crest Elevation	: 1 371.00 m
Height (From thalweg)	: 99.00 m
Height (From foundation)	: 116.00 m
Maximum Water Elevation	: 1 368.00 m
Normal Water Elevation	: 1 368.00 m
Minimum Water Elevation	: 1 340.00 m
Reservoir Area at min. Water Level	: 35.06 km^2
Reservoir Area at max. Water Level	: 54.69 km^2
Volume at Normal Water Level	: 2 097.20 hm^3
Minimum Volume	: 997.77 hm^3
Active Volume	: 1 099.43 hm^3
Side Slope	
Upstream	: 2.45 Y / 1.0 D;
Downstream	: 2.25 Y / 1.0 D;
Backfill Volume (Total)	: 12 446 062 hm^3
Regulation Proportion	
Baseline Condition	: % 92.99
Future Condition	: % 94.42
Water Use in Power Generation	
Baseline Condition	: 3 747.88 hm^3
Future Condition	: 3 198.12 hm^3
Spillway	
Spillway Entrance Peak	: 7 542.00 m^3/s
Q_{25}	: 1 874.00 m^3/s
Q_{50}	: 2 078.00 m^3/s
Type	: Radial gated
Number of Valves	: 6
Valve Width-Height	: 11.00 m width x 12.00 m
Spillway Total Gross Width	: 86.00 m
Spillway Total Net Width	: 66.00 m
Spillway Approach Channel Elevation	: 1 350.00 m
Spillway Threshold Elevation	: 1 355.50 m
Derivation Tunnel-Upstream Cofferdam	-
Number of Derivation Tunnels	: 2
Tunnel Length	: T1 = 875.00 m; T2 = 950.00 m
Diameter	: 8.00 m
Entrance Basement Elevation	: 1 274.00 m
Exit Basement Elevation	: 1 270.00 m
Tunnel 1 Slope	: 0.0046
Tunnel 2 Slope	: 0.0042
Cofferdam Type	: Clay seeded rock filled
Upstream Cofferdam Crest Elevation	: 1 301.50 m
Upstream Cofferdam Height	: 31.50 m
Downstream Cofferdam Crest Elevation	: 1 281.50 m
Sluice Outlet Diameter	: 2.50 m
Energy Tunnel	-
Number	: 2
Inner Diameter	-
Derivation Tunnel Part	: 8.00 m

Table A.1. Project Characteristics (Continued)

After the Derivation Tunnel	: 6.30 m
(Both steel coated)	-
Penstock Pipe	-
Number	: 4
Diameter	-
In Small Units	: 2.40 m
In Large Units	: 4.50 m
Height	: Each 35.00 m
ALPASLAN II HEPP (ZOROVA AXIS)	
Project Flow Rate	: 344.00 m^3/s
Unit Project Flow Rate	: 2 x 136.00 m^3/s;+2 x 36.00 m^3/s
Unit Power	: 2 x 110.00 MW + 2 x 30.00 MW
Installed Power	: 280.00 MW
Yield	: 0.94
Annual Energy Production	
Baseline Condition	
Firm Energy	: 606.35 GWh
Secondary Energy	: 255.92 GWh
Total Energy	: 862.27 GWh
Future Condition	
Firm Energy	: 511.46 GWh
Secondary Energy	: 222.34 GWh
Total Energy	: 733.80 GWh
Generator	
Type	: 4 phased synchronized generator
Number	: 2
Power	:2 x 122 222 kVA; 2 x 33 333 kVA
Power Factor	: 0.90
Frequency	: 50 Hz
Number of Poles	:24 pairs (total of 48);12 pairs (total of 24)
Number of Periods	: 125; 250
Generator Yield	: 0.975
TRANSFORMATOR	
Number	: 4
Type	: External type, 3 phases, oil isolated
Continuous Power	: 2 x 125 000 kVA; 2 x40 000 kVA
Rated Voltage	: 11 / 154 kV (+/- 2 x 2.5 %)

Geological Condition

The geological condition of the project area and its surroundings is summarized below based on the information acquired from the Feasibility Report. There are units belonging to the Precambrian, Paleozoic and Cenozoic upper systems within the region where the project area is located. At the bottom are Precambrian elderly formations that are of magmatic and metamorphic origin. The bottom foundation is made of Paleozoic elderly Bitlis massive units. Bitlis Massif is composed of mostly limestone, and sedimentary piling observed at mountain series to the south of Mus Plain. There are Cenozoic (Tertiary) formations covering Bitlis Massif to the north of Mus Plain. There are no Mesozoic formations observed in the region. There are tertiary geological formations and quaternary elderly units mantling these within the project area. The project area and its stratigraphic stacking pattern is presented in Figure A.3.

Stratigraphic Geology

The geological units that are found within the project area that belong to Senozoic (Tertiary) and Quaternary can be listed as the following (from older to younger):

1. Solhan Formation (Tsb, Tsp): Pliocene old Solhan formation is composed of basalt and andesitic (Tsb) together with pyroclastics and volcanic sediments (Tsp). The stratigraphic thickness of the formation is about 1000 m, and is observed at all lithological levels in the region. Solhan formation units are not found at the Zorova axis, but are topped at the reservoir area.

2. Zirnak Formasyonu (Tz): Zirmak formation is composed of clay, tuffaceous marl, lacustrine limestone, sandstone, pebble stone, siltstone, tuff, tuffite, argillaceous limestone, tuffaceous limestone and calcarenite. There are patches of volcanic chips (agomera, tuff, lapilli, volcanic breach), lava (mostly basalt, andesite, and trachyte types) and coal inner layers. Zirnak Formation (Tz) has a stratigraphic thickness of about 400-600 m. There is no consensus among the researchers who have studied the region to define the age of the formation. The age of the formation is stated as Upper Miocene by some researchers, while some others state it as Lower Pliocene. In this study, based on the available data, the age of Zirnak Formation was accepted as Lower Pliocene. Zirnak Formation, which is situated with an angular incompatibility on top of Adilcevaz Formation, has lateral crossing with Solhan Formation that is located above.

Boreholes that were opened within the scope of foundation studies carried out around Zorova axis revealed that Zirnak Formation at the dam site is rather loose, shows patches of foundation characteristics and a chaotic structure composed of various sizes of sandstone, limestone, clay stone, siltstone and basalt blocks in a matrix of sandstone of low-medium density, siltstone, tuff and tuffite.

3. Adilcevaz Formation (Ta): Adilcevaz Formation is of Upper Oligocene-Lower Miocene age. The stratigraphic thickness of the formation is about 1000 m. It is surfaced at the dam site, at higher elevations of both side slopes. It is composed of greenish and greenish-greyish sandstone, rough sandstone, clay stone and fine-grained conglomerate levels.

4. Alluvial (Qal): Is observed along Murat River. The thickness of the alluvial, which is generally composed of basalt and limestone blocks and pebbles, is between 2-4 m at the dam site bed. There are terrace set formations surfacing in limited areas at the hills of Murat River bed. Besides, around the project area, on the foundation rock are hillside debris of changing thicknesses and coating material that has been deposited as a result of runoff/landslide movements. Coating material properties and thicknesses around the dam site and its vicinity have been researched in detail.

5. Hillside Debris (Qym-1, Qym-2): There are two different types of hillside debris surfacing at the dam site which covers the foundation rock. Qym(1) is composed of clay and low amounts of pebble and silt mixture, while Qym(2) is composed of blocks, pebbles and low amounts of clay and silt mixture. The thickness of the hillside debris on Zirnak Formation at the hill on the right bank. At the left bank, on the other hand, the hillside debris is composed of clay and low amounts of pebble and silt mixture. Its thickness changes between 2 and 25 m going from the river bed to the higher hill elevations.

6. Landslide Material (Qhm): According to the information gathered from the boreholes opened at both the right and left banks of the dam axis upstream, where there have been previous landslides, the thickness of the landslide material is 18-24 m. Landslide material is composed of pebble, and an irregular mixture of silt and clay. Underneath the landslide material is clay stone and sandstone of Adilcevaz Formation.

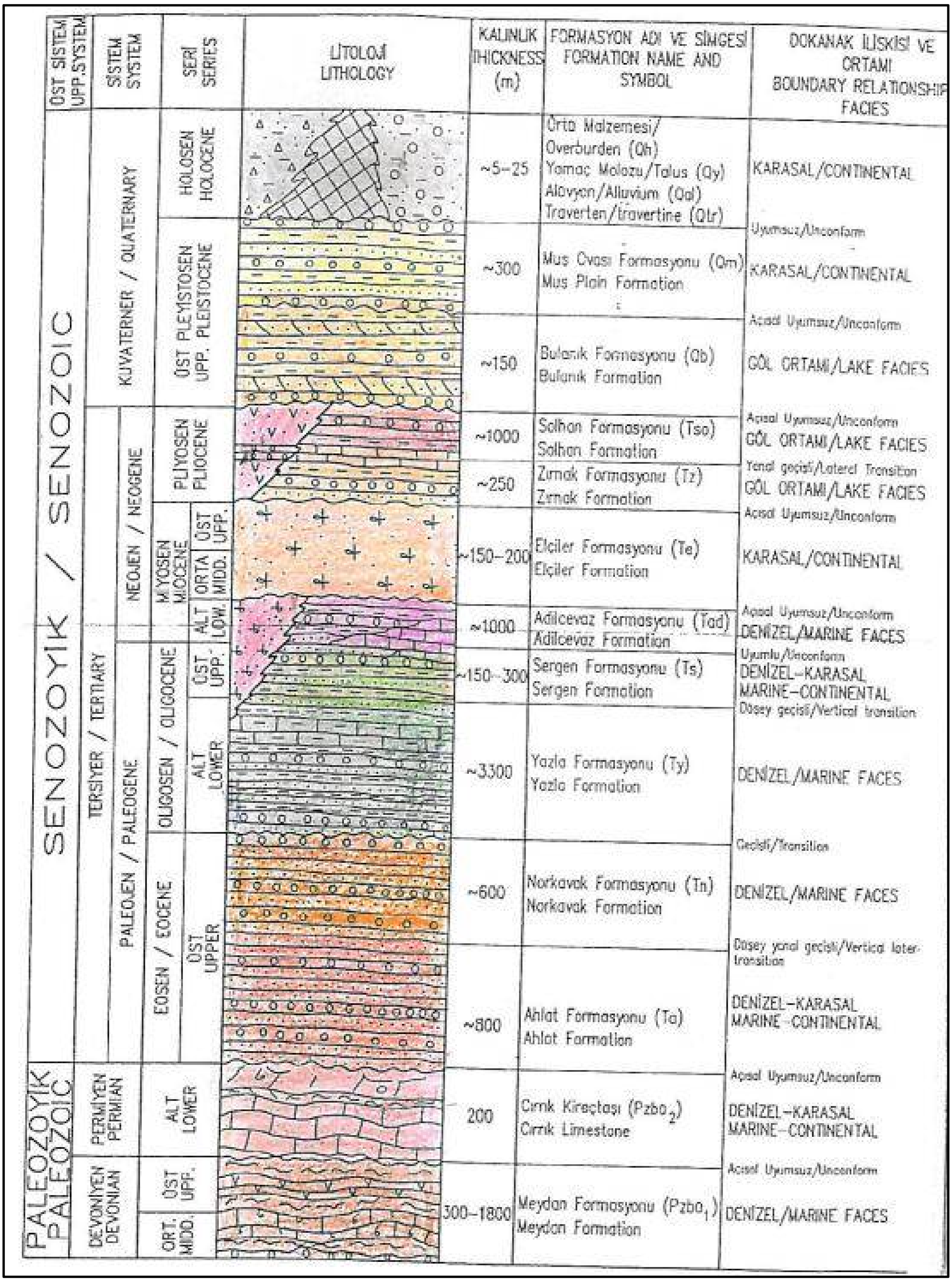

Figure A.3. The Generalized Stratigraphic Stacking of Alpaslan II Dam Site and its Surroundings

Structural Geology

There is incompatibility between Tertiary aged Adilcevaz and Zirnak formations, which are found at the dam site and its surroundings as the foundation rock. The direction of the levels within the Adilcevaz Formation, found at higher elevations around the dam site, is generally 0°-65° north-northeast, while the inclination is 15°-20° east-northeast. The other foundation rock at the dam site and its surroundings is Zirnak Formation, which has a chaotic structure with no definite layering. However, based on field observations, Zirnak Formation has an upstream inclination (north) above Adilcevaz Formation around the dam site.

There are geological structures of basalt, runoff structures at volcanic sediments, cooling cracks and typical volcanic formations that belong to Solhan Formation. The general dominant orientation of Solhan Formation units are close to being parallel.

Due to the fact that the foundation rock units around the study area are generally covered with coating material, measurements on joint systems could not be taken. Joints of sedimentary units in the region, in general, are composed of 2-3 joint orders with almost perpendicular inclination. In addition, there are also joints with lower inclination in different directions.

There are three fault systems in the region which form destructive earthquakes. The western fault system is an extension of Eastern Anatolia Fault (EAF) NE-SW with left-horizontal pulsate. The other faults extend in the NW-SE direction with right-horizontal pulsate. There are segments of Varto fault line to the north, and Mus fault line to the south, which forms the northern border of Mus Plain.

Hydrogeological Conditions

The geological formations in the project area do not show important groundwater aquiferous characteristics which have water storage and transmission capacities. However, there is a geodetic groundwater circulation due to fractures and cracks. There is no important resource discharge within the vicinity of the project area. The dominant geological units within the project area are Adilcevaz formation, and Zirnak and Solhan formations and Qaternary mantling units. Hydraulic pressure tests (HPT) were carried out at boreholes in order to identify permeability at the dam site. According to the results of HPT, Adilcevaz formation, which is the bedrock in the area, the values obtained are 0-1 lugeon, which indicates that the formation is impermeable. On the other hand, Zirnak formation is partially permeable (1-5 lugeon-slightly permeable), and permeable (5-10 lugeon-permeable). However, the overall lugeon values were determined to be 0-1. The highest permeability value (5-10 lugeon in general) as a result of HPT was obtained from the borehole numbered SK-15 at the thalweg. Zirnak formation, although possesses slightly permeable-permeable levels, is impermeable in general. Solhan formation shows similar characteristics to Zirnak formation. Alluvium has a limited distribution at a width of 2-4 m around the riverbed and its surroundings. Therefore, it does not form a significant aquiferous level.

A.1. Assessment of the hydrological-hydrogeological structure of the proposed activities area and areas it is in close interaction with, including surface water groundwater feeding-discharge relations, general water balance and regional hydrogeological processes

According to the groundwater level measurements at the boreholes, the groundwater elevation is higher than that of the river water, and the groundwater feeds the river at both of the shoulders. Although Zirnak and Adilcevaz formations located at the dam foundation are impermeable in general, considering the height of the dam and slightly permeable-permeable level of Zirnak formation, it has been concluded that it would be appropriate to locate injection screening along the dam axis at the thalweg and at a depth of 50 m at the right shoulder with gradually decreasing depths towards the left shoulder.

Considering the topographical and geological structure, at the downstream at the downstream of the Alpaslan II Dam, the river is also fed by groundwater. This process is expected to contribute to the environmental flow to be released from the dam to a certain extent. On the other hand, surface and sub-surface flow is of more importance in stream feeding. It is not expected to observe significant changes in existing hydrogeological conditions with the implementation of the project.

Geological units surrounding the river in the study area have limited water storage and transmission capacities. Therefore, there is no significant interaction between surface and groundwater resources. At valley slopes groundwater level is higher than that of the river and the flow is towards the river. There would not be an important change in load gradient between the water levels of the river and the surrounding geological units at the downstream with the implementation of the project.

A.2. Assessment of baseline meteorological and climatic conditions, and geomorphologic and ecological systems with the implementation of the project

The project area and its surroundings are under the influence of terrestrial climatic conditions. Winters are long and cold, summers, on the other hand, are hot and dry. Annual temperatures range between -29°C and +37°C. For 120 days a year, temperatures are higher than +30°C, and for 120 days they are lower than 0°C. The project area and its surroundings receive considerable high amounts of snow during winter. Annual precipitation amounts range between 350 and 1000 mm.

There are a number of stations working under the General Directorate of State Meteorological Works (Turkish acronym DMI) located within Murat River Basin, which also includes the project area. For feasibility studies data from Mus, Alpaslan, Mercimekkale, Varto, Hınıs, Dokuzpınar, Bulanık, Malazgirt, Patnos, Tutak, Eleskirt, Hamur, Agri and Diyadin stations were used. Annual average precipitation amounts and temperatures recorded at these stations area given in Table A.2.

Table A.2. Average Annual Amounts of Precipitation

Station	Amount of Precipitation (mm)	Temperature (°C)
Mus	842.28	9.6
Alpaslan	649.86	8.4
Mercimekkale	663.85	8.2
Varto	667.13	7.7
Hınıs	599.48	6.2
Dokuzpınar	353.04	7.1
Bulanık	523.37	7.3
Malazgirt	434.53	7.07
Patnos	492.15	6.99
Tutak	520.10	7.32
Eleskirt	696.73	6.32
Hamur	493.64	6.02
Ağrı	537.98	6.02
Diyadin	346.25	4.89

Evaporation observations for the project area and its surroundings are made at Alpaslan, Hinis, Malazgirt and Agri stations, data from these stations were used in evaporation calculations at Alpaslan II Dam and reservoir areas to the upstream of the dam. As a result of calculations, annual average evaporation amount was determined to be 494.3 mm.

A.3. Exhibition of potential changes in the current hydrological, geomorphologic and ecological systems with the implementation of the project

Murat River, on which the proposed project will be developed, has a length of about 600 km. It originates at Aladag Mountain to the north of Van Lake. After it merges with tributaries originating from Muratbasi Mountain, it takes up on others from Eleskirt region near Agri Province. Murat River then flows in the southwest direction and reaches Malazgirt Plain. It merges with Hinis Creek from Bingol Mountains and enters Mus Plain from the north, where it merges with another creek coming from Nemrut Mountain. It flows to the west passing through narrow channels and Palu, and then merges with Harinket Creek from Ulu Plain of Elazig Province and also Munzur-Peri Creek from Tunceli Province. Murat River also merges with Karasu at Keban region, which is another important tributary of Euphrates River, and then finally flows into Euphrates River.

With the construction of the dam, the riverine habitat will be transformed into a lentic one. At the area composed of a terrestrial ecosystem and river habitat, will be replaced by a lake ecosystem. The direct impact of dams to the vegetation is the loss of biomass that is inundated. However, due to the fact that most of the flora species that would be impacted are widespread, and those that are regional endemic have populations outside the project impact area, there is no foreseen impact on flora at species level.

With the loss of habitats provided by the inundated vegetation cover, terrestrial fauna elements that inhabit these habitats are expected to leave the area and inhabit similar habitats within the vicinity. Since there are alternative habitats which can be utilized by fauna elements for feeding and sheltering purposes around the project area, the impact on fauna species is expected to be rather low.

As can be seen in the precipitation-flow rate relation, the river flow in the study are is established through surface and subsurface alimentation. The geological units surrounding the river have limited alimentation capacity. Due to the large size of the basin, and since the upper elevations of the basin have precipitation rates that are higher than Turkey average together with the regulation impact of existing structures within the basin, the flow rate does not drop below 65 m^3/s. This is about 47% of the natural long-term annual average flow (137.571 m^3/s). The continuation of the biological and ecological structure in the long-run is a result of flow duration.

Geological units surrounding the river have limited groundwater storage and transmission capacities. Therefore, there is no significant interaction between the surface water and groundwater systems. At valley hills, the groundwater level is higher than that of the river, the groundwater flow is towards the river. With the implementation of the project, there will not be a significant change in the load gradient between the river downstream and water levels of surrounding geological units.

Potential changes that are predicted to take place within the hydrological system are outlines in Section A.1, and calculations on environmental flow rates are given in Section C. Considering the topographic and geological structure, it is understood that the river is alimented by groundwater at the downstream. This process is expected to limitedly contribute to the environmental flow that would be released from the dam. On the other hand, in river alimentation, surface and subsurface flows have a more important role. With the operation of the project, it is not expected to observe a significant change in existing hydrogeological conditions.

A.4. Aquatic and terrestrial flora and fauna species, endemic, especially local endemic plant species, animal species naturally inhabiting the basin, their distribution in the area, points where they utilize water resources, species that are protected by national and international legislation, rare and endangered species and their distribution in the basin, names of game animals, their populations, and identification and listing of Central Hunting Commission Decisions for these animals

Resources that were utilized in determining terrestrial flora and fauna species of the project area and its surroundings, and impacts of the project on the biological environment can be listed as the following:

- Related literature and scientific sources
- Interviews with local people
- Satellite images of the project area and its surroundings
- Field surveys carried out in July and November of 2010, and April of 2011

National and international threat statuses of flora and fauna species identified in the area in light of the above-mentioned resources were determined according to the IUCN 2011 (International Union for Conservation of Nature), CITES 2004 (Convention on International Trade in Endangered Species of Wild Fauna and Flora, and BERN Convention 2002. In addition, for flora species, Red Data Book of Turkish Plants (TRDB) which is based on 1994 (ver. 2.3) criteria of IUCN (Ekim et al., 2000). Threat statuses for mammals, reptiles and amphibians have been determined according to the General Zoogeography and Turkey's Zoogeography of Demirsoy (2002), and Pocket Book for Birds of Turkey by Kiziroglu (2009) was used for bird species. Additionally, hunting statuses of all fauna elements was determined according to the 2011-2012 Decision of the Central Hunting Commission.

Classification made by CITES, which is an international convention signed by 164 countries (including Turkey), aims to prevent international trade from threatening lives of wild animals and plants. The principles of CITES are based on sustainable trade, which is important for conservation of ecological sources (various wildlife products derived from massive amounts of live animals and plants, products added to food items, exotic leather products etc.). CITES was signed in 1973 and came into force in 1975. Turkey ratified the Convention in 1996.

Species covered in CITES are given under three different appendices according to their conservation status. Appendix I covers the species, which are under the threat of extinction. Trade in the specimens of these species is not allowed except extraordinary circumstances. Appendix II includes species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival. Appendix III includes species, for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country.

BERN Convention aims at conserving and promoting biodiversity, developing national policies for the conservation of wild flora and fauna and their natural habitats, protection of the wild flora and fauna from the planned development and pollution, developing trainings for protection practices, promoting and coordinating the researches made regarding this subject. It has been signed by 26 member states of the European Council (as well as Turkey) with the aim of conserving the wild life in Europe. Species that are protected under the Bern Convention are classified according to the following categories:

- Appendix I: Strictly protected flora species
- Appendix II: Strictly protected fauna species
- Appendix III: Protected fauna species

All of the nations, which are party to the BERN Convention, have signed the Convention on Biological Diversity as well. Parties of this convention are responsible from ensuring sustainable use of resources in line with their national development trends and conserving the threatened species.

The IUCN Red List intends to draw attention to species whose populations are at risk or under threat. The IUCN places a species on the Red List only after studying its population and the reasons for its decline. Some countries pay greater attention to IUCN-listed species than Bern-listed species, since the Red List relies on more research. The 1994 (ver.2.3) and 2001 (ver.3.1) categories and criteria of the IUCN Red List are presented below in Table A.3

Table A.3. IUCN Red List Categories and Criteria

IUCN Red List Categories and Criteria 1994 (ver. 2.3)		**IUCN Red List Categories and Criteria 2001 (ver. 3.1)***	
EX	Extinct	EX	Extinct
EW	Extinct in the Wild	EW	Extinct in the Wild
CR	Critically Endangered	CR	Critically Endangered
EN	Endangered	EN	Endangered
VU	Vulnerable	VU	Vulnerable
LR	Lower Risk		
	cd: conservation dependent	NT	Near Threatened
	nt: near threatened	LC	Least Concern
	lc: least concern		
DD	Data Deficient	DD	Data Deficient
NE	Not Evaluated	NE	Not Evaluated

** IUCN Red List Categories and Criteria have been formed by means of extensive reviews for developing more transparent, more open and easy to use systems in the recent years. In this respect, corrections were made and adopted by IUCN Council in February 2000 and revised Categories and Criteria (IUCN Red List Categories and Criteria, version 3.1) were published in 2001.*

In determining national threat categories for fauna species General Zoogeography and Zoogeoraphy of Turkey (Demirsoy, 2002), Pocketbook for Birds of Turkey (Kiziroglu, 2009) and Central Hunting Commission 2011-2012 Decisions, were used.

National threat categories that were defined by Demirsoy (2002) for mammal, reptiles and birds, which are included in General Zoogeography and Zoogeography of Turkey are given in Table A.4.

Table A.4. National Threat Categories (Demirsoy, 2002) for Fauna Species (Mammal-Reptile-Amphibian)

E	Endangered
Ex	Extinct
I	In determinate
K	Insufficient known
nt	Widespread, abundant
O	Out of danger
R	Rare
V	Vulnerable

In addition, national threat statuses of bird species identified in the study area were assessed according to categories defined by Pocketbook for Birds of Turkey (Kiziroglu, 2009) and listed in Table A.5.

Table A.5. Threat Categories for Bird Species (Kiziroglu, 2009)

Category A		
A.1.2	(CR)	Critically endangered and breeding species in Turkey
A.2	(EN)	Endangered and breeding species in Turkey
A.3	(VU)	Vulnerable and breeding species in Turkey
A.3.1	(D)	Declining, vulnerable and breeding species in Turkey
A.4	(NT)	Near threatened, breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey
A.5	(LC)	Least concern, breeding species that are widespread in Turkey
A.6	(DD)	Data deficient, breeding species on which there is deficient information in Turkey
A.7	(NE)	Not evaluated, Breeding species which have not been evaluated in Turkey
Category B		
B.1.2	(CR)	Critically endangered and non-breeding species in Turkey
B.2	(EN)	Endangered and non-breeding species in Turkey
B.3	(VU)	Vulnerable and non-breeding species in Turkey
B.3.1	(D)	Declining, vulnerable and non-breeding species in Turkey
B.4	(NT)	Near threatened, non-breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey
B.5	(LC)	Least Concern, non-breeding species that are widespread in Turkey
B.6	(DD)	Data deficient, non-breeding species on which there is deficient information in Turkey
B.7	(NE)	Not Evaluated, non-breeding species which have not been evaluated in Turkey

National hunting statuses of fauna species in the study area are assessed in three categories, which are defined by the General Directorate of Nature Conservation and National Parks Central Hunting Commission (CHC) Decisions of 2011-2012 (Official Gazette, Date: June 14, 2011, No: 27968):

- Appendix I; includes wildlife species which are protected by the former Ministry of Environment and Forestry (now Ministry of Environment and Urbanization)
- Appendix II; includes game animals which are protected by CHC
- Appendix III; includes game animals which are allowed to be hunted in seasons predefined by CHC.

A.4.1. Identification of terrestrial flora and fauna species

In order to identify flora and fauns species of Alpaslan II Dam and HEPP project area and its surroundings, field studies were carried out in July and November of 2010, and April of 2011. Floristic characteristics of the area were determined by Prof. Hayri Duman from Gazi University Department of Biology, and faunistic characteristics by Assoc. Prof. Zafer Ayas from Hacettepe University Department of Biology.

Study area for terrestrial flora and fauna surveys was selected to include dam site area and material burrow sites. In this respect, dam site and areas of inundation was considered to be project area. Areas within the vicinity of the project area, which are outside construction and operation activity areas, were considered project impact areas. Project activity areas were defined as areas where physical (noise, dust, etc.) and biological (habitat loss, deterioration of vegetation, etc.) will be observed. Also, considering roads that will be used by construction machinery and excavation trucks, and distances that dust would reach, areas with a diameter of about 1 km were surveyed. Areas along the river system that are outside project activity and impact areas, which have similar habitats to project area, were considered as alternative areas with suitable ecological carrying capacity. Alternative areas could be used by mobile species for feeding, sheltering and breeding.

A.4.1.1. Flora and vegetation characteristics

Eastern Anatolia Region, especially Mus-Erzurum region, is not a well-studied area in terms of its floral composition. A new *Cirsium* species, which was collected in the area within the scope of this study, was accepted to be published in *Ann. Bot. Fennici* journal as of end of 2011. This also reveals that the area has not been surveyed in detail up to date. Since habitat diversity in the region is rather low, the flora is not rich and endemizm rate is quite low as wll. The study area falls within Iran-Turan phyto-geographical region in terms of its flora geographical characteristics. It is completely under the influence of terrestrial climatic conditions.

As a result of field surveys carried out in the project area 1 species from a fern family, 1 species from 1 Gymnospermae family, and 255 species from 49 Angiospermae families were identified. A total of 257 plant taxa from 51 families were identified. 13 of these identified species are endemic. Endemic species and their IUCN threat categories are given in Table A.6.

Table A.6. Endemic Flora Species and Threat Categories

No.	Species	Endemizm	IUCN Threat Category (TRDB)
1	*Ferula huber-morathii* Pesmen	Regional	EN: Endangered
2	*Cirsium yildizianum* Arabacı & Dirmanci	Regional	EN: Endangered
3	*Centaurea fenzlii* Reichardt	Regional	VU: Vulnerable
4	*Verbascum macrosepalum* Boiss. & Kotschy ex Murb.	Regional	VU: Vulnerable
5	*Anthemis wiedemanniana*	Widespread	LC: Least Concern
6	*Achillea teretifolia* Willd.	Widespread	LC: Least Concern
7	*Alyssum filiforme* Nyar	Widespread	LC: Least Concern
8	*Bufonia calyculata* Boiss. & Bal.	Widespread	LC: Least Concern
9	*Rhamnus petiolaris* Boiss.	Widespread	LC: Least Concern
10	*Astragalus eriocephalus* Willd. Subsp. *elongatus* Chamb. & Mathews	Widespread	LC: Least Concern
11	*Verbascum oreophilum* C. Koch var. *joannis* (Bordz.) Hub.-Mor.	Widespread	LC: Least Concern
12	*Phlomis capitata* Boiss.	Widespread	LC: Least Concern
13	*Tulipa sintenisii* Baker	Widespread	LC: Least Concern

One of the three dominant vegetation types in the project area is the riparian vegetation. This vegetation types is especially spread along the alluvial plains where Murat River and Bingol Creek meet. Dominant plants of this vegetation are *Salix alba, Salix pseudodepressa, Acer tataricum,* and *Tamarix smyrnensis*. Among these trees and bushed there are species like *Phragmites australis, Sparganium erectum* and *Poa trivialis,* which have high water demand. Endemic species in the study area are more widespread within the steppe vegetation. Considering the vertical distribution of regional endemic species, it has been concluded that some of the populations will be inundated, while other populations will not be impacted due to project activities. Other widespread endemic species are not considered in any threat category. Therefore, they are not expected to be impacted by project activities.

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A.4.1.2. Faunistic characteristics

The project area and its surrounding do not bear any special habitat characteristics that would be suitable to be inhabited by threatened fauna species. 16 of the 18 mammal species identified in the area are listed as “LC: Least concern”, one species is in the category of “DD: Data deficient”. Only one mammal species *Spermophilus xanthophyrmnus* (Anatolian ground squirrel) is considered in the category of “NT: Near threatened” according to the IUCN Red List. Based on CITES categories, on the other hand, *Canis lupus* (Wolf) is listed under “Appendix 2: Species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival.”, while two other species; *Vulpes vulpes* (Red fox) and *Martes foinea* (Stone marten) are listed under “Appendix 3: Apecies, for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country”.

When considered in terms of national threat categories, 4 mammal species; *Rhinolophus hipposideros* (Lesser horseshoe bat), *Myotis blythii* (Lesser mouse-eared bat), *Pipistrellus pipistrellus* (Common pipistrelle) and *Canis lupus* (Wolf) are considered in the category of “V: Vulnerable species” according to Demirsoy (2002). In terms of 2011-2012 CHC Decisions, 13 species are listed under “Appendix 1: includes wildlife species which are protected by the former Ministry of Environment and Forestry (now Ministry of Environment and Urbanization)”, 1 species under “Appendix 2; includes game animals which are protected by CHC”, and 4 species under “Appendix 3; includes game animals which are allowed to be hunted in seasons predefined by CHC”. Mammal species that are under protection and their threat statuses are given in Table A.7.

Table A.7. National and International Conservation Statuses of Mammal Species

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	Demirsoy (2002)	CHC 2011-2012
1	*Erinaceus concolor*	Southern White-breasted Hedgehog	LC	APP-3	-	nt	APP -1
2	*Crocidura leucodon*	Bicolored Shrew	LC	APP -2	-	nt	APP -1
3	*Crocidura suaveolens*	Lesser Shrew	LC	APP -2	-	nt	APP -1
4	*Rhinolophus hipposideros*	Lesser Horseshoe Bat	LC	APP -2	-	V	APP -1
5	*Myotis blythii*	Lesser mouse -eared myotis	LC	APP -3		V	APP -1
6	*Pipistrellus pipistrellus*	Common Pipistrelle	LC	-	-	V	APP -1
7	*Lepus europaeus*	European Hare	LC	-	-	nt	APP-3
8	*Spermophilus xanthaphyrmnus*	Asia Minor Ground Squirrel	NT	-	-	nt	APP -1
9	*Arvicola terrestris*	European Water Vole	LC	-	-	nt	APP -1
10	*Spalax leucodon*	Lesser Mole Rat	DD	-	-	nt	APP -1
11	*Apodemus slyvaticus*	Long-tailed Field Mouse	LC	-	-	nt	APP -1
12	*Rattus rattus*	Black Rat	LC	-	-	nt	APP -1
13	*Mus musculus*	House mouse	LC	APP -2	-	nt	APP -1
14	*Canis lupus*	Gray Wolf	LC	-	APP -2	V	APP -1
15	*Vulpes vulpes*	Red Fox	LC	APP -3	APP -3	nt	APP-3
16	*Mustela nivalis*	Least Weasel	LC	APP -3	-	nt	APP-2
17	*Martes foinea*	Stone Marten	LC	APP -3	APP -3	nt	APP-3
18	*Sus scrofa*	Wild Boar	LC	APP -3	-	nt	APP-3

Out of 97 bird species identified within the project area and its vicinity, 56 species are protected by the BERN Convention “Appendix 2: Strictly protected fauna species”, another 34 species are protected by “Appendix 3: Protected fauna species”. 7 bird species are not listed under of the appendices of the BERN Convention. All of the bird species identified in the project area are considered in the category of "LC: Least concern" according to the IUCN. None of the identified bird species are endemic to the region or Turkey. According to the CITES classification, 10 bird species are listed under "Appendix 2: Species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival". The national and international threat statuses of bird species are given in Table A.8.

Table A.8. National and International Conservation Statuses of Bird Species

No.	Species	English Name	Uluslar arası Koruma Statusu			Ulusal Koruma Statusu	
			IUCN	BERN	CITES	MAK (2011-2012)	Kiziroğlu (2009)
1	*Tachybaptus ruficollis*	little grebe	LC	EK-2		EK-1	A.3.1
2	*Podiceps cristatus*	great crested grebe	LC	EK-3		EK-1	A.5
3	*Phalacrocorax carbo*	great cormorant	LC	EK-3		EK-2	A.3
4	*Ixobrychus minitus*	little bittern	LC	EK-2		EK-1	A.2
5	*Nycticorax nycticorax*	black-crowned night heron	LC	EK-2		EK-1	A.3.1
6	*Ardeola ralloides*	squacco heron	LC	EK-2		EK-1	A.3
7	*Egretta garzetta*	little egret	LC	EK-2		EK-1	A.3.1
8	*Casmerodius albus*	great white egret	LC	EK-2		EK-1	A.3
9	*Ardea cinerea*	grey heron	LC	EK-3		EK-2	A.3.1
10	*Ardea purpurea*	purple heron	LC	EK-2		EK-1	A.2
11	*Ciconia ciconia*	white stork	LC	EK-2		EK-1	A.3.1
12	*Tadorna tadorna*	common shelduck	LC	EK-2		EK-1	A.3.1
13	*Tadorna ferruginea*	ruddy shelduck	LC	EK-2		EK-1	A.4
14	*Anas crecca*	common teal	LC	EK-3		EK-3	A.5
15	*Anas platyrhynchos*	mallard	LC	EK-3		EK-3	A.5
16	*Milvus migrans*	black kite	LC	EK-3	EK-2	EK-1	A.3
17	*Neophron percnopterus*	Egyptian vulture	EN	EK-3	EK-2	EK-1	A.3
18	*Circaetus gallicus*	short-toed snake eagle	LC	EK-3	EK-2	EK-1	A.4
19	*Circus cyaneus*	northern harrier	LC	EK-3	EK-2	EK-1	A.1.2
20	*Accipiter nisus*	sparrowhawk	LC	EK-3	EK-2	EK-1	A.3
21	*Buteo buteo*	buzzard	LC	EK-3	EK-2	EK-1	A.3
22	*Buteo rufinus*	long-legged buzzard	LC	EK-3	EK-2	EK-1	A.3
23	*Falco tinnunculus*	common kestrel	LC	EK-2	EK-2	EK-1	A.2
24	*Alectoris chukar*	chukar partridge	LC	EK-3		EK-3	A.2
25	*Perdix perdix*	partridge	LC	EK-3		EK-2	A.2
26	*Coturnix coturnix*	quail	LC	EK-3		EK-3	A.3
27	*Gallinula chloropus*	moorhen	LC	EK-3		EK-2	A.3.1
28	*Fulica atra*	coot	LC	EK-3		EK-3	A.5
29	*Grus grus*	crane	LC	EK-2	EK-2	EK-1	A.3
30	*Charadrius dubius*	little ringed plover	LC	EK-2		EK-1	A.3
31	*Vanellus vanellus*	lapwing	LC	EK-3		EK-2	A.5
32	*Larus armenicus*	Van's gull	LC	EK-3		EK-1	A.4
33	*Sterna (Hydroprogne) caspia*	caspian tern	LC	EK-2		EK-1	A.2
34	*Sterna hirundo*	common tern	LC	EK-2		EK-1	A.3
35	*Sterna albifrons*	little tern	LC	EK-2		EK-1	A.3.1
36	*Columba livia*	rock pigeon	LC	EK-3		EK-3	A.5
37	*Streptopelia decaocto*	collared dove	LC	EK-3		EK-2	A.5
38	*Streptopelia turtur*	turtle dove	LC	EK-3		EK-3	A.3.1

Table A.8. National and International Conservation Statuses of Bird Species (Continued)

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	CHC (2011-2012)	Kiziroglu (2009)
39	*Athene noctua*	little owl	LC	APP-2	APP-2	APP-1	A.2
40	*Apus apus*	swift	LC	APP-3		APP-1	A.3.1
41	*Merops apiaster*	bee-eater	LC	APP-3		APP-1	A.3.1
42	*Upupa epops*	hoope	LC	APP-2		APP-1	A.2
43	*Dendrocopus syriacus*	syrian woodpecker	LC	APP-2		APP-1	A.2
44	*Dendrocopus medius*	middle-spotted woodpecker	LC	APP-2		APP-1	A.1.2
45	*Melanocorypha calandra*	calandra lark	LC	APP-2		APP-1	A.5
46	*Melanocorypha bimaculata*	bimaculated lark	LC	APP-2		APP-1	A.3
47	*Galerida cristata*	crested lark	LC	APP-3		APP-2	A.3
48	*Ptyonoprogne rupestris*	crag martin	LC	APP-2		APP-1	A.5
49	*Hirundo rustica*	barn swallow	LC	APP-2		APP-1	A.5
50	*Delichon urbicum*	house martin	LC	APP-2		APP-1	A.3
51	*Anthus (novaeseelandiae) richardi*	Richard's pipit	LC	APP-2		APP-1	A.2
52	*Anthus campestris*	twany pipit	LC	APP-2		APP-1	A.2
53	*Anthus spinoletta*	mountain pipit	LC	APP-2		APP-1	A.3
54	*Motacilla flava feldegg*	black-headed yeloow wagtail	LC	APP-2		APP-1	A.3
55	*Motacilla alba alba*	white wagtail	LC	APP-2		APP-1	A.3.1
56	*Cinclus cinclus*	dipper	LC	APP-2		APP-1	A.1.2
57	*Erithacus rubecula*	robin	LC	APP-2		APP-1	A.3
58	*Luscinia luscinia*	thrush nigtingale	LC	APP-2		APP-1	A.2
59	*Luscinia megarynchos*	nigtingale	LC	APP-2		APP-1	A.2
60	*Luscinia svesica*	bluethroat	LC	APP-2		APP-1	A.2
61	*Phoenicurus ochruros*	black redstart	LC	APP-2		APP-1	A.2
62	*Phoenicurus phoenicurus*	redstart	LC	APP-2		APP-1	A.3
63	*Saxicola rubetra*	whinchat	LC	APP-2		APP-1	A.3
64	*Saxicola torquata*	stonechat	LC	APP-2		APP-1	A.3
65	*Oenanthe isabellina*	isabelline wheather	LC	APP-2		APP-1	A.3
66	*Oenanthe oenanthe*	wheather	LC	APP-3		APP-1	A.3
67	*Turdus torquatus*	ring ouzel	LC	APP-2		APP-1	A.1.2
68	*Turdus merula*	blackbird	LC	APP-2		APP-3	A.3
69	*Turdus viscivorus*	mistle thrush	LC	APP-2		APP-2	A.2
70	*Cettia cetti*	cetti's warbler	LC	APP-2		APP-1	A.2
71	*Sylvia melanocephala*	sardinian warbler	LC	APP-2		APP-1	A.3
72	*Phylloscopus collybita*	chiff chaff	LC	APP-2		APP-1	A.3.1
73	*Muscicapa striata*	spotted flycatcher	LC	APP-2		APP-1	A.3
74	*Parus major*	great tit	LC	APP-2		APP-1	A.3.1
75	*Sitta neumayer*	rock nuthatch	LC	APP-2		APP-1	A.2
76	*Sitta europaea*	wood nuthatch	LC	APP-2		APP-1	A.3
77	*Lanius collurio*	red-backed shrike	LC	APP-3		APP-1	A.2
78	*Lanius excubitor*	great gray shrike	LC	APP-3		APP-1	A.1.2
79	*Garrulus glandarius*	jay	LC	-		APP-3	A.3.1
80	*Pica pica*	magpie	LC	-		APP-3	A.5
81	*Pyrrhocorax graculus*	yellow-billed chough	LC	APP-2		APP-1	A.3
82	*Corvus monedula*	jackdaw	LC	-		APP-3	A.5
83	*Corvus frugilegus*	rook	LC	-		APP-3	A.5
84	*Corvus corene*	carrion crow	LC	-		APP-3	A.5
85	*Corvus corax*	raven	LC	APP-3		APP-2	A.5
86	*Sturnus vulgaris*	starling	LC	-		APP-2	A5
87	*Sturnus roseus*	rosy starling	LC	APP-2		APP-1	A.4
88	*Passer domesticus*	house sparrow	LC	-		APP-3	A.5

Table A.8. National and International Conservation Statuses of Bird Species (Continued)

No.	Species	English Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	MAK (2011-2012)	Kiziroglu (2009)
89	*Passer montanus*	tree sparrow	LC	APP-3		APP-2	A.3
90	*Petronia brachydactyla*	pale rock sparrow	LC	APP-3		APP-2	A.2
91	*Fringilla coelebs*	caffinch	LC	APP-3		APP-2	A.4
92	*Serinus pusillus*	red-fronted serin	LC	APP-2		APP-1	A.3
93	*Carduelis chloris*	greenfinch	LC	APP-2		APP-1	A.3
94	*Carduelis carduelis*	goldfinch	LC	APP-2		APP-1	A.3.1
95	*Carduelis spinus*	siskin	LC	APP-2		APP-1	A.3
96	*Emberiza hortulana*	ortolan bunting	LC	APP-3		APP-2	A.3
97	*Miliaria calandra*	corn bunting	LC	APP-3		APP-2	A.4

As a result of studies carried out in the project area and its surroundings, 20 reptile species were identified. Only of these species *Testudo grecea* (Common tortoise) is considered in the category "VU: Vulnerable" according to IUCN. Based on the classification made by CITES, 2 species; *Testudo grecea* (Common tortoise) ve *Eryx jaculus* (Javeline sand boa), are included in "Appendix II includes species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival". Among the 20 reptile species 13 of them are protected under Bern Convention "Appendix II: Strictly protected fauna species", and 7 of them are protected under "Appendix III: Protected fauna species". Considering national threat categories, 1 one of the reptile species; *Eryx jaculus* (Javeline sand boa) is considered in the category of "R: Rare", while all of the other species are in the category of "nt: Widepread, aboundant". Conservation statuses of reptile species identified in the area are given in Table A.9.

There are also 7 amphibian species identified within fauna study area. Among these 2 species; *Bufo viridis* (European green toad) and *Hyla arborea* (European tree frog) are considered in Appendix 2 of the Bern Convention, while all of the other species are considered in Appendix 3. One the amphibian species in considered as "VU: Vulnerable" according to the IUCN Red List, while the rest of the species are evaluated as "LC: Least Concern". None of the amphibian species identified in the area are considered by CITES. Amphibian species and their conservation statuses are given in Table A.10.

Table A.9. National and International Conservation Statuses of Reptile Species

No.	Species	Turkish Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	CHC (2011-2012)	Demirsoy (2002)
1	*Mauremys caspica*	Pond turtle	LC	APP-2	-	APP-1	nt
2	*Testudo graeca*	Common tortoise	VU	APP-2	APP-2	APP-1	nt
3	*Cyrtopodion kotschyi*	Kotschy's gecko	LC	APP-2	-	APP-1	nt
4	*Hemidactylus turcicus*	Genis parmaklı keler	LC	APP-3	-	APP-1	nt
5	*Laudakia stellio*	Mediterranean house gecko	LC	APP-2	-	APP-1	nt
6	*Ophisaurus apodus*	Scheltopusik	LC	APP-2	-	APP-1	nt
7	*Parvilacerta parva*	Dwarf lizard	LC	APP-2	-	APP-1	-
8	*Lacerta (Darevskia) trilineata*	Balkan green lizard	LC	APP-2	-	APP-1	nt
9	*Ophisops elegans*	Snake-eyed lizard	LC	APP-2	-	APP-1	nt
10	*Trachylepis aurata*	Golden grass mabuya	LC	APP-3	-	APP-1	nt
11	*Eryx jaculus*	Javeline sand boa	LC	APP-3	APP-2	APP-1	R

Table A.9. National and International Conservation Statuses of Reptile Species (Continued)

No.	Species	Turkish Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	CHC (2011-2012)	Demirsoy (2002)
12	*Coluber (Dolichopis) jugularis*	Black whip snake	LC	APP-2	-	APP-1	nt
13	*Platyceps najadum*	Dahl's whip snake	LC	APP-2	-	APP-1	nt
14	*Hemorrhois ravergieri*	Spotted wipe snake	NE	APP-3	-	APP-1	nt
15	*Dolichopis schmidti*	Schmidt's whip snake	LC	APP-3	-	APP-1	nt
16	*Eirenis modestus*	Ring-headed dwarf snake	LC	APP-3	-	APP-1	nt
17	*Elaphe quatuorlineata*	Four-lines snake	LC	APP-2	-	APP-1	nt
18	*Natrix natrix*	Grass snake	LR/lc	APP-3	-	APP-1	nt
19	*Natrix tassellata*	Dice snake	LC	APP-2	-	APP-1	nt
20	*Vipera lebetina*	Bluntnosed Viper	NE	APP-2	-	APP-1	nt

Table A.10. National and International Conservation Statuses of Amphibian Species

No.	Species	Turkish Name	International Threat Status			National Threat Status	
			IUCN	BERN	CITES	CHC (2011-2012)	Demirsoy (2002)
1	*Neurergus strauchii*	Strauch's spotted newt	VU	APP-3	-	-	nt
2	*Bufo bufo*	Common toad	LC	APP-3	-	-	nt
3	*Pseudepidalea viridis*	Green toad	LC	APP-2	-	-	nt
4	*Hyla arborea*	European tree frog	LC	APP-2	-	-	nt
5	*Hyla savignyi*	Tree frog	LC	APP-3	-	-	nt
6	*Rana macrocnemis*	Long-legged wood frog	LC	APP-3	-	-	nt
7	*Pelophylax ridibundus*	Marsh frog	LC	APP-3	-	-	nt

A.4.2. Identification of aquatic flora and fauna species

The proposed Alpaslan II Dam and HEPP Project is located on Euphrates Basin in the Eastern Anatolian Region at a distance of about 34 km to Mus city center. The project is situated on Murat River. In order to identify the characteristics of the aquatic fauna in the area, two site visits were carried out in July and November of 2010. The results of field studies were evaluated in order to assess the potential impacts of the project on the aquatic ecosystem.

A.4.2.1. Material and method

In order to represent the project area, three sampling points were selected (see Figure A.4). When these sampling points were determined, dam site upstream, area between the dam site and HEPP, dam site downstream and those areas preferred by fish species (sandy-slimy, stony-rocky and vegetation cover) were considered.

Aquatic ecosystems are composed of the following organisms; phytoplanktonic organisms at the producer level (free or attached algae), zooplanktonic and benthic organism that feed on these, which are primary and secondary consumers, and tertiary consumer fish species, which depending on their food preference can feed on either zooplanktonic and benthic organisms or smaller fish.

In this context, the main links of the aquatic food chain are algae (attached or free forms, phytoplanktonic organisms), zooplanktonic organisms, benthic organisms, and fish. Changes in aquatic systems can cause changes on these organisms.

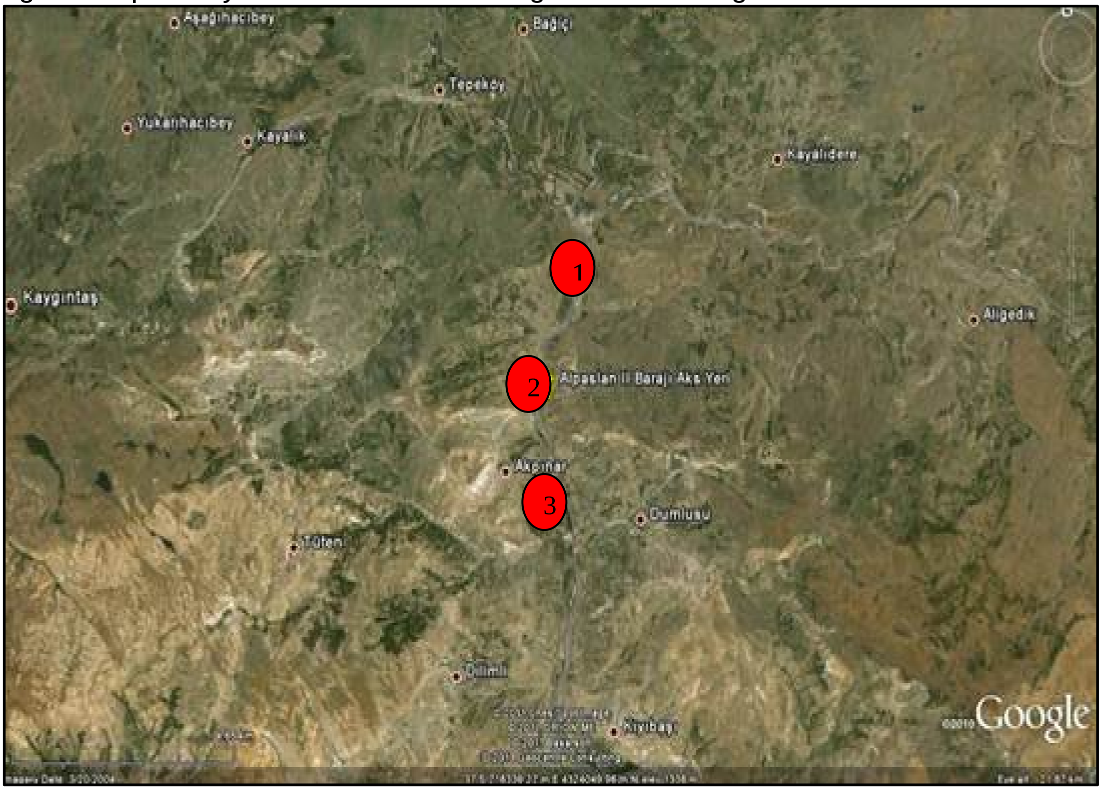


Figure A.4. Alpaslan II Dam and HEPP Area Aquatic Flora and Fauna Sampling Stations

Algae and phytoplanktonic organisms

The fundamental principle in sampling of phytoplanktonic organisms is collecing the phytoplankton from water through draining. A Hydro Bios Kiel brand Hensen type plankton grab sampler was used. Samples that were kept in water for a certain period of time and then collected in the catch pit of the grab sampler were transferred into plastic containers and taken to the laboratory after fixated with 4% formaldehyde.

Attached algae were collected by scraping. Rocks (epilithic), sediment (epipelic), plants (epiphytic) and crustaceans (epizoic) were collected and their outer parts were scraped using a toothbrush or a hard object. The scraped part was cleaned with distilled water and put into sampling bottles. It was fixated with 4% formaldehyde and taken to the laboratory. The collected samples were identified at genus and/or species levels.

Zooplanktonic organisms

Sampling method for zooplanktonic organisms is the same as that of the planktonic algae sampling.

Benthic organisms

Benthic organisms were collected from mud from sandy and puddles, gravels and underneath the rocks in stony areas. They were identified in-situ and at the laboratory at family and/or genus levels. Sieves of different pore sizes were used in sifting the bottom mud samples. Macrobenthic organisms were identified at genus level in-situ.

Fish

Fish samples, which constitute an important indicator of aquatic vertebrates, were sampled with a Samus 725 mp electroshocker where the current rate and water depth are low (see Figure A.5). At higher depths and where flow rate is higher a casting net was used. Sampled fish species were taken to the laboratory after fixated with 4% formaldehyde and 96% alcohol.

In identifying algae the following resources were utilized; Krammer and Lange-Bertalot, 1986; 1988; 1991a; 1991b; Bold and Wynne, 1985; Czernecki and Blinn, 1978; Foged, 1982; Germain 1981; Hustedt, 1930; Prescott, 1982; Patrick and Reimer, 1966; Sreenivasa and Duthie, 1973; Van Heurck, 1962; Cox, 1996; Huber Pestalozzi, 1938; 1941; 1955; 1961; 1968; 1982; Komarek, 1983. In identification of Rotifera species Hutchinson (1967); Pejler (1962); Kuttikova (1970); Kolisko (1974); Koste (1978a; 1978b) and Ridder (1981) were used while for Cladocera and Copepoda species Kiefer (1978) was used. In identification of benthic organisms the resources that were utilized are Sennika, 1943; Mann, 1962; Needham and Needham, 1962; Macan, 1982; Quigley, 1977; Pennak, 1978; Illies, 1978; Elliot and Mann, 1979; Biro, 1981; Edington, 1981; Bellman, 1988; Sahin, 1991; Gloer, 1992; Ludwig, 1993. For fish species, on the other hand, Kuru (1975), Geldiay ve Balik (1999) were used.

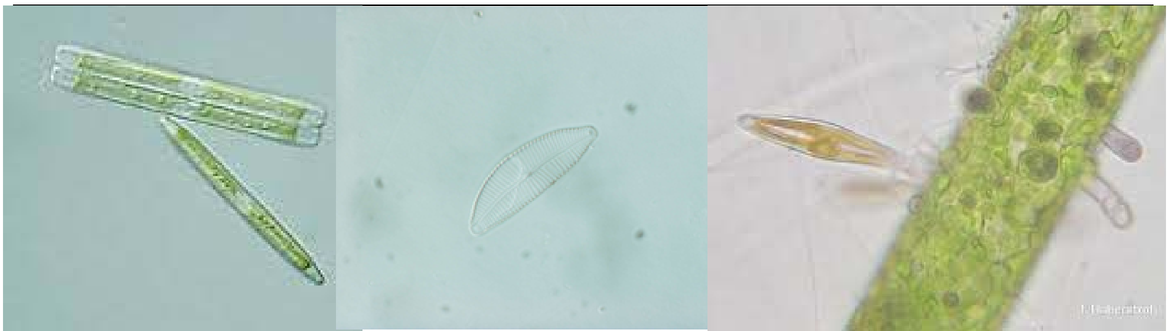
Figure A.5. Fish Sampling

A.4.2.2. Findings

Freshwater Algae

Algae are primary producers in an aquatic environment. Using the pigments in their structure, they are capable of converting carbondioxide and water into carbohydrates in light. This way they contribute to increasing the amount of nutrition and dissolved oxygen in an aquatic environment. They form the first link of the food chain by enhancing their own growth. They are important in terms of their contribution to production and relations with organisms at higher levels.

As a result of field studies carried out to identify phytoplanktonic organisms, the most dominant group at the three sampling stations is Bacillariophyceae, while Euglenophyceae and Pyrrophyceae are represented by one species each. Within the scope of the study, a total of 20 Bacillariophyceae, 5 Chlorophyceae, 4 Cyanophyceae, 1 Euglenaphyceae, and 1 Pyrrophyceae species were identified. Besides, it was determined that *Achnanthes microcephala, Cymbella affinis* and *Fragilaria ulna* from Bacillariophyceae were determined to be abundant (see Figure A.6). Phytoplanktonic organisms identified in the area are listed in Table A.11.



Fragialla ulna	*Cymbella affinis*	*Achnanthes microcephala*

Figure A.6. Samples of Phytoplantkon Species Identified in the Area

Table A.11. Phytoplankton Organisms Identified in the Project Area

PHYLUM	CLASS	GENUS /SPECIES	STATION NO.
BACILLARIOPHYTA Haeckel 1878 emend Mann in Round et al.	PENNATIBACILLARIOPYCEAE	*Amphora ovalis*	2;3
		Achnanthes microcephala	1;2;3
		Anomoeonis sphaerophora	1;3
		Caloneis permagna	2
		Cocconeis placentula	1;2;3
		Cyclotella meneghiniana	1;3
		Cymbella affinis	1;2;3
		Cymatopleura solea	!;2
		Diatome vulgaris	2;3
		Epithemia argus	1;2
		Epithemia sorex	1;2;3
		Fragillaria contruens	2
		Fragilaria ulna	1;2;3
		Gomphonema sp	1
		Melosira varians	1;2
		Navicula cryptocephala	1;2;3
		Nitzchia sigmoidae	1;2;3
		Pinnularia viridis	1;2
		Surirella brebissonii	2;3
		Surirella ovalis	1;2
CHLOROPHYTA (Yesil Algler)	CHLOROPYCEAE	*Closterium aciculare*	2;3
		Cosmarium obtusatum	1;2
		Oocystis parva	1;2;3
		Pediastrum dublex	1;2
		Scenedesmus quadricauda	1;2;3
CYANOPTHYTA	CYANOPHYCEAE	*Microcystis sp.*	1;3
		Oscillatoria sp.	1;2;3
		Oscillatoria limosa	1;3
		Spirulina sp.	1;3
EUGLENOPHYTA	EUGLENOPHYCEAE	*Euglena sp.*	2
PYRROPHYTA	PHRROPHYCEAE	*Peridinium sp.*	2;3

Zooplanktonik organisms

Cladocera, Copepoda and Rotifera are microscopic organisms, which constitute the most important groups of zooplanktons. Most of these zooplanktonic organisms are spread in freshwater and in general can be found at limnetic zones of lakes and stagnant parts of river systems. In defining water quality of freshwater systems, Rotifera species are important indicators since a number of invertebrates and vertebrates feed on these species. There are a total of 6 species identified in the area; 3 species from Rotifera, 2 from Cladocera and 1 from Copepoda (see Figure A.7). Zooplanktonic organisms identified in the study area are listed in Table A.12. All of the zooplanktonic species identified in the area are cosmopolitan and are widespread in all kinds of water.

Keratella quadrata	*Daphnia cucullata*	*Cyclops sp*

Figure A.7. Samples of Zooplankton Species Identified in the Area

Benthic organisms

Benthic organisms cover those organisms which spend at least some part of their lives at the bottom of freshwater habitats (on sediment, deposits, macrophytes and filamentous algae). Nectons and buried forms are also included in the category of benthic organisms. Since mobility of benthic organisms is quite limited, it is possible to acquire information on the situation of the aquatic environment and monitor changes by monitoring benthic organisms. The list of benthic species identified in the area are given in Table A.12, which includes larvae of Ephemeroptera species and also *Potamon potamius* from Malacostraca (see Figure A.8).

Tricoptera spp. larvae nests	*Potamon potamius*

Figure A.8. Samples of Benthic Organisms Identified in the Area

Table A.12. Zooplanktonic and Benthic Organisms Identified in the Project Area

PHYLUM	SUBPHYLUM	CLASS	ORDER	FAMILY	GENUS/SPECIES	STATION NO.
ARTHROPODA	CRUSTACEAE	BARANCHIOPODA	CLADOCERA	DAPHNIIDAE	*Daphnia cucullata*	1,2
				BOSMINIDAE	*Bosmina longirostris*	
		MAXILLOPODA	CYCLOPOIDA	CYCLOPOIDAE	*Cyclops* sp.	1
			CALANOIDA	DIAPTOMIDAE	*Acanthodiaptomus denticornis*	
		MALACOSTRACA	DECAPODA	POTAMIDAE	*Potamon potamius*	1
			AMPHIPODA	GAMMARIDAE	*Gammarus pulex*	2
	MANDIBULATA	INSECTA (HEXAPODA)	TRICOPTERA	-	Larva	2
			EPHEMEROPTERA	-	Larva	2
			COLEOPTERA	-	Larva	
			PLEOCOPTERA	-	Larva	
			DİPTERA	CHIRONOMODIEA	Larva	
MOLLUSCA	-	GASTROPODA	-	PLANORBIDAE	*Gyraulus sp.*	
ROTIFERA	-	MONOGONONTA	PLOIMA	LECANIDAE	*Lecane sp.*	1,2
				BRACHIONIDAE	*Keratella quadrata*	1,2
					Brachnious calyciflorus	

Fish

Fish species are an important part of an aquatic system being at the top of the food chain. Fish species can feed on algae, zooplankton and benthic organisms. Some species are not only important ecologically, but also in economic terms.

The Euphrates River freshwater fish fauna was researched by Kuru (1975). Based on field studies, total of 13 species were identified which 9 of them from family Cyprinidae, 2 of them from Balitoridae and one from Sisoridae. The habitats of these identified species, treath status and endemism is given in Table IV.26. Bio-ecological characteristics about these species is explained below.

Acanthobrama marmid (Heckel, 1843)

Acanthobrama marmid is mostly common in Tigris and Euphrates River. Head and body are quite flat on sides, covered with small scales and mouth is small an positioned on terminal. (see Figure A.9). Total length is 20 cm, weight is 200 g. Color is grey-yellow but paddle colour is pinkish. It mostly occupies slow flowing rivers and streams and rarely lakes.

Figure A.9. *Acanthobrama marmid*

Alburnoides bipunctatus (Bloch, 1782)

Body is quite flat on sides, and covered with small scales. Colour of dorsal side is dark and lateral sides and abdomen is silvery-white. *Generally a thick strip could seen on lateral sides of their body*, especially at reproduction period. Adults are 10-12 cm tall, maximum 16 cm. (see Figure A.10). They prefer pebbled and stony grounds and to feed on insect larvae and ground organisms. The breeding period is between the months of May and June.

Figure A.10. *Alburnoides bipunctatus-*

Table A.13. Fish Species Identified in the Project Area, Their Population Densities and Conservation Statuses

FAMILY	SPECIES	TURKISH NAME	POPULATION DENSITY	SUITABLE HABITAT STREAM (S); RIVER (R); LAKE (L)	ENDEMİZM	IUCN KIRMIZI LİSTE (2011)	BERN (2002)	CITES (2004)
CYPRINIDAE	*Acanthobrama marmid*	-	High	S / R / L	Euphrates-Tigris	-	-	-
	Alburnoides bipunctatus	Spirlin	High	S / R / L	-	-	Ek-III	+
	Alburnus mossulensis	-	High	S / R / L	Euphrates-Tigris	-	-	-
	Barbus lacerta	Kura Barbel	High	S / R / L	Euphrates-Tigris			
	Capoeta umbla	-	High	S / R / L	-	-	-	-
	Capoeta trutta	-	High	S / R / L	-	-	-	-
	Chondrostoma regium	-	Medium	S / R / L	-	-	-	-
	Garra rufa	Doctor fish	High	S / R / L	-	-	-	-
	Luciobarbus mystaceus	-	Medium	S / R / L	Euphrates-Tigris	-	-	-
	Squalius cephalus	Chup	Medium	S / R / L	-	LC	-	-
BALITORIDAE	*Oxynemacheilus argyrograma*	-	High	S / R / L	Euphrates-Tigris	-	-	-
	Oxynemacheilus euphraticus	-	High	S / R / L	Fırat-Tigris	-	-	-
SISORIDAE	*Glyptothorax kurdistanicus*	-	High	S / R	Euphrates-Tigris	-	-	-

Alburnus mossulensis **(Heckel, 1843)**

This species prefers the littoral zone of stream and lakes. They can easily seperate from other species of genus with a thick strip on lateral sides of their body (see Figure A.11). Their most important nutrient are benthic invertebrates. The breeding period is between the months of April and June and they lay their eggs upper part of stones.

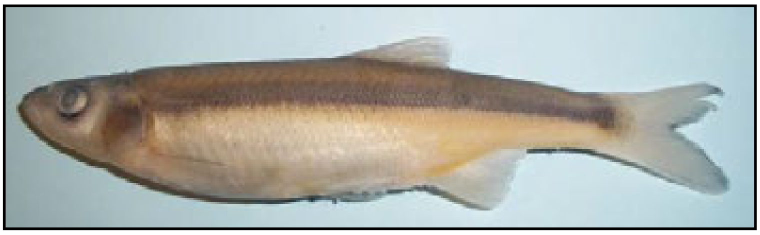


Figure A.11. *Alburnus mossulensis*

Barbus lacerta **(Heckel, 1843)**

Barbus lacerta (35-40 cm tall) is *a* bentopelagic species which is known "*Kura barbel"* (see Figure A.12). This species, which can also well adapt to standing waters, prefers habitats with high flow rates in 'Barbus Zones' and/or upstream of 'Abramis Zones'. Its reproduction period is between the months of April-July and it migrates to upstream portions of river for reproduction*.* This species capable of omnivor feding and their most important nutrients are zooplanktons at younger ages. Adult fish mostly consume benthic organisms and seed fishes.

Figure A.12. *Barbus lacerta* (Bıyıklı Balık)

Capoeta trutta **(Heckel, 1843)**

Capoeta damascina is a bentopelagic and typical species of 'Abramis Zone'. It is called "*Karabalık-Çepiç" or "Berat" by local people.* They can easily be seperated from other species of genus with their ossified last dorsal fin (see. Figure A.13). It can live in those parts of streams with both high and low flow rates and its ecological tolerance is rather high. They migrate to the lateral arms of the river. The most important nutrients are zooplanktons and aquatic invertebrates at younger ages. Adult fish mostly consume algae, parts of plants and detritus. The breeding period is between the months of April and July.

Figure A. 13. *Capoeta trutta*

Capoeta umbla (Heckel, 1843)

This is a benthopelagic fish species (see Figure A.14). It can live in, slow flowing rivers and streams, where the waterbed is semi-pebbled, sandy and slimy. In Turkey, the distribution is confined to Firat and Dicle upstreams and its ecological tolerance is rather high. The most important nutrients are zooplanktons and aquatic invertebrates at younger ages. Adult fish mostly consume algae, parts of plants and detritus. The breeding period is between the months of April and July.

Figure A.14. *Capoeta umbla*

Chondrostoma regium (Heckel, 1843)

Chondrostoma regium is preferring habitats with low flow rates, stony or gravelly grounds in ‘Abramis Zones’ of rivers and can also well adapt to standing waters. (see. Figure A.15). It generally feeds on algae and aquatic organisms. The breeding period is between the months of April and May.

Figure A.15. *Chondrostoma regium* (Kababurun)

***Garra rufa* (Heckel, 1843)**

Garra rufa is a benthopelagic fish species which can adopt different types of habitats like stream, lakes, rivers and hot spring. It generally feeds on algae ower the stones and invertebrate at bottom owing to the vantouse under their mouth. They can called "Doctor Fish" because of their ability that cleaning up scattered skin who has psora (see Figure A.16).

Figure A.16. *Garra rufa* (Doctor fish)

***Squalius cephalus* (Linnaeus, 1758)**

Squalis cephalus is called "Chup" by local people and known as a typical stream fish, which can adapt to lakes and hard waters. (see Figure A.17). The breeding period is between the months of May and June. It mostly feeds on aquatic invertebrates, insect larvae, plant parts and small fish. The adults reach sexual maturity at about 3-4 years.

Figure A.17. *Squalius cephalus* (Chup)

***Luciobarbus mystaceus* (Pallas, 1814)**

This species mostly occupies streams and rivers*, but can also adapt to standing water system well.* The breeding period is between the months of April-June and they prefer upstream portions of river for reproduction*. They lay their eggs to the areas with vegetation* and the population density of this species found in the project area was assessed to be "medium". This species capable of omnivor feding. The most important nutrients are zooplanktons at younger ages and benthic organisms and seed fishes at adult ages (see Figure A.18).

Figure A.18. *Luciobarbus mystaceus*

Oxynemacheilus argyrogramma (Heckel, 1846)

This species prefer stream system habitats with low/medium flow rates and gravelly, stony or sandy ground structures. Body long in shape and quite flat on sides. Posterior of the body is covered with scales, anterior is withour scales. Free edge of dorsal fin is slightly rounded. Free edge of ventral fin is round shaped and caudal fin is dist,nctly recessed. Body is cylindirical and flattened at posterior. *They can easily seperate from other species of genus with 10-12 interrupted black-brown strips on lateral line of their body.* Also brown stains can easily visible on and lateral sides of their head (see. Figure A.19). Mouth is ventral-positioned and its most important nutrients are benthic organisms, zooplanktons and algea. The breeding period is between the months of April and July.

Figure A.19. *Nemacheilus argyrogramma* (Copcu Balığı)

Oxynemacheilus euphraticus

This species prefer stream system habitats and gravelly, stony ground structures and they can easily adapt bank of lake or stream (see A.20). They feed on benthic organisms and zooplanktons. The breeding period is between the months of April and July. They can collect from stream systems with low flow rate and stony ground structers near bank.

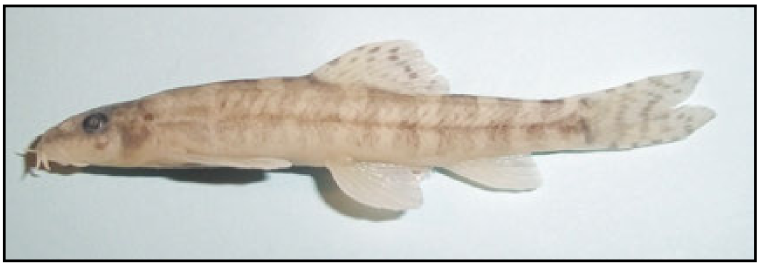


Figure A.20. *Oxynemacheilus euphraticus*

***Glyptothorax kurdistanicus* (Berg, 1931)**

These species are distributed in Firat-Dicle river system and body is eno cevered with scales. Head is flattened on top, mouth is ventrally positioned. 3 barbels can defined near its mouth (see Figure A.21). They can easily separeted from *Glyptotorax armeniacum* with flat nose and black dotted adipose fin. They have adhesive disc under their mouth. They prefer stream system and they live in benthic habitats.

Figure A.21. *Glyptothorax kurdistanicus* (Vantuzlu Yayın Balığı)

A.5. Exhibition of the relationship between the identified flora-fauna elements and especially habitat types for riparian aquatic species with the hydraulic system proposed for the activity, assessment of ecologically special habitats

A.5.1. Terrestrial flora and fauna

The most important impact of the Alpaslan II Dam and HEPP Project on terrestrial flora and fauna elements would be in the form of habitat loss. Flora and fauna species identified as a result of field surveys, and vulnerable species that might be impacted by project activities are given in detail in Section A.4.

Regional endemic species within the project area and its surroundings area found within the steppe vegetation, rather than the riparian zone. Although, some of the regional endemic species populations will be inundated, it is not expected to have any major impacts at species level since populations at higher parts of the steppe vegetation will continue to survive in the area. Species that are found within the riparian zone are widespread species like *Salix triandra, Salix alba, Salix pseudodepressa, Acer tataricum* and *Tamarix smyrnensis*. These species do not have any conservation status. Therefore, they are expected to be adversely impacted by project activities.

There are terrestrial bird species in the area, like herons, cormorants, ducks and plovers, which are dependent on water. However, these species are not expected to be affected with the transformation of the riverine water regime into a stagnant reservoir. On the other hand, since some of the terrestrial habitats will be transformed into aquatic ones, populations of water-dependent fauna elements in the area are expected to increase. As a result of field surveys, it was concluded that vulnerable fauna species in the area inhabit higher steppe vegetations. In addition, most fauna species, due to their higher mobilities, are expected to leave the project activity areas, and utilize nearby alternative areas.

A.5.2. Aquatic flora and fauna

A.5.2.1. Phytoplanktonic organisms

The main habitat for phytoplanktonic organisms is limnotic waters or lothic habitats with low flow rate. Since flow rate causes freely moving phytoplantonic organisms to drift, they either do not exist within fast flowing river systems or are represented by a small population. The dominant algae group in such systems is mostly dependent algae. Dependent algae forms adhere themselves to plants, rocks or sediment, and do not drift by minimizing the physical impact of the current. Therefore, fast flowing systems are not suitable habitats for phytoplanktons, which is supported by the fact that the number of phytoplankton species identified in the project area is rather low. In general, identified freshwater algae species (see Table A.11) are cosmopolitan, none of them being endemic to the region or being threatened.

A.5.2.2. Zooplanktonic organisms

Zooplanktonic organisms mostly shift depending on the water flow, and inhabit limnotic water habitats. Their presence within fast moving river systems is limited. Therefore, species diversity within rivers is rather low. There are no species that are protected by the Bern Convention (2002) and CITES (2004) within the identified species (see Table A.12).

A.5.2.3. Benthic organisms

There is no benthic organism identified in the area that is threatened or should be conserved (see Table A.12). Consequently, it is expected that the impact of the project on benthic organisms would be rather low.

A.5.2.4. Fish

The relationship between the fish species identified in the project area and the hydraulic system is presented in detail in Section A.4. Project activities are expected to impact the growth of fish populations rather than affecting the species composition in the area. The potential impacts of the project on aquatic species and mitigation measures to be taken are presented in detail in Section B.4. In this respect, potential impacts of the project on each of the fish species identified in the area is as the following:

Acanthobrama marmid **(Heckel, 1843):** The species population was identified to be “High”. The spawning period is between April and June. The species does not have a conservation status according to the IUCN Red List, Bern Convention and CITES. As long as the mitigation measures are in place, the project is not expected to pose an important threat on the species population and continuity in the area.

Alburnoides bipunctatus (Bloch, 1782): Population density of this species, which is considered in Appendix III of Bern Convention, is quite high. There is no conservation status for the Turkish population of the species. When the necessary measures are taken, the population of this species is not expected to be adversely affected by the proposed project.

***Alburnus mossulensis* (Heckel, 1843):** The population density of this species is also quite high. Since the fish is stringy, it is not preferred to be consumed by people**.** When the necessary measures are taken, the population of this species is not expected to be adversely affected by the proposed project.

***Barbus lacerta*:** The population density of this species is also quite high. When the necessary measures are taken, the population of this species is not expected to be adversely affected by the proposed project

***Capoeta trutta*:** The population density of this species is also quite high. When the necessary measures are taken, the population of this species is not expected to be adversely affected by the proposed project

***Capoeta umbla*:** The species does not have a conservation status according to the IUCN Red List (2011) and Bern Convention (2002). The species is quite widespread in the project area, and is consumed by local people. When the necessary measures that are mentioned in Section B.2.2 are taken, the population of this species is not expected to be adversely affected by the proposed project.

Chondrostoma regium: The population density of this species was determined to be “medium”, and it does not have a conservation status according to the IUCN Red List (2011) and Bern Convention (2002). When the necessary measures that are mentioned in Section B.2.2 are taken, the population of this species is not expected to be adversely affected by the proposed project.

Garra rufa: The population density of this species is also quite high. The breeding period for this species is between April and July. When the necessary measures are taken, the population of this species is not expected to be adversely affected by the proposed project.

***Squalius cephalus*:** The population density of this species was determined to be “medium”, and it does not have a conservation status according to the IUCN Red List (2011) and Bern Convention (2002). When the necessary measures that are mentioned in Section B.2.2 are taken, the population of this species is not expected to be adversely affected by the proposed project.

***Luciobarbus mystaceus* (Pallas, 1814):** The population density of this species was determined to be “medium”, and it does not have a conservation status according to the IUCN Red List (2011) and Bern Convention (2002). When the necessary measures that are mentioned in Section B.2.2 are taken, the population of this species is not expected to be adversely affected by the proposed project.

Oxynemacheilus argyrogramma: The population density of this species was determined to be “high”, and it does not have a conservation status according to the IUCN Red List (2011) and Bern Convention (2002). It was mostly observed in the area where Murat River meets Bingol Creek. When the necessary measures that are mentioned in Section B.2.2 are taken, the population of this species is not expected to be adversely affected by the proposed project.

Oxynemacheilus euphraticus**:** This species has high ecological tolerance. It is not only found in high densities within the project area, but also in tributaries of Murat River. It does not have a conservation status according to the IUCN Red List (2011) and Bern Convention (2002). When the necessary measures that are mentioned in Section B.2.2 are taken, the population of this species is not expected to be adversely affected by the proposed project.

Glyptothorax kurdistanicus**: The species does not have a** conservation status according to the IUCN Red List (2011) and Bern Convention (2002). When the necessary measures that are mentioned in Section B.2.2 are taken, the population of this species is not expected to be adversely affected by the proposed project.

A.6. Idenfitication of habitat demands of species like stream depth, stream flow rate and oxygen content

Alpaslan II Dam and HEPP is proposed to be built on one of the most important tributaries of Euphrates River, Murat River, at a talveg elevation of 1269 m. Alpaslan II Dam and HEPP Project is proposed to be implemented for irrigation, energy production, and flood protection purposes. The river system would not be dewatered at any time. However, during impoundment of the dam, in order to assure the survival of aquatic species population density in Murat River, it is required to provide water to the riverbed. Since, the impoundment period of the dam is not known, environmental flow rates were calculated monthly. Details on calculation of environmental flow rates are provided in Chapter C.

In this study, the riverbed was analyzed considering the quality and quantity of available data. Based on hydrobiological observations, in determining environmental flow rates (QEF_e), minimum water depth for fish species in the river was taken as 0.15 m and the minimum flow rate as 0.20 m/s (see Table C.1). During field surveys, with wetted perimeter method calculations based on calculations taking the largest river cross-section as a basis, hydraulic properties like current velocity and flow rate for the riverbed were identified. Hydraulic values obtained as a result of modeling (for example current velocity, flow rate, wetted perimeter, current area, width, etc.) were compared with values required for the aquatic habitat.

Following this study, changes in baseflow was analyzed in terms of long-term monthly average and minimum flow rates, high flow (rainy season) and low floa (dry season) monthly average flow rates were determined. Next, flow duration and minimum flows were also assessed.

Finally, flow rate values were determined for different Montana method measurements (Tennant, 1976) based on long-term flow observations.

In hydraulic model calculations for Alpaslan II Dam downstream typical river cross-section, river cross-section properties presented in Figure C.1 and C.2 were utilized. Depth-flow rate and depth-wetted perimeter relations obtained from hydraulic model calculations are presented in Chapter C. For calibration of the model, average flow rate of 1.09 m/s that was measured for the maximum depth of 1.30 m during field surveys was used. For the n value (0..030) that fits the observed riverbed geometry and conditions, the average flow rate for a depth of 1.30 m was calculated to be 1.03 m/s. This indicates that the model is in coherence with the field observations. Model flow rate result (77.21 m^3/s) is also in coherence with the riverbed geometry and average flow rate observed during field surveys.

Hydraulic model calculations carried out for the downstream of Alpaslan II Dam Site, were assessed in terms of aquatic habitat minimum water depth and flow rate limitations, critical flow rate (Q_cr) determined as a result of wetted perimeter model calculations. In these assessments, (n) normal, normal + 10% and normal – 10% fluctuations of the Manning roughness coefficient, and minimum water depth (0.15 m) and minimum flow rate (0.20 m/s) determined for aquatic habitat as a result of hydrobiological and ecological studies were taken into consideration.

It can be seen in Table A.14 that for the continuity of aquatic life, when the water depth is 0.15 m, the minimum flow rate would be between 0.25 m/s and 0.30 m/s. The flow rate that corresponds to these limits would be between 0.40 m^3/s and 0.49 m^3/s. With this water depth limit, it would also be possible to meet the minimum flow rate limit. Besides, the flow rate range that meets these limits is a lot lower than Q_YOA%10 (= 13.757 m^3/s) flow rate.

Table A.14. Hydraulic Parameter Values for Flow of Q_kr = 27.0 m^3/s ve Q_kr = 18.5 m^3/s, Aquatic Habitat Minimum Water Depth and Flow Rate Intervals for Different n Value Situations at the Downstream of Alpaslan II Dam Site Based on Hydraulic Model Results

	Depth (m)	**Current Velocity (m/s)**	**Flow (m^3/s)**	**Area (m^2)**	**Width (m)**	**Islak Cevre (m)**	**R (m)**	**D_hid (m)**
Aquatic Habitat Minimum Demand	**0.15**	**0.20**	-	-	-	-	-	-
Normal	**0.15**	0.27	0.44	1.61	16.530	16.530	0.10	0.100
Normal +%10	**0.15**	0.25	0.40	1.61	16.530	16.530	0.10	0.100
Normal -%10	**0.15**	0.30	0.49	1.61	16.530	16.530	0.10	0.100
Normal	0.09	**0.21**	0.16	0.76	11.920	11.920	0.06	0.060
Normal +%10	0.10	**0.20**	0.18	0.88	12.690	12.690	0.07	0.070
Normal -%10	0.07	**0.20**	0.11	0.54	10.380	10.380	0.05	0.050
Normal, Q_cr= 27.0 m^3/s	0.90	0.74	**26.89**	36.25	83.560	83.580	0.43	0.430
Normal, Q_cr= 18.5 m^3/s	0.76	0.71	**18.58**	26.01	63.450	63.470	0.41	0.410

In determining critical flow rate for the aquatic habitat according to the wetted perimeter method, the relationship between non-dimensional wetted perimeter (WP/WPmax) and non-dimensional flow rate (Q/Qmax), which were calculated according to "normal" hydraulic model results, were assessed (see Figure A.22). There are two different breaking points in this relationship, and the non-dimensional critical flow rate (Q_ndfr) that corresponds to these are at a level of 0.35 and 0.24, respectively.

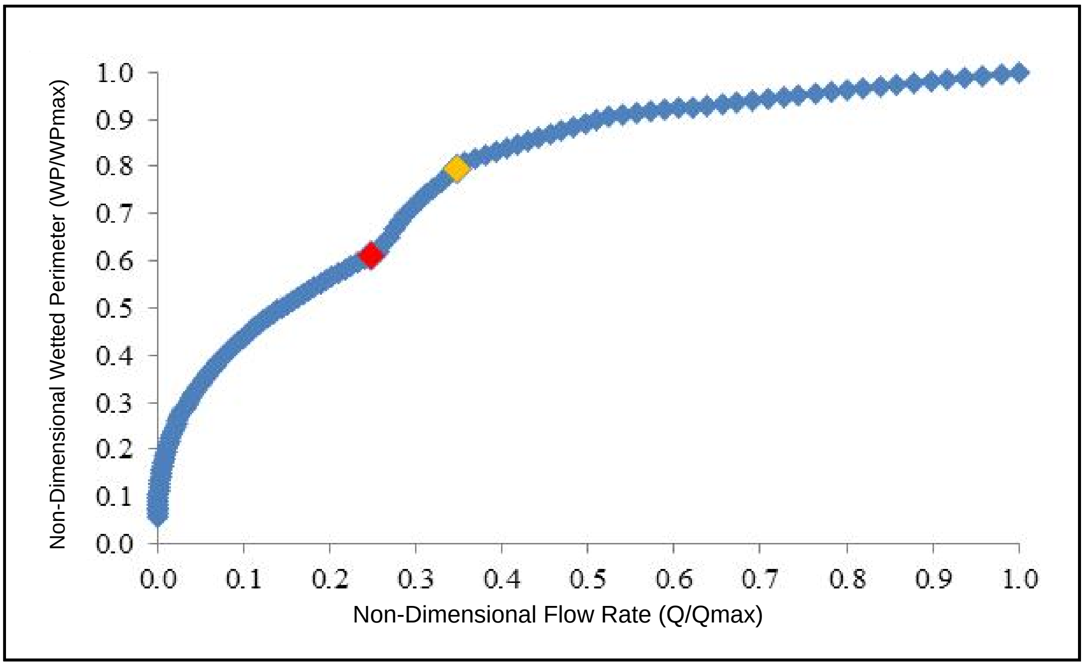


Figure A.22. Relationship Between Non-Dimensional Wetted Parameter and Non-Dimensional Flow Rate Defined for the Downstream of Alpaslan II Dam

In this respect, for Qmax=77.21 m^3/s determined by the model, dimensional flow rate values (Q_cr= Q_ndcr*Qmax=) are 27.0 m^3/s and 18.5 m^3/s, respectively. With the flow rate of Q_cr = 27.0 m^3/s, the water depth comes out as 0.90 m, average current velocity as 0.74 m/s, current area as 36.25 m^2, current cross-section surface width as 83.56 m, wetted perimeter as 83.58 m. With the flow rate of Q_cr= 18.5 m^3/s, the values are as the following; water depth: 0.76 m, average current velocity: 0.71 m/s, current area: 26.01 $m^{2,}$ current cross-section surface width: 63.45 m, and wetted perimeter: 63.47 m. For both flow rate values aquatic habitat minimum current velocity and minimum water depth limits are met.

Montana method is used to assess the year-round flow for October-March and April-September periods, considering the rainy and dry months, and water demand level of the aquatic habitat (see Chapter C). The major weaknesses of the method can be listed as it not considering the shifts in dry and rainy months of year at different parts of the world, and different inner flow condition demands of different aquatic species (like current velocity, water depth).

In the assessment made for Alpaslan II Dam Site, it was concluded that the Q_AAF%10 flow rate ((=13.757 m^3/s) can be met throughout the year with long-term monthly average flow rates. In other words, the monthly average value does not drop below Q_YOA%10 value (= Montana-Weak-minimum) at any period of the year. In addition to this, this measurement can also be met in terms of long-term monthly average minimum flow rates. This shows that the natural flow, even during extremely dry ears, does not fall below Q_YOA%10 of the long-term average flow rate.

Monthly average minimum natural flow rates, meet Montana (Good) except for June-September, and Montana (Medium-decreasing) measurements. During the period of June-September, although the natural minimum flow averages drop below Montana (Good) and Montana (Medium-decreasing) measurements, they do not drop below Montana (Weak-minimum) measurement.

A.7. Identification of geomorphologic structures like canyons, karstic formations, caves, valleys, etc., which are found within the stream bed and surroundings that can be affected by the project

There are no geomorphologic structures like canyons, karstic formations and caves within Alpaslan II Dam and HEPP Project area and its surroundings, which have a potential to be impacted by project activities.

A.8. Definition of the relationship between the identified geomorphologic structures with the proposed hydraulic system

There is no geomorphologic structure within the project area and its surroundings that could be defined to have a relationship with the proposed hydraulic system.

A.9. Assessment of the fish pass project proposed to be implemented within the scope of the activity by considering the publication of “Fish Passes – Design, dimension and monitoring” by the General Directorate of State Hydraulic Works and FAO, and without adversely impacting fish migration especially if there migrating fish species present

In general, fish species inhabiting streams, rivers and/or creeks, migrate from downstream to upstream, for breeding, feeding and wintering purposes. It is projected to establish “fish passes for dam and HEPPs in order not to prevent breeding of fish species, and “transfer stations” to prevent formation of subpopulations.

Fish Passes

Although fish species identified within the project area have high ecological tolerance and can well adapt to lentic water system, they would still show migration behavior during their breeding periods.

If a fish pass is constructed within an HEPP, the water inlet should be positioned away from the reservoir or the turbine so that fish coming out of the fish pass do not get caught in the current and drift to the turbine.

Alpaslan II Dam has been planned to have a height of 116 m from its foundation. At such a height, in most cases fish passes are not feasible for technological and economic reasons. However, according to the Article 8 of Chapter 4 of the Turkish Regulation on Fisheries (Official Gazette; Date: March 10, 1995, No: 22223), “it is required to establish fish passes, elevators and screens while building facilities like dam reservoir, ponds and sets”.

“Fish Elevator” is rarely suggested for dams this high around the world. However, depending on the height of the dam, field conditions (slope) and presence of migrating fish species from the sea to the river and/or stream to the river, a “Transfer System” is proposed to prevent formation of subpopulations of fish species migrating between river downstream and upstream for breeding and wintering.

“Elevator Type Fish Pass” for Alpaslan II Dam and HEPP Project was prepared considering the “Fish Passes – Design, dimension and monitoring” published by the State Hydraulic Works (SHW) in 2009.

In an elevator type fish pass, a vessel is used. A valve can be attached to the vessel, which can be closed and emptied by being slanted. When the vessel is in its downward position, it is submerged in the base. Fish are directed into the elevator with a leading current. In addition, a foldable sliding grid cover helps fish to be directed first to the elevator and then to the carrying vessel. The bottom cover of the elevator is closed in periodical intervals. Fish collected in the vessel cannot escape, and are transported to the upstream in the vessel. A water resistant connection can be made between the vessel and the upper water elevation, or the vessel can be emptied into the upstream inlet directly. Water and fish in the vessel reach the upper channel, where there should be a significant directing current. The working regime of the elevator is arranged according to the migration seasons, and it is usually operated automatically (SHW, 2009). A general evaluation of fish elevators are given below:

- The area requirement is very low, and elevation difference in very high dams can be easily overcome by fish elevators.
- Since fish are transferred to upstream passively, fish elevators work for both big fish, and also weak species with low swimming performance.
- Fish elevators are not appropriate for upstream migration of invertebrates.
- Maintenance and construction cost of fish elevators are quite high.

A schematic scheme for the suggested fish elevator and its working principle is given in Figure A.23. An example of fish elevator that was built in France is also provided in Figure A.24.

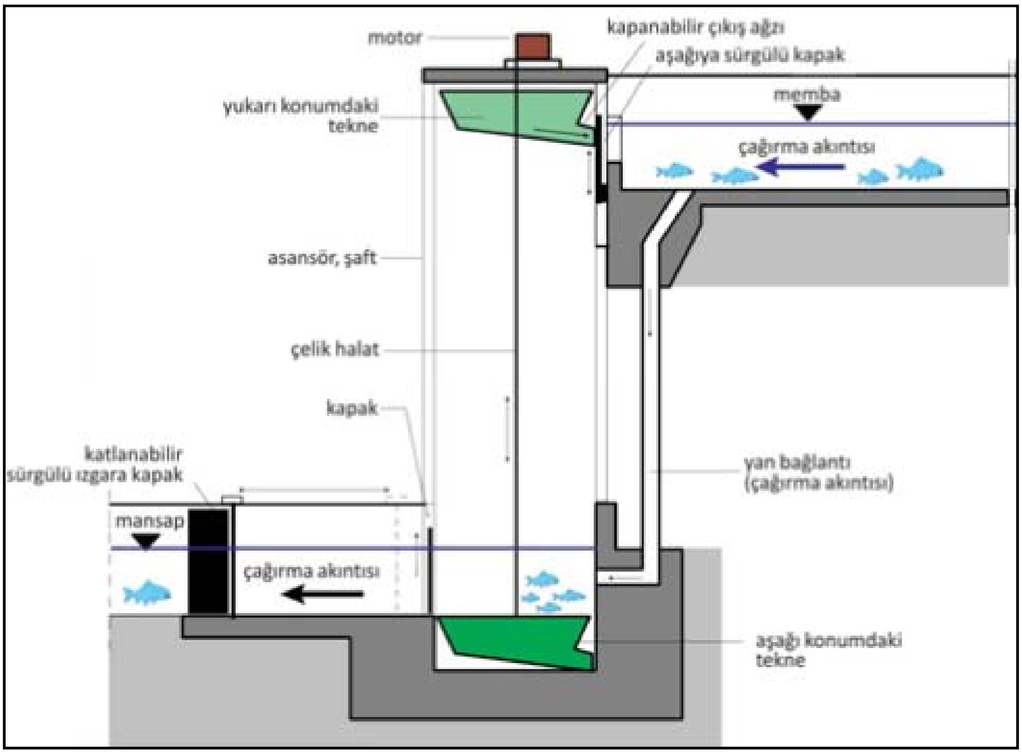


Figure A.23. Schematic Scheme for a Fish Elevator

Figure A.24. Tuilieres Fish Elevator, France

Considering there is no fish species present in the area, which migrates between the sea and stream and vice versa, and the fact that construction of a fish elevator can be either very hard and/or not feasible at all, a “Transfer System” should be assessed for the project. With the establishment of a “Transfer System”, fish species at the downstream can be caught in certain periods and transferred to the upstream. This way, formation of subpopulations will be prevented and species can be transferred for breeding.

A.10. Site selection of rock quarries, excavation storage areas, energy transmission lines and their structure, and hydraulic derivation-conveyance lines, if proposed, without impacting the existing hydrological system, ecological processes, and landscape integrity. Assessment of excavation storage areas, if there are any, without adversely impacting biological diversity

During excavation activities to be carried out within the scope of Alpaslan II Dam and HEPP Project, the topsoil will be stripped so that it is not contaminated. It will then be stored in a way that it does not lose its productivity. The undersoil, which procures continuity of the topsoil will also be stripped and deposited without letting it lose its horizons. While topsoil is removed, all materials other than the soil itself should be separated. Plant parts that help germination of plant species, like seeds and legumes will also be removed. In addition, the upper layer of the vegetative soil will be protected against erosion, drying-out and invasion of weeds. For the soil to preserve its vitality, it will be covered with grass, and other meadow and pasture species. Stripped vegetative soil will be used for landscape restoration and landscape arrangement of recreation areas. Since all excavation storage areas will be inundated with the operation phase of the project, these areas will not have any impact on biodiversity of the area. Some of the material burrow sites will also be inundated. At burrow sites that are above the water level, upon completion of construction works, landscaping projects will be carried out within the scope of rehabilitation works. During forestation of the area, the dominant vegetation cover will be considered, and tree species will be selected accordingly. In addition to tree species, herbaceous plants will also be used due to their high coverage percentages.

B. DETERMINATION OF HYDROLOGICAL, ECOLOGICAL AND GEOMORPHOLOGIC IMPACTS OF THE PROJECT

B.1. Exhibition of impacts of the planned HEPP project on flora and fauna elements, geomorphologic structure and hydrological system, which are identified in the first stage

Potential impacts of Alpaslan II Dam and HEPP Project on terrestrial flora and fauna elements, and mitigation measures to be taken to minimize these are presented in Section B.2. Impacts of the project on the hydrological system are given in Section A.3, and calculations regarding environmental flow are presented in Chapter C.

B.2. Identification of separate protection measures for construction and operation phases of the project, for ecosystem to be affected by the planned HEPP project , and related flora and fauna

B.2.1. Potential impacts on terrestrial flora and fauna, and measures to be taken

As a result of field studies carried out in the area, 257 flora species belonging to 51 families were identified. 13 of these species are endemic. Considering that 34% of Turkish flora is endemic, endemizm rate of the area is quite low. However, when endemizm rate of Eastern Anatolia plants are evaluated, the outcome is as expected. Since Eastern Anatolia Region of Turkey has low habitat diversity, the endemizm rates are quite low in general. Endemic species in this region are concentrated mostly at high mountainous areas. Species of steppe habitat, on the other hand, have very low endemizm rates. There are 4 regional endemic species identified in the area. These are; *Ferula huber-morathii* Pesmen (EN), *Cirsium yildizianum* Arabacı & Dirmanci (EN), *Centaurea fenzlii* Reichardt (VU) and *Verbascum macrosepalum* Boiss. & Kotschy ex Murb. (VU). These species are mostly distributed within the steppe habitat within the project area. Looking at the vertical distribution of these species, some of the populations will be inundated. However, some other populations will be left above the water level. Other endemic species identified in the area are widespread species and their IUCN threat category is “LC: Least Concern”.

Seeds of especially regionally endemic species will be collected from the project area. These seeds will be both sent to the gene bank, and also planted at heights above the water elevation. This way population that would be lost due to habitat loss would recover in a short time. *Cirsium yildizianum* is one of the species that is widespread in the area that would be inundated. However, this species, which has not been published yet, is also widespread in steppe habitats above the dam site.

It is inevitable for flora and fauna species to be adversely impacted by the project due to the loss of habitat that would be caused by intense construction activities and permanent facilities to be built. However, the presence of alternative habitats for fauna species within the vicinity of the project area, most species having high mobility, and the fact that the area is mostly utilized by fauna species for roaming and feeding, indicates that the degree of impacts might be low.

There will be permanent habitat loss within areas where there would be permanent structures and hard surfaces during the construction and operation phases of the project. There will be also high levels of noise and light generated that would cause considerable disturbances on the ecosystems. With the establishment of facilities, some of the rocky areas as well as agricultural fields will be lost. However, these habitats are quite widespread outside project activity areas, and also in alternative areas within the vicinity of the project area. This is another indicator that the impact on fauna groups would be low.

Animals would be leaving the project area due to intense construction activities. In order to minimize impacts on especially underground and ground-nesting species, these species should be transferred to alternative areas during construction activities if they are encountered.

Although some of the fauna species identified in the project area are considered in the IUCN categories, these area widespread species in Turkey and the entire western palearctic region. When faunistic study results are evaluated, due to the following reasons, impacts of the project were assessed to be rather low and localized:

- The surroundings of the project activity area show similar habitat diversity
- Fauna species considered within threat categories are widespread species
- There are no endemic fauna species

In addition due to noise levels that would be generated during construction activities, fauna species might temporarily leave the area. Alternative habitats that mammal and bird species would be expected to inhabit during construction activities are present within the vicinity of the project area. For those species that have limited mobility, which would be crashed under construction machinery, personnel who would be operating such machinery should be informed on the existence of these species in the area.

Since the project area is located within the Eastern Anatolia Region of Turkey, it is appropriate for tree species that are widespread in the Iran-Turan phyto-geographic region. There will a dam reservoir that would be formed upon completion of the Alpaslan II Dam and HEPP Project. It would be possible to create a wonder of nature. For this purpose it would be appropriate to use pedunculate oak (*Quercus robur* subsp. *pedunculiflora*), which grows naturally in the area, for forestation purposes. Oak acorns will be collected before the onset of construction activities, and an appropriate number of saplings will be grown. Upon completion of construction activities, these saplings will be planted along the reservoir. In addition, narrow-leaved ash (*Fraxinus angustifolia*) can also used for this purpose. When these trees reach a certain height, the soil enriched in terms of its organic content, risk of erosion will be minimized and visually pleasant scenery will be formed. When the organic matter content in the soil reaches a certain level, *Tulipa sintenisii* species can be planted in openings within forested areas.

When the organic content of the soil reaches a certain extent, *Tulipa sintenisii* species will be used at open spaces in areas that are forested. With landscaping projects to be prepared within the scope of the project areas that would be impacted due to project activities will be reinstated.

With the formation of the reservoir, part of the terrestrial habitat will be changed into an aquatic habitat. This will result in changes in land use, and water and food chains. Some of the woodland, which provides a habitat for terrestrial fauna species and would be inundated, has already been disrupted through illegal deforestation, and formation of agricultural lands. However, since these areas will be inundated, the living habitats of certain mammal, reptile and bird species will be narrowed. Alternative habitats, that would potentially be used by impacted fauna species, in terms of their living and feeding habitats, like small mammals (rodents, etc.), reptiles (tortoises, lizards, etc.) and birds, are present both at higher elevations, and also within the vicinity of the project area.

While terrestrial fauna would be leaving areas that would be inundated, aquatic fauna will be developing in the area. Fauna species that live by lentic environments (amphibians, water snakes, etc.) will be positively impacted by the formation of the reservoir. Also, the dam reservoir will provide a suitable breeding, sheltering and feeding habitat for a number of bird species. This way, it would also be possible for migratory and predatory bird species to inhabit the area. During the migration season, with the presence of suitable lentic water habitats, it would be possible for the ornito-ecological significance of the area to increase. Similar situations have been observed at other dam reservoirs in our country. One of the positive impacts of a dam is the increase in fish populations in the reservoir, and this providing an additional income for local people.

B.2.2. Potential impact on aquatic flora and fauna, and measures to be taken

In terms of their environmental impacts, hydroelectric power plants are among the least harmful energy generation facilities. These facilities do not pose any air and water pollution and radioactive leakage threats. Therefore, it is important to analyze not the facility itself, but the basins they are constructed in.

In general, hydroelectric power plants cause changes in the water regime, surface and groundwater quality and vegetation structure. Therefore, they might have positive or negative impacts on fish population and diversity. The transformation of a riverine habitat into a lentic one (as a result of dam construction) is mostly effective on not the fish species composition but fish growth.

The following mitigation measures will be taken in order to minimize the potential impacts of the Alpaslan II Dam and HEPP Project on aquatic ecosystem and species:

- In order not to adversely impact the species in the area, mitigation measures will be in place during construction and operation phases of the HEPP. In this scope, water pollution will be prevented during the construction phase considering biological and ecological characteristics of fish. Especially during the breeding season of fish species (April-July), continuous water flow will be maintained.

- After the formation of the reservoir, the required physical conditions will be maintained for fish species (Minimum values for species of Cyprinidae family: Water depth: 15 cm, Flow rate: 0.20 m/sec, Dissolved oxygen< 5 mg/l) (Cows and Welcomme, 1998).

- Water temperature is one of the most important factors impacting the life in aquatic ecosystems. Increase in temperature speed up the fish metabolism, and age of sexual maturity decreases. In addition, temperature affects species distribution, feeding, spawning and general behavior. Most species of Cyprinidae (Minnow family) stop feeding behavior when the temperature drops under 8-10ºC, and start breeding at temperatures above 15ºC (Nikolskii, 1963).

- One of the water quality parameters that would be periodically monitored is pH, which is an indicator of acidic and basic characteristics of water. It is very important in terms of fish life and productivity. Freshwater fish usually prefer pH levels between 6.5 and 8.5.

- Dissolved oxygen (DO) is another parameter that is recommended to be continuously monitored. It is quite important for organisms that are dependent on aerobic metabolism. Amount of dissolved oxygen decreases with decreasing temperature and organic matter concentrations. It increases with increasing air pressure (Yaramaz, 1992). In addition, factors like salinity and flow rate also affect amount of dissolved oxygen (Wetzel, 1983). Bremond et Vuichard (1973), states that for Cyprinidae to survive in a habitat the dissolved oxygen concentration should be at least 5 mg/l.

- Electrical conductivity (EC) value, which defines the electrical transmission capability of water ions, changes with salt density in the water. As salinity in water increases, electricity conductivity increases (Wetzel, 1989). Therefore, it is another parameter to be monitored during especially construction period of HEPP. Besides, Bremond et Vuichard (1973) states that electrical conductivity is an indicator of dissolved matter and fluctuates between 150 and 750 µS/cm in inland waters suitable for fish species. When it reaches a concentration of 3000 µS/cm, it causes disruption of ecological balance in water.

Since the HEPP will cause changes in water flow, there will also be habitat changes. Assessing this situation in terms of aquatic organisms:

- This would mean that habitats for algae will diminish, and there will be new habitats formed. Instead of riverine algae, there will be free living phytoplanktonic organisms dominant in the lentic environment. Those forms on sediment, rocks and plants will continue to exist within the lentic environment. Increasing phytoplanktonic organisms will constitute a food source for zooplanktonic organisms. In general, there will not be an adverse impact on freshwater algae flora since algae will be able to continue their populations within the reservoir system.

- The stagnant water formation at the reservoir area will provide suitable living habitats for zooplanktonic organisms. Increase in phytoplanktons will positively impact zooplanktons, both in terms of density and also species diversity. Zooplanktonic organisms, which have limited diversity and population density in streams and rivers of the region, will be represented by a high number of species and density. As a result, the planned activity will provide optimum conditions for zooplanktonic organisms.

- Some of the benthic organism might leave the reservoir area, where the riverine habitat will be transformed into a lentic one. On the contrary, some other benthic organisms will become dominant. These species prefer to live in deep habitats that are densely silted with sedimentation. This way, it would add to the biological diversity to have benthic species that are adapted to the riverine habitat to the downstream of the HEPP, and also those species that are adapted to the lentic system.

- Increase in planktonic species, which constitute nutrition for fish species, would result in a positive impact on the growth of lentic fish species.

- Another factor that would contribute to the increase in biological diversity in the region would be formation of a lentic water habitat with the reservoir, and riverine habitats at the downstream. These two habitats will have different species compositions.

Due to the nature of Alpaslan II Dam and HEPP, during the water impoundment period, at the high flow season, which also covers the breeding season of fish species, the following rate should be considered: Q_can= 27.0 m^3/s (Q_Can/YOA (%)=19.6), and during low flow season the rate should be kept at Q_can= 18.5 m^3/s (Q_Can/YOA (%)=13.4).

In general, fish species inhabiting streams, rivers and/or creeks migrate from downstream to upstream in order for breeding and wintering. In order not to prevent existing fish species from breeding, there should be fish passes constructed at the dam and HEPP, and a “Transfer Station” is recommended to prevent formation of subpopulations. Details on fish passes and transfer station are given in Section A.9.

B.3. Identification of special status areas within the project area and its surroundings, distances to these areas, and evaluation of project impacts on these areas

During surveys carried out for conservation areas, all areas defined by law and regulations, and are protected like cultural and natural areas with special features and/or resources, national parks, natural habitats, protected habitats, genetic reserves, limited development areas (touristic sites), were evaluated.

According to the Provincial Environmental Status Report, the following are the wetlands located within the Mus provincial boundaries that are protected by Regional Environmental Commission Decision:

- Buyuk Hamurpet Lake
- Kucuk Hamurpet Lake
- Hacli Lake
- Kaz Lake
- Degerli Lake
- Kumlukiyi Lake
- Yurttutan Kuru Lake
- Korkut Sazlikbasi
- Değerli Golu
- Kumlukıyı Golu
- Yurttutan Kuru Golu
- Korkut Sazlikbasi Marsh
- Merkez Bostankent Marsh
- Merkez Kiyi Marsh
- Bulanik Sorgol Marsh

These wetlands are not located within the project area. The nearest of these wetlands to the dam lake area is Kucuk Hamurpet Lake and Kumlukiyi Lake. The distance between Kucuk Hamurpet Lake and the dam lake area is about 8.5 km, and Kumlukiyi Lake is at a distance of about 2 km.

Construction and operation phases of the project will comply with the Regulation on Conservation of Wetlands (Official Gazette; Date: May 17, 2005, No: 25818).

B.4. Special statuses to be considered in the assessment and related legislative framework

The assessments made within the scope of Alpaslan II Dam and HEPP Project Ecosystem Assessment Report, on ecosystem within the project area and its surroundings, natural areas, conservation areas and species, were made in accordance with the legislation listed below:

- Law on National Parks, Law No.2873 (National Park, Nature Park, Nature Conservation Area, Natural Monument)
- Law on Terrestrial Hunting, Law No. 4915 (Wildlife Development Area, Wildlife Conservation Area, Bio-genetic Reserve)
- Wetlands included in Ramsar Convention
- Regulation on Conservation of Wetlands

B.5. Assessment of cumulative impacts considering other HEPP projects at the upstream and downstream, besides individual impacts of the project that is submitted

There are existing projects in Murat River basin, implemented for the purpose of irrigation, energy generation and utilization of drinking-potable water, at the upstream and downstream of Alpaslan II Dam. Since water use would impact Alpaslan II Dam energy production rate, upstream projects were analyzed one by one. Alpaslan II Dam water supply charts were formed with the assumption that all upstream projects might be in operation. In this respect, Alpaslan I Dam located at the upstream of Alpaslan II Dam was considered in the assessments.

The Water Use Rights Report (2011), which ENERJISA had prepared according to the standards of General Directorate of State Hydraulic Works (Turkish acronym DSI), and DSI 17th Regional Directorate approved, identified the existing irrigation channels of Arincik Regulator. Besides, it was identified that irrigation is carried out in Akpinar and Kiyibasi villages with water that is provided through a motor-pump from Murat River. However, construction of Alpaslan II Dam will not adversely impact these irrigation practices since there will not be continuous impoundment. Water will be left back into the riverbed following energy generation.

According to the evaluations made in the Feasibility Report, water that will be run through the turbines would be enough to meet the irrigation demands of Mus Plain. However, if Alpaslan II Dam is operated at its maximum flow rate, less water would be released during periods when water is collected at the upstream. It has been mentioned in the Feasibility Report that apart from the operational flow, essential amounts of environmental flow and irrigation water will be released downstream. In the same report, environmental flow rate was determined as 13.00 m^3/s, which is the 10% of the average of the last 10 years flow rates. Considering the environmental flow and irrigation water demand, two large and two small turbines have been planned to be used within the scope of the project. Project flow rates for the large units would be 136 m^3/s and for smaller units it would be 36 m^3/s.

Since drinking and other domestic water need of the nearby settlements are supplied from local resources, the planned project would not have any adverse impacts on water use. Since downstream agricultural land will have continuous irrigation water upon completion of the project, this is also expected not to cause any problems. It would be required to release adequate amount of minimum flow, so that the aquatic habitat is not adversely affected along the riverbed.

C. DETERMINATION OF THE ENVIRONMENTAL FLOW

C.1. Study methodology

The approach that was used within the scope of this study in order to determine the appropriate environmental flow (QEF_e) value while considering quality and quantity of available data is as the following: As a result of hydrobiological surveys carried out at the downstream of Alpaslan II Dam, the minimum water depth for fish species in the river was identified as 0.15 m and minimum current velocity as 0.20 m/s (Table C.1). Then, based on measurements carried out for the selected river cross-section, hydrological characteristics like current velocity, rate, etc. for the riverbed were determined for different water depths. In modellin studies, the largest cross-section of the riverbed at the downstream of the dam were used. Hydraulic values (eg. Current velocity, flow rate, wetted perimeter, current area, width, etc.) obtained through modeling were compared to demands of aquatic habitat.In the next step, base-flow variations were analyzed in terms of long-term monthly average and minimum flows, and high flow (rainy season) and low flow (dry season) monthly average flow rates were determined. Consequently, flow duration and minimum flows were analyzed, which was followed by determination of flow rates corresponding to Montana method various criteria (Tennant, 1976), taking long-term flow rate observations into consideration. Continuity of these with the natural flow was also analyzed. At the end of this chapter, as a result of these evaluations, hydrogeological data and field observations, environmental flow rate values that would be released during high flow and low flow seasons were recommended.

Table C.1. Minimum Water Depth (m) and Flow Rate (m/s) for Fish Species Identified in the Project Area

Fish Species	Minimum Depth of Inhabitance (m)	Minimum Flow Rate of Inhabitance (m/sn)
Acanthobrama marmid	0.15	0.15
Alburnoides bipunctatus	0.15	0.20
Alburnus mossulensis	0.15	0.20
Barbus lacerta	0.15	0.20
Capoeta umbla	0.10	0.20
Capoeta trutta	0.15	0,20
Chondrostoma regium	0.15	0,20
Garra rufa	0.10	0.15
Luciobarbus mystaceus	0.15	0.20
Squalius cephalus	0.15	0.20
Oxynemacheilus argyrograma	0.10	0.15
Oxynemacheilus euphraticus	0.10	0.15
Glyptothorax kurdistanicus	0.15	0.20

C.2. Wetted perimeter method calculations

In hydraulic model calculations for Alpaslan II Dam downstream typical river cross-section, river cross-section characteristics shown in Figure C.1 and Figure C.2 were used. Based on field surveys carried out in June of 2011, maximum water depth at the riverbed is 1.30 m, flow section surface width is 105 m, and current velocity at water surface is 1.36 m/s. It was assumed that the average current velocity is 80% (1.09 m/s) of this value. Considering the average curren velocity and bed geometry, flow rate at the time of observation was predicted to be at a level of 36 m^3/s. Riverbed material consists of the following: 25% large blocks (>250 mm), 25% blocks (64-250 mm), 65% gravel (16-64 mm) and 5% sand (<16 mm). According to the field observations water surface inclination was determined as 0.0015 for low and high flows. It was assumed that this value does not change for low and high flows below the flood base threshold level.

Considering the objective of the study, calculations were only made for the section that is below the riverbed flood base threshold level. Manning roughness coefficient, which was corrected using correction factors determined by considering riverbed characteristics, was predicted to be 0.030 (Table C.2). Hydraulic modeling studies were carried out for the n value and cross-section geometry selected on-site. In model sensitivity analyses, it was assumed that the ne value might have a +/-10 error.

Table C.2. Manning Roughness Coefficient (n) Correction Factors for the Downstream of Alpaslan II Dam

Faktor	Tanım	Ortalama Değer
Nb	Cakıl-İri Cakıl	0.025
n1	Az	0.001
n2	Nadiren değisen	0.001
n3	İhmal edilebiir	0.001
n4	Az	0.001
M	Az	1.05
N	-	0.030

Figure C.1. General View of Alpaslan II Dam Typical Riverbed

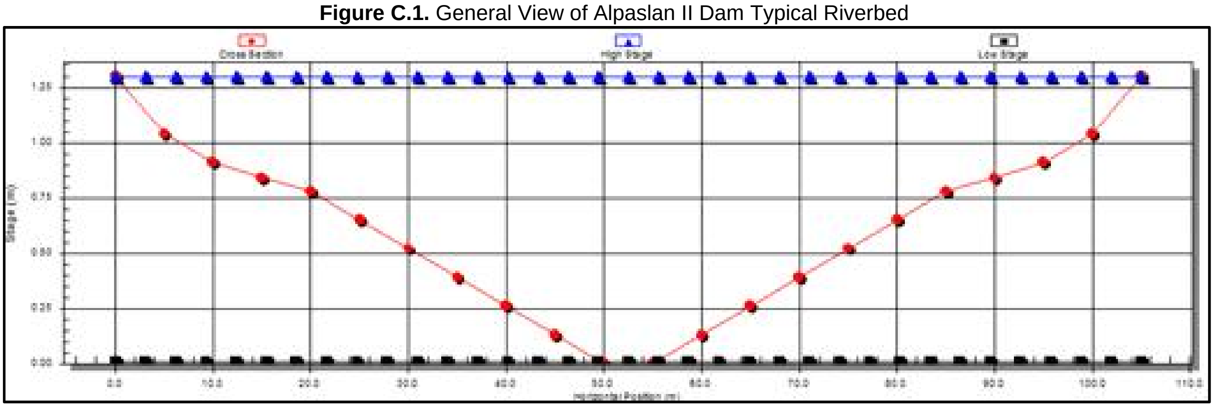


Figure C.2. "Normal" Stream Cross-Section Geometry Used in Alpaslan II Dam Downstream Hydraulic Model Calculations

Hydraulic model calculation results are given in Table C.3, depth-flow rate and flow rate-wetted perimeter relations are shown in Figure C.3 and Figure C.4. For the calibration of the model, the current velocity of 1.09 m/s, which was defined for the related maximum depth (1.30 m) during field observations, was used. The model calculations, which were done using riverbed geometry observed on-site, and n value (0.030) that fits the riverbed conditions, yielded an average current velocity of 1.03 m/s for a water depth of 1.30 m. This value indicates that the field observations are line with the model to an acceptable extent. The flow rate value (77.21 m^3/s) obtained as a result of the model is also compatible with the selected riverbed geometry and average current velocity observed on-site.

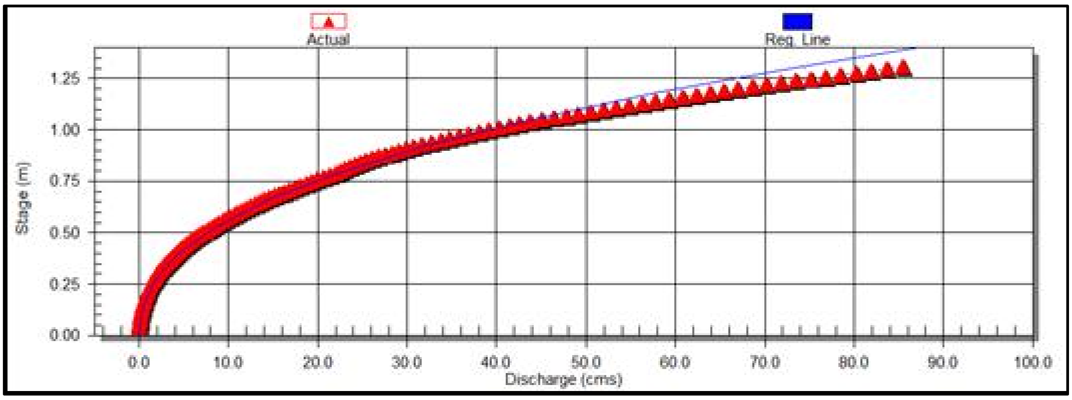


Figure C.3. Level-Flow Relationship Defined for Normal Bed Geometry and n Value as a Result of Alpaslan II Dam Downstream Riverbed Wetted Parameter Hydraulic Model Calculations

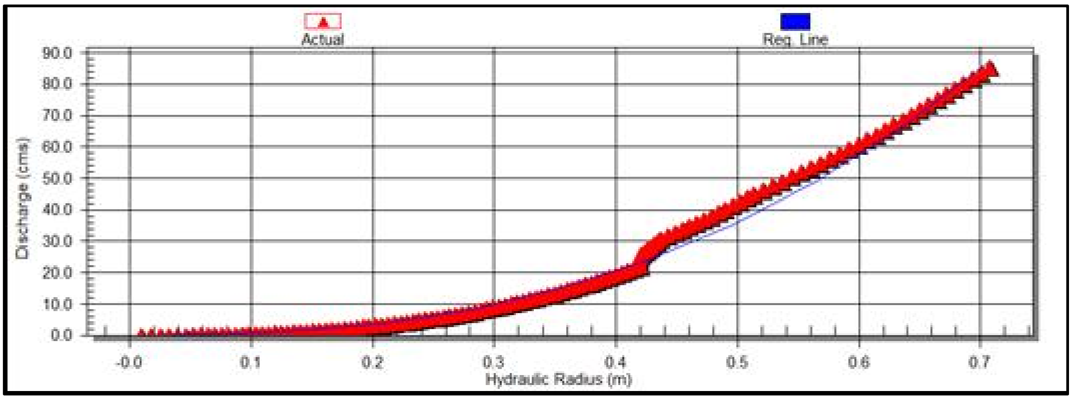


Figure C.4. Flow Rate-Hydraulic Radius Relationship for Normal Bed Geometry and n Value as a Result of Alpaslan II Dam Downstream Riverbed Wetted Perimeter Hydraulic sero Calculations

C.3. Sensitivity analyses

In order to determine the uncertainty in the model geometry and n value used in the above calculations, the same calculations were repeated when the n value and riverbed geometry (Normal) is increased for 10% (Normal +10%), and decreased for 10% (Normal-10%) (Table C.3 and C.4). With this approach, in the calculations it was assumed that the river inclination (0.0015) was representing the region, and did not show any significant spatial variation. For maximum water depth (1.30 m), which was observed using different input values, the calculated flow values were 77.21 m^3/s (normal), 69.89 m^3/s (normal+%10 ve 85.45 m^3/s (normal-%10). Average current velocities corresponding to these flow values are also compatible with the value observed on-site.

Table C.3. Hydraulic Model Results for Selected Average n and Streambed Geometrical Values (Normal) for the Downstream of Alpaslan II Dam

Depth (m)	Area (m^2)	Wetted Perimeter (m)	Width (m)	R (m)	D_hid (m)	n	Average Current Velocity (m/s)	Flow Rate (m^3/s)
0.01	0.05	5.770	5.770	0.01	0.010	0.030	0.06	0.00
0.02	0.12	6.530	6.530	0.02	0.020	0.030	0.09	0.01
0.03	0.18	7.300	7.300	0.03	0.030	0.030	0.11	0.02
0.04	0.26	8.070	8.070	0.03	0.030	0.030	0.13	0.03
0.05	0.35	8.840	8.840	0.04	0.040	0.030	0.15	0.05
0.06	0.44	9.610	9.610	0.05	0.050	0.030	0.17	0.07
0.07	0.54	10.380	10.380	0.05	0.050	0.030	0.18	0.10
0.08	0.65	11.150	11.150	0.06	0.060	0.030	0.19	0.13
0.09	**0.76**	**11.920**	**11.920**	**0.06**	**0.060**	**0.030**	**0.21**	**0.16**
0.10	0.88	12.690	12.690	0.07	0.070	0.030	0.22	0.19
0.11	1.01	13.460	13.450	0.08	0.080	0.030	0.23	0.23
0.12	1.15	14.230	14.220	0.08	0.080	0.030	0.24	0.28
0.13	1.30	15.000	14.990	0.09	0.090	0.030	0.25	0.33
0.14	1.45	15.770	15.760	0.09	0.090	0.030	0.26	0.38
0.15	**1.61**	**16.530**	**16.530**	**0.10**	**0.100**	**0.030**	**0.27**	**0.44**
0.16	1.78	17.300	17.300	0.10	0.100	0.030	0.28	0.51
0.17	1.96	18.070	18.070	0.11	0.110	0.030	0.29	0.58
0.18	2.14	18.840	18.840	0.11	0.110	0.030	0.30	0.65
0.19	2.34	19.610	19.610	0.12	0.120	0.030	0.31	0.73
0.20	2.54	20.380	20.380	0.12	0.120	0.030	0.32	0.82
0.21	2.74	21.150	21.150	0.13	0.130	0.030	0.33	0.91
0.22	2.96	21.920	21.920	0.14	0.140	0.030	0.34	1.01
0.23	3.18	22.690	22.680	0.14	0.140	0.030	0.35	1.11
0.24	3.41	23.460	23.450	0.15	0.150	0.030	0.36	1.22
0.25	3.65	24.230	24.220	0.15	0.150	0.030	0.37	1.34
0.26	3.90	25.000	24.990	0.16	0.160	0.030	0.38	1.46
0.27	4.15	25.770	25.760	0.16	0.160	0.030	0.38	1.59
0.28	4.41	26.540	26.530	0.17	0.170	0.030	0.39	1.73
0.29	4.68	27.310	27.300	0.17	0.170	0.030	0.40	1.87
0.30	4.96	28.080	28.070	0.18	0.180	0.030	0.41	2.02
0.31	5.24	28.850	28.840	0.18	0.180	0.030	0.42	2.18
0.32	5.54	29.620	29.610	0.19	0.190	0.030	0.42	2.34
0.33	5.84	30.390	30.380	0.19	0.190	0.030	0.43	2.52
0.34	6.14	31.150	31.150	0.20	0.200	0.030	0.44	2.69
0.35	6.46	31.920	31.920	0.20	0.200	0.030	0.45	2.88
0.36	6.78	32.690	32.680	0.21	0.210	0.030	0.45	3.08
0.37	7.11	33.460	33.450	0.21	0.210	0.030	0.46	3.28
0.38	7.45	34.230	34.220	0.22	0.220	0.030	0.47	3.49
0.39	7.80	35.000	34.990	0.22	0.220	0.030	0.48	3.71
0.40	8.15	35.770	35.760	0.23	0.230	0.030	0.48	3.94
0.41	8.51	36.540	36.530	0.23	0.230	0.030	0.49	4.17
0.42	8.88	37.310	37.300	0.24	0.240	0.030	0.50	4.42
0.43	9.26	38.080	38.070	0.24	0.240	0.030	0.50	4.67
0.44	9.64	38.850	38.840	0.25	0.250	0.030	0.51	4.93
0.45	10.03	39.620	39.610	0.25	0.250	0.030	0.52	5.20
0.46	10.43	40.390	40.380	0.26	0.260	0.030	0.53	5.48

Table C.3. Hydraulic Model Results for Selected Average n and Streambed Geometrical Values (Normal) for the Downstream of Alpaslan II Dam (Continued)

Depth (m)	Area (m^2)	Wetted Perimeter (m)	Width (m)	R (m)	D_hid (m)	n	Average Current Velocity (m/s)	Flow Rate (m^3/s)
0.47	10.84	41.160	41.150	0.26	0.260	0.030	0.53	5.77
0.48	11.26	41.930	41.920	0.27	0.270	0.030	0.54	6.07
0.49	11.68	42.700	42.680	0.27	0.270	0.030	0.55	6.37
0.50	12.11	43.470	43.450	0.28	0.280	0.030	0.55	6.69
0.51	12.55	44.240	44.220	0.28	0.280	0.030	0.56	7.02
0.52	13.00	45.010	44.990	0.29	0.290	0.030	0.57	7.35
0.53	13.45	45.780	45.760	0.29	0.290	0.030	0.57	7.70
0.54	13.91	46.540	46.530	0.30	0.300	0.030	0.58	8.05
0.55	14.38	47.310	47.300	0.30	0.300	0.030	0.59	8.42
0.56	14.86	48.080	48.070	0.31	0.310	0.030	0.59	8.79
0.57	15.34	48.850	48.840	0.31	0.310	0.030	0.60	9.18
0.58	15.83	49.620	49.610	0.32	0.320	0.030	0.60	9.57
0.59	16.33	50.390	50.380	0.32	0.320	0.030	0.61	9.98
0.60	16.84	51.160	51.150	0.33	0.330	0.030	0.62	10.40
0.61	17.36	51.930	51.920	0.33	0.330	0.030	0.62	10.82
0.62	17.88	52.700	52.680	0.34	0.340	0.030	0.63	11.26
0.63	18.41	53.470	53.450	0.34	0.340	0.030	0.64	11.71
0.64	18.95	54.240	54.220	0.35	0.350	0.030	0.64	12.17
0.65	19.49	55.010	54.990	0.35	0.350	0.030	0.65	12.64
0.66	20.05	55.780	55.760	0.36	0.360	0.030	0.65	13.12
0.67	20.61	56.550	56.530	0.36	0.360	0.030	0.66	13.62
0.68	21.18	57.320	57.300	0.37	0.370	0.030	0.67	14.12
0.69	21.76	58.090	58.070	0.37	0.370	0.030	0.67	14.64
0.70	22.34	58.860	58.840	0.38	0.380	0.030	0.68	15.16
0.71	22.93	59.630	59.610	0.38	0.380	0.030	0.68	15.70
0.72	23.53	60.400	60.380	0.39	0.390	0.030	0.69	16.25
0.73	24.14	61.160	61.150	0.39	0.390	0.030	0.70	16.82
0.74	24.75	61.930	61.920	0.40	0.400	0.030	0.70	17.39
0.75	25.38	62.700	62.680	0.40	0.400	0.030	0.71	17.98
0.76	26.01	63.470	63.450	0.41	0.410	0.030	0.71	18.58
0.77	26.65	64.240	64.220	0.41	0.410	0.030	0.72	19.19
0.78	27.29	65.010	64.990	0.42	0.420	0.030	0.73	19.81
0.79	27.95	66.670	66.650	0.42	0.420	0.030	0.73	20.27
0.80	28.63	68.340	68.320	0.42	0.420	0.030	0.72	20.75
0.81	29.32	70.000	69.980	0.42	0.420	0.030	0.72	21.25
0.82	30.03	71.670	71.650	0.42	0.420	0.030	0.72	21.77
0.83	30.75	73.340	73.320	0.42	0.420	0.030	0.73	22.30
0.84	31.49	75.000	74.980	0.42	0.420	0.030	0.73	22.86
0.85	32.25	76.440	76.410	0.42	0.420	0.030	0.73	23.49
0.86	33.02	77.860	77.840	0.42	0.420	0.030	0.73	24.13
0.87	33.81	79.290	79.270	0.43	0.430	0.030	0.73	24.79
0.88	34.61	80.720	80.700	0.43	0.430	0.030	0.74	25.47
0.89	35.42	82.150	82.130	0.43	0.430	0.030	0.74	26.17
0.90	36.25	83.580	83.560	0.43	0.430	0.030	0.74	26.89
0.91	37.09	85.010	84.990	0.44	0.440	0.030	0.74	27.63
0.92	37.94	85.780	85.760	0.44	0.440	0.030	0.75	28.52

Table C.3. Hydraulic Model Results for Selected Average n and Streambed Geometrical Values (Normal) for the Downstream of Alpaslan II Dam (Continued)

Depth (m)	Area (m^2)	Wetted Perimeter (m)	Width (m)	R (m)	D_hid (m)	n	Average Current Velocity (m/s)	Flow Rate (m^3/s)
0.93	38.81	86.550	86.530	0.45	0.450	0.030	0.76	29.43
0.94	39.67	87.320	87.300	0.45	0.450	0.030	0.77	30.36
0.95	40.55	88.090	88.070	0.46	0.460	0.030	0.77	31.30
0.96	41.44	88.860	88.840	0.47	0.470	0.030	0.78	32.26
0.97	42.33	89.630	89.610	0.47	0.470	0.030	0.79	33.24
0.98	43.23	90.400	90.380	0.48	0.480	0.030	0.79	34.23
0.99	44.14	91.170	91.150	0.48	0.480	0.030	0.80	35.23
1.00	45.05	91.940	91.920	0.49	0.490	0.030	0.80	36.25
1.01	45.97	92.710	92.680	0.50	0.500	0.030	0.81	37.29
1.02	46.90	93.480	93.450	0.50	0.500	0.030	0.82	38.35
1.03	47.84	94.250	94.220	0.51	0.510	0.030	0.82	39.42
1.04	48.79	95.020	94.990	0.51	0.510	0.030	0.83	40.51
1.05	49.74	95.410	95.380	0.52	0.520	0.030	0.84	41.72
1.06	50.70	95.790	95.770	0.53	0.530	0.030	0.85	42.95
1.07	51.66	96.180	96.150	0.54	0.540	0.030	0.86	44.19
1.08	52.62	96.560	96.530	0.54	0.550	0.030	0.86	45.45
1.09	53.59	96.950	96.920	0.55	0.550	0.030	0.87	46.73
1.10	54.56	97.330	97.300	0.56	0.560	0.030	0.88	48.02
1.11	55.53	97.720	97.690	0.57	0.570	0.030	0.89	49.33
1.12	56.51	98.100	98.070	0.58	0.580	0.030	0.90	50.66
1.13	57.49	98.490	98.460	0.58	0.580	0.030	0.90	52.00
1.14	58.48	98.870	98.840	0.59	0.590	0.030	0.91	53.35
1.15	59.47	99.260	99.230	0.60	0.600	0.030	0.92	54.73
1.16	60.47	99.640	99.610	0.61	0.610	0.030	0.93	56.11
1.17	61.46	100.030	100.000	0.61	0.610	0.030	0.94	57.52
1.18	62.47	100.410	100.380	0.62	0.620	0.030	0.94	58.94
1.19	63.47	100.800	100.770	0.63	0.630	0.030	0.95	60.37
1.20	64.48	101.180	101.150	0.64	0.640	0.030	0.96	61.82
1.21	65.49	101.570	101.540	0.64	0.650	0.030	0.97	63.29
1.22	66.51	101.960	101.920	0.65	0.650	0.030	0.97	64.77
1.23	67.53	102.340	102.310	0.66	0.660	0.030	0.98	66.27
1.24	68.56	102.730	102.690	0.67	0.670	0.030	0.99	67.79
1.25	69.59	103.110	103.070	0.67	0.680	0.030	1.00	69.32
1.26	70.62	103.500	103.460	0.68	0.680	0.030	1.00	70.87
1.27	71.66	103.880	103.840	0.69	0.690	0.030	1.01	72.43
1.28	72.70	104.270	104.230	0.70	0.700	0.030	1.02	74.01
1.29	73.74	104.650	104.610	0.70	0.700	0.030	1.03	75.60
1.30	74.79	105.040	105.000	0.71	0.710	0.030	1.03	77.21

Table C.4. Hydraulic Model Results for 10% Decrease in n Value Selected for the Downstream of Alpaslan II Dam

Depth (m)	Area (m^2)	Wetted Perimeter (m)	Width (m)	R (m)	D_hid (m)	n	Average Current Velocity (m/s)	Flow Rate (m^3/s)
0.01	0.05	5.770	5.770	0.01	0.010	0.027	0.06	0.00
0.02	0.12	6.530	6.530	0.02	0.020	0.027	0.10	0.01
0.03	0.18	7.300	7.300	0.03	0.030	0.027	0.12	0.02
0.04	0.26	8.070	8.070	0.03	0.030	0.027	0.15	0.04
0.05	0.35	8.840	8.840	0.04	0.040	0.027	0.17	0.06
0.06	0.44	9.610	9.610	0.05	0.050	0.027	0.18	0.08
0.07	0.54	10.380	10.380	0.05	0.050	0.027	0.20	0.11
0.08	0.65	11.150	11.150	0.06	0.060	0.027	0.22	0.14
0.09	0.76	11.920	11.920	0.06	0.060	0.027	0.23	0.17
0.10	0.88	12.690	12.690	0.07	0.070	0.027	0.24	0.22
0.11	1.01	13.460	13.450	0.08	0.080	0.027	0.26	0.26
0.12	1.15	14.230	14.220	0.08	0.080	0.027	0.27	0.31
0.13	1.30	15.000	14.990	0.09	0.090	0.027	0.28	0.37
0.14	1.45	15.770	15.760	0.09	0.090	0.027	0.29	0.43
0.15	1.61	16.530	16.530	0.10	0.100	0.027	0.30	0.49
0.16	1.78	17.300	17.300	0.10	0.100	0.027	0.32	0.56
0.17	1.96	18.070	18.070	0.11	0.110	0.027	0.33	0.64
0.18	2.14	18.840	18.840	0.11	0.110	0.027	0.34	0.72
0.19	2.34	19.610	19.610	0.12	0.120	0.027	0.35	0.81
0.20	2.54	20.380	20.380	0.12	0.120	0.027	0.36	0.91
0.21	2.74	21.150	21.150	0.13	0.130	0.027	0.37	1.01
0.22	2.96	21.920	21.920	0.14	0.140	0.027	0.38	1.12
0.23	3.18	22.690	22.680	0.14	0.140	0.027	0.39	1.24
0.24	3.41	23.460	23.450	0.15	0.150	0.027	0.40	1.36
0.25	3.65	24.230	24.220	0.15	0.150	0.027	0.41	1.49
0.26	3.90	25.000	24.990	0.16	0.160	0.027	0.42	1.62
0.27	4.15	25.770	25.760	0.16	0.160	0.027	0.43	1.77
0.28	4.41	26.540	26.530	0.17	0.170	0.027	0.43	1.92
0.29	4.68	27.310	27.300	0.17	0.170	0.027	0.44	2.08
0.30	4.96	28.080	28.070	0.18	0.180	0.027	0.45	2.25
0.31	5.24	28.850	28.840	0.18	0.180	0.027	0.46	2.42
0.32	5.54	29.620	29.610	0.19	0.190	0.027	0.47	2.60
0.33	5.84	30.390	30.380	0.19	0.190	0.027	0.48	2.79
0.34	6.14	31.150	31.150	0.20	0.200	0.027	0.49	2.99
0.35	6.46	31.920	31.920	0.20	0.200	0.027	0.50	3.20
0.36	6.78	32.690	32.680	0.21	0.210	0.027	0.50	3.42
0.37	7.11	33.460	33.450	0.21	0.210	0.027	0.51	3.64
0.38	7.45	34.230	34.220	0.22	0.220	0.027	0.52	3.88
0.39	7.80	35.000	34.990	0.22	0.220	0.027	0.53	4.12
0.40	8.15	35.770	35.760	0.23	0.230	0.027	0.54	4.37
0.41	8.51	36.540	36.530	0.23	0.230	0.027	0.54	4.64
0.42	8.88	37.310	37.300	0.24	0.240	0.027	0.55	4.91
0.43	9.26	38.080	38.070	0.24	0.240	0.027	0.56	5.19
0.44	9.64	38.850	38.840	0.25	0.250	0.027	0.57	5.48
0.45	10.03	39.620	39.610	0.25	0.250	0.027	0.58	5.78
0.46	10.43	40.390	40.380	0.26	0.260	0.027	0.58	6.09

Table C.4. Hydraulic Model Results for 10% Decrease in n Value Selected for the Downstream of Alpaslan II Dam (Continued)

Depth (m)	Area (m^2)	Wetted Perimeter (m)	Width (m)	R (m)	D_hid (m)	n	Average Current Velocity (m/s)	Flow Rate (m^3/s)
0.47	10.84	41.160	41.150	0.26	0.260	0.027	0.59	6.41
0.48	11.26	41.930	41.920	0.27	0.270	0.027	0.60	6.74
0.49	11.68	42.700	42.680	0.27	0.270	0.027	0.61	7.08
0.50	12.11	43.470	43.450	0.28	0.280	0.027	0.61	7.43
0.51	12.55	44.240	44.220	0.28	0.280	0.027	0.62	7.79
0.52	13.00	45.010	44.990	0.29	0.290	0.027	0.63	8.17
0.53	13.45	45.780	45.760	0.29	0.290	0.027	0.64	8.55
0.54	13.91	46.540	46.530	0.30	0.300	0.027	0.64	8.95
0.55	14.38	47.310	47.300	0.30	0.300	0.027	0.65	9.35
0.56	14.86	48.080	48.070	0.31	0.310	0.027	0.66	9.77
0.57	15.34	48.850	48.840	0.31	0.310	0.027	0.66	10.20
0.58	15.83	49.620	49.610	0.32	0.320	0.027	0.67	10.64
0.59	16.33	50.390	50.380	0.32	0.320	0.027	0.68	11.09
0.60	16.84	51.160	51.150	0.33	0.330	0.027	0.69	11.55
0.61	17.36	51.930	51.920	0.33	0.330	0.027	0.69	12.02
0.62	17.88	52.700	52.680	0.34	0.340	0.027	0.70	12.51
0.63	18.41	53.470	53.450	0.34	0.340	0.027	0.71	13.01
0.64	18.95	54.240	54.220	0.35	0.350	0.027	0.71	13.52
0.65	19.49	55.010	54.990	0.35	0.350	0.027	0.72	14.04
0.66	20.05	55.780	55.760	0.36	0.360	0.027	0.73	14.58
0.67	20.61	56.550	56.530	0.36	0.360	0.027	0.73	15.13
0.68	21.18	57.320	57.300	0.37	0.370	0.027	0.74	15.69
0.69	21.76	58.090	58.070	0.37	0.370	0.027	0.75	16.26
0.70	22.34	58.860	58.840	0.38	0.380	0.027	0.75	16.85
0.71	22.93	59.630	59.610	0.38	0.380	0.027	0.76	17.45
0.72	23.53	60.400	60.380	0.39	0.390	0.027	0.77	18.06
0.73	24.14	61.160	61.150	0.39	0.390	0.027	0.77	18.69
0.74	24.75	61.930	61.920	0.40	0.400	0.027	0.78	19.32
0.75	25.38	62.700	62.680	0.40	0.400	0.027	0.79	19.98
0.76	26.01	63.470	63.450	0.41	0.410	0.027	0.79	20.64
0.77	26.65	64.240	64.220	0.41	0.410	0.027	0.80	21.32
0.78	27.29	65.010	64.990	0.42	0.420	0.027	0.81	22.01
0.79	27.95	66.670	66.650	0.42	0.420	0.027	0.81	22.52
0.80	28.63	68.340	68.320	0.42	0.420	0.027	0.81	23.06
0.81	29.32	70.000	69.980	0.42	0.420	0.027	0.81	23.61
0.82	30.03	71.670	71.650	0.42	0.420	0.027	0.81	24.18
0.83	30.75	73.340	73.320	0.42	0.420	0.027	0.81	24.78
0.84	31.49	75.000	74.980	0.42	0.420	0.027	0.81	25.40
0.85	32.25	76.440	76.410	0.42	0.420	0.027	0.81	26.10
0.86	33.02	77.860	77.840	0.42	0.420	0.027	0.81	26.81
0.87	33.81	79.290	79.270	0.43	0.430	0.027	0.81	27.55
0.88	34.61	80.720	80.700	0.43	0.430	0.027	0.82	28.30
0.89	35.42	82.150	82.130	0.43	0.430	0.027	0.82	29.08
0.90	36.25	83.580	83.560	0.43	0.430	0.027	0.82	29.88
0.91	37.09	85.010	84.990	0.44	0.440	0.027	0.83	30.70
0.92	37.94	85.780	85.760	0.44	0.440	0.027	0.84	31.69

Table C.4. Hydraulic Model Results for 10% Decrease in n Value Selected for the Downstream of Alpaslan II Dam (Continued)

Depth (m)	Area (m^2)	Wetted Perimeter (m)	Width (m)	R (m)	D_hid (m)	n	Average Current Velocity (m/s)	Flow Rate (m^3/s)
0.47	10.84	41.160	41.150	0.26	0.260	0.027	0.59	6.41
0.48	11.26	41.930	41.920	0.27	0.270	0.027	0.60	6.74
0.49	11.68	42.700	42.680	0.27	0.270	0.027	0.61	7.08
0.50	12.11	43.470	43.450	0.28	0.280	0.027	0.61	7.43
0.51	12.55	44.240	44.220	0.28	0.280	0.027	0.62	7.79
0.52	13.00	45.010	44.990	0.29	0.290	0.027	0.63	8.17
0.53	13.45	45.780	45.760	0.29	0.290	0.027	0.64	8.55
0.54	13.91	46.540	46.530	0.30	0.300	0.027	0.64	8.95
0.55	14.38	47.310	47.300	0.30	0.300	0.027	0.65	9.35
0.56	14.86	48.080	48.070	0.31	0.310	0.027	0.66	9.77
0.57	15.34	48.850	48.840	0.31	0.310	0.027	0.66	10.20
0.58	15.83	49.620	49.610	0.32	0.320	0.027	0.67	10.64
0.59	16.33	50.390	50.380	0.32	0.320	0.027	0.68	11.09
0.60	16.84	51.160	51.150	0.33	0.330	0.027	0.69	11.55
0.61	17.36	51.930	51.920	0.33	0.330	0.027	0.69	12.02
0.62	17.88	52.700	52.680	0.34	0.340	0.027	0.70	12.51
0.63	18.41	53.470	53.450	0.34	0.340	0.027	0.71	13.01
0.64	18.95	54.240	54.220	0.35	0.350	0.027	0.71	13.52
0.65	19.49	55.010	54.990	0.35	0.350	0.027	0.72	14.04
0.66	20.05	55.780	55.760	0.36	0.360	0.027	0.73	14.58
0.67	20.61	56.550	56.530	0.36	0.360	0.027	0.73	15.13
0.68	21.18	57.320	57.300	0.37	0.370	0.027	0.74	15.69
0.69	21.76	58.090	58.070	0.37	0.370	0.027	0.75	16.26
0.70	22.34	58.860	58.840	0.38	0.380	0.027	0.75	16.85
0.71	22.93	59.630	59.610	0.38	0.380	0.027	0.76	17.45
0.72	23.53	60.400	60.380	0.39	0.390	0.027	0.77	18.06
0.73	24.14	61.160	61.150	0.39	0.390	0.027	0.77	18.69
0.74	24.75	61.930	61.920	0.40	0.400	0.027	0.78	19.32
0.75	25.38	62.700	62.680	0.40	0.400	0.027	0.79	19.98
0.76	26.01	63.470	63.450	0.41	0.410	0.027	0.79	20.64
0.77	26.65	64.240	64.220	0.41	0.410	0.027	0.80	21.32
0.78	27.29	65.010	64.990	0.42	0.420	0.027	0.81	22.01
0.79	27.95	66.670	66.650	0.42	0.420	0.027	0.81	22.52
0.80	28.63	68.340	68.320	0.42	0.420	0.027	0.81	23.06
0.81	29.32	70.000	69.980	0.42	0.420	0.027	0.81	23.61
0.82	30.03	71.670	71.650	0.42	0.420	0.027	0.81	24.18
0.83	30.75	73.340	73.320	0.42	0.420	0.027	0.81	24.78
0.84	31.49	75.000	74.980	0.42	0.420	0.027	0.81	25.40
0.85	32.25	76.440	76.410	0.42	0.420	0.027	0.81	26.10
0.86	33.02	77.860	77.840	0.42	0.420	0.027	0.81	26.81
0.87	33.81	79.290	79.270	0.43	0.430	0.027	0.81	27.55
0.88	34.61	80.720	80.700	0.43	0.430	0.027	0.82	28.30
0.89	35.42	82.150	82.130	0.43	0.430	0.027	0.82	29.08
0.90	36.25	83.580	83.560	0.43	0.430	0.027	0.82	29.88
0.91	37.09	85.010	84.990	0.44	0.440	0.027	0.83	30.70
0.92	37.94	85.780	85.760	0.44	0.440	0.027	0.84	31.69

Table C.4. Hydraulic Model Results for 10% Decrease in n Value Selected for the Downstream of Alpaslan II Dam (Continued)

Depth (m)	Area (m^2)	Wetted Perimeter (m)	Width (m)	R (m)	D_hid (m)	n	Average Current Velocity (m/s)	Flow Rate (m^3/s)
0.93	38.81	86.550	86.530	0.45	0.450	0.027	0.84	32.70
0.94	39.67	87.320	87.300	0.45	0.450	0.027	0.85	33.73
0.95	40.55	88.090	88.070	0.46	0.460	0.027	0.86	34.78
0.96	41.44	88.860	88.840	0.47	0.470	0.027	0.86	35.85
0.97	42.33	89.630	89.610	0.47	0.470	0.027	0.87	36.93
0.98	43.23	90.400	90.380	0.48	0.480	0.027	0.88	38.03
0.99	44.14	91.170	91.150	0.48	0.480	0.027	0.89	39.15
1.00	45.05	91.940	91.920	0.49	0.490	0.027	0.89	40.28
1.01	45.97	92.710	92.680	0.50	0.500	0.027	0.90	41.44
1.02	46.90	93.480	93.450	0.50	0.500	0.027	0.91	42.61
1.03	47.84	94.250	94.220	0.51	0.510	0.027	0.92	43.80
1.04	48.79	95.020	94.990	0.51	0.510	0.027	0.92	45.01
1.05	49.74	95.410	95.380	0.52	0.520	0.027	0.93	46.35
1.06	50.70	95.790	95.770	0.53	0.530	0.027	0.94	47.72
1.07	51.66	96.180	96.150	0.54	0.540	0.027	0.95	49.10
1.08	52.62	96.560	96.530	0.54	0.550	0.027	0.96	50.50
1.09	53.59	96.950	96.920	0.55	0.550	0.027	0.97	51.92
1.10	54.56	97.330	97.300	0.56	0.560	0.027	0.98	53.36
1.11	55.53	97.720	97.690	0.57	0.570	0.027	0.99	54.81
1.12	56.51	98.100	98.070	0.58	0.580	0.027	1.00	56.28
1.13	57.49	98.490	98.460	0.58	0.580	0.027	1.00	57.77
1.14	58.48	98.870	98.840	0.59	0.590	0.027	1.01	59.28
1.15	59.47	99.260	99.230	0.60	0.600	0.027	1.02	60.81
1.16	60.47	99.640	99.610	0.61	0.610	0.027	1.03	62.35
1.17	61.46	100.100	100.020	0.61	0.610	0.027	1.04	63.88
1.18	62.47	100.550	100.420	0.62	0.620	0.027	1.05	65.43
1.19	63.47	101.000	100.820	0.63	0.630	0.027	1.06	67.00
1.20	64.48	101.440	101.220	0.64	0.640	0.027	1.06	68.58
1.21	65.50	101.880	101.610	0.64	0.640	0.027	1.07	70.19
1.22	66.51	102.310	102.000	0.65	0.650	0.027	1.08	71.81
1.23	67.54	102.750	102.390	0.66	0.660	0.027	1.09	73.45
1.24	68.56	103.180	102.770	0.66	0.670	0.027	1.10	75.11
1.25	69.59	103.610	103.150	0.67	0.670	0.027	1.10	76.79
1.26	70.62	104.030	103.520	0.68	0.680	0.027	1.11	78.48
1.27	71.66	104.450	103.900	0.69	0.690	0.027	1.12	80.19
1.28	72.70	104.870	104.270	0.69	0.700	0.027	1.13	81.93
1.29	73.75	105.280	104.630	0.70	0.700	0.027	1.13	83.68
1.30	74.80	105.690	104.990	0.71	0.710	0.027	1.14	85.45

C.4. Base-flow assessments

Temporal change of monthly average flows at Alpaslan II Dam site, which are approved by DSI (1970-2008, 39 years) is shown in Figure C.5. As can be seen in the graph, the flow increases mostly due the melting of snow cover, and the low (base) flow period is observed in July-February while the high flow period is observed in March-June. Considering the long-term monthly average flows, it is understood that the breeding season of fish (end of March-end of June), which is an indicator of aquatic life cycle, corresponds to the high flow period. On the other hand, growth (July-October) and wintering (November-February) seasons correspond to low flow period.

At Alpaslan II Dam site in a year of average precipitation during the high flow period (March-June) the monthly average flow is 314.4 m^3/s, at low flow period (July-February), on the other hand, it is 49.2 m^3/s. In a dry year, at high flow period (March-June), monthly average flow is 81.7 m^3/s, while at low flow period (July-February), it is 23.1 m^3/s. At the dam site, minimum monthly average flow is 14.5 m^3/s (September). Dam site baseline Q_AAF%10 flow rate is 13.757 m^3/s. According to the above assessments, a flow rate at this level can be met with monthly average flows, and even during the lowest flow month (September) of dry years.

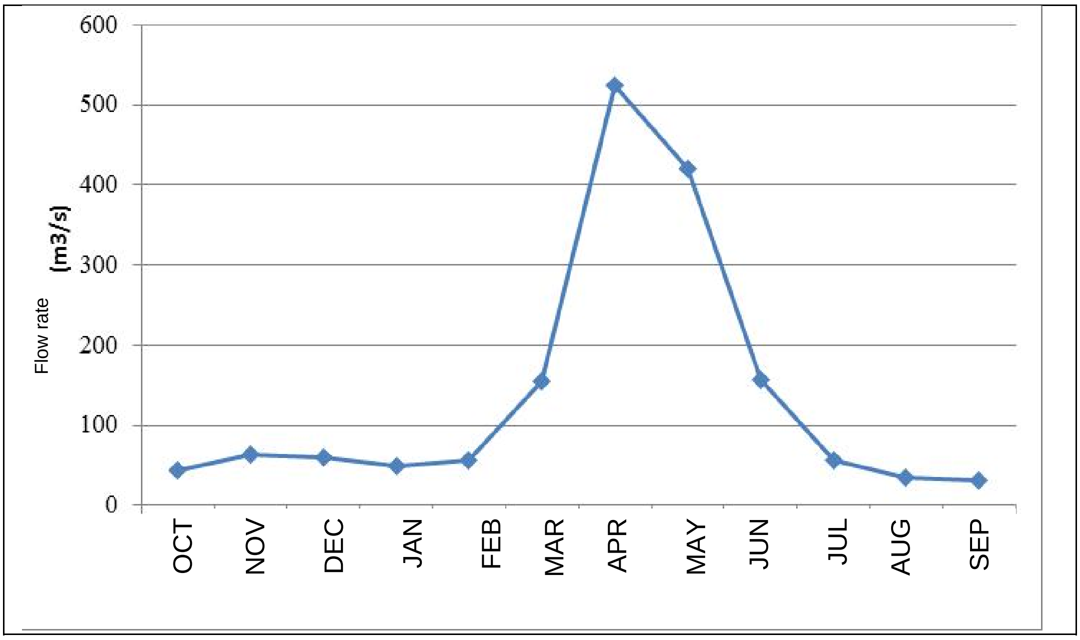


Figure C.5. Temporal Change in Alpaslan II Dam Site Monthly Average Flow

C.5. Flow duration curve and minimum flow assessments

Alpaslan II Dam has been planned to be constructed with a HEPP, which could be operated at the maximum flow rate when needed. When the HEPP is operated required a long-term storage, there would be changes in existing flow-duration relations. According to the flow duration curve data, prepared with baseline flows (Figure C.6), the flow rate at the dam site is above 67.5 m^3/s for 100% of the time, above 68 m^3/s for 95% of the time, 69 m^3/s for 90% of the time, 70 m^3/s for 85% of the time, 71 m^3/s for 80% of the time, 71 m^3/s for 75% of the time and 72 m^3/s for 70% of the time. According to the data, it is understood that the flow rate (13.757 m^3/s), which corresponds to 10% of the annual average flow, is present in the riverbed at all time. As a result of assessments carried out for the Alpaslan II Dam site long-term daily flow series, minimum flow values were determined as 8.36 m^3/s (7Q1) and 14.28 m^3/s (7Q10).

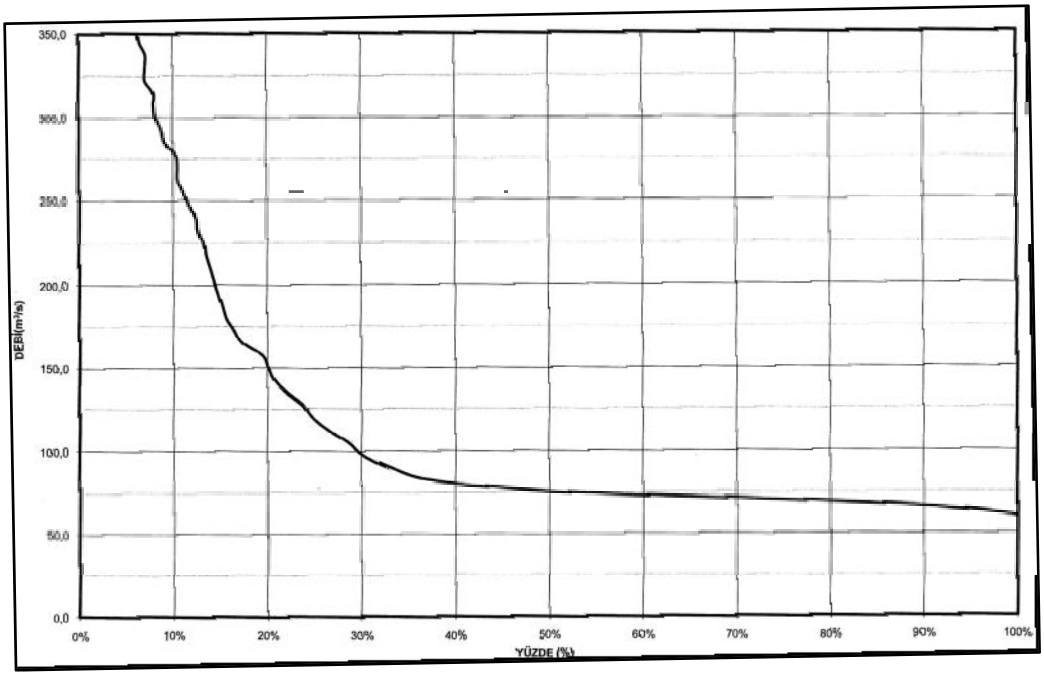


Figure C.6. Alpaslan II Dam Site Flow Duration Curve (Baseline)

C.6. Montana method calculations

Alpaslan II Dam site long-term (1978-2009, 32 years) statistics on monthly average flow values, 10% of the Annual Average Floa (Q_AAF%10) and changes in flow rate corresponding to “Good”, “Medium-declining” and “Weak-minimum” conditions according to Montana management criteria, are given in Table C.5. The assessments on Alpaslan II Dam site revealed that the Q-AAF%10 flow rate (=13.757 m^3/s) can be met throughout the year with long-term monthly average flow rates (Table C.5). In other words, monthly average does not fall below the Q_AAF%10 (=Montana-Weak-minimum) value in any month of the year. On the other hand, in terms of long-term monthly average minimum flows, this criterion is met throughout the year (Figure C.7). This indicates that the natural flow does not drop under the long-term average flow Q_AAF%10, even during extremely dry years. Monthly average minimum natural flows meet Montana Good and Montana Medium-declining criteria, except for June-September period. Although natural minimum flow averages fall below Montana Good and Montana Medium-declining criteria, they do not drop under Montana Weak-minimum criterion. The proportion of Q_AAF%10 rate that is used in the assessment to monthly average flow fluctuates between 3% (April-May) and 45% (September) throughout the year.

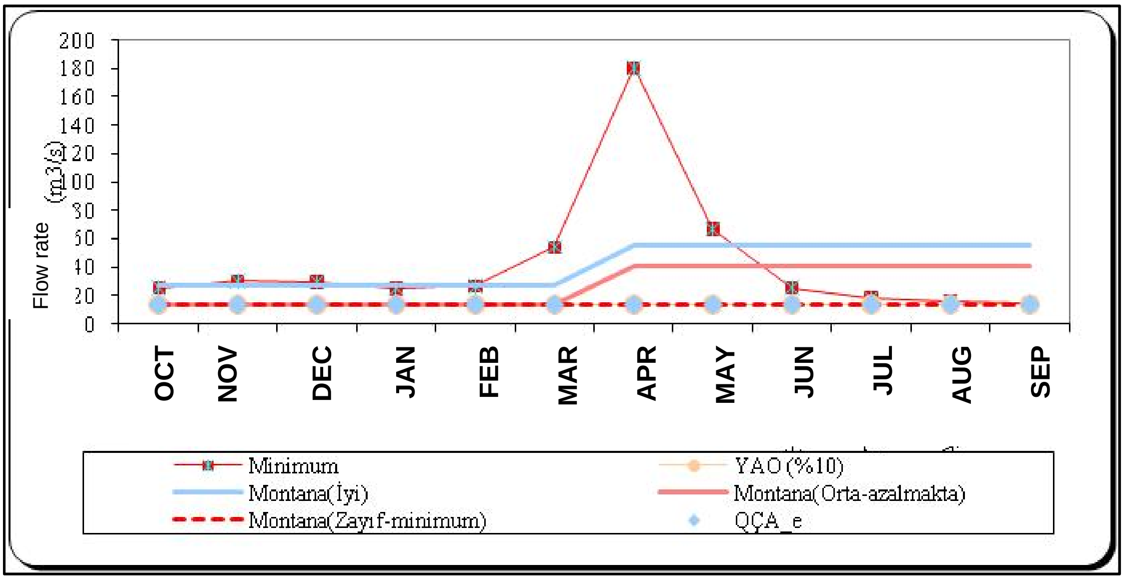


Figure C.7. Comparison of Alpaslan II Dam Site Q_AAF%10 with Montana Different Standard Flow Rates

Alpaslan II Dam site long-term daily flow series were assessed and the following minimum flow rate values were obtained: 8.36 m^3/s (7Q1), 9.29 m^3/s (7Q2), 11.41 m^3/s (7Q5), 14.28 m^3/s (7Q10), 17.47 m^3/s (7Q20) and 18.74 m^3/s (7Q25).

C.7. Recommended environmental flow rates

Based on hydrogeological assessments carried out within the scope of this study, and analyses done to determine the amount of environmental flow, recommendations regarding the flow rates to be released from Alpaslan II Dam to downstream are given in Table C.5. Considering uncertainties that might happen at l/s level during operation phase environmental flow rate measurements, recommended flow rate values are presented with 2 decimal places for sensitivity.

Due to the nature of Alpaslan II Dam and HEPP Project, additional downstream environmental release will only take place when the dam operates at its maximum. Alpaslan II HEPP was designed to have 4 units considering the environmental flow and irrigation water. Two of these units are large (2 x 136.00 m^3/s), and two of them are small (2 x 36.00 m^3/s). Under these circumstances, three different cases were assessed for the environmental flow to be released from Alpaslan II Dam; 1: Impoundment phase, 2: Operation phase with peak flow rate, 3: Operation of the HEPP. When the HEPP is in operation, since all of the flow will be released downstream after it goes through the turbines, there will be no need for determination of an environmental flow rate value.

During water impoundment, it is targeted to establish the normal water level (NSS=1,368 m) in the shortest possible period of time. At this level the lake volume is about 2.1 10^9 m^3. The time that is required for the dam to reach the NSS during water impoundment, depends on the season when water impoundment starts, average flow during impoundment phase and the magnitude of environmental flow that will be released downstream during this period.

Wetted perimeter model calculation results show that flow values that correspond to aquatic habitat minimum current velocity and minimum water depth will be between 0.40 m^3/s and 0.49 m^3/s. The flow range that correspond to these constraints are quite lower than Q_AAF10% (=13.757 m^3/s). Based on the wetted perimeter method, for the non-dimensional wetted perimeter and non-dimensional flow rate relation, at two different breaking points, the critical flow rate values for the aquatic habitat are at a level of 27.0 m^3/s and 18.5 m^3/s. In the feasibility study, environmental flow rate was projected as Q_AAF10% (=13.757 m^3/s). For the dam volume to be met at NSS (2.1 10^9 m^3), without releasing environmental flow downstream, the dam should be filled with long-term annual average flow (Q_AAF =136.26 m^3/s) for 178 days. In order to the reach the dam volume at NSS with the same reservoir inlet flow (Q_AAF =136.26 m^3/s), if environmental flow is released the number of days required would be 197, if environmental flow is released at a level of Q_kr (= 18.5 m^3/s) it would be 206 days, and at a level of Q_kr (= 27.0 m^3/s), it would be 222 days. When compared to the condition where no water is released downstream during the impoundment phase, the time required to reach NSS for Q_can=13.757 m^3/s would be 19 days longer, for Q_can= 18.5 m^3/s, it would be 28 days longer, and for Q_can= 27.0 m^3/s it would be 44 days longer.

For Alpaslan II Dam cross-section high flow period (March-June) is also the breeding season for aquatic habitat. Water demand of the aquatic habitat during this period would be higher than the following low flow (growth) period. For this reason, it would be appropriate to have an environmental flow rate of Q_can= 27.0 m^3/s during the water impoundment high flow (breeding) period, and a flow rate of Q_can= 18.5 m^3/s for the low flow period. With the HEPP to be built, during the operation phase of the project, it would also be appropriate to have the above-mentioned flows released downstream. When the HEPP is operated at its peak, the same environmental flows could be released downstream.

The distribution of recommended environmental flow rates according to months of high and low flow periods are shown in Table C.6. At monthly basis, the ratio of environmental flow rates to AAF at high flow period is 19.6%, while it is 13.4% during low flow period. These ratios correspond to 15.5% at annual basis.

Environmental flow rates determined by using various methods are given in Table C.7. The ratio of these environmental flow values to annual average flow and monthly average flow values are given in Table C.8 and Table C.9, respectively.

Table C.5. Comparison of Q_AAF%10 Flow Rate and Natural Flow Statistics and Different Montana Standard Flow Rates for Alpaslan II Dam Site

Alpalan II Dam Site	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	ANN. AVE.
Avarage	44.356	63.576	59.209	49.657	55.654	155.443	525.083	420.335	156.644	56.236	34.138	30.524	137.571
Standard deviation	10.877	26.492	27.515	17.226	16.785	81.032	188.054	191.994	78.325	23.805	12.190	9.628	40.526
Median	42.790	58.256	51.523	45.600	53.770	148.000	514.660	384.595	150.865	53.332	32.993	30.330	132.890
Minimum	25.323	30.100	29.260	25.080	26.690	54.000	180.413	66.888	25.312	18.095	15.978	14.530	74.583
Maximum	74.178	154.707	189.665	113.200	93.079	455.122	1036.000	1040.995	396.627	146.682	89.767	69.682	278.810
Q_AAF (%10)	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757
Montana(Good)	27.514	27.514	27.514	27.514	27.514	27.514	55.028	55.028	55.028	55.028	55.028	55.028	41.271
Montana(Medium-declining)	13.757	13.757	13.757	13.757	13.757	13.757	41.271	41.271	41.271	41.271	41.271	41.271	27.514
Montana(Weak-minimum)	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757
Q_AAF%10	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757	13.757
Q_AAF%10/MAF	31	22	23	28	25	9	3	3	9	24	40	45	10

Table C.6. Environmental Flow Rates (Q_Can, m^3/s) for Alpaslan II Dam Site Low and High Flow Periods

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	ANN. AVE.
Flow Period	Low	Low	Low	Low	Low	High	High	High	High	Low	Low	Low	
Aquatic Period	Growth	Growth	Growth	Growth	Growth	Breeding	Breeding	Breeding	Breeding	Growth	Growth	Growth	
Q_Can (recom.)	18.5	18.5	18.5	18.5	18.5	27.0	27.0	27.0	27.0	18.5	18.5	18.5	21.33
Q_Can/MAF (%)	41.7%	29.1%	31.2%	37.3%	33.2%	17.4%	5.1%	6.4%	17.2%	32.9%	54.2%	60.6%	
Q_Can/AAF (%)	13.4%	13.4%	13.4%	13.4%	13.4%	19.6%	19.6%	19.6%	19.6%	13.4%	13.4%	13.4%	15.5%

Table C.7. Environmental Flow Values Calculated with Various Methods for Alpaslan II Dam Site

Method	Flow Rate (m^3/s)
Wetted Perimeter (High Flow Period) (Annual average of recommended monthly environmental flows)	**27.0**
Wetted Perimeter (Low Flow Period) (Annual average of recommended monthly environmental flows)	**18.5**
AAF%10 (10% of long-term annual average flow value)	13.8
YOA%10 (last 10 years) (10% of the average flow value of the last 10 years)	13.4
Base-Flow (Average of minimum monthly average flows during low flow period of dry years)	23.1
Montana (Zayıf-minimum) (yıllık ortalama değer)	13.8
Montana (Orta-azalmakta) (yıllık ortalama değer)	27.5
Montana (İyi) (yıllık ortalama değer)	41.3
Flow Duration Curve, Q 98	67.7
Flow Duration Curve, Q 95	68.0
Flow Duration Curve, Q 90	69.0
Minimum flow, 7Q1	8.4
Minimum flow, 7Q2	9.3
Minimum flow, 7Q5	11.4
Minimum flow, 7Q10	14.3
Minimum flow, 7Q20	17.5
Minimum flow, 7Q25	18.7

Note: Recommended values are presented in bold.

Table C.8. Proportion of Environmental Flow Rate Values Calculated with Various Methods for Alpaslan II Dam Site to Annual Average Flows

Method	Flow (m^3/s)	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
Monthly Average Flow		44.36	63.58	59.21	49.66	55.65	155.44	525.08	420.33	156.64	56.24	34.14	30.52
Wetted Perimeter (High Flow)	27.0	60.9%	42.5%	45.6%	54.4%	48.5%	17.4%	5.1%	6.4%	17.2%	48.0%	79.1%	88.5%
Wetted Perimeter (Low Flow)	18.5	41.7%	29.1%	31.2%	37.3%	33.2%	11.9%	3.5%	4.4%	11.8%	32.9%	54.2%	60.6%
AAF%10	13.8	31.0%	21.6%	23.2%	27.7%	24.7%	8.9%	2.6%	3.3%	8.8%	24.5%	40.3%	45.1%
AAF%10 (last 10 years)	13.4	30.1%	21.0%	22.6%	26.9%	24.0%	8.6%	2.5%	3.2%	8.5%	23.8%	39.1%	43.8%
Base-Flow	23.1	52.1%	36.3%	39.0%	46.5%	41.5%	14.9%	4.4%	5.5%	14.7%	41.1%	67.7%	75.7%
Montana (Weak-minimum)	13.8	31.0%	21.6%	23.2%	27.7%	24.7%	8.9%	2.6%	3.3%	8.8%	24.5%	40.3%	45.1%
Montana (Medium-declining)	27.5	62.0%	43.3%	46.5%	55.4%	49.4%	17.7%	5.2%	6.5%	17.6%	48.9%	80.6%	90.1%
Montana (Good)	41.3	93.0%	64.9%	69.7%	83.1%	74.2%	26.6%	7.9%	9.8%	26.3%	73.4%	120.9%	135.2%
Flow Duration Curve, Q 98	67.7	152.6%	106.5%	114.3%	136.3%	121.6%	43.6%	12.9%	16.1%	43.2%	120.4%	198.3%	221.8%
Flow Duration Curve, Q 95	68.0	153.3%	107.0%	114.8%	136.9%	122.2%	43.7%	13.0%	16.2%	43.4%	120.9%	199.2%	222.8%
Flow Duration Curve, Q 90	69.0	155.6%	108.5%	116.5%	139.0%	124.0%	44.4%	13.1%	16.4%	44.0%	122.7%	202.1%	226.1%
Minimum flows, 7Q1	8.4	18.8%	13.1%	14.1%	16.8%	15.0%	5.4%	1.6%	2.0%	5.3%	14.9%	24.5%	27.4%
Minimum flows, 7Q2	9.3	21.0%	14.6%	15.7%	18.7%	16.7%	6.0%	1.8%	2.2%	5.9%	16.5%	27.2%	30.4%
Minimum flows, 7Q5	11.4	25.7%	18.0%	19.3%	23.0%	20.5%	7.3%	2.2%	2.7%	7.3%	20.3%	33.4%	37.4%
Minimum flows, 7Q10	14.3	32.2%	22.5%	24.1%	28.7%	25.7%	9.2%	2.7%	3.4%	9.1%	25.4%	41.8%	46.8%
Minimum flows, 7Q20	17.5	39.4%	27.5%	29.5%	35.2%	31.4%	11.2%	3.3%	4.2%	11.2%	31.1%	51.2%	57.2%
Minimum flows, 7Q25	18.7	42.2%	29.5%	31.6%	37.7%	33.7%	12.1%	3.6%	4.5%	12.0%	33.3%	54.9%	61.4%

Table C.9. Proportion of Environmental Flow Rate Values Calculated with Various Methods for Alpaslan II Dam Site to Monthly Average Flows

Method	Flow (m^3/s)	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
Monthly Average Flow		44.36	63.58	59.21	49.66	55.65	155.44	525.08	420.33	156.64	56.24	34.14	30.52
Wetted Perimeter (High Flow)	27.0	60.9%	42.5%	45.6%	54.4%	48.5%	17.4%	5.1%	6.4%	17.2%	48.0%	79.1%	88.5%
Wetted Perimeter (Low Flow)	18.5	41.7%	29.1%	31.2%	37.3%	33.2%	11.9%	3.5%	4.4%	11.8%	32.9%	54.2%	60.6%
AAF%10	13.8	31.0%	21.6%	23.2%	27.7%	24.7%	8.9%	2.6%	3.3%	8.8%	24.5%	40.3%	45.1%
AAF%10 (last 10 years)	13.4	30.1%	21.0%	22.6%	26.9%	24.0%	8.6%	2.5%	3.2%	8.5%	23.8%	39.1%	43.8%
Base-Flow	23.1	52.1%	36.3%	39.0%	46.5%	41.5%	14.9%	4.4%	5.5%	14.7%	41.1%	67.7%	75.7%
Montana (Weak-minimum)	13.8	31.0%	21.6%	23.2%	27.7%	24.7%	8.9%	2.6%	3.3%	8.8%	24.5%	40.3%	45.1%
Montana (Medium-declining)	27.5	62.0%	43.3%	46.5%	55.4%	49.4%	17.7%	5.2%	6.5%	17.6%	48.9%	80.6%	90.1%
Montana (Good)	41.3	93.0%	64.9%	69.7%	83.1%	74.2%	26.6%	7.9%	9.8%	26.3%	73.4%	120.9%	135.2%
Flow Duration Curve, Q 98	67.7	152.6%	106.5%	114.3%	136.3%	121.6%	43.6%	12.9%	16.1%	43.2%	120.4%	198.3%	221.8%
Flow Duration Curve, Q 95	68.0	153.3%	107.0%	114.8%	136.9%	122.2%	43.7%	13.0%	16.2%	43.4%	120.9%	199.2%	222.8%
Flow Duration Curve, Q 90	69.0	155.6%	108.5%	116.5%	139.0%	124.0%	44.4%	13.1%	16.4%	44.0%	122.7%	202.1%	226.1%
Minimum flows, 7Q1	8.4	18.8%	13.1%	14.1%	16.8%	15.0%	5.4%	1.6%	2.0%	5.3%	14.9%	24.5%	27.4%
Minimum flows, 7Q2	9.3	21.0%	14.6%	15.7%	18.7%	16.7%	6.0%	1.8%	2.2%	5.9%	16.5%	27.2%	30.4%
Minimum flows, 7Q5	11.4	25.7%	18.0%	19.3%	23.0%	20.5%	7.3%	2.2%	2.7%	7.3%	20.3%	33.4%	37.4%
Minimum flows, 7Q10	14.3	32.2%	22.5%	24.1%	28.7%	25.7%	9.2%	2.7%	3.4%	9.1%	25.4%	41.8%	46.8%
Minimum flows, 7Q20	17.5	39.4%	27.5%	29.5%	35.2%	31.4%	11.2%	3.3%	4.2%	11.2%	31.1%	51.2%	57.2%
Minimum flows, 7Q25	18.7	42.2%	29.5%	31.6%	37.7%	33.7%	12.1%	3.6%	4.5%	12.0%	33.3%	54.9%	61.4%

D. GENERAL EVALUATIONS AND RECOMMENDATIONS

The geological structure at the project area is composed of Cenozoic (Tertiary) and Quaternary geological units. The dominant geological units are Adilcevaz formation, and Zirnak and Solhan formations with Quaternary units that are located on top. According to the pressurized water tests (PWT) carried out at the dam site to determine the level of permeability, Adilcevaz formation is impermeable. According to the PWT results, Zirnak formation, although includes patches of permeable-impermeable levels, is impermeable in general. Solhan formation shows similar characteristics to Zirnak formation. Alluvial is found at a thickness of 2-4 m around the streambed, and has a limited distribution. Therefore, it does not form a significant aquifer level. Based on the results of the groundwater level measurements at boreholes, groundwater levels area above the water level, and feeds the river at both sides.

Considering the topographical and geological structure, it is understood that the river section at the downstream of Alpaslan II Dam is also fed by groundwater. This is predicted to contribute to the environmental flow that would be released from the dam. On the other hand, surface and undersurface flow is more important in river feeding. The existing hydrogeological conditions are not expected to change considerably with the implementation of the project.

The project area and its surroundings are under the influence of terrestrial climatic conditions. Winters are long and cold, summers, on the other hand, are hot and dry. Annual temperatures range between -29°C and +37°C. For 120 days a year, temperatures are higher than +30°C, and for 120 days they are lower than 0°C. The project area and its surroundings receive considerable high amounts of snow during winter. Annual precipitation amounts range between 350 and 1000 mm. Annual net evaporation amount from Alpaslan II reservoir has been determined as 494.3 mm.

In the Feasibility Study, Alpaslan II Dam current rates have been determined as "natural state", "existing state" and "developing state". The average flows for natural, existing and developing states for the period of 1970-2008 are 4297.17 hm^3 (136.169 m^3/s), 4030.51 hm^3 (127.719 m^3/s) 3386.99 hm^3 (107.327 m^3/s), respectively. The natural annual average flow at the Alpaslan II dam site has been determined as 136.26 m^3/s within the scope of the feasibility studies. The average flow for the last 10 years has been given as 128.27 m^3/s. Within the scope of this study, 10% of all natural flow values between the years 1970 and 2007 has been calculated as 13.757 m^3/s. According to the flow duration curve data, dam site existing flow does not drop under 67.5 m^3/s for 100% of the time, and 75.0 m^3/s for 50% of the time. According to these data, it is understood that the flow rate that corresponds to 10% of the annual average flow is present at the streambed year-round.

There are a number of irrigation, energy and drinking-potable water projects within Murat River Basin, at the upstream and downstream of Alpaslan II Dam. According to the evaluations in the Feasibility Report, there is the Mus Plain irrigation project at the downstream, which is implemented to provide water for an area of 78.210 ha of land. Water to be turbined for energy generation at the dam would be enough to meet this demand. In the Feasibility Report, the environmental flow rate was anticipated as 13.00 m^3/s , which is 10% of the last 10 years average flow rate. Considering the environmental flow and irrigation water demand, two large and two small turbines have been planned to be used within the scope of the project.

Since drinking and other domestic water need of the nearby settlements are supplied from local resources, the planned project would not have any adverse impacts on water use. Since downstream agricultural land will have continuous irrigation water upon completion of the project, this is also expected not to cause any problems. It would be required to release adequate amount of minimum flow, so that the aquatic habitat is not adversely affected along the riverbed.

Impoundment within the scope of Alpaslan II Dam and HEPP Project, is not expected to adversely impact the local meteorological conditions. Similarly, the existing hydrogeological conditions at the downstream of the dam are not expected to change. In this section, groundwater is expected to feed the stream, in a rather weaker fashion than the surface flow.

As can be seen from the precipitation-flow relationship, stream flow in the study area is fed through surface and undersurface flow. The contribution of the geological units surrounding the stream is limited. Due to the size of the basin, the fact that the upper elevations of the basin receive more precipitation that Turkey average and the regulation impact of the upstream facilities, the stream flow does not drop below 65 m^3/s. This value corresponds to approximately 47% of the long-term annual natural average flow (137.571 m^3/s). In the long run, the continuity of the biological and ecological structures is a result of this flow duration.

The storage and transmission capacity of geological units surrounding the stream are limited in the study area. Therefore, there is no significant interaction between the surface water and groundwater. At hillsides, groundwater level is higher than that of the stream, and groundwater flow is towards the stream direction. It is not expected to have an important change in load-gradient between the water levels of the geological units at the downstream with the implementation of the project.

Wetted perimeter model calculation results show that flow values that correspond to aquatic habitat minimum current velocity and minimum water depth will be between 0.40 m^3/s and 0.49 m^3/s. The flow range that correspond to these constraints are quite lower than Q_AAF10% (=13.757 m^3/s). In determining the critical flow rate for the aquatic habitat according to the Wetted Perimeter Method, the relationship between the dimensionless wetted perimeter and dimensionless flow rate, which are calculated through the "normal" hydraulic model results, was also assessed. There are two breaking points for this relationship, and the flow rate values that correspond to these are 27.0 m^3/s and 18.5 m^3/s, respectively. For the flow rate of Q_kr= 27.0 m^3/s, the water depth is 0.90 m, average current rate is 0.74 m/s, flow area is 36.25 m^2, flow cross-section surface width is 83.56 m, and the wetted perimeter is 83.58 m. For Q_kr= 18.5 m^3/s, the water depth is 0.76 m, average current rate is 0.71 m/s m/s, flow area is 26.01 m^2, flow cross-section surface width is 63.45 m, and the wetted perimeter is 63.47 m. For both of the flow rate values, constraints for aquatic habitat minimum current rate and minimum water depth are met.

It has been determined within the scope of base flow evaluations that the low (base) flow period is July-February, when flow is based on mostly melting snow, and high flow period is March-June. Considering the long-term monthly average flows, fish breeding season (End of March-End of June), which is an important indicator of the aquatic life cycle, also takes place during the high flow season. On the other hand, growth (July-October) and wintering (November-February) take place during the low flow period. Monthly average flow during the high flow period (March-Haziran) at Alpaslan II Dam during a year with medium level precipitation is 314.4 m^3/s, while it is 49.2 m^3/s during the low flow (July-February) period. In a dry year, on the other hand, the monthly average flow rate during high flow period is 81.7 m^3/s, and during low flow period it is 23.1 m^3/s. The minimum monthly average flow at the dam site is 14.5 m^3/s (September). Dam site baseline Q_AAF10% flow rate is 13.757 m^3/s. These evaluations show that a flow rate at this level can be met by the natural flow with monthly average flows and even during the minimum flow month (September) of dry years.

Due to the nature of Alpaslan II Dam and HEPP Project, additional downstream environmental release will only take place when the dam operates at its maximum. In the event that the HEPP is operated to have long-term impoundment, there would be changes in the baseline flow-duration relationship. According to the flow duration curve data based on the baseline flow rates, the flow rate at the dam site is above 67.5 m^3/s for 100% of the time, above 68 m^3/s for 95% of the time, 69 m^3/s for 90% of the time, 70 m^3/s for 85% of the time, 71 m^3/s for 80% of the time, 71 m^3/s for 75% of the time and 72 m^3/s for 70% of the time. According to the data, it is understood that the flow rate (13.757 m^3/s), which corresponds to 10% of the annual average flow, is present in the riverbed at all time.

According to the Montana method it has been determined that the Q-AAF%10 flow rate (=13.757 m^3/s) can be met throughout the year with long-term monthly average flow rates. In other words, monthly average does not fall below the Q_AAF%10 (=Montana-Weak-minimum) value in any month of the year. On the other hand, in terms of long-term monthly average minimum flows, this criterion is met throughout the year. This indicates that the natural flow does not drop under the long-term average flow Q_AAF%10, even during extremely dry years. Monthly average minimum natural flows meet Montana Good and Montana Medium-declining criteria, except for June-September period. Although natural minimum flow averages fall below Montana Good and Montana Medium-declining criteria, they do not drop under Montana Weak-minimum criterion. The proportion of Q_AAF%10 rate that is used in the assessment to monthly average flow fluctuates between 3% (April-May) and 45% (September) throughout the year.

Due to the nature of Alpaslan II Dam and HEPP Project, additional downstream environmental release will only take place when the dam operates at its maximum. Alpaslan II HEPP was designed to have 4 units considering the environmental flow and irrigation water. Two of these units are large (2 x 136.00 m^3/s), and two of them are small (2 x 36.00 m^3/s). Under these circumstances, three different cases were assessed for the environmental flow to be released from Alpaslan II Dam; 1: Impoundment phase, 2: Operation phase with peak flow rate, 3: Operation of the HEPP. When the HEPP is in operation, since all of the flow will be released downstream after it goes through the turbines, there will be no need for determination of an environmental flow rate value.

During water impoundment, it is targeted to establish the normal water level (NSS=1,368 m) in the shortest possible period of time. At this level the lake volume is about 2.1 10^9 m^3. The time that is required for the dam to reach the NSS during water impoundment, depends on the season when water impoundment starts, average flow during impoundment phase and the magnitude of environmental flow that will be released downstream during this period.

Wetted perimeter model calculation results show that flow values that correspond to aquatic habitat minimum current velocity and minimum water depth will be between 0.40 m^3/s and 0.49 m^3/s. The flow range that correspond to these constraints are quite lower than Q_AAF10% (=13.757 m^3/s). Based on the wetted perimeter method, for the non-dimensional wetted perimeter and non-dimensional flow rate relation, at two different breaking points, the critical flow rate values for the aquatic habitat are at a level of 27.0 m^3/s and 18.5 m^3/s. In the feasibility study, environmental flow rate was projected as Q_AAF10% (=13.757 m^3/s). For the dam volume to be met at NSS (2.1 10^9 m^3), without releasing environmental flow downstream, the dam should be filled with long-term annual average flow (Q_AAF =136.26 m^3/s) for 178 days. In order to the reach the dam volume at NSS with the same reservoir inlet flow (Q_AAF =136.26 m^3/s), if environmental flow is released the number of days required would be 197, if environmental flow is released at a level of Q_kr (= 18.5 m^3/s) it would be 206 days, and at a level of Q_kr (= 27.0 m^3/s), it would be 222 days. When compared to the condition where no water is released downstream during the impoundment phase, the time required to reach NSS for Q_can=13.757 m^3/s would be 19 days longer, for Q_can= 18.5 m^3/s, it would be 28 days longer, and for Q_can= 27.0 m^3/s it would be 44 days longer.

For Alpaslan II Dam cross-section high flow period (March-June) is also the breeding season for aquatic habitat. Water demand of the aquatic habitat during this period would be higher than the following low flow (growth) period. For this reason, it would be appropriate to have an environmental flow rate of Q_can= 27.0 m^3/s during the water impoundment high flow (breeding) period, and a flow rate of Q_can= 18.5 m^3/s for the low flow period. With the HEPP to be built, during the operation phase of the project, it would also be appropriate to have the above-mentioned flows released downstream. When the HEPP is operated at its peak, the same environmental flows could be released downstream.

The period of March and June also covers the vegetation period for riparian flora species. Although species found within the riparian zone of the project area are widespread species, for the continuity of their populations, their water demand would be higher than other periods. Therefore, high flow environmental flow rate (Q_can= 27.0 m^3/s) that is proposed for the aquatic habitat would also be appropriate for the riparian flora species.

The monthly distribution of suggested environmental flow rates for high and low flow periods are given in Table C.10. On a monthly basis the ratio of environmental flow rates to AAF is 19.6% during the high flow period and it is 13.4% during the low flow period. This ratios are 15.5% on a yearly basis.

Table C.10. Environmental Flow Rates (Q_Can) Recommended for Alpaslan II Dam Site Impoundment Period

	Statistical Flow Rate m^3/s	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	ANN. AVE.
	Average	44.356	63.576	59.209	49.657	55.654	155.443	525.083	420.335	156.644	56.236	34.138	30.524	137.571
	Flow Period	Dusuk	Dusuk	Dusuk	Dusuk	Dusuk	Yuksek	Yuksek	Yuksek	Yuksek	Dusuk	Dusuk	Dusuk	
Ecologist	Q_Can (recommend.)	18.5	18.5	18.5	18.5	18.5	27.0	27.0	27.0	27.0	18.5	18.5	18.5	21.33
	Q_Can/MAF (%)	41.7%	29.1%	31.2%	37.3%	33.2%	17.4%	5.1%	6.4%	17.2%	32.9%	54.2%	60.6%	
	Q_Can/AAF (%)	13.4%	13.4%	13.4%	13.4%	13.4%	19.6%	19.6%	19.6%	19.6%	13.4%	13.4%	13.4%	15.5%
Hydrogeologist	Q_Can (recommend.)	18.5	18.5	18.5	18.5	18.5	27.0	27.0	27.0	27.0	18.5	18.5	18.5	21.33
	Q_Can/MAF (%)	41.7%	29.1%	31.2%	37.3%	33.2%	17.4%	5.1%	6.4%	17.2%	32.9%	54.2%	60.6%	
	Q_Can/AAF (%)	13.4%	13.4%	13.4%	13.4%	13.4%	19.6%	19.6%	19.6%	19.6%	13.4%	13.4%	13.4%	15.5%
Hydrobiologist	Aquatic Organisms	Growth Feeding	Growth Feeding	Wintering	Wintering	Wintering	Spawning	Spawning	Spawning	Spawning	Growth Feeding	Growth Feeding	Growth Feeding	
	Q_Can (recommend.)	18.5	18.5	18.5	18.5	18.5	27.0	27.0	27.0	27.0	18.5	18.5	18.5	21.33
	Q_Can/MAF (%)	41.7%	29.1%	31.2%	37.3%	33.2%	17.4%	5.1%	6.4%	17.2%	32.9%	54.2%	60.6%	
	Q_Can/AAF (%)	13.4%	13.4%	13.4%	13.4%	13.4%	19.6%	19.6%	19.6%	19.6%	13.4%	13.4%	13.4%	15.5%

E. BIBLIOGRAPHY

- Anonim, 2009; Balık Gecitleri, Tasarım, Boyutlandırma ve İzleme. DSİ, FAO, DWA, 142s.
- Arcement, Jr. G.J. and Schneider V.R., (2011) Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains, United States Geological Survey Water-supply Paper 2339 (http://www.fhwa.dot.gov/bridge/wsp2339.pdf).
- Balık, S., Ustaoğlu, R., 1992; Turkiye Tatlısu Balıklarını Tanımlama Esasları, E.U. Fen Fakultesi Kitaplar Serisi No:137, İzmir, 58 s
- Bellmann, H., 1988; *Leben in Bach und Teich. Pflanzen und Wirbellose der Kleingewsser*. Steinbach Naturfuhrer. 287 s.
- Biro, K., 1981; *Kleiner Bestimmungsschlussel fur Zuckmuckenlarven (Diptera: Chironomidae).* Wien 329 s.
- Bold, H. C., Wynne, M. J., 1978; Introduction to the Algae, Sutructure and Reproduction, 706 p., Prentice-Hall ed., USA
- Bremond, R. et Vuichard, R.,1973. Parameters de la Qualite des Eaux: Ministere de la Protection de la Nature et de Environnemet, Documentation Francaise, Paris, 179 p.
- Cox, E.J., 1996; Identification of Freshwater Diatoms From Live Material, Chapman and Hall, 158 pp., London
- Cowan, W.L., (1956) Estimating hydraulic roughness coefficients: Agricultural Engineering, v. 37, no. 7, p. 473-475.
- Cows, I. G. and Welcomme, R. L., 1998; Rehabilitation of Rivers for Fish. FAO.
- Czernecki. D. B. and Blinn, D. W., 1978; Diatoms of Colarado River, J. Cramer, 181 p. Germany Foged, N., 1981, Diyatoms in Alaska, J. Cramer, 310 p., Germany.
- Dungan, P.J., 1990; Sulakalanların Korunması, IUCN-The World Conservation Union, DHKD Yayınları, 95 sf., İstanbul
- Donald J. O., Maughan, O. E., 1981**;** Evaluatıon of The "Montana Method" For Recommending Instream Flows In Oklahoma Streams, Okla. Acad. Sci. 61:62-66
- Edington, J. M., A. G. Hildrew (1981); Caseless Caddis larvae of the British Isles. Freshwater Biological Association Scientific Publication No:43, 92 p.
- Elliot, J. M., K. H. Mann (1979); A key to British Freshwater Leeches. Freshwater Biological Association Scientific Publication No: 40, 72 s.
- Elliot. W., Stoching, C. R., Barbour, M. G., Rost, T. L., 1992; Botany, An Introduction to Plant Biology, 6 nd. Ed., John Wiley and Sons, Singapure.
- Erdoğan, S., Guher, H., 2005; The Rotifera Fauna of Gala Lake (Edirne-Turkey), Pakistan Journal of Biological Sciences 8 (11): 1579-1583.
- Foged, N., 1982; Diatoms in Bornholm, Denmark, J. Cramer, 174., Germany
- Geldiay, R. ve Balik, S., 1999, Turkiye Tatlısu Balıkları, E.U. Su Urunleri Fakultesi Yayınları No:46, Izmir, 532 s.
- Germain, H., 1981, Flora Des Diatomeés, Diatomophycées, 441 p., Paris.
- Gippel, C.J., Stewardson, M.J., (1998), Use of wetted perimeter in defining minimum environmental flows, Regulated Rivers: Research & Management, 14: 53–67.
- Gloer, P., Meier Brook, C., Ostermann O., 1992, Susswasser mollusken: Ein Bestimmung-sschlussel fur die Bundesrepublic Deutchland. Hamburg. 111 s.
- Guher, H., Kırgız, T., 2007, Gala Golu Milli Parkı'nda Makrofıtler İle Mıkrocrustacea (Cladocera, Copepoda) İliskisi Uzerine Bir Arastırma, *Trakya Univ J Sci, 8(2): 109-114*
- HIDRODİZAYN (2011), Alpaslan II Barajı ve HES Projesi Fizibilite Raporu, Alpaslan II Enerji Uretim Sanayi ve Ticaret AS.
- Huber Pestalozzi G (1941). *Das Phytoplankton des Suswassers, 2. Teil, 1. Hälfte, Chrysophyceen.* Stuttgart: E. Schweizerbart'sche Verlagsbuehhandlung.
- Huber Pestalozzi G (1955). *Das Phytoplankton des Suswassers, 4. Teil, Euglenophyceen.* Stuttgart: E. Schweizerbart'sche Verlagsbuehhandlung.
- Huber Pestalozzi G (1961*). Das Phytoplankton des Suswassers, 5. Teil, Chrysophyceae (Ordung:Volvocales).* Stuttgart: E. Schweizerbart'sche Verlagsbuehhandlung.

- Huber Pestalozzi G (1968). *Das Phytoplankton des Susswassers, 3. Teil, Cryptophyceae, Chloromonadophyceae, Dinophyceae.* Stuttgart: E. Schweizerbart'sche Verlagsbuehhandlung.
- Huber Pestalozzi G (1982). *Das Phytoplankton des Suswassers, 8. Teil, 1. Hälfte, Conjugatophyceae (Zynematales und Desmidiales).* Stuttgart: E. Schweizerbart'sche Verlagsbuehhandlung.
- Hustedt, 1930, Die Suswasser-Flora Mitteleuropas, 466 pp. Jena
- Hustedt, F., 1930, Die Suswasser-Flora Mitteleuropas, 446 p., Jena
- Hutchinson, G.E., 1967, A Tereatise on Limnology, Department of Yale University, 1115 P.
- Illies, J., 1978, *Limnofauna Europea*. Gustav Fisher Verlag. 532 s.
- Kiefer, F., 1978, Das Zooplankton der Binnengewasser E. Schweizerbart'sche Vertagsbuchhandlung, Stuttgart, 378 P.
- Kolisko, R. A., 1974, Plankton Rotifers Taxonomy and Biology, Biological Station Lunz of the Austrian Academy of Science, Stuttgart, 274 p.
- Komárek J (1983). *Das Phytoplankton des Suswassers, 7. Teil, 1. Hälfte, Chlorophyceae (Ordung: Chlorococcales).* Stuttgart: E. Schweizerbart'sche Verlagsbuehhandlung.
- Korsgaard, L., 2003, Environmental Flows in Integrated Water Resources Management: Linking Flows, Services and Values, Ph.D. Thesis, Institute of Environment & Resources, Technical University of Denmark, 60 p.
- Koste, W., 1978a, Die Radetiere Mitteleuropas 1. texband Berlin Stutgart 670 P.
- Koste, W., 1978b, Die Radertiere Mitteleuropas II. Tafelband Berlin Stutgart, 235 P.
- Krammer, K., Lange-Bertalot, H., 1986, Sußwasserflora von Mitteleuropa, Bacillariophyceae, Band 2/1, 1. Teil: Naviculaceae, Gustav Fischer Verlag, 876 pp., Stuttgart
- Krammer, K., Lange-Bertalot, H., 1988, Sußwasserflora von Mitteleuropa, Bacillariophyceae, Band 2/2, 2. Teil: Bacillariaceae. Epithemiaceae, Surirellaceae, Gustav Fischer Verlag, 584 pp., Stuttgart
- Krammer, K., Lange-Bertalot, H., 1991a, Sußwasserflora von Mitteleuropa, Bacillariophyceae, Band 2/3, 3. Teil: Centrales, Fragilariaceae, Gustav Fischer Verlag, 576 pp., Stuttgart.
- Krammer, K., Lange-Bertalot, H., 1991b, Sußwasserflora von Mitteleuropa, Bacillariophyceae, Band 2/4, 4. Teil: Achnanthaceae, Kritische Ergänzungen zu Navicula (Lineolatae) und Gomphonema Gesamtliteraturverzeichnis, Gustav Fischer Verlag, 436 pp., Stuttgart
- Kuru, M., 1975, Tigris – Fırat, Kura – Aras, Van Golu Ve Karadeniz Havzası Tatlısularında Yasayan Balıkların (Pisces) Sistematik Ve Zoocoğrafik Yonden İncelenmesi, Ataturk Univ. Yay. Docentlik Tezi, Erzurum.
- Kuttikova, A., 1970, Rotatoria (The Rotifer fauna of SSCB), 670 P.
- Limerinos, J.T., (1970) Determination of the Manning coefficient from measured bed roughness in natural channels: U.S. Geological Survey Water-Supply Paper 1898-B, 47 p.
- Ludwig, H.W., 1993, *Tiere in Bach, Fluss, Tumpel, See, Merkmale, biologie, Lebensraum Gefhrdung* BLV Bestimmungsbuch 255 s.
- Macan, T.T. 1982 *A guide to Freshwater Invertebrate Animals*. Longman. 118 p.
- Mann, K. H. (1962): Leeches (Hirudinea) Their Structure, Physiology, Ecology and Embryology. Pergamon Press. 201 p.
- Manning, R., 1891. On the flow of water in open channels and pipes. Transactions, Institution of CivilEngineers of Ireland 20:161-207.
- Mann, J., 2006, Instream Flow Methodologies: An Evaluation Of The Tennant Method For Higher Gradient Streams In The National Forest System Lands In The Western U.S., Ph.D. Thesis, Colorado State University Fort Collins, Colorado, 143 p.

- Needham, J.G., Needham P.R., 1962, *A guide to the study of Freshwater Biology*. San Francisco 107 p.
- Nikolskii, G. V., 1962. Special Ichthyology: Translated for Scientific Translations, Jerusalem, 583 p.
- Ozdemir, A.D., Karaca, O., Erkus, M.K., 2 007, Low flow calculation to maintain ecological balance in Streams, Proc. of International Congress On River Basin Management, 22-24 March 2007, Gloria Golf Resort Hotel Antalya, p.p. 402-412 (http://www.dsi.gov.tr/english/congress2007/chapter_2/32.pdf)
- Patrick, R., Reimer, C. W., 1966, The Diatoms of the United States, Vol. 1-2, Part I, Philadelphia.
- Pejler, B., 1962, Taxonomic notes on some planktonic-freswater rotifers, zoologiska Bidrag Fran Uppsalla, Bond 35, 302-319
- Pennak, R. W. (1978): Freshwater Invertebrates of the United States. John Wiley and Sons Publication. 803 p.
- Prescott, G.W., 1982, Algae of Western Great Lake Area, Brown Comp. Pub., 977 p.
- Pyrce, R., 2004., Hydrological Low Flow Indices and Their Uses, Watershed Science Centre, Trent University, Canada.
- Quigley, M., 1977, Invertebrates of Streams and Rivers. A key to Identification. London 874 p.
- Rider, M. de, 1981, Rotifera, Cercle Hydrobiologique de Bruxelles, 190 P.
- Round, F.E., 1973, The Biology of the Algae, Second Ed., Edward Arnold Pub., 278 pp., London
- Schlosser, J. I., 1985. Flow Regime, Juvenile Abundance and the Assemblage Structure of Stream Fishes. Ecology, 66 (5): 1484-1490.
- Sennika, S.A.B. (1943): Contributions to the Ecology and Biology of the Danish Freshwater Leeches (Hirudirea). Københaum Denmark 109 p.
- Sreenivasa, M. R., Duthie, H. C., 1973, Diatom Flora of the Grand River Ontario, Canada, Hydrobiologia, 42: 161-224.
- Sahin, Y. (1991): Turkiye Chironomidae Potomofaunası TUBİTAK Proje No: TBAG-869. Ankara 88 s.
- Tennant, D. L., 1976. Instream flow regimens for fish, wildlife, recreation and related environmental resources. Fisheries 1(4):6-10.
- Tharme, R. E., 2003. A global perspective on environmental flow assessment: Emerging trends in the development and application of environmental flow methodologies for rivers. River Research And Applications 19(5-6):397-441.
- Van Heurck, H., 1962, A Treatise on the Diatomaceae, J. Cramer, 555 p., London.
- Wetzel, R. G., 1983. Limnology. 2nd Edition, Saunders College Pub, USA, 767 p.
- Yaramaz, S., 1992. Su Kalitesi. Ege Universitesi Su Urunleri Yuksekokulu Yayın No: 14, Bornova, Izmir, 104 s.

APPENDICES

APPENDIX I. METHODS FOR ENVIRONMENTAL FLOW DETERMINATION

Determination of the “Optimum Environmental Flow Rate (QEF_e)” is important in terms of identifying the impact of HEPP projects on an ecosystem. The methods applied for determination of the QEF_e value are listed below from the simplest to the most complex, respectively (Pyrce, 2004):

- Hydrological Methods
- Hydraulic Ratio Methods
- Habitat Modeeling Methods
- Holistic Methods

In general, “Hydrological Methods” are used in planning studies for water-use within basins at national level, “Hydraulic Ratio Methods” are used in planning and impact assessment studies at basin level, “Habitat Modelling Methods” are used in impact assessment studies and “Holistic Methods” are used in river restoration studies.

Data required for the above-mentioned QEF_e determination methods increases in the given order. While hydrological methods are applied within desktop studies based on existing or estimated river flow values, for the application of other methods data based on field studies are required. For the “Hydraulic Ratio Method” the data can be acquired in rather short period of time. On the other hand, for “Habitat Modelling” and “Holistic” methods, hydraulic, hydrobiological and ecological observations of one year or longer periods of time are required. According to a recent assessment, 207 different methods are applied in 44 different countries for determination of QEF_e (Tharme, 2003). These methods have various strengths and weaknesses depending on where they are applied (Mann, 2003; Korsgaard, 2006)

In this study, considering the quality and quantity of existing data, Montana hydrological method (Tennant, 1976) and Wetted Perimeter hydraulic ratio method have been applied. In addition, since evaluations made for determination of the QEF_e enabled hydrobiological, ecological and hydraulic field data to be taken into consideration, they were carried out applying Wetted Perimeter method. Besides the mentioned methods, information about other methods that were used for determination of QEF_e are given below:

I.1. Montana Method

Montana Method was developed by Tennant (1976) when in 1970s water structures in the USA were densely constructed on streams and negative impacts of such projects were observed widely. The method is based on the “generalized flow rate ratio chart”, which was created according to the relation between river hydraulic observations (eg. Current rate, riverbed depth) made in Montana State of the USA (see Table I.1). This chart, in principle, was formed with generalization of the results obtained through application of the Wetted Perimeter Method.

Table I.1. Flow Rate Ratios for Fish, Wildlife and Recration According to Montana (Tennant, 1976) Method

Verbal Description of General Flow Conditions	Suggested Flow Regime Annual Average Flow Percentage	Suggested Flow Regime Annual Average Flow Percentage
	October-March Period	**April-September Period**
Overflow or Maximum Water Level	200%	200%
Optimum Water Level	%60-%100	%60-%100
Quite Good	40%	60%
Excellent	30%	50%
Good	20%	40%
Medium or Declining	10%	30%
Weak or Minimum	10%	10%
Extreme Decline	<%10	<%10

The percentage values of Montana method annual average flow (AAF) presented in Table I.1, are defined in verbal terms for the aquatic habitat in the related rows. For example, in a river where the AAF value is 100 m^3/sec, in case the flow rate for October-March period is 30 m^3/s or higher, and for April-September period 50 m^3/s, then the conditions for the aquatic habitat is considered as “excellent”. In Montana Method, considering the rainy and dry months in a year, and water demand of the aquatic habitat, October-March and April-September periods are assessed separately. The major weaknesses of the method arise from the fact that it does not consider variations in dry and rainy months in other parts of the world, and different instream demand (eg. Flow rate, water depth) of different species. It has been determined by another assessment carried out by Mann (2003) covering other states of the USA, flow rates produced by the method have been shown to describe the QEF_e values for related habitats correctly.

I.2. Seven-Day Low Flow Method

In this method, existing historical flow data is used to determine the average of the lowest flow rates ((7Q) QCA_e) observed for 7 days. However, there is no consensus on how long of a period the 7Q value that is used to determine the CA value should depend on. Such average values can be identified for observation periods of different durations like 1 (7Q1), 2 (7Q2), 5 (7Q5), 10 (7Q10), 20 (7Q20) ya da 25 (7Q25) years (Pyrce, 2004). One of the major weakneses of the method is that it is questionable whether the cross-section where the flow data is obtained from is representatiove of the other sections of a stream. In addition, it is open to debate how the 7Q flow, which is used independent of the observation period, is related to other requirements of the aquatic habitat (like current rate and water depth). Another limitation is that the long-term observations that 7Q flow rate depends on, differ from dry and rainy seasons.

I.3. Flow Duration Curve Method

Flow duration curve method is a statistical approach to determine the cumulative frequency distribution of flow rate values which pass through the riverbed within a pre-determined percentage of time, which is defined based on long-term daily flow rate data. In this method, the minimum flow rate value is determined that takes place within a selected percentage of a certain time in a year that would form a flow rate duration curve (Smakhtin, 2001). Although in practice Q90 ve Q95 values are used commonly, Q75, Q97 and other values are also used. The weaknesses of the Seven-Day Low Flow Method are also valid for this method.

I.4. Aquatic Base Flow Method

In this method August average flow rate is selected as QCA_e, assuming that the flow conditions in this season provide the minimum conditions for the aquatic habitat. Since there area no long-term flow rate data for the month of August, based oon observations carried out in New England, USA, within existing cross-sections for each 2.5 km^2 section roughly QCA_e amount at a level of 14 l/s is suggested.

For spawning and migration seasons of fish, the fall QCA_e amount is suggested as ~30 l/s_2.5 km^2, and for winter-spring months it is suggested as ~60 l/s_2.5 km^2. Like the Seven-Day Flow and Flow Duration Curve methods, this method does not consider important variables for the aquatic habitat such as flow rate and water depth. The validity of this method outside New England, USA, where it was developed, is debatable.

I.5. Instream Flow Incremental Method

Instram Flow Incremental Method is an approach that is based on extensive and lon-term hydrobiological and ecological observations in the riverbed. The method requires observation of representative fish densities at different flow condition for the duration of a year. Then based on the minimum habitat abundance, the QCA_e is determined. The major weakness of this method is the fact that it requires long-term and frequently collected aquatic habitat data.

I.6. Wetted Perimeter Method

The reason for Wetted Perimeter Method to be applied in determinin the QCA_e vaue is to identify the minimum water depth and/or minimum flow rate value that corresponds to the minimum current rate. Wetted perimeter method is based on the Manning (1892) equilibrium.

$$Q = \frac{1}{n} \bullet A \bullet R^{\frac{2}{3}} \bullet S^{\frac{1}{2}} \qquad (1)$$

Here,

Q (m^3/s) represents the flow rate at the river bed, n is the Manning roughness coefficient (dimensionless), A (m^2) is the river cross-section that is perpendicular to the current, R (m) is the hydraulic radius and S (dimensionless) is the water surface inclination.

Hydraulic radius (R)

$$R = \frac{A}{P} \qquad (2)$$

is defined as above, and P (wetted perimeter, m) represents the base length that is perpendicular to the current.

In a stream, water depth, flow area, riverbed base characteristics that determine the n coefficient, R and S values change with changing flow rates. Therefore, it is required to carefully determine the impact of changing current conditions, in accordance with changing flow rate and depth, on these variables. If not, than flow rate, water depth and current rate would not meet the values required for the aquatic habitat.

The most effective variable on current rate and flow, which are calculated by the Manning equilibrium, is the roughness coefficient. With increasing flow rate (also depth) the stream bed widens, which changes the characteristics of the riverbed (eg. Clay, sand, gravel percentage distribution). In some cases instream material clustering changes the stream extension (eg. Bending, meandering formation). In some other cases it could also include the riverbed vegetation. All of these variables might cause a change in n coefficient value which corresponds to riverbed cross-sections for different flow rates.

Two of the main approaches that are used to determine the n coefficient values valid for streams of different character or for varying depths are; i)use of album, or ii)use of correction factors based on variables affecting the n value. In Album Use approach, a photogprah that is similar to the studied stream is picked out from a photograph album. The assumption here is that the n value calculated for the example in the photograph is also valid for the stream in question. In this study the approach suggested by Arcement and Schneider (2011) is used in determining the corrected n values (Appendix 1).

In this study, a hydraulic model, which is based on the Manning equilibrium was also utilized. The idea here was to determine the relationship between the flow rate and water depth and current rate. The main inputs for the model are; i) data on stream cross-section geometry that is perpendicular to the current, ii) Manning roughness coefficient values (n) determined for the lowest and highest water depth, and iii) water surface inclination of the cross-section defined by the topographic maps and field observations.

The model calculates the water depth (m), current area (m^2), wetted perimeter (W_P, m), water surface width (m), hydraulic radius (m), hydraulic depth (m), water surface inclination (m/m), average current rate (m/s), and flow rate (m^3/s). The n values to be used for different depths are determined by linear interpolation of th ne values defined for the minimum and maximum water levels. The accuracy of the calculations are controlled through comparing the current rate measured at the maximum depth of the related cross-section with the average rate determined by the model .In order to achieve an overlap the input variable values are changed within observation/calculation error limits.

In determinin the QCA_e amount using the Wetted Perimeter Method, the relationship between the Wetted Perimeter (P, y axis) and flow rate (Q, x axis) is utilized. According to this approach, the Q value that corresponds to the breaking point of the curve within the P-Q graph is accepted as the QCA_e value. If the breaking point is chosen by manually, QCA_e values corresponding to different breaking points determined by different people (subjectively) can vary up to five times (eg. Gippel and Stewardson, 1998). In order to remove the problems resulting from personal judgement disperancies, P-Q curve of the streambed should be defined as a function, and the derivative of this function should be taken for the calculations.

P-Q curves are consistent with exponential functions for triange shaped streambeds, and logarithmic functions for rectangular streambeds. These functions are as the following, a and b being the related coefficients:

$$P = Q^b \tag{3}$$

$$P = a \bullet \ln(Q) + 1 \tag{4}$$

The primary derivatives of the above functions that yield the slope of the functions are as the following:

$$\frac{dy}{dx} = b \bullet Q^{b-1} \tag{5}$$

Ve

$$\frac{dy}{dx} = \frac{a}{Q} \tag{6}$$

On the other hand, depending on the type of the P-Q curve, the proposition that the flow rates determined by Equilibrium 5 or Equilibrium 6 correspond to minimum QCA_e amount is an assumption. Since this assumption does not consider variables like current rate and water depth, whether the determined QCA_e value meets the aquatic habitat requirements is under debate.

APPENDIX II. MANNING ROUGHNESS COEFFICIENT CORRECTION APPROACH (Arcement and Schneider, 2011)

Correction Factors for Riverbed n Value

Some n (nb) value can be selected from Table II.1 for linear riverbeds that have almost uniform cross-section or can be determined by Limeniros (1970) equilibrium. Riverbed irregularities, changes in direction, impediments, vegetation and meandering increase roughness in the riverbed. Therefore, the value should be corrected adding values of related factors to the nb value.

Bed Irregularity (n1): In the event that the bed width to depth ratio is low, roughness due to corrdoded or carved slopes, projections towards the riverbed and tree roots could cause an important increase in the nb value.

Variation in Riverbed Cross-Section (n2): The continuous enlargement and contraction of the riverbed cross-section, sudden inflections, narrowing, the flow density continuously being diverted from one slope to another increase the roughness (n) value.

Impediments (n3): Tree trucks, boulders, debris, jetty or bridge piers change the form of the riverbed flow and increase roughness. The amount of increase increases with the density, magnitude, form and in-between-distance of these impediments. The impact of these impediments on roughness is based on the flow rate. As the flow rate increases the impact area of the impediment increases.

Vegetation (n4): The impact of plants on rougness is based on flow depth, the size of the area of the wetted perimeter covered by plants, plant density under water level, the amount of plant repose by the flow and plants' form of orientation towards the flow.

Meandering (m): Meandering level is based on the ration of the riverbed length to the length of the valley the bed is located at. Meandering is considered as "low" when this ratio is between 1.0 and 1.2, "significant" when the ratio is between 1.2 and 1.5, and "dense" when it is higher than 1.5. Meandering can increase the nb value up to 30%.

Riverbed n Values

The most important factor affecting the riverbed n value are: 1. The type and size of geological materials that form the riverbed and its slopes and 2. Form of the riverbed. According to the approach developed by Cowan (1956) the n value which considers the effect of these factors is determined according to the following equilibrium:

$$n = (nb + n1 + n2 + n3 + n4) \bullet m$$

Here,

nb, is the linear, uniform and softly displacive bed base n value which has been formed in the natural geological material.
n1, is the correction factor that considers the bed surface irregularity,

n2, is the correction factor that considers the form and size change in the riverbed cross-section,

n3, is the correction factor that considers the flow impediments in the riverbed,

n4, is the correction factor that considers the plants and flow conditions in the riverbed,

m, is the correction factor that considers the meandering level of the bed.

In implementing the equilibrium, for those n1, n2, n3 and n4 factors that are considered as insignificant, zero (0) value could be used.

Example:

For a linear, uniform and softly displacive river bed, which is composed of gravel size of 2 mm-64 mm, the average base n value was selected as nb=0.040. The riverbed irregularity is at medium level (n1=0.008). The riverbed form is composed of narrow and wide section that change infrequently (n2=0.003). Less than 15% of the riverbed cross-section includes impediments (n3=0.010). The vegetation in the riverbed is limited (n4=0.05). The meandering level at the riverbed is insignificant (m=1).

In this case, for the above-mentioned riverbed the Manning n value is n=(0.04 + 0.008 + 0.003 + 0.01 + 0.05) x 1 = 0.111.

Another approach used for determining base n value is the following Limerinos (1970) equilibrium, which is based on riverbed properties observed in-situ:

$$nb = \frac{0.8204 \bullet R^{\frac{1}{6}}}{1.16 + 20 \bullet \log\left(\frac{R}{d84}\right)}$$

Here,

R, is the hydraulic radius (m); d84, is 84% of the grain-size of the grains (from finest to the most coarse) that formt the riverbed material (m). This value is usually determined as a result of 100 different field observations.

Table II.1. Base Roughness Coefficient (nb) Values for Stable-Smooth Riverbeds

Riverbed Material	Riverbed Material Median Size (mm)	Nb Value Range
Firm Soil	--	0.025-0.032
Coarse Sand	1-2	0.026-0.035
Gravel	2-64	0.028-0.035
Cobble	64-256	0.030-0.050
Boulder	>256	0.040-0.070

Table II.2. n1 Correction Factor for Riverbed Irregularities

Level of Irregularity	n Value Range	Explanation
Soft	0	Refers to the condition where the lowest resistance to the flow at the related riverbed is observed.
Low	0.001- .005	Refers to riverbed conditions where the bedrock is organized through excavation/screening, and the slopes show limited erosion.
Medium	0.006- .010	Refers to riverbed conditions where the bedrock is organized through excavation/screening, constitutes medium-high levels of riverbed irregularities, and slopes show mid-level erosion.
High	0.011- .020	Includes riverbed surfaces that are disorganized/formless, slopes are highly eroded.

Table II.3. n2 Correction Factor for Riverbed Cross-Section Form and Size Variations

Riverbed Cross-Section Variation	n Value Range	Explanation
Soft	0	The size and form of the riverbed changes softly.
Rarely Varying	0.001- 0.005	Riverbed cross-section rarely narrows and widens, or the weight of the flow rarely varies between slopes.
Frequently Varying	0.010- 0.015	Riverbed cross-section frequently narrows and widens, or the weight of the flow frequently varies between slopes.

Table II.4. n3 Correction Factor for Impediments

Impediment Impact	n Value Range	Explanation
Negligible	0.000-0.004	Impediments that cover less than 5% of the river cross section area, such as debris, tree roots, branches, posts or boulders.
Weak	0.005-0.015	Impediments that cover less than 15% of the river cross section area, such as debris, tree root, branches, posts or boulders, whose impacts on river flow does not reach one another. Depending on the impediment surface being soft or angular, low or high n value could be selected.
Significant	0.020-0.030	Impediments that cover 15-50% of the river cross section area, such as as debris, tree roots, branches, posts or boulders, whose impact on flow reachs the other impediment, and limits river flow in that section.
Strong	0.040-0.050	Impediments that are close to one another that they cover more than 50% of the river cross section area, or caouse turbulent flow in a large section of the river flow.

Table II.5. n4 Correction Factor for Plants and Flow Conditions

Amount of Plant	n Value Range	Explanation
Low	0.002-0.010	Dense turff grass or wild grass whose height is less than half the water depth in the river bed; salix, sagittaria and populous seedlings with flexible trunks whose height is lower than one third of the average water depth at the riverbed.
Medium	0.010-0.025	Medium density turff grass, wild grass. Average water depth that is two or three times the tree seedlings, or salix like 1-2 year-old plants, insignificant vegetation at the riverbed, hydraulic radius that is greater than 0.6 m.
High	0.025-0.050	Average water depth at the riverbed equals turff grass height, 8-10 year-old salix and populous tress mixed with bushes, hydraulic radius greater than 0.6, no significant plants at the riverbed foundation.
Very High	0.050-0.100	Average water depth half the height of riverbed turff grass, wild grass at the hills mixed with 1 year-old salix tress, or dense reeds and wild grass mixed with trees at the riverbed foundation.

Table II.6. Correction Factor for m Meandering

Meandering Level	m Value	Explanation
Low	1	Riverbed length to valley length raito is between 1.0 and 1.2
Significant	1.15	Riverbed length to valley length raito is between 1.2 and 1.5
Dense	1.3	Riverbed length to valley length raito is greater than 1.5

APPENDIX III. FLOW DATA USED IN THE STUDY

Table III.1. Alpaslan II Dam Site Monthly Average Natural Flow Rates (m^3/s) and Related Statistics

WATER YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	ANN.AVE.
1970	56.830	60.970	62.130	62.640	76.300	189.400	428.600	199.125	53.693	32.574	29.845	29.651	106.813
1971	40.095	46.700	44.200	29.800	33.500	158.000	255.000	247.269	84.334	27.908	25.117	22.642	84.547
1972	36.975	43.050	47.990	36.370	36.910	87.010	560.100	426.069	202.534	62.028	39.277	32.222	134.211
1973	44.115	69.660	45.690	29.970	49.770	104.100	499.400	335.469	109.134	44.708	24.887	24.582	115.124
1974	39.603	48.990	34.720	34.780	58.640	259.500	388.500	324.867	108.056	36.680	38.375	46.155	118.239
1975	33.073	44.210	44.060	34.030	26.690	63.150	487.300	399.667	122.256	39.440	25.615	27.715	112.267
1976	40.160	42.680	37.010	44.750	59.210	100.400	754.500	634.095	271.927	83.332	39.747	35.182	178.583
1977	60.290	65.900	58.890	45.920	66.040	184.000	529.400	431.995	178.827	53.332	33.637	31.102	144.944
1978	38.880	43.030	51.020	113.200	80.770	140.500	614.200	495.695	232.527	78.662	37.997	33.862	163.362
1979	42.930	47.920	48.770	54.430	74.060	122.700	320.000	269.895	181.327	61.712	28.247	22.082	106.173
1980	53.230	97.580	74.920	44.840	36.700	153.800	606.700	368.795	108.127	44.962	37.267	31.952	138.239
1981	41.430	53.920	45.500	32.010	53.770	165.300	347.400	317.795	189.827	94.152	33.367	28.972	116.954
1982	45.980	71.660	58.580	64.010	65.000	90.040	753.600	558.395	225.427	63.072	43.377	36.042	172.932
1983	42.790	45.640	29.260	25.080	29.290	85.780	285.500	365.495	141.927	48.912	32.577	32.032	97.024
1984	39.600	93.360	66.820	47.140	47.440	236.200	369.000	384.595	174.127	68.722	35.267	32.412	132.890
1985	36.480	47.100	39.480	42.450	39.320	78.060	654.500	270.895	65.157	32.582	27.267	24.312	113.134
1986	35.160	40.570	43.320	44.770	55.180	103.900	381.800	247.295	155.727	47.162	25.897	25.852	100.553
1987	48.590	67.390	44.940	44.480	66.890	63.070	759.700	825.395	242.427	66.982	41.847	35.572	192.274
1988	43.510	82.470	100.300	61.760	85.830	192.100	1036.000	1040.995	396.627	146.682	89.767	69.682	278.810
1989	74.178	101.576	99.517	49.219	46.714	199.385	180.413	66.888	25.312	18.095	15.978	17.716	74.583
1990	63.037	141.933	189.665	59.502	93.079	279.472	430.111	322.100	130.296	40.961	21.480	19.142	149.231
1991	30.127	70.314	65.754	34.890	54.030	305.619	517.645	274.354	91.076	34.993	22.332	19.654	126.732
1992	38.198	66.335	55.523	44.041	43.841	83.943	565.391	490.346	263.301	68.358	31.370	25.281	147.994
1993	38.086	55.820	75.417	55.693	60.680	134.530	822.307	766.648	256.637	70.624	40.077	31.567	200.674
1994	37.006	65.767	58.933	72.575	69.206	241.958	531.855	298.287	75.886	40.101	26.606	23.893	128.506
1995	41.823	69.700	72.200	93.100	82.100	148.000	835.000	639.100	245.803	88.069	47.426	44.830	200.596
1996	66.623	87.300	64.900	57.400	72.600	140.000	476.000	456.100	110.803	46.869	30.426	33.530	136.879

Table III.1. Alpaslan II Dam Site Monthly Average Natural Flow Rates (m^3/s) and Related Statistics (Continued)

WATER YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	ANN.AVE.
1997	54.223	60.000	86.900	68.100	46.000	60.700	465.000	462.100	122.803	50.469	31.026	30.930	128.188
1998	54.023	50.200	41.500	42.500	46.600	150.000	542.000	356.100	157.803	47.669	32.426	28.630	129.121
1999	33.323	42.500	69.200	45.600	52.800	111.000	452.000	247.100	79.903	43.469	26.326	25.030	102.354
2000	32.623	37.600	38.400	37.000	32.700	54.000	395.000	202.100	51.103	26.069	17.146	14.530	78.189
2001	25.923	32.000	35.200	30.600	34.800	153.000	250.000	219.100	68.003	29.369	20.326	15.230	76.129
2002	25.323	30.100	48.200	45.100	45.000	236.000	650.000	465.100	195.803	83.069	41.126	30.330	157.929
2003	45.623	51.900	42.300	54.900	52.400	73.300	824.000	461.100	181.803	58.969	37.526	37.130	160.079
2004	59.214	154.707	82.885	59.737	73.036	455.122	399.691	589.271	273.164	84.493	46.882	38.646	193.071
2005	46.520	58.256	51.523	59.737	63.657	151.956	514.660	363.763	146.235	54.251	40.087	38.221	132.406
2006	48.013	51.312	56.377	47.790	68.618	220.654	729.552	440.675	85.278	58.732	32.993	29.811	155.817
2007	52.493	76.775	38.829	37.709	37.698	133.289	350.309	717.333	150.865	59.852	46.882	34.247	144.690
2008	43.778	62.575	58.308	49.000	53.620	153.324	516.089	411.685	153.246	55.134	33.563	30.047	135.031
Average	44.356	63.576	59.209	49.657	55.654	155.443	525.083	420.335	156.644	56.236	34.138	30.524	**137.571**
Standard Deviation	10.877	26.492	27.515	17.226	16.785	81.032	188.054	191.994	78.325	23.805	12.190	9.628	40.526
Median	42.790	58.256	51.523	45.600	53.770	148.000	514.660	384.595	150.865	53.332	32.993	30.330	132.890
Minimum	25.323	30.100	29.260	25.080	26.690	54.000	180.413	66.888	25.312	18.095	15.978	14.530	74.583
Maximum	74.178	154.707	189.665	113.200	93.079	455.122	1036.000	1040.995	396.627	146.682	89.767	69.682	278.810

APP 19

LIST OF FLORA AND FAUNA SPECIES

List Terrestrial Flora and Fauna

Legend for Flora and Fauna Tables

BERN CONVENTION	
Annex I: Strictly Protected Flora Species	
Annex II: Strictly Protected Fauna Species	
Annex III: Protected Fauna Species	
IUCN (International Union for Conservation of Nature) Red List of Threatened Species) *(IUCN 2009. IUCN Red List of Threatened Species. Version 2010.1 <www.iucnredlist.org>. Updating; March 11, 2010.)*	
1994 (Version 2.3)	**2001 (Version 3.1)**
EX: Extinct	**EX:** Extinct
EW: Extinct in the wild	**EW:** Extinct in the wild
CR: Critically endangered	**CR:** Critically endangered
EN: Endangered	**EN:** Endangered
VU: Vulnerable	**VU:** Vulnerable
LR: Lower risk	**NT:** Near Threatened
cd: conservation dependent	**LC:** Least Concern
nt: near threatened	**DD:** Data deficient
lc: least concern	**NE**: Not evaluated
DD: Data deficient	
NE: Not evaluated	
CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora)	
Appendix I: Bu türlerin nesli tehlike altındadır ve ticaretleri yasaktır.	
Appendix II: Türlerin nesilleri mutlak olarak tükenme tehlikesiyle karşı karşıya olmamakla birlikte, nesillerinin devamıyla bağdaşmayan kullanımlarını önlemek amacıyla ticaretleri belirli esaslara bağlanmıştır.	
Appendix III: Taraflardan herhangi birinin aşırı kullanımını önlemek veya kısıtlamak amacıyla kendi yetki alanında düzenlemeye tabi tutulan ve ticaretinin denetime alınmasında diğer taraflar ile işbirliğine ihtiyaç duyduğu belirtilen bütün	
NATIONAL HUNTING STATUS (According to Central Hunting Commission, 2009-2010) (for fauna species)	
Appendix I: Wildlife species which are protected by Ministry of Environment and Forestry	
Appendix II: Game animals which are protected by Central Hunting Commission	
Appendix III: Game animals which are allowed to be hunted in predefined seasons by Central Hunting Commission	
NATIONAL THREAT CATEGORIES *(for bird species)* *(Kiziroğlu,İ., 2009. The Pocket Book for Birds of Türkiye, ISBN: 975-7460-01-X, Ankamat Matbaası, Ankara, 564*	
A.1.2. CR) Critically endangered and breeding species in Turkey	
A.2. **(EN)** Endangered and breeding species in Turkey	
A.3. (VU) Vulnerable and breeding species in Turkey	
A.3.1. (D) Declining, vulnerable and breeding species in Turkey	
A.4. (NT) Near threatened. Breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey	
A.5. (LC) Least Concern. Breeding species that are widespread in Turkey	
A.6. (DD) Data Defficient. Breeding species on which there is deficient information in Turkey	
A.7. (NE) Not Evaluated. Breeding species which have not been evaluated in Turkey	
B.1.2. (CR) Critically endangered and non-breeding species in Turkey	
B.2. **(EN)** Endangered and non-breeding species in Turkey	
B.3. (VU) Vulnerable and non-breeding species in Turkey	
B.3.1. (D) Declining, vulnerable and non-breeding species in Turkey	
B.4. (NT) Near threatened, non-breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey	
B.5. (LC) Least Concern, non-breeding species that are widespread in Turkey	
B.6. (DD) Data Defficient, non-breeding species on which there is deficient information in Turkey	
B.7. (NE) Not Evaluated, non-breeding species which have not been evaluated in Turkey	
ENDEMISM (for flora species)	

R: Regional Endemic
L: Local Endemic

Legend for Flora and Fauna Tables (Continued 1)

NATIONAL THREAT CATEGORIES (for fauna species) *(Demirsoy, A. 2002. General Zoogeography and Turkey's Zoogeography, Meteksan Publications Ankara, ISBN:975-7746-33-9)*
E: Endangered
Ex : Extinct
I : In determinate
K: Insufficient known
nt: Widespread,abundant
O: Out of danger
R: Rare
V: Vulnerable
NATIONAL THREAT CATEGORIES (for flora species, According to IUCN Criteria 2001 Version 3.1) *Ekim, T. et al. 2000.* Red data book of Turkish plants*. Turkish Association fort he Conservation of Nature. Pub. No:18.*
EX: Extinct
EW: Extinct in the Wild
CR: Critically Endangered
EN: Endangered
VU: Vulnerable
NT: Near Threatened
LC: Least Concern
DD: Data Deficient
NE: Not Evaluated
RELATIVE ABUNDANCE (observational)
1: Very Rare
2: Rare
3: Moderate
4: Abundant
5: Very Abundant
HABITAT (for flora species)
1: Steppe
2: Riparian, humid areas
3: Oak forest
4: Agricultural land
DATA SOURCE (for fauna species)
G: O: Direct observation in the field
L: L: Literature
A: A: Public surveys, interviews and questionnaires
H: H: Habitat suitability

Table 19.1. List of Flora Species Identified on the Study Area

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP	1	2	3	4	1	2	3	4	5
PTERIDOPHYTA																				
EQUISETACEAE	1	*Equisetum ramosissimum* Desf.	British horsetail	Widespread									x			x				
SPERMATOPHYTA																				
GYMNOSPERMAE																				
PINACEAE	2	*Pinus nigra* Arn. Subsp. *pallasiana*	Black pine	Widespread											x	x				
ANGIOSPERMAE																				
DICOYLEDONES																				
RANUNCULACEAE	3	*Consolida orientalis* (Gay) Schröd.	Oriental knight's spur	Widespread								x				x				
	4	*Clematis orientalis* L.	-	Widespread								x				x				
	5	*Nigella segetalis* Bieb.	-	Widespread								x								
	6	*Ranunculus repens* L.	Creeping buttercup	Widespread									x				x			
	7	*Ranunculus constantinopolitanus* (DC.) d'Urv.	Buttercup	Widespread									x				x			
	8	*Ranunculus ficaria* L. Subsp. *ficariiformis* Rouy & Fouc.	Lesser celandine	Widespread								x				x				
	9	*Thalictrum flavum* L.	Common (yellow) meadow-rue	Avrupa-Sibirya									x			x				
	10	*Ceratocephalus falcatus* (L.) Pers.	Field ranunculus	Widespread								x					x			
PAPAVERACEAE	11	*Glaucium grandiflorum* Boiss. & Huet. Var. *grandiflorum*	-	Widespread								x					x			
	12	*Papaver rhoeas* L.	Common poppy	Widespread								x					x			
	13	*Fumaria vaillantii* Lois.	Earthsmoke	Widespread								x				x				
CRUCIFERAE	14	*Descurainia sophia* (L.)	Herb sophia	Widespread									x				x			
	15	*Hirschfeldia incana* (L.) Lag.-Foss.	Meditarranean mustard	Widespread								x					x			
	16	*Alyssum desertorum* Stapf. Var. *desertorum*	Desert madwort	Widespread								x				x				
	17	*Alyssum filiforme* Nyar	-	Widespread		x	LC					x				x				
	18	*Camelina rumelica* Vel.	Graceful false flax	Widespread								x				x				
	19	*Isatis glauca* Aucher ex Boiss. Subsp. *glauca*	-	İran-Turan								x				x				
	20	*Lepidium perfoliatum* L.	Clasping pepperweed	Widespread										x	x	x				
	21	*Leontice leontopetalum* L. subsp. *ewersmannii* (Bunge) Coode	-	Widespread										x		x				
	22	*Chorispora tenella* (Pall.) DC.	Purple (blue) mustard	Widespread											x	x				
	23	*Crambe orientalis* L. var. *orientalis*	-	İran-Turan								x				x				
	24	*Helianthemum salicifolium* (L.) Miller	Willowleaf frostweed	Widespread								x				x				
	25	*Cardaria draba* (L.) Desv. subsp. *draba*	Whitetop	Widespread									x				x			
	26	*Eruca sativa* Miller	Arugula	Widespread										x			x			
	27	*Bunias erucago* L.	Southernwarty-cabbage	Widespread										x		x				
	28	*Thlaspi perfolatum* L.	Cotswold pennycress	Widespread										x		x				
	29	*Capsella bursa-pastoris* (L.) Medik.	Sepherd's purse	Widespread										x			x			
	30	*Sisymbrium officinale* (L.) Scop.	Hedge mustard	Widespread										x			x			
RESEDACEAE	31	*Reseda lutea* L. var. *lutea*	Wild mignotte	Widespread										x			x			
CARYOPHYLLACEAE	32	*Minuartia hamata* (Hausskn.) Mattf.	Cumberland sandwort	Widespread										x		x				
	33	*Bufonia calyculata* Boiss. & Bal.	-	Widespread		x	LC					x				x				
	34	*Cerastium dichotomum* L. subsp. *dichotomum*	Forked chickweed	Widespread								x				x				
	35	*Dianthus cyri* Fisch. & Mey.	-	İran-Turan								x				x				
	36	*Gypsophila ruscifolia* Boiss.	-	İran-Turan								x				x				
	37	*Saponaria tridentata* Boiss.	-	İran-Turan								x				x				
	38	*Silene pungens* Boiss.	-	Widespread								x				x				
	39	*Holosteum umbellatum* L. var. *umbellatum*	Jagged chickweed	Widespread								x					x			
	40	*Velezia rigida* L.	Velezia	Widespread								x					x			

Table 19.1. List of Flora Species Identified on the Study Area (Continued)

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP 3	1	2	3	4	1	2	3	4	5
	41	*Silene vulgaris (Moenc) Garcke var. vulgaris*	Bladder campion	Widespread								x					x			
ILLECEBRACEAE	42	*Herniaria incana* Lam.	Gray rupturewort	Widespread								x				x				
POLYGONACEAE	43	*Polygonum cognatum* Meissn.	Knotweed	Widespread								x					x			
	44	*Polygonum arenastrum* Bor.	Common knotweed	Widespread										x		x				
	45	*Polygonum lapathifolium* L.	Curlytop knotweed	Widespread									x			x				
	46	*Polygonum pulchellum* Lois.	-	Widespread										x		x				
	47	*Rumex alpinus* L.	-	Widespread									x			x				
	48	*Rumex scutatus* L.	Buckler-leaved sorrel	Widespread								x					x			
AMARANTHACEAE	49	*Amaranthus albus* L.	Prostrate pigweed	Widespread									x				x			
GUTTIFERAE	50	*Hypericum triquetrifolium* Turra	Tangled hypericum	Mediterranean										x			x			
	51	*Hypericum perforatum* L.	St.John's wort	Widespread										x		x				
GERANIACEAE	52	*Erodium cicutarium* (L.) L. Herit subsp. *cicutarium*	Redstem filaree	Widespread										x		x				
MALVACEAE	53	*Malva neglecta* Wallr.	Common mallow	Widespread											x	x				
	54	*Althea officinalis* L.	Marshmallow	Widespread								x				x				
	55	*Alcea hohenackeri* (Boiss.& Huet) Boiss.	-	Widespread								x				x				
CHENOPODIACEAE	56	*Chenopodium foliosum* (Moench) Aschers	Leafy goosefoot	Widespread											x	x				
	57	*Salsola ruthenica* Iljin	Prickly Russian thistle	Widespread											x		x			
TAMARICACERAE	58	*Tamarix smyrnensis* Bunge	Salt cedar	Widespread									x				x			
RHAMNACEAE	59	*Rhamnus petiolaris* Boiss.	Buckthorn	İran-Turan		x	LC						x			x				
ACERACEAE	60	*Acer tataricum* L.	Tatar maple	Widespread									x	x		x				
LEGUMINOSAE	61	*Astragalus angustifolius* C. Koch subsp. *angustifolius*	Milk vetch	İran-Turan								x				x				
	62	*Astragalus amblolepis* Fischer	-	İran-Turan								x					x			
	63	*Astragalus eriocephalus* Willd. Subsp. *elongatus* Chamb. & Matthews	Thorny milkvetch	İran-Turan		x	LC					x					x			
	64	*Astragalus gummifer* Lab.	Goat's-thorn	İran-Turan								x					x			
	65	*Astragalus oleifolius* DC.	-	İran-Turan								x					x			
	66	*Coronilla orientalis* Miller var. *orientalis*	-	Widespread								x					x			
	67	*Robinia pseudoacacia* L.	Black locust	Widespread									x			x				
	68	*Glycyrrhiza glabra* L. var. *glandufera* (Waldst. & Kit.) Boiss.	Liquorice	Widespread									x				x			
	69	*Lotus corniculatus* L. var. *corniculatus*	Bird's-foot Trefoil	Widespread									x				x			
	70	*Ononis spinosa* L. Subsp. *leiosperma* (Boiss.) Sirj.	Spiny restharrow	Widespread								x					x			
	71	*Trigonella monantha* C.A. Meyer subsp. *Monantha*	Sweet trefoil	İran-Turan								x				x				
	72	*Vicia cracca* L. subsp. *stenophylla* Vel.	Tufted Vetch	Widespread								x				x				
	73	*Vicia sericocarpa* Fenzl var. *sericocarpa*	-	Widespread								x				x				
	74	*Trifolium campestre* Schreb.	Low hop clover	Widespread								x					x			
	75	*Trifolium physodes* Stev. ex Bieb. *pyhsodes*	Clover	Widespread								x					x			
	76	*Trifolium arvense* L. subsp. *arvense*	Haresfoot clover	Widespread								x					x			
	77	*Trifolium diffusum* Ehrh.	Diffuse Clover	Widespread								x					x			
	78	*Medicago lupulina* L.	Meddick	Widespread								x					x			

Table 19.1. List of Flora Species Identified on the Study Area (Continued)

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP 3	1	2	3	4	1	2	3	4	5
	79	*Medicago x varia* Martyn	Hybrid lucerne	Widespread								x					x			
	80	*Melilotus officinalis* (L.) Desr.	Yellow sweet clover	Widespread									x							
	81	*Medicago rigidula* (L.) All. Var. *rigidula*	Tifton burclover	Widespread								x					x			
ROSACEAE	82	*Cerasus brachypetala* Boiss. Var. *bornmuelleri* (Schneider) Browicz	-	İran-Turan								x				x				
	83	*Cerasus mahaleb* (L.) Miller var. *mahaleb*	Mahaleb cherry	Widespread									x	x		x				
	84	*Crataegus pseudoheterophylla* Pojark.	-	İran-Turan								x				x				
	85	*Malus sylvestris* Miller subsp. *orientalis* (A. Uglitskich) Browicz var. *orientalis*	Wild apple	Widespread								x				x				
	86	*Potentilla recta* L.	Sulphur cinquefoil	Widespread								x					x			
	87	*Prunus spinosa* L. subsp. *dasyphylla* (Schur) Domin	Blackthorn	Avrupa-Sibirya									x			x				
	88	*Pyrus elaeagnifolia* Pallas subsp. *kotschyana* (Boiss.) Browicz	Wild pear	Widespread								x				x				
	89	*Rosa canina* L.	Dog rose	Widespread								x				x				
	90	*Rosa hemispherica* J. Herm	-	İran-Turan								x				x				
	91	*Sanguisorba minor Scop. Subsp. muricata (Spach)Brig*	Small burnet	Widespread								x				x				
	92	*Rubus canescens* DC. Var. *canescens*	Dewberries	Widespread									x				x			
	93	*Rubus caesius* L.	European dewberry	Widespread									x				x			
LYTHRACEAE	94	*Lythrum salicaria* L.	Purple loosestrife	Avrupa-Sibirya									x			x				
ONAGRACEAE	95	*Epilobium angustifolium* L.	Fireweed	Widespread									x			x				
	96	*Epilobium parviflorum* Schreber	Smallflower hairy willowherb	Widespread									x			x				
UMBELLIFERAE	97	*Bupleurum croceum* Fenzl.	-	İran-Turan								x					x			
	98	*Bupleurum kurdicum* Boiss.	-	İran-Turan								x				x				
	99	*Scandix iberica* Bieb.	-	Widespread								x				x				
	100	*Eryngium campestre* L. var. *campestre*	Field eryngo	Widespread								x						x		
	101	*Eryngium billardieri* Delar	-	Widespread								x				x				
	102	*Falcaria vulgaris* Bernh.	Sickleweed	Widespread								x					x			
	103	*Ferula huber-morathii* Peşmen	-	İran-Turan	x		EN					x					x			
	104	*Prangos ferulacea* (L.) Lindl.	-	Widespread								x				x				
	105	*Prangos a* Boiss. Ex Tchih. subsp. *platychlaena*	-	İran-Turan								x				x				
	106	*Seseli peucedanoides* (Bieb.) Kozo-Pol.	-	Avrupa-Sibirya								x				x				
	107	*Daucus carota* L.	Carrot	Widespread								x				x				
	108	*Turgenia latifolia* (L.) Hoffm.	Broadleaf false carrot	Widespread								x				x				
CORNACEAE	109	*Cornus sanguinea* L. subsp. *australis* (C.A. Meyer) Jav.	Common dogwood	Avrupa-Sibirya									x				x			
DIPSACACEAE	110	*Scabiosa argentea* L.	Mourning bride	Widespread								x					x			
	111	*Cephalaria syriaca* (L.) Schrader	Syrian Cephalaria	Widespread								x				x				
COMPOSITAE	112	*Bellis perennis L.*	Common daisy	Widespread								x				x				
	113	*Senecio vernalis* Waldst. et Kit	Eastern groundsel	Widespread											x	x				
	114	*Achillea biebersteinii* Afan	-	Widespread											x	x				
	115	*Achillea vermicularis* Trin	-	Widespread								x				x				
	116	*Achillea teretifolia* Willd.	-	İran-Turan		x	LC					x				x				

Table 19.1. List of Flora Species Identified on the Study Area (Continued)

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP 3	1	2	3	4	1	2	3	4	5
	117	*Arctium minus* (Hill) Bernh. Subsp. *pubens* (Babington) Arenes	Lesser burdock	Widespread									x			x				
	118	*Artemisia austriaca* Jacq.	Warmwood	Widespread								x				x				
	119	*Artemisia campestris* L.	Field wormwood	Widespread									x			x				
	120	*Centaurea balsamita* Lam.	-	İran-Turan								x				x				
	121	*Centaurea iberica* Trev. Ex Sprengel	Iberian Knapweed	Widespread								x				x				
	122	*Centaurea fenzlii* Reichardt	-	İran-Turan		x	VU					x				x				
	123	*Centaurea polypodiifolia* Boiss. Var. *polypodifolia*	-	Widespread								x				x				
	124	*Centaurea pterocaula* Trautv.	-	İran-Turan								x				x				
	125	*Centaurea solstitialis* L. subsp. *solstitialis*	Yellow starthistle	Widespread								x					x			
	126	*Centaurea virgata* Lam.	Squarrose knapweed	Widespread								x					x			
	127	*Crupina vulgaris* Cass.	Common crupina	Widespread								x					x			
	128	*Cnicus benedictus* L.	Blessed thistle	Widespread											x		x			
	129	*Cichorium intybus* L.	Common chicory	Widespread											x		x			
	130	*Sonchus asper* (L.) Hill	Sharp-fringed sow thistle	Widespread									x				x			
	131	*Scariola viminea* (L.) F.W. Schmidt	-	Widespread								x					x			
	132	*Anthemis tinctoria* L	Yellow chamomile	Widespread								x					x			
	133	*Anthemis wiedemanniana* Fisch. & Mey.	-	Widespread		x	LC					x				x				
	134	*Onopordum acanthium* L.	Cotton thistle	Widespread								x				x				
	135	*Picnomon acarna* (L.) Cass.	-	Mediterranean								x					x			
	136	*Carduus pycnocephalus* L.	Italian thistle	Widespread								x					x			
	137	*Carduus nutans* L. sensu lato	Musk thistle	Widespread								x					x			
	138	*Cirsium elodes* Bieb.	-	Widespread									x				x			
	139	*Cirsium haussknechtii* Boiss.	-	İran-Turan								x					x			
	140	*Cirsium lappaceum* (Bieb.) Fischer subsp. *anatolicum Petrak*	-	Widespread								x					x			
	141	*Cirsium yildizianum* Arabacı & Dirmenci	-	İran-Turan	x		EN					x					x			
	142	*Chondrilla juncea* L . var. *juncea*	Gum succory	Widespread								x					x			
	143	*Lactuca serriola* L.	Prickly lettuce	Widespread								x					x			
	144	*Crepis sancta* (L.) Babcock	Holy's hawk's beard	Widespread								x					x			
	145	*Crepis pulchra* L. var. *pulchra*	Smallflower hawksbeard	Widespread											x		x			
	146	*Crepis foetida* L. subsp. *commutata* (Spreng.) Babcock	Stinging hawk's beard	Widespread								x					x			
	147	*Echinops pungens* Trautv. var. *pungens*	Globe Thistle	Widespread								x					x			
	148	*Gundelia tournefortii* L. var. *tournefortii*	-	Widespread								x					x			
	149	*Helichrysum plicatum* DC. Subsp. *plicatum*	Tumbleweed	Widespread								x					x			
	150	*Inula britannica* L.	British yellowhead	Avrupa-Sibirya								x					x			
	151	*Picris strigosa* Bieb. Subsp. *strigosa*	-	Widespread								x					x			
	152	*Pilosella x fallax* (Willd.) Arvet-Tovvet	-	Widespread								x				x				
	153	*Pulicaria vulgaris* (L.) Gaertner	-	Avrupa-Sibirya									x			x				
	154	*Sonchus asper (L.) Hill*	Sharp-fringed sow thistle	Widespread								x				x				

Table 19.1. List of Flora Species Identified on the Study Area (Continued)

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP 3	1	2	3	4	1	2	3	4	5
	155	*Tanacetum vulgare* L.	Tansy	Widespread								x				x				
	156	*Xanthium spinosum* L.	Spiny cocklebur	Widespread									x			x				
	157	*Xanthium strumarium* L. subsp. *strumarium*	Cocklebur	Widespread									x				x			
	158	*Xeranthemum inapertum* (L.) Miller	-	Widespread								x					x			
	159	*Xeranthemum longipapposum* Fisch. & Mey.	-	Widespread								x					x			
	160	*Xeranthemum annuum* L.	Purple passion	Widespread								x					x			
CAMPANULACEAE	161	*Asyneuma virgatum* (Labill.) Bornm. Subsp. *virgatum*	-	Widespread								x					x			
PRIMULACEAE	162	*Androsace maxima* L.	Greater rockjasmine	Widespread								x					x			
OLEACEAE	163	*Fraxinus angustifolia* Vahl. Subsp. *syriaca* (Boiss.) Yaltırık	Narrow-leafed Ash	İran-Turan										x			x			
ASCLEPIADACEAE	164	*Vincetoxicum tmoleum* Boiss.	-	İran-Turan								x				x				
BORAGINACEAE	165	*Echium italicum L.*	Italian viper's bugloss	Mediterranean								x					x			
	166	*Buglossoides arvensis* (L.) Johnston	Corn gromwell	Widespread								x					x			
	167	*Cerinthe minor* L. var. *auriculata* (Ten.) Domac	Bouquet gold	Widespread								x					x			
	168	*Anchusa strigosa* Labill.	Prickly alkanet	Widespread								x				x				
	169	*Anchusa leptophylla* Roemer & Schultes subsp. *incana* (Ledeb.) Chaub.	-	Widespread								x					x			
	170	*Heliotropium europaeum* L.	Common heliotrope									x				x				
	171	*Heliotropium ellipticum* Ledeb.	-	Widespread								x				x				
	172	*Onosma dicroıonthum* Boiss.	-	İran-Turan								x				x				
	173	*Rochelia disperma* (L.fil) C. Koch var. *disperma*	-	Widespread								x				x				
SCROPHULARIACEAE	174	*Veronica anagallis-aquatica* L.	Water speedwell	Widespread									x			x				
	175	*Verbascum agrimoniifolium* (C.Koch) Hub.-Mor. Subsp. *agrimoniifolium*	-	İran-Turan								x					x			
	176	*Verbascum oreophilum* C. Koch var. *joannis* (Bordz.) Hub.-Mor.	-	İran-Turan		x	LC					x					x			
	177	*Verbascum macrocephalum* Boiss. & Kotschy ex murb.		İran-Turan		x	VU					x				x				
	178	*Verbascum cheiranthifolium* Boiss. Var. *cheriranthifolium*	-	Widespread								x				x				
	179	*Veronica gentianoides* Vahl.	Gentian Speedwell	Avrupa-Sibirya									x			x				
	180	*Lagotis stolonifera* (C.Koch) Maxim.	-	Widespread								x				x				
	181	*Parentucellia latifolia* (L.) Caruel *subsp. latifolia*	Broadleaf glandweed	Mediterranean								x					x			
CONVOLVULACEAE	182	*Convolvulus arvensis L.*	Field bindweed	Widespread								x					x			
	183	*Convolvulus betonicifolius* Miller subsp. *betonicifoılius*	-	Widespread								x				x				
CUSCUTACEAE	184	*Cuscuta kurdica* Engelmann	-	Widespread								x				x				
OROBANCHACEAE	185	*Orobanche alba* Stephan	Red broomrape	Widespread								x				x				

Table 19.1. List of Flora Species Identified on the Study Area (Continued)

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP 3	1	2	3	4	1	2	3	4	5
LABIATAE	186	*Acinos rotundifolius* Pers.	-	Widespread								x					x			
	187	*Marrubium parviflorum* Fisch. & Mey subsp. *oligodon* (Boiss.) Seyboıld	-	Widespread								x					x			
	188	*Mentha longifolia* (L.) Hudson subsp. *longifolia*	Horse mint	Widespread									x				x			
	189	*Phlomis capitata* Boiss.	-	İran-Turan		x	LC					x					x			
	190	*Phlomis rigida* Labill.	-	İran-Turan								x					x			
	191	*Salvia multicaulis* Vahl.	Low-growing perennial shrub	İran-Turan								x					x			
	192	*Salvia virgata* Jacq.	Southern meadow sage	Widespread								x					x			
	193	*Salvia suffruticosa* Montbret & Aucher ex Bentham	-	İran-Turan								x					x			
	194	*Sideritis montana* L. subsp. *montana*	Mountain ironwort	Mediterranean								x					x			
	195	*Teucrium chamaedrys* L. subsp. *syspirense (C.Koch) Rech.fil.*	Wall germander	İran-Turan								x					x			
	196	*Teucrium orientale* L. var. *orientale*	Oriental germander	İran-Turan								x					x			
	197	*Teucrium polium L.*	Felty germander	Widespread								x					x			
	198	*Thymus fallax* Fisch. & Mey.	-	İran-Turan								x					x			
	199	*Ziziphora capitata* L.	-	İran-Turan								x					x			
	200	*Lamium amplexicaule* L.	Henbit dead-nettle	İran-Turan											x		x			
	201	*Prunella laciniata (*L.) L.	Large self-heal	Avrupa-Sibirya									x			x				
	202	*Stachys annua* (L.) subsp. *annua* var. *annua*	Annual hedgegenette	Widespread								x				x				
PLUMBAGINACEAE	204	*Plumbago europaea* L.	Common leadwort	Avrupa-Sibirya								x				x				
PLANTAGINACEAE	205	*Plantago lanceolata* L.	Narrow eaf plantain	Widespread									x				x			
ELAEAGNACEAE	206	*Elaeagnus angustifolia* L.	Silver berry	Widespread									x				x			
FAGACEAE	207	*Quercus robur* L. subsp. *pedunculiflora* (C.Koch) Menitsky	English oak	İran-Turan										x					x	
SALICACEAE	208	*Populus alba* L.	Silver poplar	Widespread									x				x			

Table 19.1. List of Flora Species Identified on the Study Area (Continued)

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP 3	1	2	3	4	1	2	3	4	5
	209	*Populus nigra* L. subsp. *caudina* (Ten.) Bugala	Black poplar	Widespread									x				x			
	210	*Salix alba* L.	White willow	Avrupa-Sibirya									x				x			
	211	*Salix pseudodepressa* A.Skv.	-	Avrupa-Sibirya									x				x			
	212	*Salix triandra* L. subsp. *triandra*	Almond Willow	Avrupa-Sibirya									x				x			
EUPHORBIACEAE	213	*Euphorbia herniariifolia* Willd. Var. *herniariifolia*	-	Widespread								x					x			
	214	*Euphorbia macroclada Boiss.*	-	Widespread								x					x			
	215	*Euphorbia virgata* Waldst. & Kit.	-	Widespread								x					x			
URTICACEAE	216	*Urtica dioica* L.	Stingin nettle	Widespread									x				x			
ULMACEAE	217	*Celtis tournefortii* Lam.	Oriental Hackberry	Widespread									x			x				
RUBIACEAE	218	*Cruciata taurica* (Pallas ex Willd.) Ehrend.	-	İran-Turan								x					x			
	219	*Asperula stricta* Boiss. Subsp. *libanotica* (Boiss.) Ehrend.	-	İran-Turan								x					x			
MONOCOTYLEDONES	220											x					x			
LILIACEAE	221	*Asphodeline damascena* (Boiss.) Baker subsp. *damascena*	-	İran-Turan								x					x			
	222	*Allium atroviolaceum* Boiss.	Broadleaf wild leek	Widespread								x					x			
	223	*Allium kharputense* Freyn & Sint.	-	İran-Turan								x					x			
	224	*Bellevalia pycnantha* (C.Koch) A. Los.-Los	Giant grape hyacinth	İran-Turan								x					x			
	225	*Colchicum kotschyi* Boiss.	-									x					x			
	226	*Gagea luteoides* Stapf	-	Widespread								x					x			
	227	*Muscari armeniacum* Leichtlin ex Baker	Grape hyacinth	Widespread								x					x			
	228	*Muscari longipes* Boiss.	-	Widespread								x					x			
	229	*Ornithogalum oligophyllum* E.D.Clarke	-	Widespread								x					x			
	230	*Tulipa sintenisii* Baker	-	İran-Turan		x	LC					x					x			
IRIDACEAE	231	*Crocus cancellatus* Herbert subsp. *damascenus (Herbert) Mathew*	-	İran-Turan								x				x				
	232	*Gladiolus atroviolaceus* Boiss.	Aleppo wild gladiolus	İran-Turan								x					x			
TYPHACEAE	233	*Typha laxmannii* Lepechin	Graceful cattail	Widespread								x				x				
SPARGANIACEAE	234	*Sparganium erectum* L. subsp.*microcarpum* (Neuman) Domin	Simplestem bur-reed	Avrupa-Sibirya									x				x			
JUNCACEAE	235	*Juncus articulatus* L.	Jointleaf rush	Avrupa-Sibirya									x			x				
	236	*Juncus compressus* Jacq.	Round fruited rush	Widespread									x			x				
	237	*Juncus heldreichianus* Marsson subsp. *orientalis* Snog.	-	İran-Turan									x				x			

Table 19.1. List of Flora Species Identified on the Study Area (Continued)

FAMILY	NO	TAXON	ENGLISH NAME	PHYTOGEOGRAPHIC REGION	ENDEMISM		TRDB	BERN	CITES			HABITAT				ABUNDANCE				
					R	L		APP I	APP 1	APP 2	APP 3	1	2	3	4	1	2	3	4	5
CYPERACEAE	238	*Carex hardeistichos* Vill.		Widespread									x			x				
	239	*Cyperus longus* L.	Common Galingale	Widespread									x			x				
	240	*Bolboschoenus maritimus* (L.) Palla var. *maritimus*	Cosmopolitan bulrush	Widespread									x				x			
GRAMINEAE	241	*Aegilops cylindrica* Host	Jointed goatgrass	İran-Turan								x					x			
	242	*Alopecurus arundinaceus* Poiret	Creeping meadow foxtail	Avrupa-Sibirya								x					x			
	243	*Bromus tectorum* L.	Cheatgrass	Widespread								x					x			
	244	*Bromus scoparius L*	Broom brome									x					x			
	245	*Bromus japonicus* Thunb. subsp. *japonicus*	Japanese bromus	Widespread								x					x			
	246	*Cynodon dactylon* (L.) Pers.	Bermuda Grass	Widespread								x					x			
	247	*Elymus hispidus* (Opiz) Melderis subsp. *barbulatus* (Schur) Melderis	-	Widespread								x					x			
	248	*Lolium perenne* L.	English Ryegrass	Avrupa-Sibirya								x					x			
	249	*Phragmites australis* (Cav.) Trin. Ex Steudel	Common reed	Avrupa-Sibirya									x				x			
	250	*Stipa holosericea* Trin.	-	İran-Turan								x					x			
	251	*Poa trivialis* L.	Rough meadow-grass	Widespread								x					x			
	252	*Poa bulbosa* L.	Bulbous bluegrass	Widespread								x					x			
	253	*Zingeria biebersteiniana* Tutin	-	Widespread								x					x			
	254	*Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman	Cock's-foot	Mediterranean								x					x			
	255	*Hordeum bulbosum* L.	Bulbous Barley	Widespread								x					x			
	256	*Echinaria capitata* (L.) Desf.	-	Widespread								x					x			
	257	*Taeniatherum caput-medusae* Nevsk subsp. *crinitum* (Schreber) Melderis	Medusahead	Mediterranean								x					x			

Table 19.2. List of Mammal Species Identified on the Study Area

FAMİLY	SPECIES		ENGLISH NAME	ENDEMİSM	INTERNATIONAL THREAT CATEGORIES			NATIONAL THREAT CATEGORIES		OBSERVATION AREA			DATA SOURCE
					IUCN	BERN	CITES	Demirsoy (2002)	MAK (2011-2012)	Project Area	Impact Area	Alternative Area	
ERINACEIDAE	1	*Erinaceus concolor*	Hedgehod	-	LC	-	-	nt	APP-1	+	+	+	O-A
SORICIDAE	2	*Crocidura leucodon*	Bicolored shrew	-	LC	APP-3	-	nt	APP-1	-	+	+	L
SORICIDAE	3	*Crocidura suaveolens*	Lesser white-toothed shrew	-	LC	APP-2	-	nt	APP-1	-	+	+	L
RHINOLOPHIDAE	4	*Rhinolophus hipposideros*	Lesser horseshoe bat	-	LC	APP-2	-	V	APP-1	-	+	+	L
VESPERTILIONIDAE	5	*Myotis blythii*	Lesser Mouse-eared bat	-	LC	APP-2		V	APP-1	+	+	+	O
VESPERTILIONIDAE	6	*Pipistrellus pipistrellus*	Common pipistrelle	-	LC	APP-3	-	V	APP-1	+	+	+	O
LEPORIDAE	7	*Lepus europaeus*	Brown hare	-	LC	-	-	nt	APP-3	+	+	+	O-A
SCIURIDAE	8	*Spermophilus xanthaphyrmnus*	Suslic	-	NT	-	-	nt	APP-1	+	+	+	O-L
CRICETIDAE	9	*Arvicola terrestris*	European water vole	-	LC	-	-	nt	APP-1	-	+	+	L
SPALACIDAE	10	*Spalax leucodon*	Lesser mole rat	-	DD	-	-	nt	APP-1	+	+	+	O
MURIDAE	11	*Apodemus slyvaticus*	Wood mouse	-	LC	-	-	nt	APP-1	+	+	+	O-L
MURIDAE	12	*Rattus rattus*	Black rat	-	LC	-	-	nt	APP-1	-	+	+	L-A
MURIDAE	13	*Mus musculus*	House mouse	-	LC	-	-	nt	APP-1	-	+	+	L-A
CANIDAE	14	*Canis lupus*	Wolf	-	LC	APP-2	APP-2	V	APP-1	-	+	+	L-A
CANIDAE	15	*Vulpes vulpes*	Red fox	-	LC	-	APP-3	nt	APP-3	+	+	+	O-A
MUSTELIDAE	16	*Mustela nivalis*	Weasel	-	LC	APP-3	-	nt	APP-2	-	+	+	L-A
MUSTELIDAE	17	*Martes foinea*	Marten	-	LC	APP-3	APP-3	nt	APP-3	-	+	+	L-A
SUIDAE	18	*Sus scrofa*	Wild boar	-	LC	APP-3	-	nt	APP-3	+	+	+	O-L-A

Table 19.3. List of Bird Species Identified on the Study Area

FAMİLY	SPECIES		ENGLISH NAME	ENDEMİSM	INTERNATIONAL THREAT CATEGORIES			NATIONAL THREAT CATEGORIES		OBSERVATION AREA			DATA SOURCE
					IUCN	BERN	CITES	Kiziroglu (2009)	MAK (2011-2012)	Project Area	Impact Area	Alternative Area	
PODICIPEDIDAE	1	*Tachybaptus ruficollis*	Little grebe	-	LC	APP-2		A.3.1	APP-1	-	+	+	O
	2	*Podiceps cristatus*	Great crested grebe	-	LC	APP-3		A.5	APP-1	-	+	+	O
PHALACROCORACIDAE	3	*Phalacrocorax carbo*	Cormorant	-	LC	APP-3		A.3	APP-2	+	+	+	O
ARDEIDAE	4	*Ixobrychus minutus*	Little Bittern	-	LC	APP-2		A.2	APP-1				
	5	*Nycticorax nycticorax*	Night heron	-	LC	APP-2		A.3.1	APP-1	-	+	+	O
	6	*Ardeola ralloides*	Squacco heron	-	LC	APP-2		A.3	APP-1	-	+	+	O
	7	*Egretta garzetta*	Little egret	-	LC	APP-2		A.3.1	APP-1	-	+	+	O
	8	*Casmerodius albus*	Great egret	-	LC	APP-2		A.3	APP-1	+	+	+	O
	9	*Ardea cinerea*	Grey heron	-	LC	APP-3		A.3.1	APP-2	+	+	+	O
	10	*Ardea purpurea*	Purple heron	-	LC	APP-2		A.2	APP-1	+	+	+	O
CICONIIDAE	11	*Ciconia ciconia*	White stork	-	LC	APP-2		A.3.1	APP-1	+	+	+	O
ANATIDAE	12	*Tadorna tadorna*	Common shelduck	-	LC	APP-2		A.3.1	APP-1				
	13	*Tadorna ferruginea*	Ruddy shelduck	-	LC	APP-2		A.4	APP-1	+	+	+	O
	14	*Anas crecca*	Common teal - Eurasian treal	-	LC	APP-2		A.5	APP-3	+	+	+	O
	15	*Anas platyrhynchos*	Mallard	-	LC	APP-3		A.5	APP-3	+	+	+	O
ACCIPITRIDAE	16	*Milvus migrans*	Black kite	-	LC	APP-3	APP-2	A.3	APP-1	+	+	+	O
	17	*Neophron percnopterus*	Egyptian vulture	-	EN	APP-3	APP-2	A.3	APP-1	-	+	+	O
	18	*Circaetus gallicus*	Short-toed eagle	-	LC	APP-3	APP-2	A.4	APP-1	-	+	+	O
	19	*Circus cyaneus*	Hen harrier	-	LC	APP-3	APP-2	A.1.2	APP-1	+	+	+	O
	20	*Accipiter nisus*	Eurasian (or Northern) sparrowhawk	-	LC	APP-3	APP-2	A.3	APP-1	+	+	+	O
	21	*Buteo buteo*	Buzzard	-	LC	APP-3	APP-2	A.3	APP-1	+	+	+	O
	22	*Buteo rufinus*	Long-legged	-	LC	APP-3	APP-2	A.3	APP-1	+	+	+	O
FALCONIDAE	23	*Falco tinnunculus*	Common kestrel	-	LC	APP-2	APP-2	A.2	APP-1	+	+	+	O
PHASIANIDAE	24	*Alectoris chukar*	Chukar partrdige	-	LC	APP-3		A.2	APP-3	+	+	+	O
	25	*Perdix perdix*	PartrIdge	-	LC	APP-3		A.2	APP-2	-	+	+	L-A
	26	*Coturnix coturnix*	QuaIl	-	LC	APP-3		A.3	APP-3	-	+	+	O
RALLIDAE	27	*Gallinula chloropus*	Moorhen	-	LC	APP-3		A.3.1	APP-2	-	+	+	O
	28	*Fulica atra*	Eurasian coot	-	LC	APP-3		A.5	APP-3	-	+	+	O
GRUIDAE	29	*Grus grus*	Common crane	-	LC	APP-2	APP-2	A.3	APP-1	-	+	+	L-A
CHARADRIIDAE	30	*Charadrius dubius*	Little ringed plover	-	LC	APP-2		A.3	APP-1	+	+	+	O
	31	*Vanellus vanellus*	LapwIng	-	LC	APP-3		A.5	APP-2	+	+	+	O
LARIDAE	32	*Larus armenicus*	Armenian gull	-	LC	APP-3		A.4	APP-1	+	+	+	O
STERNIDAE	33	*Sterna (Hydroprogne) caspia*	Caspian tern	-	LC	APP-2		A.2	APP-1				
	34	*Sterna hirundo*	Common tern	-	LC	APP-2		A.3	APP-1	+	+	+	O
	35	*Sterna albifrons*	Little tern	-	LC	APP-2		A.3.1	APP-1	+	+	+	O
COLUMBIDAE	36	*Columba livia*	Domestic pigeon	-	LC	APP-3		A.5	APP-3	+	+	+	O
	37	*Streptopelia decaocto*	Collared dove	-	LC	APP-3		A.5	APP-2	+	+	+	O
	38	*Streptopelia turtur*	Turtle dove	-	LC	APP-3		A.3.1	APP-3	-	+	+	O
STRIGIDAE	39	*Athene noctua*	LIttle owl	-	LC	APP-2	APP-2	A.2	APP-1	+	+	+	O
APODIDAE	40	*Apus apus*	Swift	-	LC	APP-3		A.3.1	APP-1	+	+	+	O
MEROPİDAE	41	*Merops apiaster*	Bee-eater	-	LC	APP-3		A.3.1	APP-1	+	+	+	O
UPUPIDAE	42	*Upupa epops*	Hoopoe	-	LC	APP-2		A.2	APP-1	+	+	+	O
PICIDAE	43	*Dendrocopus syriacus*	Syrian woodpecker	-	LC	APP-2		A.2	APP-1				
	44	*Dendrocopus medius*	Middle spotted woodpacker	-	LC	APP-2		A.1.2	APP-1	+	+	+	O
ALAUDIDAE	45	*Melanocorypha calandra*	Calandra lark	-	LC	APP-2		A.5	APP-1	+	+	+	O
	46	*Melanocorypha bimaculata*	Bimaculated lark	-	LC	APP-2		A.3	APP-1	+	+	+	O
	47	*Galerida cristata*	Crested lark	-	LC	APP-3		A.3	APP-2	+	+	+	O
HIRUNDINIDAE	48	*Ptyonoprogne rupestris*	Crag martin	-	LC	APP-2		A.5	APP-1	+	+	+	O
	49	*Hirundo rustica*	Swallow	-	LC	APP-2		A.5	APP-1	+	+	+	O
	50	*Delichon urbicum*	Common house martin	-	LC	APP-2		A.3	APP-1	+	+	+	O
MOTACILLIDAE	51	*Anthus (novaeseelandiae) richardi*	Richard's pipit	-	LC	APP-2		A.2	APP-1				
	52	*Anthus campestris*	Tawny pipit	-	LC	APP-2		A.2	APP-1	+	+	+	O

Table 19.3. List of Bird Species Identified on the Study Area (Continued)

FAMİLY	SPECIES		ENGLISH NAME	ENDEMİSM	INTERNATIONAL THREAT CATEGORIES			NATIONAL THREAT CATEGORIES		OBSERVATION AREA			DATA SOURCE
					IUCN	BERN	CITES	Kiziroglu (2009)	MAK (2011-2012)	Project Area	Impact Area	Alternative Area	
	53	*Anthus spinoletta*	Water pipit	-	LC	APP-2		A.3	APP-1	+	+	+	O
	54	*Motacilla flava feldegg*	Black-headed wagtail	-	LC	APP-2		A.3	APP-1	+	+	+	O
	55	*Motacilla alba alba*	White wagtail	-	LC	APP-2		A.3.1	APP-1	+	+	+	O
CINCLIDAE	56	*Cinclus cinclus*	White-throated dipper	-	LC	APP-2		A.1.2	APP-1	+	+	+	O
TURDIDAE	57	*Erithacus rubecula*	Robin	-	LC	APP-2		A.3	APP-1	+	+	+	O
	58	*Luscinia luscinia*	Thrush nightingale	-	LC	APP-2		A.2	APP-1	+	+	+	O
	59	*Luscinia megarynchos*	Nigtingale	-	LC	APP-2		A.2	APP-1	+	+	+	O
	60	*Luscinia svecica*	Bluethroat	-	LC	APP-2		A.2	APP-1	+	+	+	O
	61	*Phoenicurus ochruros*	Black redstart	-	LC	APP-2		A.2	APP-1	+	+	+	O
	62	*Phoenicurus phoenicurus*	Common redstart	-	LC	APP-2		A.3	APP-1	+	+	+	O
	63	*Saxicola rubetra*	Whinchat	-	LC	APP-2		A.3	APP-1	+	+	+	O
	64	*Saxicola torquata*	Stonechat	-	LC	APP-2		A.3	APP-1	+	+	+	O
	65	*Oenanthe isabellina*	Isabelline wheather	-	LC	APP-2		A.3	APP-1	+	+	+	O
	66	*Oenanthe oenanthe*	Wheather	-	LC	APP-3		A.3	APP-1	+	+	+	O
	67	*Turdus torquatus*	Ring ouzel	-	LC	APP-2		A.1.2	APP-1	+	+	+	O
	68	*Turdus merula*	Blackbird	-	LC	APP-2		A.3	APP-3	+	+	+	O
	69	*Turdus viscivorus*	Mistle thrush	-	LC	APP-2		A.2	APP-2	+	+	+	O
SYLVIIDAE	70	*Cettia cetti*	Cettl's warbler	-	LC	APP-2		A.2	APP-1	+	+	+	O
	71	*Sylvia melanocephala*	Sardinian warbler	-	LC	APP-2		A.3	APP-1	+	+	+	O
	72	*Phylloscopus collybita*	Chlff chaff	-	LC	APP-2		A.3.1	APP-1	+	+	+	O
MUSCICAPIDAE	73	*Muscicapa striata*	Spotted flycatcher	-	LC	APP-2		A.3	APP-1	+	+	+	O
PARIDAE	74	*Parus major*	Great tit	-	LC	APP-2		A.3.1	APP-1	+	+	+	O
SITTIDAE	75	*Sitta neumayer*	Rock nuthatch	-	LC	APP-2		A.2	APP-1	+	+	+	O
	76	*Sitta europaea*	Eurasian nuthatch	-	LC	APP-2		A.3	APP-1	+	+	+	O
LANIIDAE	77	*Lanius collurio*	Red-backed shrike	-	LC	APP-3		A.2	APP-1	+	+	+	O
	78	*Lanius excubitor*	Graet grey shrike	-	LC	APP-3		A.1.2	APP-1	+	+	+	O
CORVIDAE	79	*Garrulus glandarius*	Jay	-	LC	-		A.3.1	APP-3	+	+	+	O
	80	*Pica pica*	Magpie	-	LC	-		A.5	APP-3	+	+	+	O
	81	*Pyrrhocorax graculus*	Yellow-billed chough	-	LC	APP-2		A.3	APP-1	+	+	+	O
	82	*Corvus monedula*	Jackdaw	-	LC	-		A.5	APP-3	+	+	+	O
	83	*Corvus frugilegus*	Field raven	-	LC	-		A.5	APP-3	+	+	+	O
	84	*Corvus corene*	Hooded crow	-	LC	-		A.5	APP-3	+	+	+	O
	85	*Corvus corax*	Common raven	-	LC	APP-3		A.5	APP-2	+	+	+	O
STURNIDAE	86	*Sturnus vulgaris*	Starling	-	LC	-		A5	APP-2	+	+	+	O
	87	*Sturnus roseus*	Rosy starling	-	LC	APP-2		A.4	APP-1	+	+	+	O
PASSERIDAE	88	*Passer domesticus*	House sparrow	-	LC	-		A.5	APP-3	+	+	+	O
	89	*Passer montanus*	Tree sparrow	-	LC	APP-3		A.3	APP-2	+	+	+	O
	90	*Petronia brachydactyla*	Pale rock sparrow	-	LC	APP-3		A.2	APP-2	+	+	+	O
FRINGILLIDAE	91	*Fringilla coelebs*	Chaffinch	-	LC	APP-3		A.4	APP-2	+	+	+	O
	92	*Serinus pusillus*	Red-fronted serin	-	LC	APP-2		A.3	APP-1	+	+	+	O
	93	*Carduelis chloris*	Green finch	-	LC	APP-2		A.3	APP-1	+	+	+	O
	94	*Carduelis carduelis*	Gold finch	-	LC	APP-2		A.3.1	APP-1	+	+	+	O
	95	*Carduelis spinus*	Eurasian siskin	-	LC	APP-2		A.3	APP-1	+	+	+	O
EMBERIZIDAE	96	*Emberiza hortulana*	Ortolan bunting	-	LC	APP-3		A.3	APP-2	+	+	+	O
	97	*Miliaria calandra*	Corn bunting	-	LC	APP-3		A.4	APP-2	+	+	+	O

Table 19.4. List of Reptile Species Identified on the Study Area

FAMİLY	SPECIES		ENGLISH NAME	ENDEMISM	INTERNATIONAL THREAT CATEGORIES			NATIONAL THREAT CATEGORIES		OBSERVATION AREA			DATA SOURCE
					IUCN	BERN	CITES	Demirsoy (2002)	MAK (2010-2011)	Project Area	Impact Area	Alternative Area	
Emydidae	1	*Mauremys caspica*	Stripe-necked	-	LC	APP-2	-	nt	APP-1	+	+	+	O-L
Tesdudinidae	2	*Testudo graeca*	Common tortoise	-	VU	APP-2	APP-2	nt	APP-1	+	+	+	O-L
Gekkonidae	3	*Cyrtopodion kotschyi*	Kotschy's gecko	-	LC	APP-2	-	nt	APP-1	+	+	+	O-L-A
Agamidae	4	*Hemidactylus turcicus*	Mediterranean house gecko	-	LC	APP-3	-	nt	APP-1	+	+	+	O-L-A
Lacertidae	5	*Laudakia stellio*	star lizard	-	LC	APP-2	-	nt	APP-1	+	+	+	O-L
	6	*Ophisaurus apodus*	European legless lizard	-	LC	APP-2	-	nt	APP-1	+	+	+	O-L
	7	*Parvilacerta parva*	Dwarf Lizard	-	LC	APP-2	-	-	APP-1	+	+	+	O-L
	8	*Lacerta (Darevskia) trilineata*	Balkan green lizard	-	LC	APP-2	-	nt	APP-1	+	+	+	O-L
	9	*Ophisops elegans*	Snake-eyed lizard	-	LC	APP-2	-	nt	APP-1	+	+	+	O-L
Scincidae	10	*Trachylepis aurata*	-	-	LC	APP-3	-	nt	APP-1	-	-	+	L
Boidae	11	*Eryx jaculus*	Sand boa	-	LC	APP-3	APP-2	R	APP-1	-	-	+	L-A
Colubridae	12	*Coluber (Dolichopis) jugularis*	Black whip snake	-	LC	APP-2	-	nt	APP-1	-	-	+	L
	13	*Platyceps najadum*	Dahl's whip snake	-	LC	APP-2	-	nt	APP-1	-	-	+	L
	14	*Hemorrhois ravergieri*	Spotted whip snake	-	NE	APP-3	-	nt	APP-1	-	-	+	L-A
	15	*Dolichopis schmidti*	Coluber schmidti	-	LC	APP-3	-	nt	APP-1	-	-	+	O-L
	16	*Eirenis modestus*	Ring-headed dwarf snake	-	LC	APP-3	-	nt	APP-1	+	+	+	L-A
	17	*Elaphe quatuorlineata*	Four-lined snake	-	LC	APP-2	-	nt	APP-1	-	-	+	O-L
	18	*Natrix natrix*	Grass snake	-	LR/lc	APP-3	-	nt	APP-1	+	+	+	O-L
	19	*Natrix tasellata*	Dice snake	-	LC	APP-2	-	nt	APP-1	+	+	+	L-A
Viperidae	20	*Vipera lebetina*	Levantine viper	-	NE	APP-2	-	nt	APP-1	-	-	+	L-A

Table 19.5. List of Amphibian Species Identified on the Study Area

FAMİLY	SPECIES		ENGLISH NAME	ENDEMISM	INTERNATIONAL THREAT CATEGORIES			NATIONAL THREAT CATEGORIES		OBSERVATION AREA			DATA SOURCE
					IUCN	BERN	CITES	Demirsoy (2002)	MAK (2010-2011)	Project Area	Impact Area	Alternative Area	
Salamandridae	1	*Neurergus strauchii*	Strauch's spotted newt	-	VU	APP-3	-	nt	-	-	-	+	**L**
Bufonidae	2	*Bufo bufo*	Common toad	-	LC	APP-3	-	nt	-	+	+	+	**O-L**
Hylidae	3	*Pseudepidalea viridis*	Green Toad	-	LC	APP-2	-	nt	-	-	-	+	**O-L**
	4	*Hyla arborea*	European tree frog	-	LC	APP-2	-	nt	-	-	-	+	**L**
Ranidae	5	*Hyla savignyi*	Common tree frog	-	LC	APP-3	-	nt	-	+	+	+	**L**
	6	*Rana macrocnemis*	Long-legged Wood Frog	-	LC	APP-3	-	nt	-	-	-	+	**O-L**
	7	*Pelophylax ridibundus*	Eurasian marsh frog	-	LC	APP-3	-	nt	-	+	+	+	

APP 20

APPROVED FLOW RATE

Approved Flow Rate Report

EİE

Sf:1/1

21 - FIRAT-DİCLE HAVZASI (Fırat Nehri ve Kolları)

2174 - MURAT NEHRİ - AKKONAK

Yeri : (41° 31' 11'' D - 39° 02' 29'' K) (Erzurum - J47) Muş - Erzurum kara yolu üzerinde Muş'a 36 km mesafede Muş - Erzurum - Elazığ yol ayrımının 21. km'sindeki Akkonak köyü Göçmenler mezrası önündedir.

Yağış Alanı : 17435.1 km²

Yaklaşık Kot : 1285 m

Gözlem Süresi: 01.10.1979 -

Uzun Süreli Ortalama Akım : 135. m³/s

Seviye Ölçeği: Eşel

Ek Bilgiler : NOT:2009 VE 2010 SU YILLARI AKIM DEĞERLERİ KESİN DEĞİLDİR.

AYLIK ORTALAMA AKIMLAR (m³/s)

YIL / AY	EKİM	KASIM	ARALIK	OCAK	ŞUBAT	MART	NİSAN	MAYIS	HAZİRAN	TEMMUZ	AĞUSTOS	EYLUL	Y.ORT.
1980	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	42.6	45.6	29.3	25.1	29.3	85.8	286.	363.	137.	41.3	26.6	29.5	95.0
1984	39.4	93.4	66.8	47.1	47.4	236.	369.	382.	170.	61.1	29.3	29.8	131.
1985	36.3	47.1	39.5	42.5	39.3	78.1	655.	268.	60.6	25.0	21.3	21.7	111.
1986	34.9	40.6	43.3	44.8	55.2	104.	382.	244.	151.	39.6	19.9	23.3	98.6
1987	48.4	67.4	44.9	44.5	66.9	63.1	760.	822.	238.	59.4	35.8	33.0	190.
1988	43.3	82.5	100.	61.8	85.8	192.	1036.	1038.	392.	139.	83.6	67.1	277.
1989	-	-	-	-	-	-	-	-	-	-	-	-	-
1990	-	-	-	-	-	-	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-	-	-	-	-	-	-
1993	-	-	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	41.6	69.7	72.2	93.1	82.1	148.	835.	636.	240.	77.5	39.0	41.1	198.
1996	66.4	87.3	64.9	57.4	72.6	140.	476.	453.	105.	36.3	22.0	29.8	134.
1997	54.0	60.0	86.9	68.1	46.0	60.7	465.	459.	117.	39.9	22.6	27.2	126.
1998	53.8	50.2	41.5	42.5	46.6	150.	542.	353.	152.	37.1	24.0	24.9	126.
1999	33.1	42.5	69.2	45.6	52.8	111.	452.	244.	74.1	32.9	17.9	21.3	99.7
2000	32.4	37.6	38.4	37.0	32.7	54.0	395.	199.	45.3	15.5	8.72	10.8	75.5
2001	25.7	32.0	35.2	30.6	34.8	153.	250.	216.	62.2	18.8	11.9	11.5	73.5
2002	25.1	30.1	48.2	45.1	45.0	236.	650.	462.	190.	72.5	32.7	26.6	155.
2003	45.4	51.9	42.3	54.9	52.4	73.3	824.	458.	176.	48.4	29.1	33.4	157.
2004	59.1	155.	83.0	59.8	73.1	455.	400.	586.	267.	73.9	38.5	34.9	190.
2005	46.3	58.2	51.6	59.7	63.6	152.	515.	361.	139.	43.6	31.7	34.5	130.
2006	47.8	51.5	56.3	47.8	68.4	221.	730.	437.	79.3	48.1	24.6	26.1	153.
2007	52.3	76.9	38.7	37.7	37.7	133.	351.	714.	145.	49.3	38.4	30.5	142.
2008	35.20	44.10	48.0	34.60	44.6	297.0	201.	123.	50.9	18.60	16.70	16.80	77.5
2009	36.20	30.80	11.9	11.9	12.	33.7	137.	189.0	158.	81.	45.1	24.8	64.3
2010	7.5	32.4	56.20	163.0	144.0	353.0	369.	454.	343.	24.3	25.2	34.3	167.2
A.Ort. :	41.2	58.5	53.1	52.5	56.0	160.	504.	430.	159.	49.2	29.3	28.8	135.
Verim :	2.36	3.35	3.05	3.01	3.21	9.20	28.9	24.7	9.11	2.82	1.68	1.65	7.75
Akış :	6.33	8.70	8.16	8.06	7.77	24.6	74.9	66.1	23.6	7.56	4.50	4.28	245.
Akım :	110.	152.	142.	141.	136.	430.	1305.	1152.	411.	132.	78.5	74.6	4264.

Aylık Ortalama (m³/s) Verim (l/s/km²) Akış (mm) Akım (milyon m³)

Hidrometrik Değerlendirme
Şube Müdürlüğü

ASLI GİBİDİ

Ömer AY
Hidrolik Etütler Daire
Başkanı

APP 21

AIR QUALITY MODELLING

AIR QUALITY MODELING

1. Introduction

Dust and gas emissions were investigated within the scope of the assessment of potential impacts on air quality expected to be generated during the construction and operation phases of the Alpaslan II Dam and HEPP Project.

2. Legal Framework

Particulates vary widely with respect to size and composition. PM_{10} (particulate matter smaller than 10μm) standard identifies particulates which people may inhale and has became mostly accepted criterion for particulate matter in atmosphere. In this respect, the limit values regarding the particulate matter in both Regulation on Assessment and Management of Air Quality (RAMAQ) and Regulation on Air Pollution Control Sourced from Industry (RAPCSI) are set as PM_{10}. Therefore, calculations have been carried out in respect to PM_{10} values.

Regulation on Assessment and Management of Air Quality (RAMAQ)

Regulation on Assessment and Management of Air Quality came into force following the publishing in Official Gazette numbered 26898, dated June 6, 2008. The Air Pollution Control Regulation (APCR) was repealed with this regulation. In the scope of the EU harmonization process, the short term and long term limit values have been re-defined in this regulation with the purpose of being in line with related environmental legislations of EU. However, a transition period has foreseen for the adaptation to implement these limits.

Regulation on Air Pollution Control Sourced from Industry (RAPCSI)

Regulation on Air Pollution Control Sourced from Industry (RAPCSI), came into force following the publishing in Official Gazette numbered 27277, dated July 3, 2009, aims to control emissions emitted to atmosphere in the forms of smut, dust, gas, vapor and aerosols as a result of activities of industrial and energy generation facilities, to protect human health and the environment from risks originating from pollution in receiving air environment, to mitigate the negative impacts on the public and neighborhoods caused by air pollution, and to prevent the generation of these impacts. Regulation on Air Pollution Control Sourced from Industry (RAPCSI) published in Official Gazette numbered 26236, dated July 22, 2006 was repealed with this regulation

In this regulation, limit values for stack and places other than stack, which require calculation of contribution to air quality values if exceeded, are provided in Annex 2. These values are presented in Table 18.1.

Table 18.1. Limit Values for the Emissions Sourced from the Stack and Places other than Stack

Parameters	Mass Flows (kg/hour)	
	From Stack	From Places other than Stack
CO	500	50
NO_x	40	4
SO_x	60	6
PM	10	1

Emission values expected to be originated from construction and operation activities that will be carried out within the scope of the Project will be calculated and compared with limit values indicated above table. In the conditions that the calculated emission values exceeds the limit values, modeling study will be carried out and contribution of this emission values to air quality will be calculated.

3. Methodology

The potential impacts of the emissions on air quality were estimated by the means of the ISCST3 model (Industrial Source Complex - Short Term 3), developed by USEPA (United States Environmental Protection Agency).

The dust emissions are expected to be originated as a result of following activities to be carried out within the context of construction phase of the Project; dismantling activities, loading the excavation materials, and unloading the materials.

The emission factors used in dust emissions calculations are given in Table 18.2.

Table 18.2. Emission Factors used in Dust Emission Calculations (RAPCSI)

Sources	Emission Factors (kg/ton)	
	Uncontrolled	Controlled
Dismantling	0.025	0.0125
Loading	0.010	0.005
Unloading	0.010	0.005

ISCST3 as one of the most widely used computer models provides estimates hourly, daily and annual ground level concentrations by using real time values that varies in time. The model includes different dispersion model calculations for different types of sources (point, volume, line) including the fugitive pollutants being emitted from the isolated stacks.

ISCST3 model works in a network system defined by the user, and calculations are done for corner points of each receptor element which forms network system. Network system used in ISCST3 model can be defined as polar or cartesian; besides remote receptors outside the network can be determined and more detailed calculations can be made for that points, and in addition to ground level concentrations, calculations also can be done for certain heights of the atmosphere.

In accordance with the Model, working area was defined with about 40 km in the direction of east-west and 27 km in north-south direction in a manner that cover the Project area and settlements located in the vicinity. Within the borders of this defined area, about 1,800 receiving points were established in both direction with 750 m intervals and calculations were done for all these points. In addition to calculated values for these points, concentration and deposition amounts expected to be generated in the related settlements were calculated, as well.

Model user also imports the meteorological data of the defined project area, in which the calculations will be done, into the Model by means of specific formatted file. This meteorological data is prepared hourly, and in this scope, some values such as; dominant wind direction, average wind speed, average ambient temperatures, urban mixing height, rural mixing height, Monin-Obukhov length, surface roughness length are introduced to the Model on a hourly basis.

For the determination of the year that represents the longstanding meteorological data of the defined project area, firstly, overall monthly wind values between 2001-2010 years were gathered from the Varto Meteorology Station which is the closest station to the project area, and then dominant wind directions (with respect to wind values) were determined, accordingly. Following this, determined dominant wind directions (1.,2. and 3.) were compared with “overall monthly wind values” and consequently year of 2010 was determined as most appropriate representative year.

In this respect, meteorological data including temperature, wind speed, dominant wind direction, cloudiness, pressure and humidity was obtained from the Varto Meteorology Station while mixing height was taken from Erzurum Meteorology Station which is the closest radiosonder type station.

4. Air Emission Sources Related with the Project

4.1. Construction Phase

Construction phase of the Alpaslan II Dam and HEPP Project is expected to take 4 years. Dust emissions are expected to be generated from construction activities, such as; excavation and filling works, loading/unloading of the excavated materials, hauling of the material taken from the quarries and transportation on roads, which will be carried out during the construction phase planned to be started in 2012. On the other hand, as some part of the activities will be carried out in underground and some of in wet environment, dust emissions will not be generated within these activities.

Above mentioned activities will be carried out in different periods within 4-year construction phase. In calculations of the dust emissions expected to be sourced from construction activities, a worst case scenario considering the most concentrated period with respect to dust emissions was taken into account and excavation and filling amounts to be generated within this period was determined, accordingly. Determined excavation and filling amounts are given in Table 18.3.

Table 18.3. Excavation and Filling amounts Expected to be Generated during the Construction Activities

Emission Source	Material Amount (ton)
K-1 Rock Quarry	400,000
K-2 Rock Quarry	400,000
K-3A Rock Quarry	400,000
K-5 Rock Quarry	400,000
K-6A Rock Quarry	400,000
K-6B Rock Quarry	400,000
A Impervious Material Borrow Area	3,240,000
B Impervious Material Borrow Area	90,000
C Impervious Material Borrow Area	234,000
D Impervious Material Borrow Area	216,000
Excavation and Filling of Dam Shaft	5,500,000
TOTAL	**11,680,000**

The amount of dust emissions expected to be generated during the construction activities are given in Table 18.4.

Table 18.4. Dust Emission Amounts Expected to be Generated during Construction Activities

Emission Source	Emission Amount (PM_{10})	
	Uncontrolled (kg/hour)	Controlled (kg/hour)
K-1 Rock Quarry	2.0254	1.0127
K-2 Rock Quarry	2.0254	1.0127
K-3A Rock Quarry	2.0254	1.0127
K-5 Rock Quarry	2.0254	1.0127
K-6A Rock Quarry	2.0254	1.0127
K-6B Rock Quarry	2.0254	1.0127
A Impervious Material Borrow Area	16.4062	8.2031
B Impervious Material Borrow Area	0.4558	0.2279
C Impervious Material Borrow Area	1.1848	0.5924
D Impervious Material Borrow Area	1.0938	0.5469
Crushing and Screening Plant	16.4844	8.2422
Excavation and Filling of Dam Shaft	18.8078	9.4039
TOTAL	**66.5852**	**33.2926**

Other emission source of the construction phase is expected to be construction vehicles and equipments which will be used in the course of construction activities. Primary exhaust dispersions from that vehicles are NO_2, CO, HC, SO_2, PM and lead in PM. Emission features depend on the parameters, such as; age of vehicle, engine speed, operating temperature, ambient temperature, pressure, fuel type and fuel quality. Emissions of lead doped petrol and diesel fuel per vehicle defined by EPA are listed in Table 18.5.

Table 18.5. Emissions Sourced from Vehicles (USEPA)

POLLUTANTS	EMISSIONS (g/km/vehicle)	
	Lead Doped Petrol	Diesel Fuel
Nitric Oxides (NO_x)	1.2	9.0
Carbon Monoxide (CO)	39.0	15.0
Sulphur Dioxide (SO_2)	0.08	1.5
Hydrocarbon (HC)	2.6	2.9
Particulate Matter (PM)	0.4	0.8
Lead (Pb) [1]	0.064	--

[1] Diesel fuel does not include lead.

Gas and PM emission amounts expected to be emitted from the exhausts of the vehicles to be used in construction and operation phase are given in Table 18.6.

Table 18.6. Emission Amounts Expected to be Generated from the Exhaust of Construction Vehicles

Emission Amounts (kg/hour)				
NO_X	CO	SO_2	HC	PM_{10}
0,198	0,330	0,033	0,064	0,018

As PM_{10} value expected to be generated during construction activities exceed the limit values identified for places other than stack (1 kg/hour), dispersion of the PM_{10} emissions under meteorological and topographical conditions were modeled by means of ISCST3 model. NO_2, CO, HC, SO_2 amounts are under the limit values; therefore, modeling studies were not carried out for them.

6. Modeling Results

As a result of the modeling studies, annual and daily maximum dust concentrations, and short term and long term dry deposition values expected to be received in settlements located in the vicinity of Project area were determined. For the comparison of these determined values with limit values defined in regulation, Table 18.7 is established and given below.

Table 18.7. Maximum Dust Concentrations and Deposition Values Expected to be Received in Settlements (Construction Phase)

Settlement	Modeling Result	Limit Value (RAPCSI*)
Dogdap		
Daily PM_{10} Concentration	7,72 µg/m^3	140 µg/m^3
Annual PM_{10} Concentration	2,01 µg/m^3	78 µg/m^3
Long Term Dry Deposition Value	30 mg/m^{2}day	442 mg/m^{2}day
Short Term Dry Deposition Value	2,08 mg/m^{2}day	238 mg/m^{2}day
Bagici		
Daily PM_{10} Concentration	13,13 µg/m^3	140 µg/m^3
Annual PM_{10} Concentration	3,54 µg/m^3	78 µg/m^3
Long Term Dry Deposition Value	30 mg/m^{2}day	442 mg/m^{2}day
Short Term Dry Deposition Value	3,56 mg/m^{2}day	238 mg/m^{2}day

Table 18.7. Maximum Dust Concentrations and Deposition Values Expected to be Received in Settlements (Construction Phase) (Continued)

Settlement	Modeling Result	Limit Value (RAPCSI*)
Kayalidere		
Daily PM_{10} Concentration	27,67 µg/m3	140 µg/m^3
Annual PM_{10} Concentration	14,78 µg/m3	78 µg/m^3
Long Term Dry Deposition Value	90 mg/m^2day	442 mg/m^2day
Short Term Dry Deposition Value	12,90 mg/m^2day	238 mg/m^2day
Akkonak		
Daily PM_{10} Concentration	33,13 µg/m^3	140 µg/m^3
Annual PM_{10} Concentration	14,65 µg/m^3	78 µg/m^3
Long Term Dry Deposition Value	90 mg/m^2day	442 mg/m^2day
Short Term Dry Deposition Value	15,95 mg/m^2day	238 mg/m^2day
Dumlusu		
Daily PM_{10} Concentration	14,86 µg/m^3	140 µg/m^3
Annual PM_{10} Concentration	3,73 µg/m^3	78 µg/m^3
Long Term Dry Deposition Value	130 mg/m^2day	442 mg/m^2day
Short Term Dry Deposition Value	4,14 mg/m^2day	238 mg/m^2day
Akpinar		
Daily PM_{10} Concentration	22,54 µg/m^3	140 µg/m^3
Annual PM_{10} Concentration	5,47 µg/m^3	78 µg/m^3
Long Term Dry Deposition Value	80 mg/m^2day	442 mg/m^2day
Short Term Dry Deposition Value	5,92 mg/m^2day	238 mg/m^2day

* 2012 limit values

Model results representing the long term and short term equal concentration curves of construction sourced PM_{10} values on the settlements are given in Figure 1 and Figure 2 respectively. Long term and short term dry deposition curves of the model are represented in Figure 3 and Figure 4, as well.

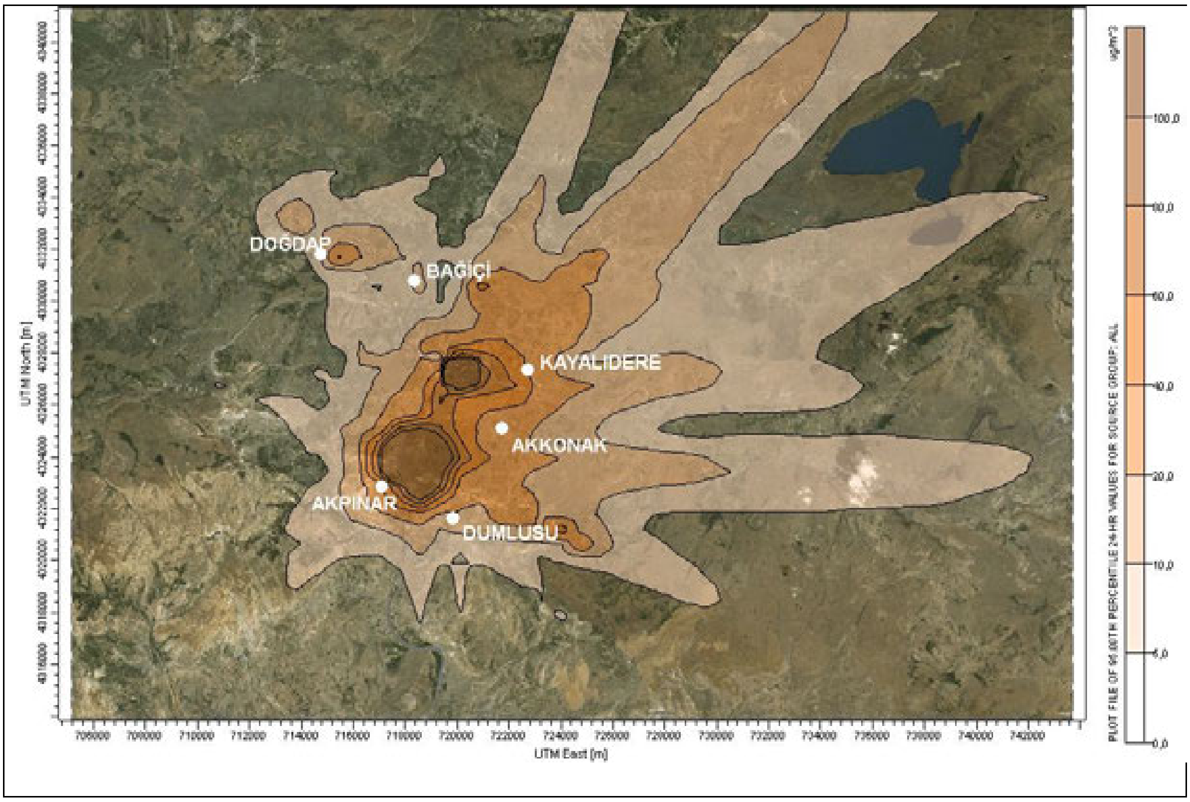


Figure 18.1. Construction Sourced PM_{10} Long Term Concentrations

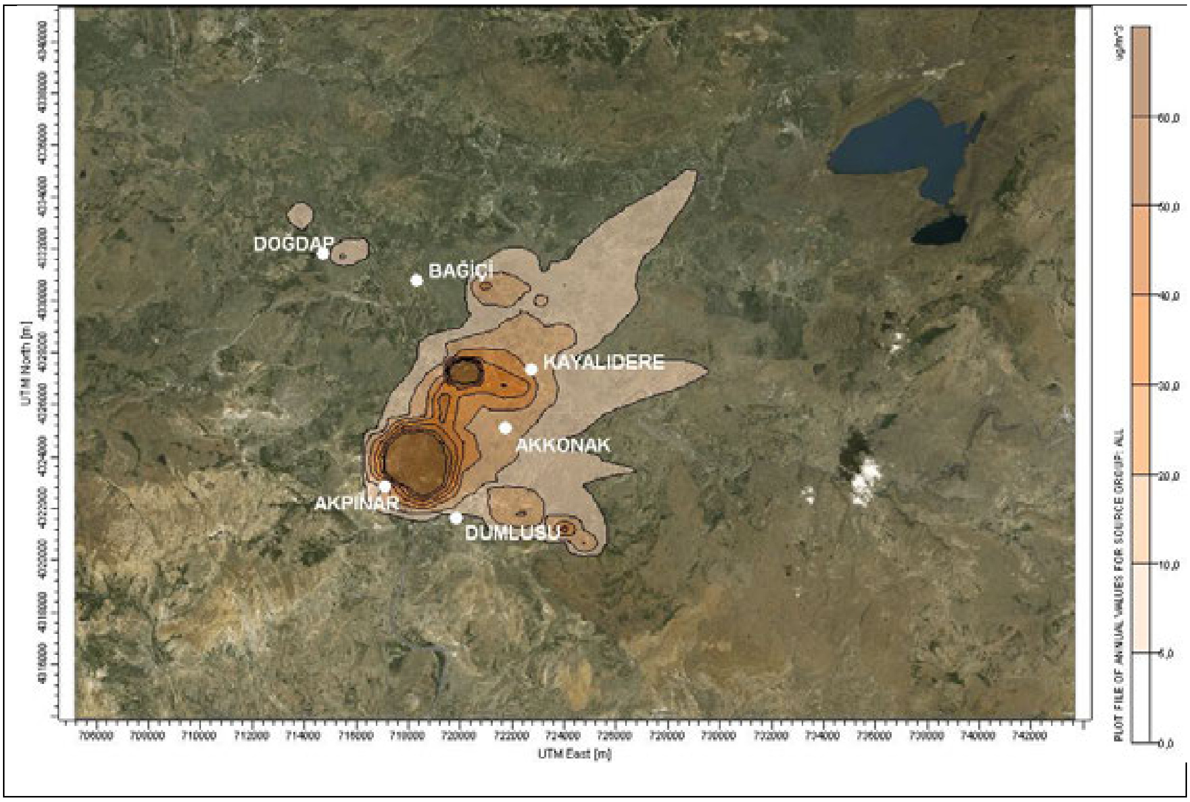


Figure 18.2. Construction Sourced PM_{10} Short Term Concentrations

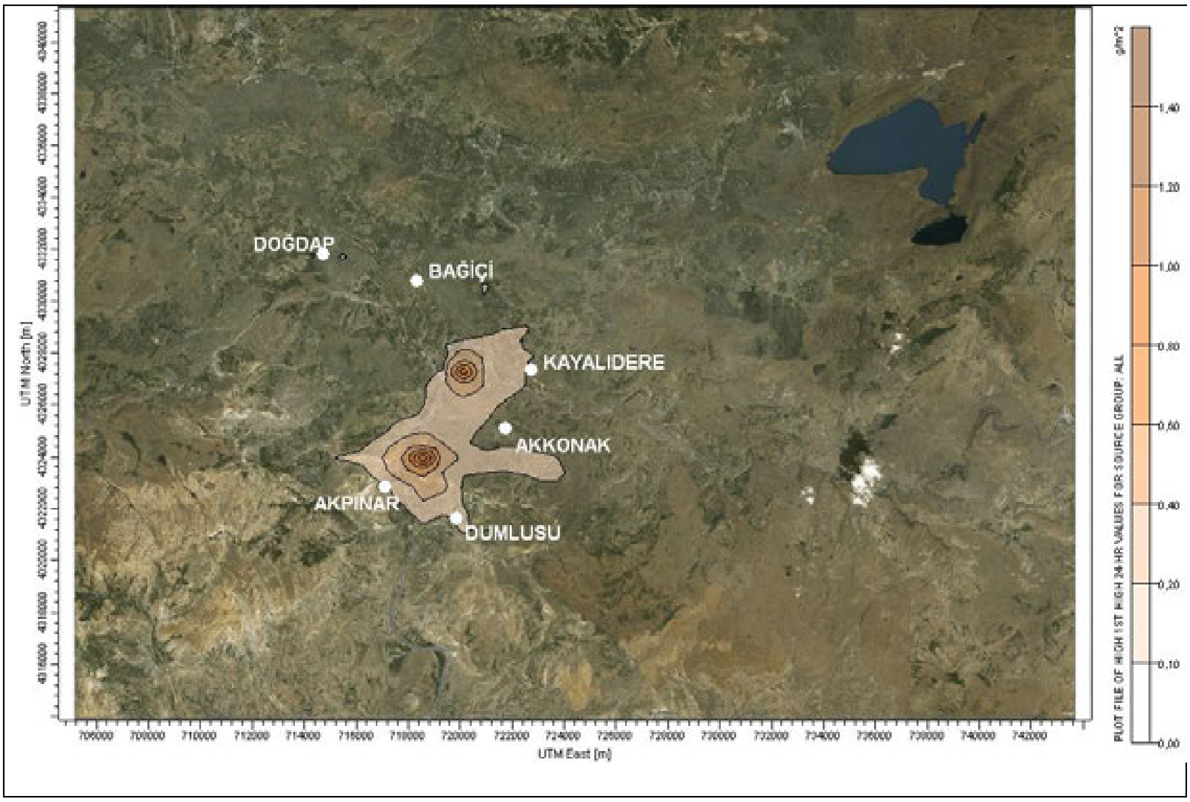


Figure 18.3. Construction Sourced PM_{10} Long Term Dry Deposition Concentrations

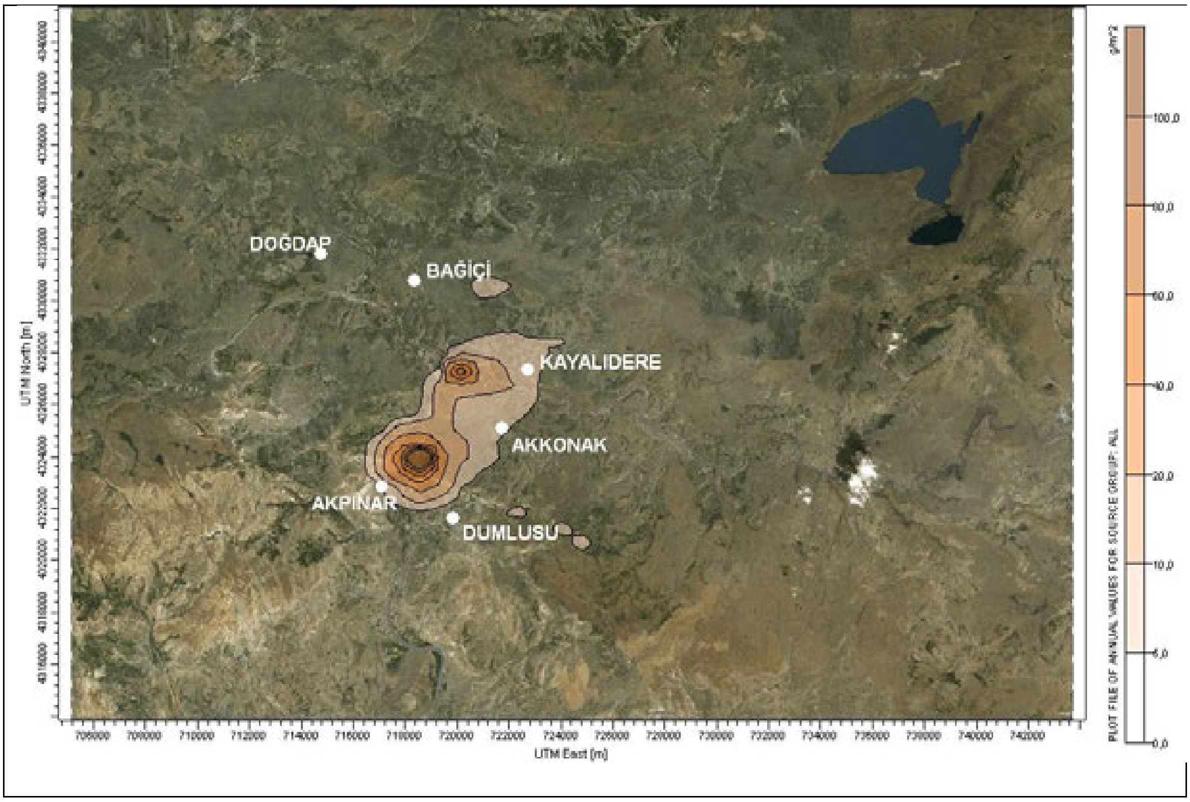


Figure 18.4. Construction Sourced PM_{10} Short Term Dry Deposition Concentrations

According to Regulation on Air Pollution Control Sourced from Industry (RAPCSI), for facilities containing loading, unloading, separation, screening, crushing and grinding activities, concentration of the dust (PM_{10}) will not exceed the value of 3 mg/Nm^3 at 3 m away from the source considering the dominant wind direction. In this respect, maximum daily dust concentration is expected to be as 1.84 mg/Nm^3 which is under the regulation limit value.

14.7. General Evaluation

In this section, emission amounts expected to be generated during the construction phase of the Alpaslan II Dam and HEPP Project and distributions of these emissions under meteorological and topographical conditions are assessed.

Dust emissions will be generated due to activities such as; excavation-fill works, loading/unloading of the excavated materials, hauling of the material taken from the quarries, which will be carried out within the scope of the construction phase of Project planned to be commenced in 2012. Additionally, the other emission source of the construction phase will be exhaust emissions of the construction equipments to be used during construction phase.

Apart from dust emissions, there will be NO_2, CO, HC, SO_2, PM and lead in PM emissions from the exhaust of the construction equipments, as well.

In the conditions that any measures do not taken, expected PM_{10} value for the construction phase was calculated as 66.59 kg/hour. As this value exceed the limit value (1 kg/hour), defined in Annex-2 of RAPCSI and required to be calculated for air quality contribution values if exceeded, modeling study was carried out and by this means distribution pattern of the dust was studied. Modeling study was not carried out for the NO_2, CO, HC, SO_2 since they are under the limit values.

All emission values obtained from the model study are under the limit values defined in RAPCSI. (see Table 18.7)

In order to control the dust emissions expected to be generated during construction activities, roads will be suppressed with water, there will be speed limits for vehicles and new and well-kept will be used, as possible. Blasting will be carried out in line with the related rules and regulations. In addition, in the process of storing the excavation material outdoors, the following measures stated in Annex-1 of RAPCSI will be taken in order to keep up with the air quality standards:

- Loading and unloading will be carried out without throwing.
- The materials will be covered with a nylon canvas, or material having grain size larger than 10 mm.
- Upper layers will be kept at a humidity of 10% and equipment required for providing this condition will be established.

For the purpose of minimizing dust emission amounts to be sourced from the construction vehicles and equipments during the construction phase of the Project and keeping them under the limit values, provisions of Regulation on Assessment and Management of Air Quality (RAMAQ) came into force following the publishing in Official Gazette numbered 26898, dated June 6, 2008 and Regulation on Air Pollution Control Sourced from Industry (RAPCSI), came into force following the publishing in Official Gazette numbered 27277, dated July 3, 2009 will be complied. Additionally, within the scope of the monitoring plan, dust (particulate matter) measurement will be conducted in settlement located in the vicinity of the Project area. Further information regarding this issue is given in Section VIII.

APP 22

EMERGENCY ACTION PLAN

EMERGENCY ACTION PLAN

1. Objective

The aim of the Emergency Action Plan (EAP) is to protect lives that might be affected from situations such as emergency states that are unforeseen at the construction and operation phases of the dam, natural disasters (fire, earthquake, lightning, etc.), closing down of the roads, communication losses, accidents within the plan, incorrect operation, irregular maintenance, and also to reduce the possible impacts on the dam or the surrounding residential locations.

For the successful application of the Emergency Action Plan to be prepared at the construction phase, the dam owner / representative shall assign an Emergency action Plan Coordinator and team, these personnel shall be trained and assigned tasks. Furthermore, each personnel has to be informed concerning his/her responsibility in order to minimize the chaos at the possible emergencies and to ensure that the plan can be successful.

The accidents, natural disasters, etc. events that can occur during the construction and operation of the dam, the measures to be taken in these events and the duties and responsibilities of the emergency action team is provided below.

2. Duties and Responsibilities

Dam Owner or Representative

Every kind of activity and action performed at the construction and operation phase of the project is under the responsibility of the dam owner / representative. The other duties and responsibilities of the dam owner / representative within the Emergency action Plan has been defined as follows:

- Selection of the Emergency action Plan Coordinator and approval of the gathered Emergency action Team,
- Participating to the EAP review meetings held once a year and approving the final form of AMP,
- In case of emergency, providing approval for applicability for the actions that are not present within the AMP,
- Examining the reports prepared after the emergency.

Emergency Action Plan Coordinator (EAPC)

The Emergency Action Plan Coordinator is responsible from executing the actions developed in case of an unexpected event in conformity with the prepared Emergency Action Plan and the development of this plan. The other duties and responsibilities of the EAPC are summarized below:

- Forming the Emergency Action Team (EAT),
- Training of the participants to intervene in emergencies,
- Arranging work sharing within the Emergency action Team,
- Review of the EAP with the participants annually, making the necessary changes, distribution of the updated copes thereof to the participants,
- Arranging practices at certain intervals to check the compliance and functionality of AMP,

- Depending on the type of emergency, determination of the contact persons to be called in case of emergency action and keeping these contact information in writing at a place that is accessible to everyone within the team,
- Reflecting any changes at the contact information of EAP team and the emergency contacts to the contact list,
- In case of an emergency, making sure that the Emergency action Team acts in conformance to the EAP,
- Where EAP proves to be insufficient during intervention, realizing actions independent from the EAP after obtaining the approval of the dam owner / representative and later reflecting these actions to the EAP,
- After the end of the emergency, preparing a status review report together with the Emergency action Team and submitting this report to the dam owner / representative.

Emergency Action Team (EAT)

An Emergency Action Team is gathered by considering the individual capabilities of the persons working under EAPC. The duties and responsibilities of EIT are as follows:

- Participating to the training and practices for EAP realization,
- Performing annual EAP reviews with the EAPC,
- Informing the EAPC in case of an emergency,
- Depending on the type of emergency, taking the necessary actions according to the AMP,
- Notifying the predetermined contact persons regarding the emergency,
- After the end of the emergency, reviewing the status together with the EAPC and contribute in the preparation of the report.

Possible Emergencies

3.1. Accidents

The accidents that may occur during the dam construction and operation process can cause injuries and even deaths. In such situations, first of all it is planned to benefit from the EIT at the worksite that knows first aid, the cottage hospitals present at the nearest residential locations, and if not sufficient, then from the nearest hospital. In case of injuries to occur at the plan, the first intervention shall be made at the place of the event by the emergency action team member that knows first aid and/or the doctor present at the worksite. During these actions, the other team members shall ensure the safety of the surrounding to prevent any more damage, any possible fire threats shall be sought, spilled materials, if any, shall be cleaned.

As a result of certain accidents, fuel, oil, gasoline or other hazardous liquids can intermix to the surface waters. When fuel or other hazardous substances are seen to be floating on the water, the first intervention shall be made by the EAT, if not sufficient, then the fire brigade shall be contacted for help. Fuel, oil/grease, gasoline and other similar floating substances shall be separated from the water via scraping. These substances shall be collected and kept at impermeable containers, and then disposed as per the “Waste Oils Control Regulation”.

Duties and Responsibilities of the First Aid and Rescue Teams

1) All the team members should be aware of the type of injury risks present at each region.

2) In case of emergency, the team members search for injured at their responsibility zones. The team leader can allocate duties in this respect if necessary.

3) When an injured is detected, immediately first aid activity is commenced. However, if there is any hesitation regarding first aid, an authorized person should be waited. An intervention that might worsen the situation of the injured should not be made.

4) A member to be commissioned by the leader during the first aid activities goes to the most suitable road junction where the ambulance can come and directs the incoming vehicle to the place of event.

5) After the ambulance arrives, if requested, the team members help in the first aid activities.

6) Prevents the entrance of irrelevant persons to the region during the first aid operations.

7) After necessary interventions are made on the injured and/or the injured is transferred to the hospital, a minutes is prepared related to the accident.

8) If an injured has not been determined after the emergency, the team members are counted and the members are kept ready under the leadership of the team leader.

3.2. Fire

Precautions should be developed regarding the fires that can occur at the dam worksite and thus the fire will be prevented from occurring. Furthermore, fire extinguisher tools and equipment shall be placed at suitable location in the work site against any possible fire.

However, since the forested areas are especially sensitive against fire, no open fire shall be lit outside the worksite at dry seasons and necessary precautions shall be taken to prevent the occurrence of fire at the works to be performed.

Duties and Responsibilities of the Emergency Action Team

All the team members should be aware for the type of fire threat present at every zone. Again, they should be informed concerning how to intervene to each type of fire and with which type of extinguisher.

In case of emergency, the team members perform fire search at their regions of responsibility. The team leader can allocate duties in this respect if necessary.

1) If a fire is detected or if the emergency itself is fire, the fire extinguishing activities are commenced, without panic, under the control of the team leader.

2) During the extinguishing activities, a member to be commissioned by the leader, goes to the most suitable road junction where the fire brigade can come and directs the incoming vehicle to the place of fire.

3) After the fire brigade arrives, if requested, the team members help in the fire extinguishing activities.

4) Prevents the entrance of irrelevant persons to the region during the fire extinguishing operations.

5) If a fire has not been determined after the emergency, the team members are counted and the members are kept ready under the leadership of the team leader.

3.3. Earthquake

The personnel working at the plant should be trained as to how to act to secure him/herself in case of an earthquake. If an earthquake at an intensity of 5 or above as per the Richter scale has been detected at the region and if the commissioned persons can feel the ground vibrations or become subject to certain earthquake criteria (being felt by everyone, the persons being unable to walk straight, the items in the shelves moving / falling down, the furniture moving / falling down, cracking at weak plaster and walls, visible shaking at the trees and bushes and hearing voices/sounds), the following steps shall be followed and implemented;

1. After the earthquake, visual inspection shall be made at the dam in general.

2. After the inspection and controls are completed, the findings shall be immediately notified to the related authorities.

3. If the dam is collapsing or has received damage such that it may collapse; the residential areas downstream and the other dam enterprises shall be immediately notified. Furthermore, the water level within the reservoir shall be reduced under control.

4. If the dam is not collapsing but a significant damage has been detected at its embankment, the water level within the reservoir shall be reduced under control. The water discharging operation shall be continued until controlled by the authorized engineer or the dam owner.

5. If the dam has been damaged but the damage is not as serious to cause collapsing, the nature shall be observed and the risk of collapsing shall be assessed. Then, the local and national institutions shall be contacted and the instructions shall be applied.

3.4. Flood Risk

There may be rises in the dam water level with the impact of excess rain or current at the dam area. In such situations, the following steps shall be applied in order to prevent negative impact on the reservoir area surrounding, residential areas and arable fields downstream.

1. Local emergency units and SI shall be contacted. They shall be notified regarding the following matters.

    - Present reservoir height and freeboard (safety margin) height
    - Reservoir rate of ascent

- Weather conditions (past-present-future)
- Evacuation/discharge status at downstream of the river
- The leak rate from the channels

2. If possible, the discharge amounts at the cover and spillway shall be increased gradually.

3. The public downstream shall be warned the discharge amounts shall be gradually increased to prevent the downstream public from being negatively affected.

4. Depending on the change in the water level, the increasing or decreasing leak shall be controlled.

5. The areas near the dam foundation or crest shall be checked against signs of leak, sink, depression, slide and other dangerous statuses. If such status is seen, the downstream residential areas and DSI shall be immediately notified.

3.5. Leak – Spill

Road or Soil Pollution

Oil, fuel oil and dye, etc. materials can spill within the project area and/or the used roads. The actions to be taken within the first 30 minutes after the spill of these items on the highway are very important in terms of preventing pollution. In case of any leak and/or spill after an accident, the actions to be taken are as follows:

1. The source of the leak should be determined and if possible the leak should be stopped,

2. Sand bags shall be placed around it to prevent the spreading of the leak,

3. In major leaks, depending on the slope of the land, a small channel shall be opened at the bottom end of the leak, inside shall be filled with absorbing material and the leaking substance shall be ensured to accumulate here, thereby, the intermixing of the leak with the groundwater shall be prevented,

4. The pollutant, polluted absorbent material and soil shall be placed inside bags of suitable site and strength, and labeled.

5. In case the leak and spill is too much, the accident shall be immediately notified to the worksite chief.

6. Any truck, work machinery, etc. vehicles making an accident on the highway shall be brought to its normal position as soon as possible to prevent the formation of further leak and spills.

Leaks to the Water Resources

Absorbent barges shall be used to prevent the spreading and collect any oil-fuel oil and chemical substance leaks that may seep to the water resources as a result of any accident. The interior of the absorbent barges shall be filled with absorbing fibrous material. By considering the size of the leak and the flow rate of the water resource, a few series of barges shall be used until the leak is completely gathered. The water quality of the water resource shall be monitored at the downstream and upstream of the area where leak has originated.

Pollution Preventing Equipment and Materials

- Sand: Sand is a good material to absorb the pollution created on the road and soil and to prevent its spreading. However, the sand has to be dry.
- Sawdust: Sawdust is one of the materials that can be used to prevent the spreading of the liquid substances that have spilled on the road and the soil.
- In leaks occurring from tins, barrels, etc. packaging, and the material shall be immediately poured to a sound tin, barrel, etc.
- Absorbent barges.
- Absorbent cushion.
- Rubber gloves, special clothing and personal protective equipment.
- Vacuum pump.
- Barrels resistant to chemical substance.
- Sound plastic bags.

4. End of the Emergency Situation and Subsequent Acts

If the conditions evidencing the end of the emergency at the dam area have occurred and the EAPC has approved the safety of the project site, the necessary departments are notified regarding the situation. The emergency action team gathers under the chairmanship of the EAPC, conducts an overall evaluation of the situation and a minutes is prepared regarding the emergency. The compliance of the actions undertaken during emergency action to the EAP is discussed; the necessary corrections and/or additions are integrated to the plan. When an unforeseen emergency is encountered, it will be ensured that this event is included to the EAP and that the preventive measures and intervention plans concerning this event are developed.

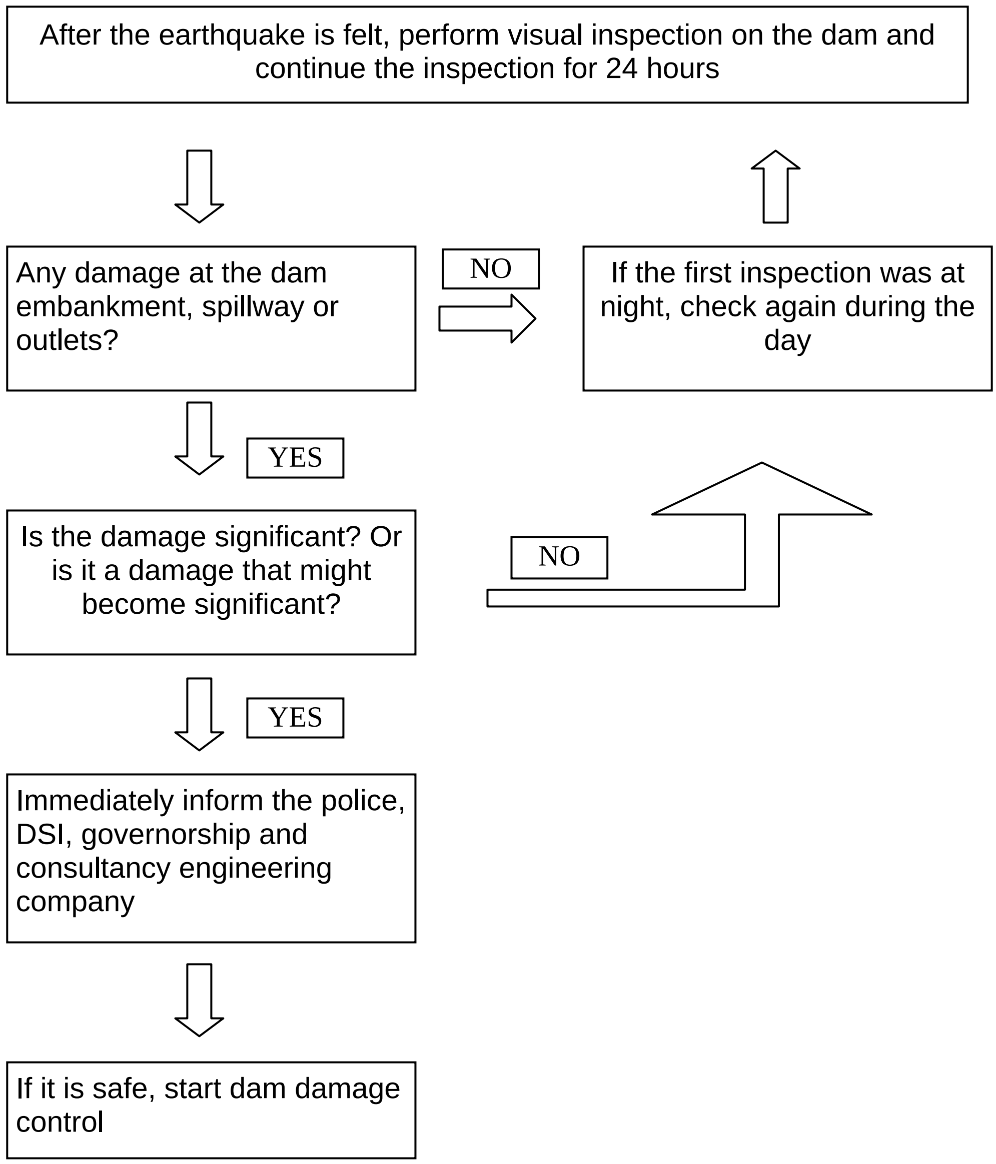
List of Contacts to be Called in Case of Emergency

Name of Institution	Contact Person's Name	Contact Number	
Mus Security Directorate	------------------------------	------------------------------	Office Out of office
Mus governorship	------------------------------	------------------------------	Office Out of office
Provincial Disaster and Emergency Directorate	------------------------------	------------------------------	Office Out of office
Mus Municipality	------------------------------	------------------------------	Office Out of office
………….. Village Mukhtar	------------------------------	------------------------------	Office Out of office
………….. Village Mukhtar	------------------------------	------------------------------	Office Out of office
………….. Village Mukhtar	------------------------------	------------------------------	Office Out of office
Fire Brigade	------------------------------	------------------------------	Office Out of office

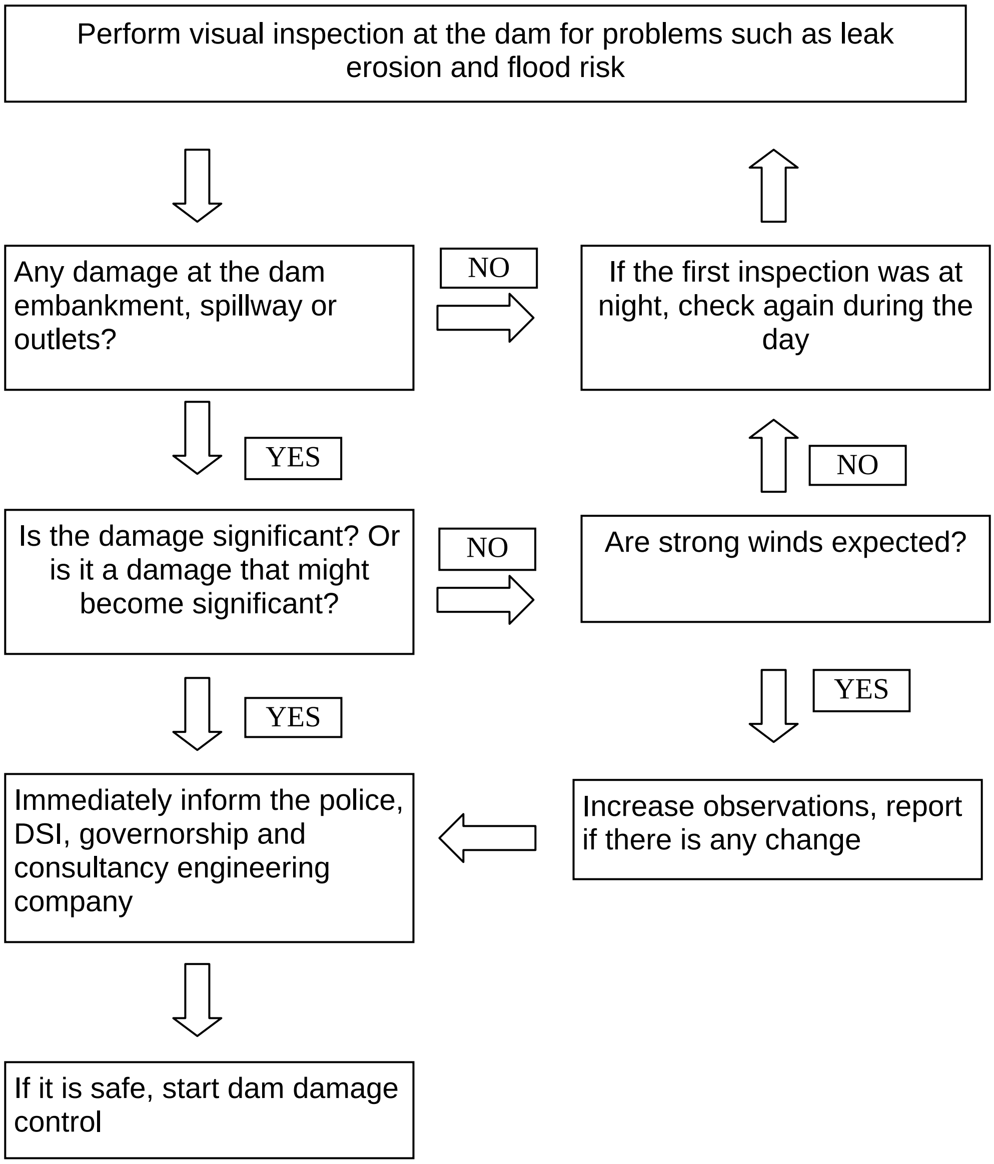
Name of Institution	Contact Person's Name	Contact Number	
DSI General Directorate	--	--	Office Out of office
.... Hospital	--	--	Office Out of office
Consulting Engineering Company	--	--	Office Out of office
Alpaslan I Dam and HEPP Operation	--	--	Office Out of office
____________________	--	--	Office Out of office
____________________	--	--	Office Out of office
____________________	--	--	Office Out of office
____________________	--	--	Office Out of office
____________________	--	--	Office Out of office

Emergency Action Flow Schemes

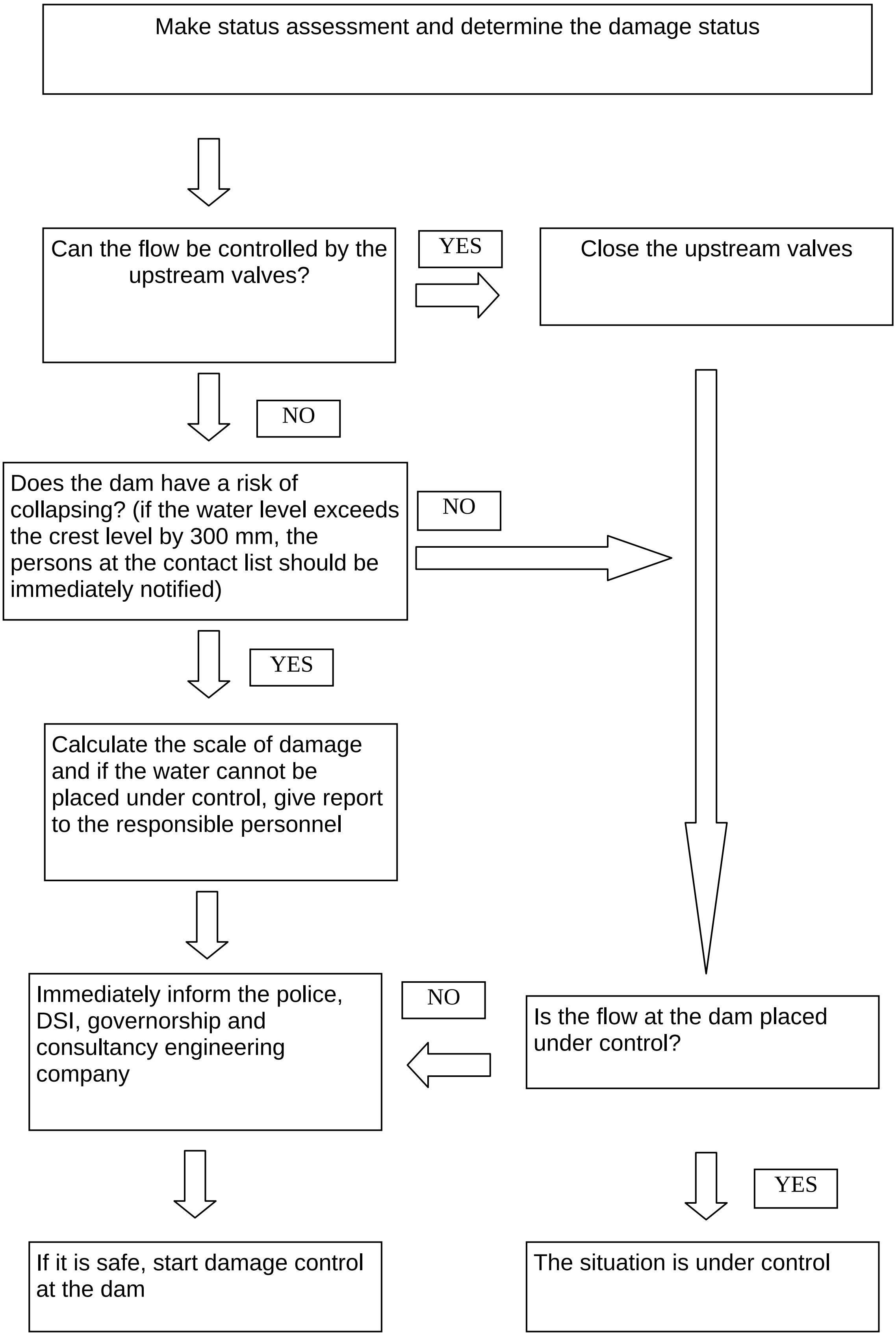
Earthquake:



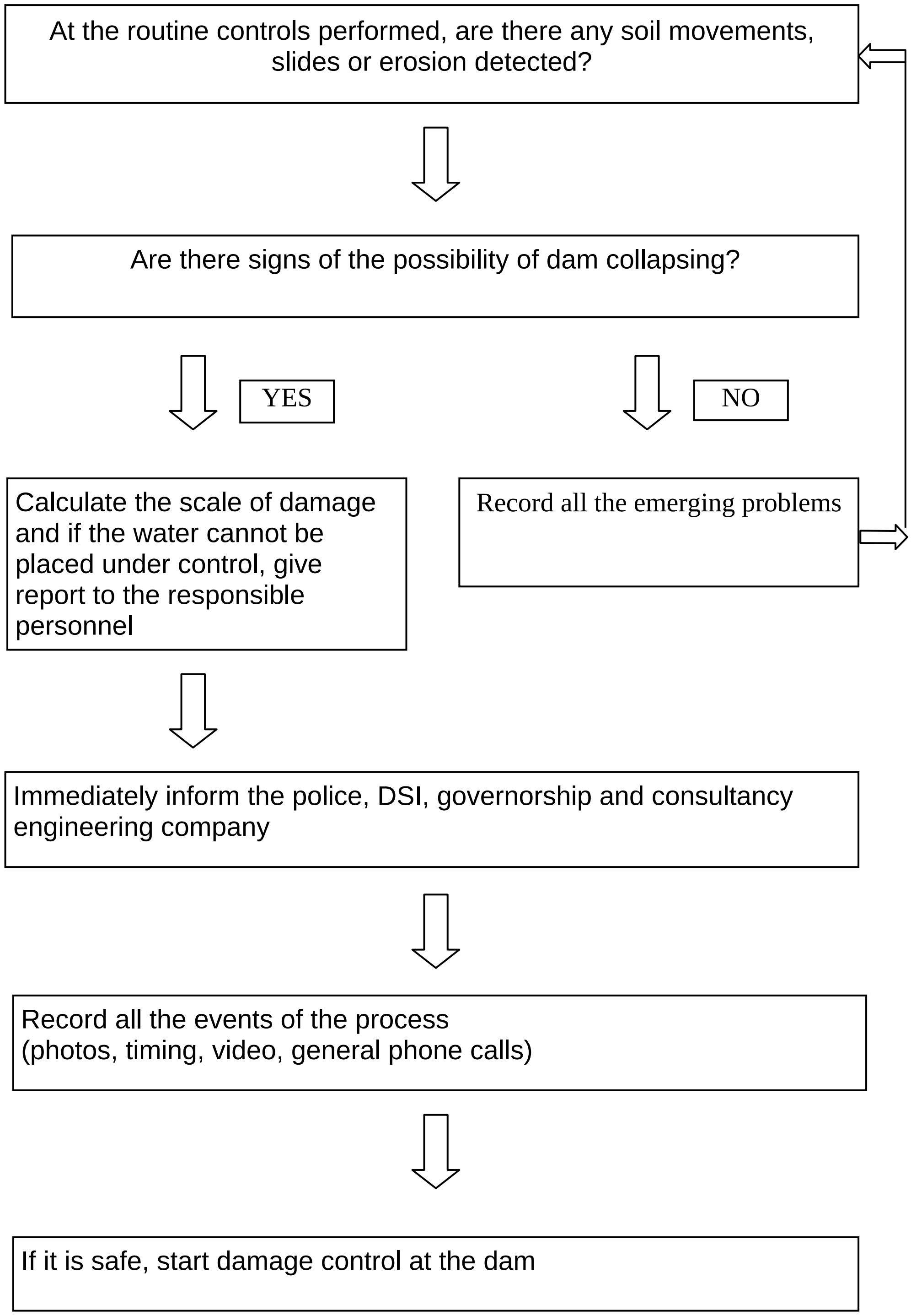
Excess Rain / Flow:



Failure of Operation of the Water Evacuation Equipment:

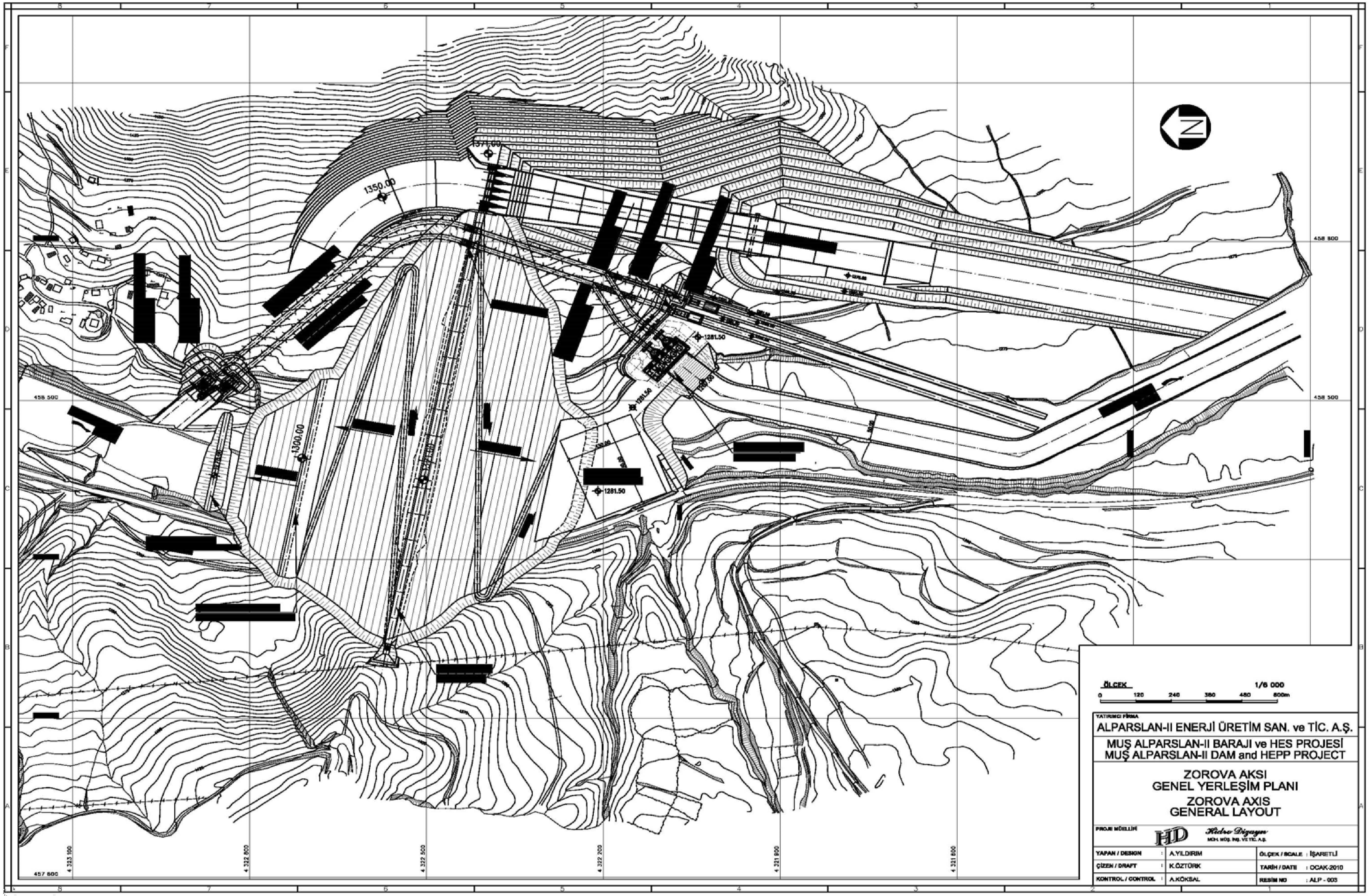


In Case of Fundemental Structural Damages:

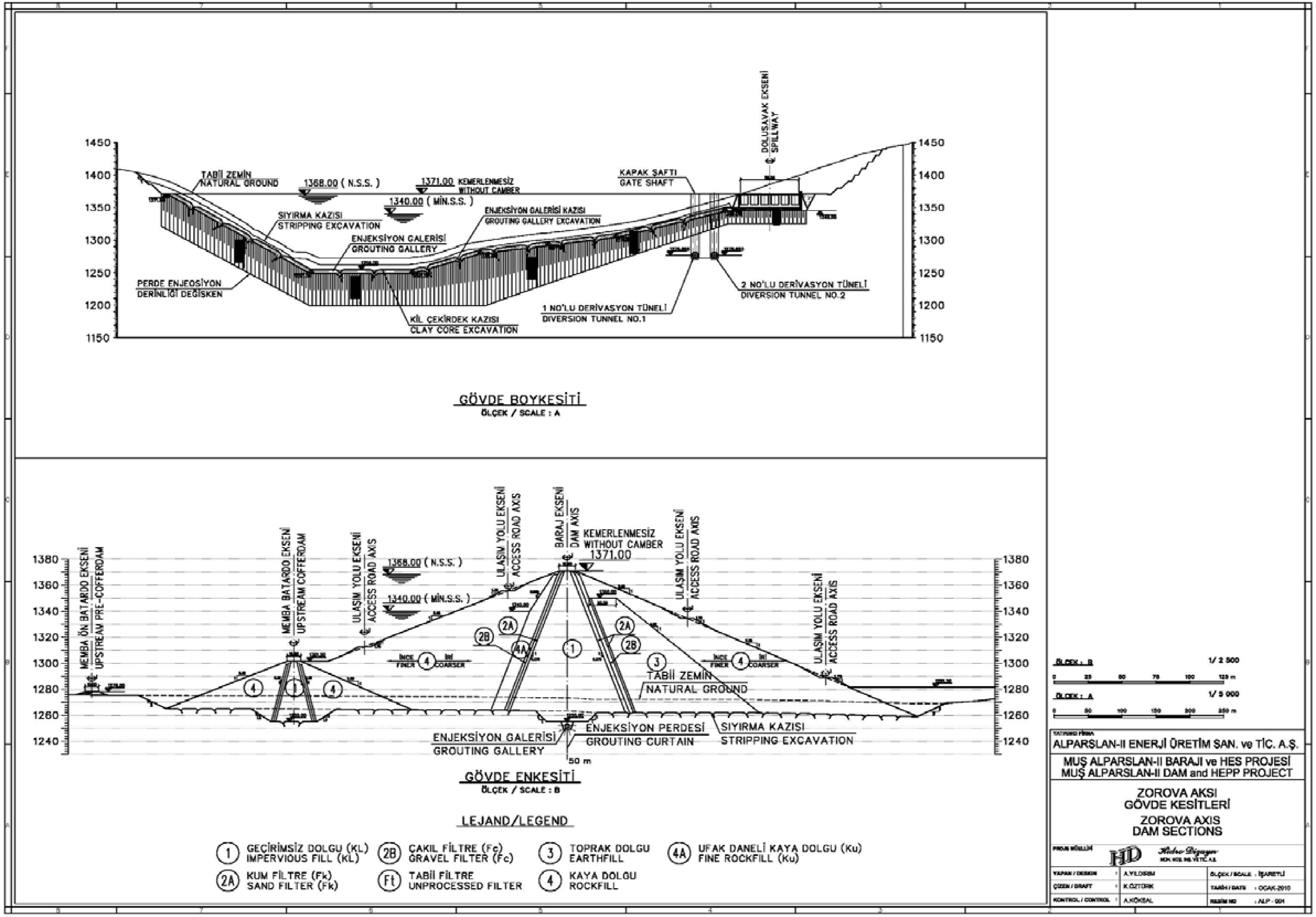


APP 23

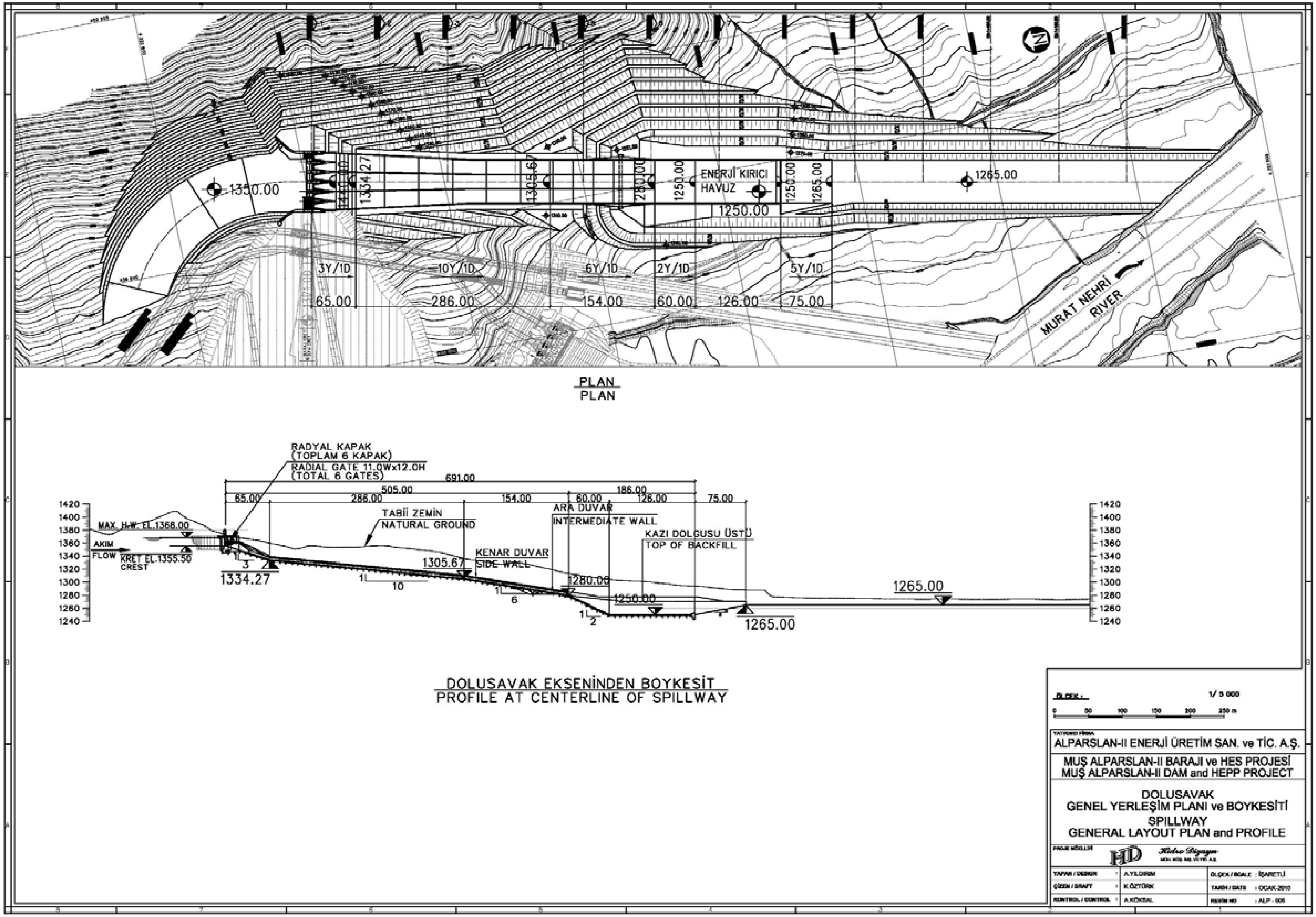
SECTION PLANS FOR UNITS



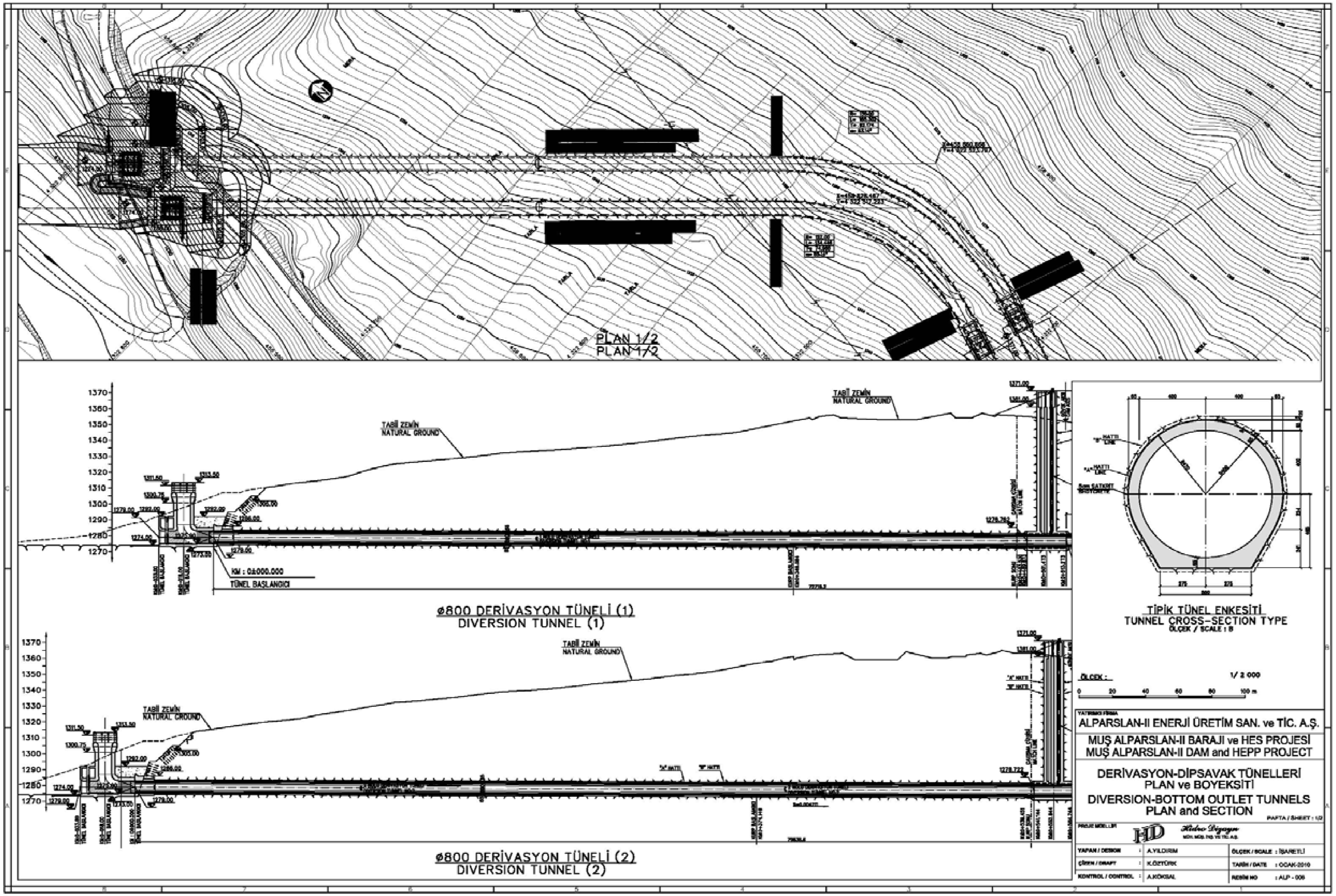
App 23.1. Alpaslan II Dam and HPPS Project General Layout



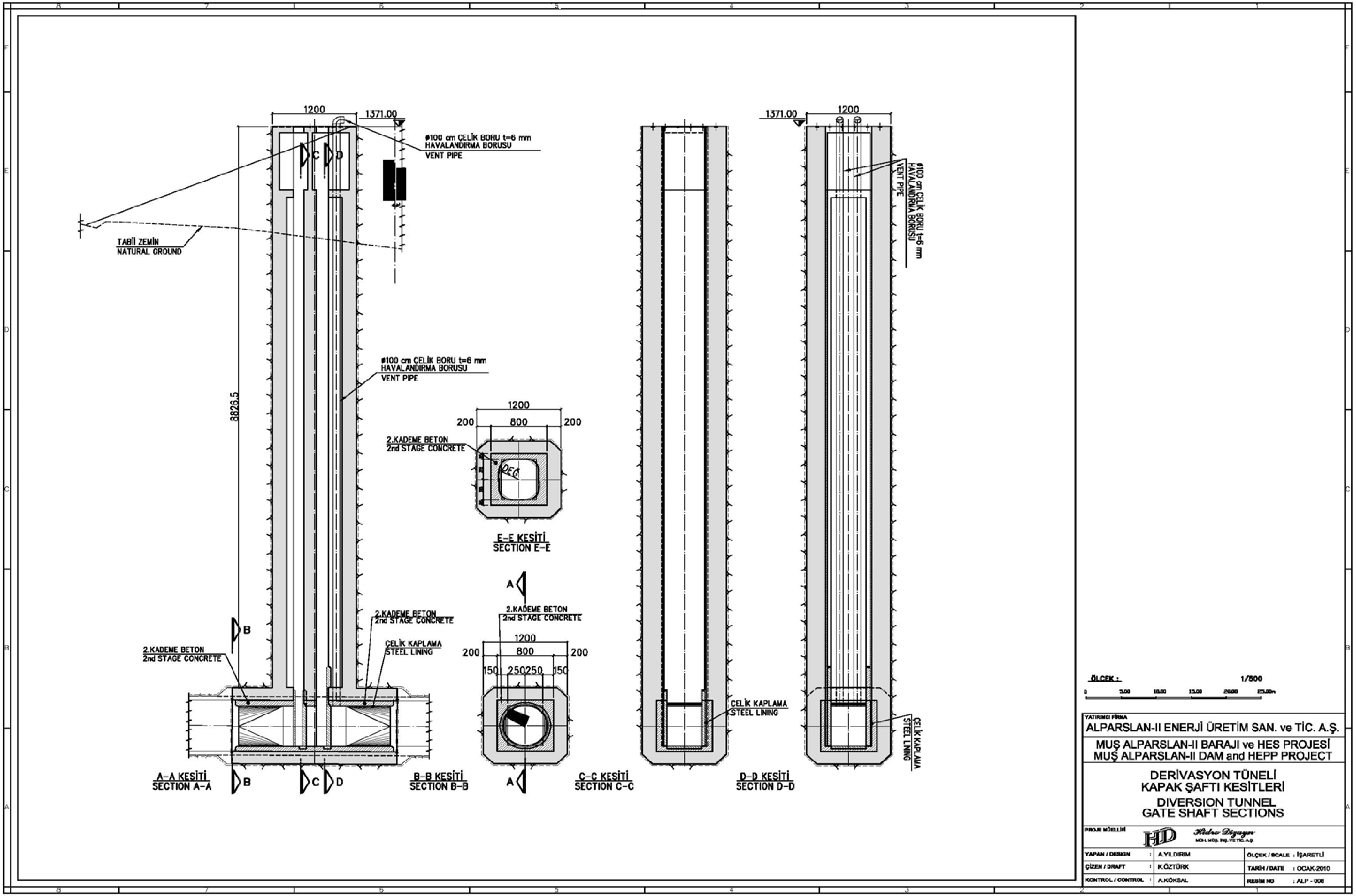
App 23.2. Dam Sections



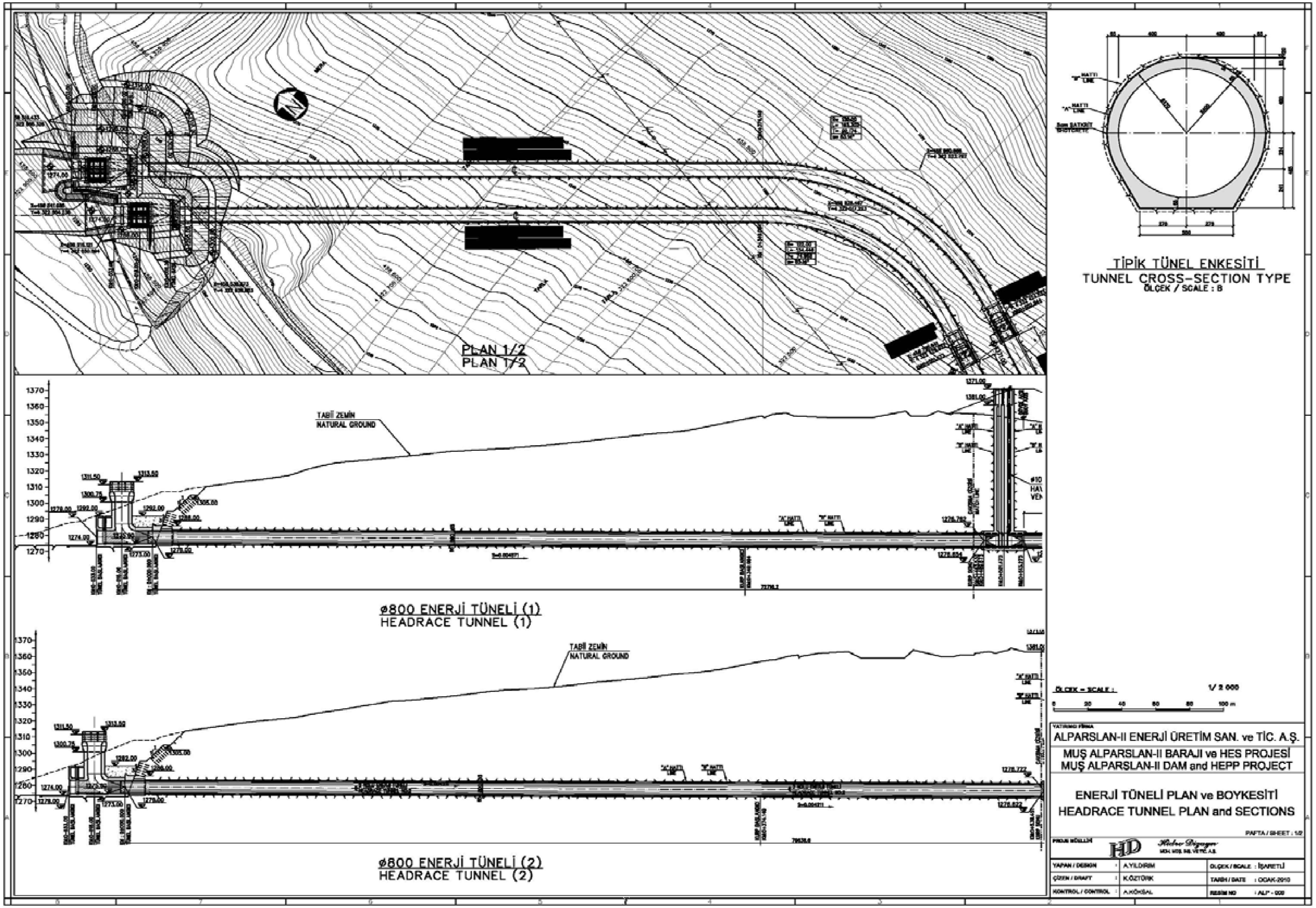
App 23.3. Spillway General Layout Plan and Profile



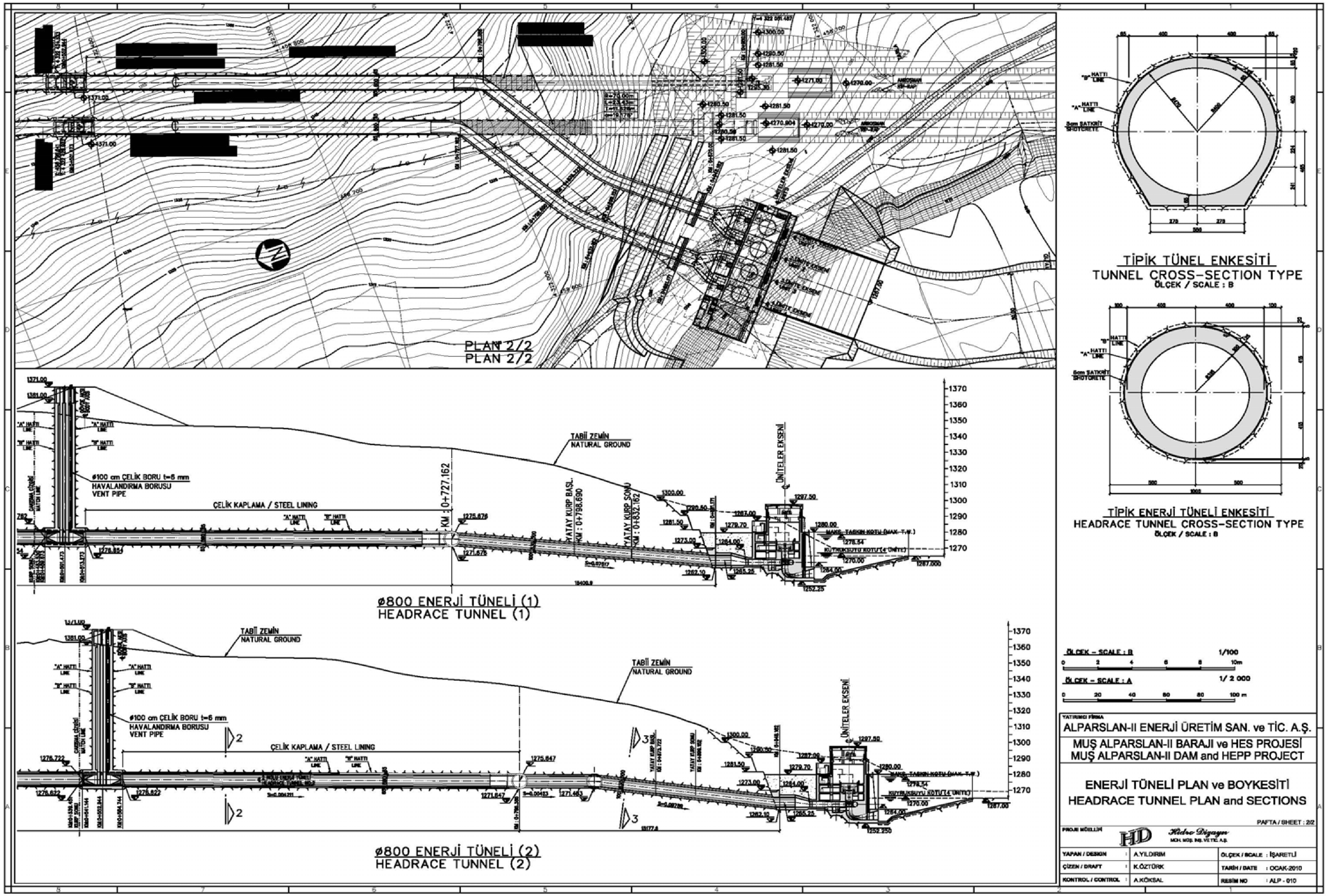
App 23.4. Diversion-Bottom Outlet Tunnels Plan and Section



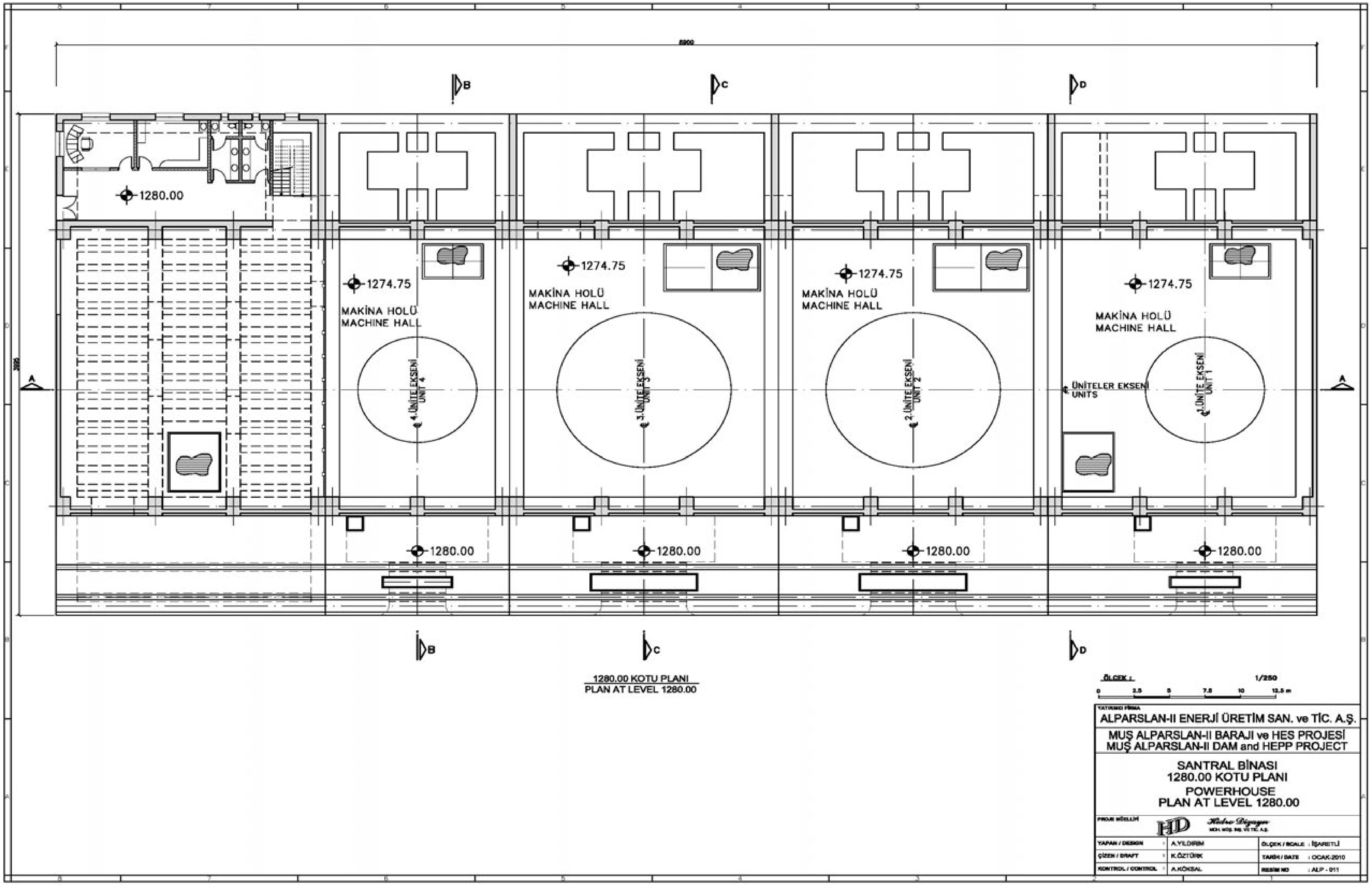
App 23.5. Diversion Tunnel Gate Shaft Sections



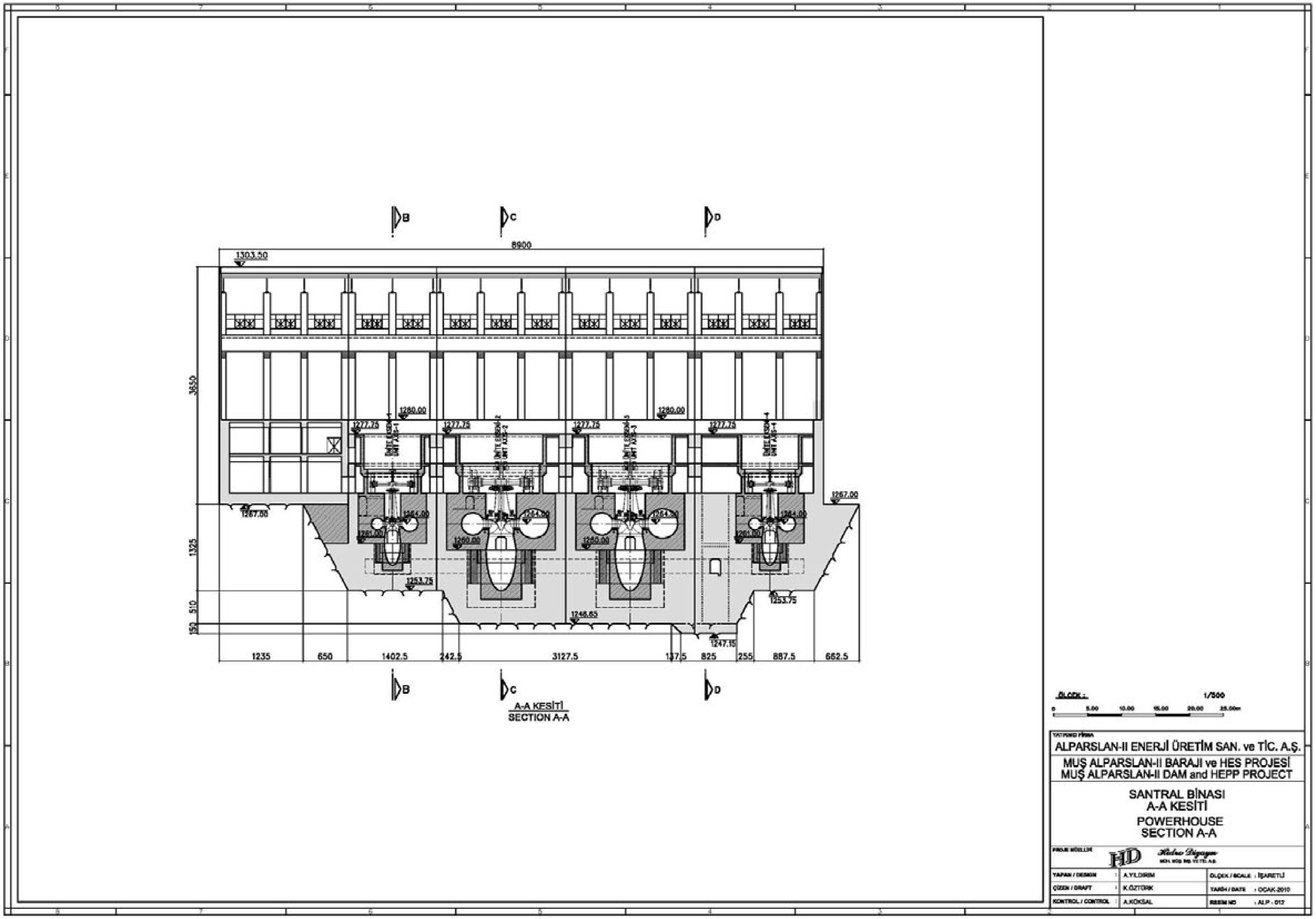
App 23.6. Headrace Tunnel Plan and Sections



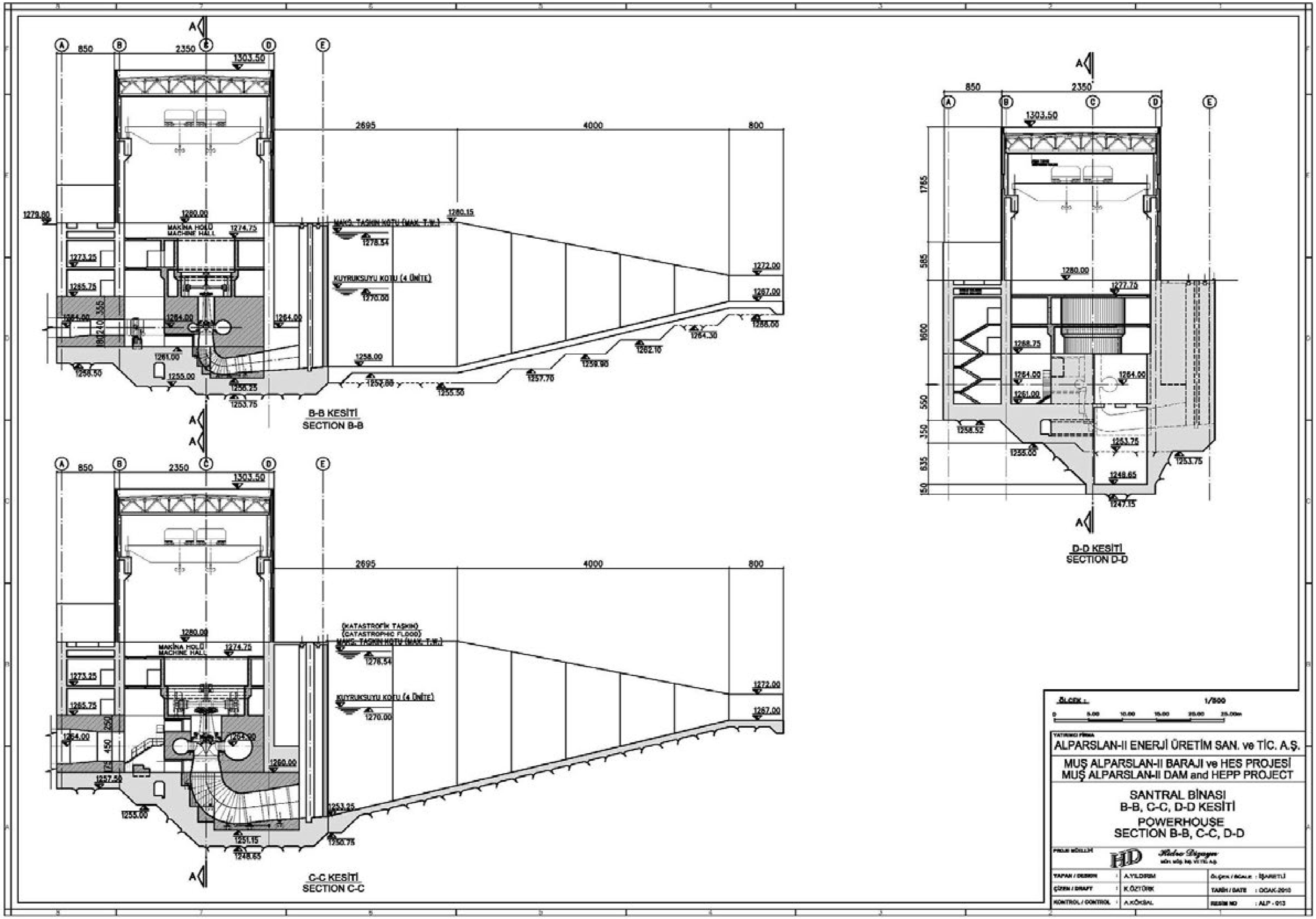
App 23.7. Headrace Tunnel Plan and Sections



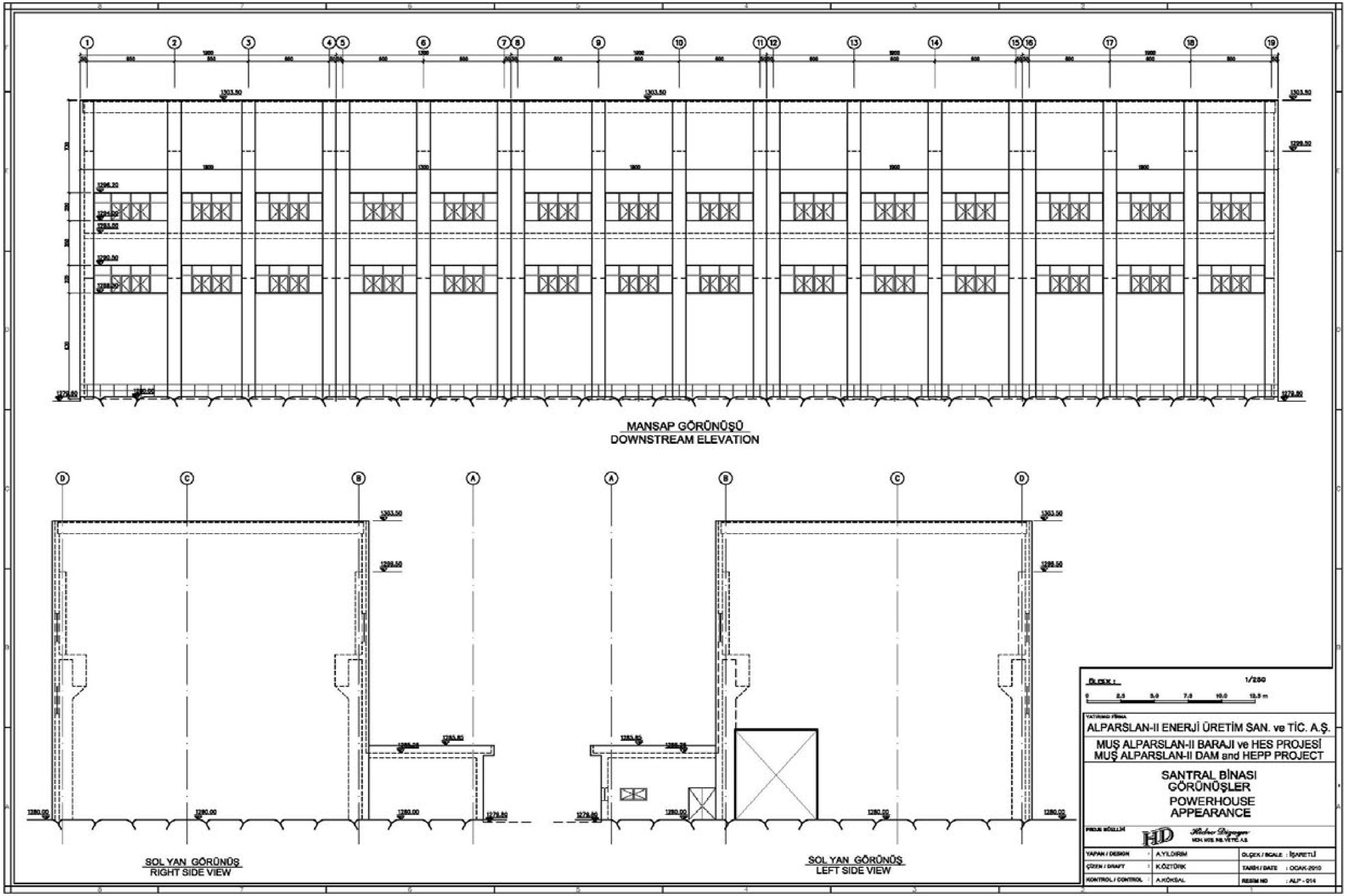
App. 23.8. Powerhouse Plan at Level 1,280.00



App. 23.9 Powerhouse Section A-A



App.23.10. Powerhouse Section B-B, C-C, D-D



App. 23.11. Powerhouse Appearance

APP 24

PUBLIC PARTICIPATION

Official Minute of Public Participation Meeting

T.C.
MUŞ VALİLİĞİ
İl Çevre ve Orman Müdürlüğü

Sayı :B.18.4.İÇO.49.00.02/ 12 04

09/08/2011

Konu :Alparslan II Barajı ve HES Projesi
Halkın Katılım Toplantısı

ÇEVRE VE ŞEHİRCİLİK BAKANLIĞI
(Çevresel Etki Değerlendirmesi, İzin ve Denetim Genel Müdürlüğü)

İlgi : 20.07.2011 tarih ve 402 sayılı yazınız

İlgi sayılı yazınız ve ÇED Yönetmeliğinin 9. maddesi gereğince; Muş İli, Merkez ve Varto İlçeleri sınırları içerisinde Alparslan-II Enerji Üretim ve Madencilik Sanayi Ticaret A.Ş. tarafından yapılması planlanan **"Alparslan-II Barajı ve HES (288,66MW$_m$ / 280 MW$_e$)"** projesi ile ilgili olarak; ÇED sürecine halkın katılımını sağlamak, faaliyet hakkında bilgilendirmek, görüş ve önerilerini almak amacıyla "Halkın Katılımı Toplantısı" İl Müdürlüğümüz başkanlığında, **08.08.2011 tarihinde saat 10:30 da** Muş İli, Merkez İlçesi, **Varto Yolu 38. Km. Abdurrahman Paşa Köprüsü Yanı adresinde bulunan Köprübaşı Tesislerinde** yöre halkı ve ilgili kurum ve kuruluşların temsilcilerinin katılımıyla yapılmış olup; toplantı ile ilgili bilgi ve belgeler ekte sunulmuştur.

Bilgilerinizi ve gereğini arz ederim.

Rifat NEHİR
Vali a.
İl Çevre ve Orman Müdürü

EKLER :
1- Toplantı Tutanağı (3 sayfa)
2- Toplantı Katılım Listesi (4 sayfa)
3- İlan yapılan Ulusal ve Yerel Gazeteler (2 adet)

Yazışma Adresi: istasyon Cad. No:34
MUŞ

İl Md. Santral Tel : 0436 212 18 30
Fax: 0436 212 18 22

TUTANAKTIR

Muş İli, Merkez ve Varto İlçeleri sınırları içerisinde Alparslan-II Enerji Üretim ve Madencilik Sanayi Ticaret A.Ş. tarafından yapılması planlanan **"Alparslan-II Barajı ve HES (288,66MW$_m$ / 280 MW$_e$)"** projesi ile ilgili olarak; ÇED sürecine halkın katılımını sağlamak, faaliyet hakkında bilgilendirmek, görüş ve önerilerini almak amacıyla "Halkın Katılımı Toplantısı" İl Müdürlüğümüz başkanlığında, **08.08.2011 tarihinde saat 10:30 da** Muş İli, Merkez İlçesi, **Varto Yolu 38. Km. Abdurrahman Paşa Köprüsü Yanı adresinde bulunan Köprübaşı Tesislerinde** yöre halkı ve ilgili kurum ve kuruluşların temsilcilerinin katılımıyla halkın katılımı toplantısı yapılmış olup; aşağıdaki hususlar görüşülmüştür.

1- İl Çevre ve Orman Müdürü; Rıfat NEHİR tarafından projenin amacı ve genel etkilerini açıklayıcı açılış konuşması yapıldı.

2. Projenin ÇED sürecinde PTD'yi hazırlayan Encon şirketi temsilcisi Hakan YILMAZ tarafından projenin özeti ve önemli çevresel etkileri hakkında genel bilgiler verildi.

3- Alparslan-II Enerji ve Üretim Mad. San. Tic. A.Ş yetkilisi Kürşat KOCAHASANOĞLU tarafından projenin amacı ve hedefleri hakkında bilgiler verildi.

4- Şahin ÇİFTÇİ (Sunay Mahallesi Muhtarı); kamulaştırma bedellerinin düşük belirlendiğini vatandaşın bu fiyatlar verilirse mağdur edileceğini söyledi, Şirket temsilcisi tarafından muhtara cevap verildi.

5- Maşallah KORKMAZ (Göçmenler Mah.); Mera konusunda sıkıntılarının olduğunu, bu sıkıntıların giderilmesi gerektiğini söyledi.

6- Kerem TAŞ (Akkonak Köyü): Proje kapsamında kullanılacak meralarla ilgili olarak köylüye bedel ödenip ödenmeyeceği konusunu sordu. Arazi bedellerini sordu.

7- Tacettin ÖZER (Tepebaşı Köyü Muhtarı); Proje dolayısıyla yöre halkının mağdur edilmemesi, kamulaştırma bedellerinin arttırılması gerektiğini söyledi.

8- Yalçın TURAN (Doğantepe Mah.); Verimli tarım arazilerinin suyun altında kalacak, yüksek ve verimsiz araziler dışında

9- Hamit KÖK (Topaktaş Köyü); Kamulaştırma bedellerinin her arazi için olmaması gerektiğini söyledi:

10- Abdulbaki KARAALP (Bağiçi Köyü I. Azası): Aralarında[illegible] arazi bedelleri göz önüne alınarak kamulaştırmanın yapılması gerekir dedi|

11- Fadlı ÖZER (Kayalıdere Köyü); Köyümüzün tarla arazilerinin %20'si, meralarım %90'ı, su altında kalmaktadır. Kararın sağılması gerektiğini söyledi:

12- Harun DURSUN (Sarılca Köyü); Kamulaştırma bedellerinin kabul edilemeyecek kadar düşük olduğunu söyledi:

13- Celalettin KILIÇ (Aligedik Köyü Muhtarı); Kamulaştırma ve arazi bedellerinin gerçekçi ve doğru dille getirilmesi gerekir dedi|

14- Mahmut MACİT (Alapınar Köyü I. Aza): Kamulaştırma bedeli konusunda şirketle anlaşılamadığını, değerlerin kabul edilemeyeceğini söyledi:

15- Muhtesim KILIÇ (Aligedik Köyü); Projenin faydalarının olacağını ve doğru değerlendirmelerin yapılması gerektiğini söyledi: Mahkemelik konuların değerlendirilmesini söyledi:

16- Fesih YÜKSEL (Sarılca Köyü); Projenin hem çevresel etkilerinin olacağını, hem de kamulaştırma bedellerinin açıklanmasını gerektiğini söyledi|

7- Proje temsilcisi (Enerjisa) sorulan tüm sorulara yönelik kısa açıklamalarda bulundu. Tüm sorulara genel anlamda açıklama getirmeye çalıştı.

8- Toplantı; İl müdürünün konuyu özetlemesi, Enerji temsilcisinin konuyu açıklaması, dilek ve temennilerle sona erdirildi.

Rifat DEMİR
Muş İl Çevre ve Orman Müdürü

Erdal ULUDAĞ
GSD Şb. Müdürü
Muş İsam

... Şahin
Şb. Md.
Muş İsam

Murat BOZDURUŞ
Müh.
Muş İsam

Hakan ...
Encon Tems.

Kürşat KOÇAKLAHTADOĞLU
Enerji SA Tems.

Metin SARIASLAN
Jeo. Yük. Müh.
MTA Gn. Md. lüğü

Emin ESEN
ENCON

HALKIN KATILIMI TOPLANTISI KATILIM LİSTESİ

Muş İli, Merkez ve Varto İlçeleri sınırları içerisinde Alparslan-II Enerji Üretim ve Madencilik Sanayi Ticaret A.Ş. tarafından yapılması planlanan **"Alparslan-II Barajı ve HES (288,66MW$_m$ / 280 MW$_e$)"** projesi ile ilgili olarak "Halkın Katılımı Toplantısı" İl Müdürlüğümüz başkanlığında, **08.08.2011 tarihinde saat 10:30 da** Muş İli, Merkez İlçesi, **Varto Yolu 38. Km. Abdurrahman Paşa Köprüsü Yanı adresinde bulunan Köprübaşı Tesislerinde** yapılan toplantıya katılım sağlayanların listesi;

ADI SOYADI	ÜNVANI / KURUMU/ KÖYÜ	İMZASI
Nizamettin Abdar	(Halktan) Bağiçi	
Ekrem Çelik	Akpınar köyü	
Necil macit	Akpınar köyü	
Akpınar Köyü	Mehmet Aktaş	
Fehim Koç	Akpınar köyü	
Alaattin Yıldırım	Akpınar köyü	
Şerefettin Akan	Akpınar köyü	
A. Hamit Koç	Tepe.	
İlyas AKTAŞ	Akpınar köyü	
mehmet çelik	tepeköyü	
midhat Aydı	Akpınar köyü	
Hadi dursun	Sarılıc köyü	
omer çelik	Sarılıcı köyü	
Fesih Yüksel	Sarılıca köyü	
Aydın Dursun	Sarılıca köyü	
[illegible]	Sarılıca köyü	
İsamettin Dursun	Sarılıca köyü	
Fadlı ÖZEN	Kayalıdere	
Sahip Çiftçi	Akkonak köyü	
Muhlis Turan	Göçmenköy	
Maşallah Dursun	Sarılıca köyü	
Hikmet Tekin	Sarılıca köyü	
YAKUP KARABAĞ	Sarılıca	
Refik Demirhan	Sarılıca Köyü	

ADI SOYADI	ÜNVANI / KURUMU/ KÖYÜ	İMZASI
Tacettin Özer	Tesv muh	[signature]
Dursun yolcu	Akpınar Köy	[signature]
Mahmut Macit	Akpınar Köyü	[signature]
Yemen Aktaş	Akpınar Köyü	[signature]
Oktay Aydemir	[illegible]	[signature]
Abdullah yalçın	ulusirt köyü	[signature]
Adil pirat	Şevket kantar	[signature]
Yalçın TURAN.	Doğdap Mah. (Tepe)	[signature]
Selim Yenilmen	Akpınar Köyü	[signature]
Mahmut Gülük	Ulusırt Köyü	[signature]
Abdulselam KESKİN	Tepeköyü	[signature]
AZİZ YILMAZ	ULUSIRT köyü	[signature]
Hayrettin ÖZER	TEPE köyü	[signature]
Mustafa yalçın	AKPINAR köyü	[signature]
Behzat DEMİRTAŞ	ULUSIRT köyü	[signature]
Haydar Kocakaya	Tepe Köyü	[signature]
Ümit Demir	Ulusırt köy	[signature]
Zübeyir	Kuyurnca Tepeköyü	[signature]
Mehmet Ferit Sözen	İmar ve Koop. Şub. Md. V. Çevre ve Şehircilik İl Müdür	[signature]
Mehtap ALTUN	Harita Tek. Çevre ve Şehircilik Müd.	[signature]
Ali Alol	Tepe köy	[signature]
Tacettin Kaya	Tepe Köy	[signature]
Ali Bingöl	AKPINAR köyü	[signature]
mehmet Yıldırım	AKPINAR-Köyü	[signature]
Salih Alım	Sağlık Müdürlüğü	[signature]
Mahmut KAYA	Doğdap köyü	[signature]
Erhan Keskin	Tepeköy	[signature]
Cisim Celtıy	Tepeköy	[signature]
Cengiz [illegible]	Akpınar	[signature]

(2)

ADI SOYADI	ÜNVANI / KURUMU/ KÖYÜ	İMZASI
HAKAN TAN	Tepe köy	
Müslüm Turhan	Tepe köyü	
[illegible]	[illegible]	
İbrahim ARSLAN	Tepeköyü	
Maşallah Korkmaz	Göçmenler Mah.	
Yakup Tekemen	kayalı dere köyü	
Serhat Tekemen	kayalı dere köyü	
Veysi Özen	kayalıdere köyü	
m.Ali yıldırım	akkonak mah	
Celal kaya	Göçmen mah	
Erhan ARSLAN	Tepeköyü	
Ahmet AKPOLAT	Tepe köyü	
Muhteşim Kılıç	Alipedile Köyü	
Celalettin Kılıç	" "	
Ferit Kılıç	" "	
Fethan ASLAN	tepe köyü	
Fesih Tekeman	Kayalıdere köyü	
Abdulbaki Koyuncu	Bağtepe köyü	
Kazım Toprak	Bağtepe köyü	
Dedebey Dağlar	Bağtepe köyü	
mehmet yıldız	Bağtepe köyü	
mehmet yıldız	Bağtepe köyü	

(3)

ADI SOYADI	ÜNVANI / KURUMU/ KÖYÜ	İMZASI
ismail Çelik	Tepe Köy	
Serafettin CEYLAN	Bağiçi köyü	
Mehmet Korkmaz	Göçmenler köyü	
Ayhan SÖNMEZ	Göçmenler	
Ekin KORKMAZ	Göçmenler	
Abdurrahman SÖNMEZ	"	
Ahmet [illegible]	"	
Eşref DEMİR	Dumlusu K.M	
M.Reşit Aykan	Dumlusu köyü	
Yenal DURAN	DSİ 172.Şb müd	
Hakim KAYAALP	Bağiçi köyü	
Ali Çelik	Tepe köy.	
M. Sedat [illegible]	Bakkaya - Tepe köy	
Nazmi BOZKURT	Tepe köyü	
Yekta Özkan	Çevre Müh. İl Tarım	
Fırat ÖNER	Tepeköy	
Ferzende SATAN	Muş İçom / mühendis	
Hakan YILMAZ	Encon Çevre Dan. Ltd.Şti	
Murat BAĞATUR	Muş İçom/Müh.	
Rifat NEHİR	Muş İçom / İlaldan	
Emin ESEN	ENCON	
Erdal İLHNER	Muş İçom / Şb.md.	
Bayır GÜNEŞ	ENERJİSA	
Metin SARIASLAN	Jeoloji Y.M. / MTA	
Murat POYRAZ	DSİ 172 Şube.V.	
Murat Eriz	ENERJİSA	
Hayati ERCAN	Danışman	

APP 25

LANDSCAPING AND REINSTATEMENT PROJECT

THE ALPASLAN II DAM
EROSION AND SEDIMENT CONTROL & LANDSCAPING AND REINSTATEMENT PROJECT

C		
B		
A	22.08.2011	
Rev. No.	Date	Description

AITY

ANKARA ADVANCED TECHNOLOGIES INVESTMENTS

Contractor
ENERJiSA

DESIGN WORKS FOR ALPASLAN II (ALP) DAM EROSION AD SEDIMENT CONTROL & LANDSCAPING AND REINSTATEMENT PROJECT (ALP - ESC & LRP)

August 2011

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ABBREVIATIONS

AITY: Ankara Advanced Technologies Investments (AATI)
HEPP: Hydroelectric Power Plant
ALP: Alpaslan II
ALP-D: The Alpaslan II dam
EIA: Environmental Impact Assessment
IFC: International Finance Corporation
ESC & LRP: Erosion and Sediment Control & Landscape and Reinstatement Project
FSF: Field Survey Form
EC: Erosion Control
SC: Sediment Control
LR: Landscape and Reinstatement

1. INTRODUCTION

This report compiles and presents the results of “Erosion and Sediment Control and Landscaping and Reinstatement Project” of Alpaslan II dam and HEPP (ALP-R-HEPP) in Turkey.

2. AIMS AND OBJECTIVE

To improve Turkish economy and energy market, investment of “Alpaslan II Dam, Hydraulic Energy Power Plant project (ALP-D-HEPP) were planned on the Murat river which is one of the main tributaries of the Euphrates river by the ALPASLAN II ENERGY PRODUCTION AND MANING INDUSTRY INC within the borders of the central and Varto districts of the Mus province.

ALP-D-HEPP, Material query, crushing-screening-washing plant, concrate production plant, relocation roads were planned in the Mus province on the Murat River, located in the Europtes River watershed, at the 1265 m thalveg elevation, which is far from 30 km from Mus province.

There is Mus plain at the downstream of the Alpaslan II Dam. After constructing ALP-HEPP project, 733,80 GWh energy will be produced annually with 98 m maximum gross head and 344 m3/s flow rate by the 280 MWe installed power. At the same time 68.060 ha land will be irrigated and protected from the floods at the Mus plain.

Enerjisa has in place an Erosion and Sedimentation Control Plan for each Project. Sites have worked in accordance with these broad conceptual Plans where feasible, however due to the nature of the sites and the degree of excavation works and blasting the sites are considerably modified and there exists short 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 and drawings are required.

The study has two key objectives to be undertaken in two stages as follows:
1: To determine and design site specific measures for controlling erosion and ensuring medium and long-term reinstatement at Alpaslan II site.
2: Develop long term landscape plans for the site to mitigate visual impact and enhance the ecological and landscape character of and Alpaslan II for Operations phase.

3. METHODOLOGY

Phase I of the methodology was a desk study of the background information about the project area and surroundings. Based on the desk study, Phase II entailed on-site visit and evaluation and Phase III involved in report completion with ESC & LR specifications and finally Phase IV entailed the development of recommendations and tools for ALP – ESC & LRP.

Desk study: This was required before the field survey for overall understanding of the ESC & LRP and EIA requirements and accordingly for collecting and reviewing the background information about the project area and surroundings. Site inspections were conducted after the sources of information on soil types, watercourses, all crossings, riparian zones, vegetation, slope failures, erosion sites and sensitive sites

Site visit: Field surveys have been carried out by Prof. Dr. Günay Erpul, Assoc. Prof. Dr. İlhami Bayramin and Assist. Prof. Dr. Ekrem Kurum from Ankara University, Faculty of Agriculture. After completion of Stage A, the site team can make a further site visit if deemed necessary to appraise the site from a landscaping perspective. During this site visit the following actions were undertaken:

- The temporary and permanent Project areas were appraised from overall ESC & LR perspectives.
- Project areas were inspected for preparation of an erosion and sedimentation control strategy. Observations of the site conditions provided the greatest level of detail for characterizing potential erosion and sedimentation control concerns.
- The landscape was assessed in relation to shape, scale, color 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 the landscape impacts from construction and operations as well as enhance the landscape character of the operating HEPP Projects. Landscaping measures may include planting with appropriate species, civil works, re-contouring and smoothing/reshaping construction areas.
- The lack of local topsoil, access to water, safe access and steep slopes were taken into consideration when determining landscape options.
- The soil and plant ecologies of the area were reviewed to determine appropriate species and style of landscaping to be applied.

Reporting: For each facility, “Field Survey Form” (FSF) was filled in and included the following data (Table 1).

Table 1: Field Survey Form

	Site	Observations	Recommendations	
			ALP-EC & ALP-SC	ALP-LR
1				
2				

Recommendations: Recommendations included information on location of risk area, photographs, short term ESC & LR measures, cost and timeframe of short term measures, long term ESC & LR measures, cost and timeframe of long term measures, maintenance requirements of the ESC & LR measures; costs of maintenance and constraints/risks.

To simply reference to the measures and practices, a protocol was introduced by assembling a number of measures into “Erosion Control” (EC), “Sediment Control” (SC) and “Landscape and Reinstatement” (LR) and the details of each were given in Tables 2, 3 and 4, respectively, with their number, name and description and purpose. Only their number(s) was shown in Table 1 of FSF to entail the required recommendations. A fact sheet was then prepared for each EC and SC measure and LR practice. Fact sheets included detailed information on description and purpose, limitations, implementations, timing, design and layout, costs, inspection and maintenance and references.

.........3.1 Erosion and Sediment Control (ESC)

Excessive erosion and sedimentation are the most visible water quality impacts due to construction activities. This part provides the biotechnical engineering and engineering considerations associated with the basic types of erosion and sediment control measures in ALP construction site. ESC measures will be grouped as EC and SC and effectively integrated with LR techniques during the implementation of the ALP-ESC & LRP.

3.1.1. Erosion Control (EC)

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 plans for construction sites. The key to erosion control is preventing the detachment of soil particles and reducing the volume of runoff. 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 or applying a compost blanket or erosion control mat.

All inactive soil-disturbed areas on the ALP project 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. To be effective, 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.

EC consisted of preparing the soil surface and implementing one or more of the measures shown in Table 2, to disturbed soil areas in ALP construction site.

3.1.2. Sediment Control (SC)

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 methods should be also well integrated with EC techniques summarized in Table 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 practices 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.

As mentioned earlier, SC measures are most effective when used in conjunction with EC practices of Table 2. The combination of EC and SC is usually the most effective means to prevent sediment from leaving the project site and potentially entering storm drains or receiving waters.

SC will consist of preparing the soil surface and implementing one or more of the measures shown in Table 3 in combination with EC practices, to disturbed soil areas in ALP construction site.

3.2. Landscape and Reinstatement (LR)

Landscape survey and analysis is required for the analysis of the visual, functional and topographical integration between project components and their surroundings considering the following planning elements; existing vegetative structure and topography in planning area; other land uses and transportation corridors near 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.

3.2.1. Landscaping (L)

The strategies and guidelines that will support rehabilitation at the construction site and stabilization of the landscape around the dam wall and spillway 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.

In the ALP dam 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 the original topography and landscape characteristics of the area. Due to these measures there will be no negative impact to the landscape.

3.2.2. Reinstatement (R)

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 dam construction 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.

For the reestablishment of the original vegetation cover at the site proper soil management is an important issue of general landscape management especially for the bio-restoration purpose

Table 2. ALP – EC Measures

Measure #	Name	Description and Purpose
ALP-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.
ALP-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.
ALP-EC3	Hydraulic Mulch	Hydraulic mulch consists of applying a mixture of shredded wood fiber 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.
ALP-EC4	Hydroseeding	Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydromulch equipment, to temporarily protect exposed soils from erosion by water and wind.
ALP-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 vegetation is established.
ALP-EC6	Earth Dikes and Drainage Swales	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, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.
ALP-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.
ALP-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.

The scope of the Landscaping and Reinstatement Project (LRP) will be developed in accordance with the above mentioned project requirements and covered the following systematically constructed tasks, shown in Table 4. Unquestionably, LR practices will as well be conducted in combination with both EC and SC measures.

LRP will contain “Landscape Strategies Development” and “Plantation Plan Development”. In the former, functional and aesthetical relationships will be established between project area and surroundings, considering the harmony between constructional units-facilities and planning-design elements. The plantation design will be performed according to seasonal climatic properties and finally maintenance requirements will be taken into account for plantation design solutions. In the later, plant selection and plantation plan will be conducted in accordance with the minimum maintenance requirements and the functions of different landscape zones will be provided with plants considering their characteristics and planting locations.

Table 3. ALP – SC Measures

Measure #	Name	Description and Purpose
ALP-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.
ALP-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.
ALP-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.
ALP-SC4	Wind Erosion Control	Wind erosion control, to prevent and alleviate dust problems, it contains the application of water or other dust palliatives.
ALP-SC5	Tracking and controlling vehichels and construction equipments	Tracking and controlling vehichels and construction equipments is implemented to prevent and alleviate the vehicle-generated sediment transport. It involves such measures as street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway.
ALP-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.

Table 4. ALP – LR Practices

Practice #	Name	Description and Purpose
ALP-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.
ALP-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.
ALP-LR3	Permanent Seeding	It is establishment of sufficient vegetation cover to reinstate the local plant species and ecology for t he longer term. Perennial vegetative cover is established on disturbed areas by planting seed. 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.
ALP-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 biorestoration 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.

4. FIELD SURVEY FINDINGS

Some information and data about soil, climate, geology, vegetation in this section were benefited from project presentation files.

4.1 Alpaslan II Dam

Alpaslan II Dam Zorova axle, on the Murat River, is approximately 34.00 km far from the city center, and can be reached by the Mus - Varto - Erzurum state highway route. This asphalt road is open every season. The dam is designed as an impervious clay core rock-fill type. Mus – Varto state road and Karaağıl province road are located in the dam resorvoir. These two roads will be relocated during the construction. Location of the project area is presented in Figure 1.

Murat River has average annual flow rate of 4.297,17 hm3 and 17.505,77 km2 watershed drainage area. Some of the properties of the planned dam are presented in Table 5.

Table 5 Some properties of the ALP-D-HEPP project (Source: project presentation file)

Crest length	844,00 m (including spillway 936,00 m)
Crest width	12,00 m
Thalveg elevation	1 272,00 m
Crest elevation	1 371,00 m
Crest hight (from thalveg)	99,00 m
Crest hight (from basic)	116,00 m
Maximum water level	1 368,00 m
Normal water level	1 368,00 m
Minimum water level	1 340 m
Minimum surface area	35.06 km2
Maximum surface area	54.69 km2
Normal water volume	2 097,20 hm3
Minimum Hacim	997,77 hm3
Active volume	1 099,43 hm3

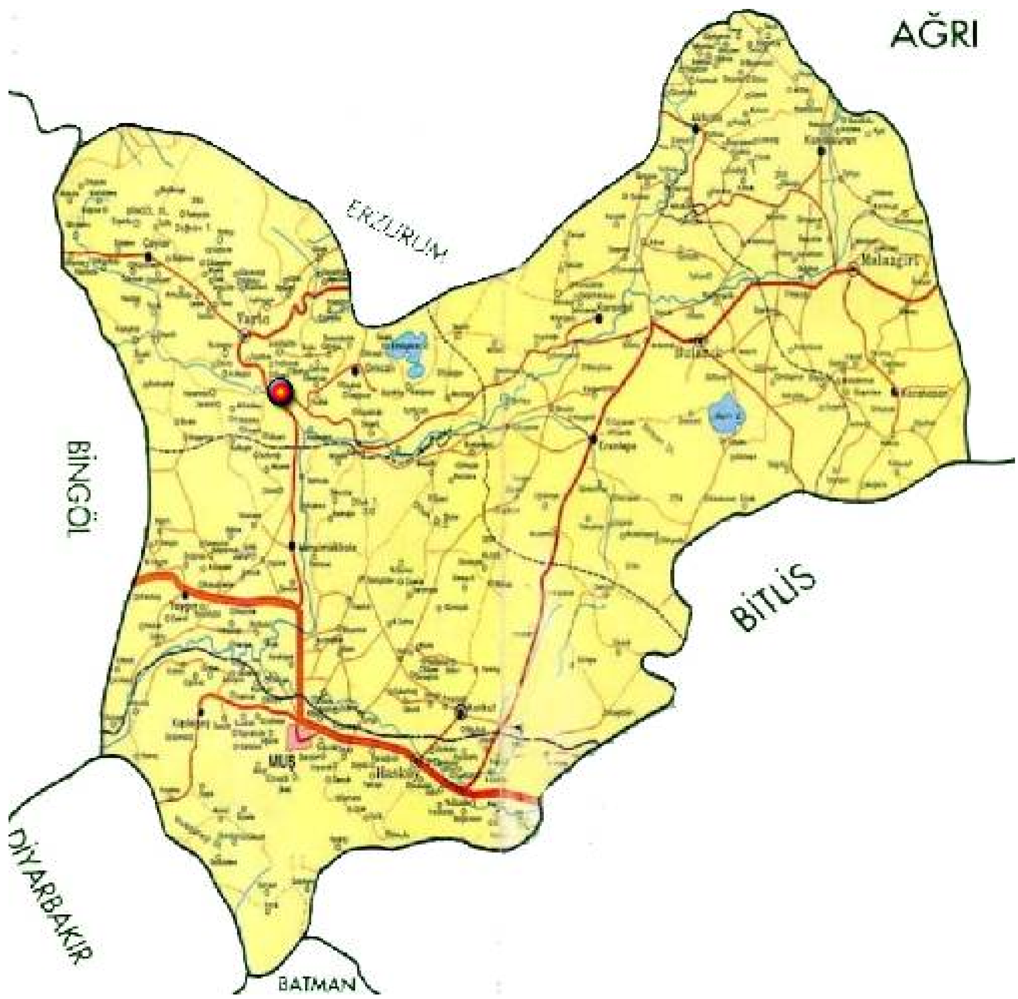

Figure 1. Location of the project area

The spillway, 2 diversion tunnels - the upstream coffer dam, 2 power tunnes of, 4 penstock, power house, 4 transformer, generator constitute the main units of the project. Under the project impermeable, permeable material, and rock quarries will be opened for filling. Under the project, one 400 tons / hour capacity, crushing-screening-washing plant and 3 concrete plants will be operated. Also within the scope of the project consisting of 6 storage area is planned for the storage of excavation material.

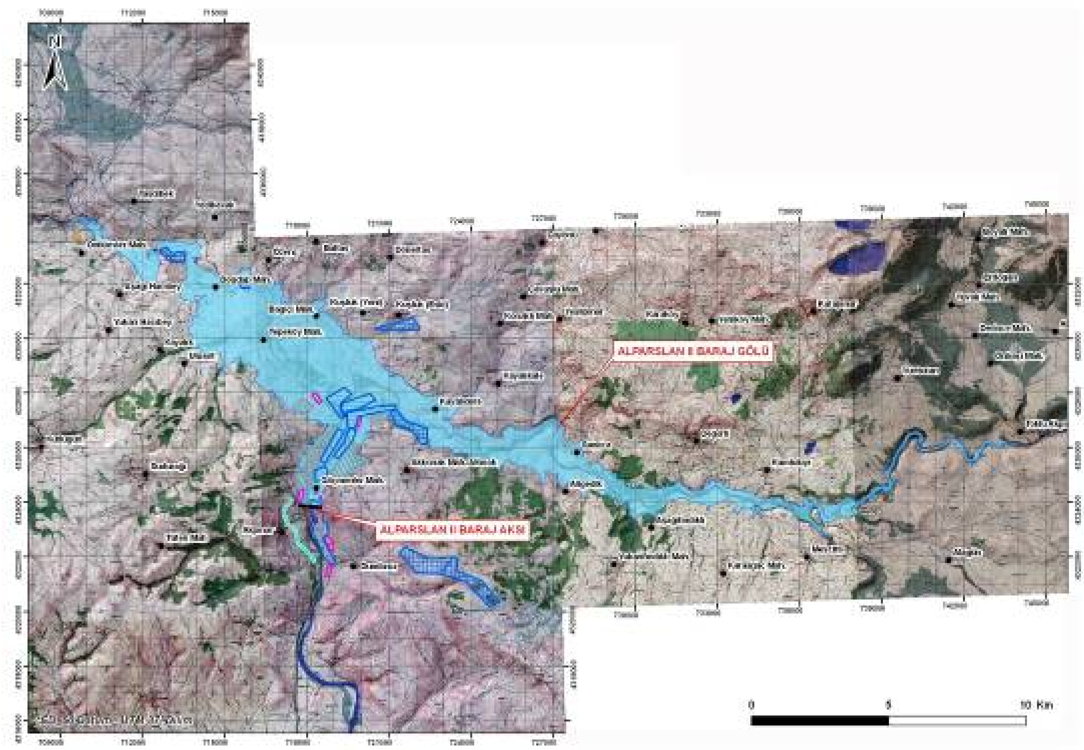

Figure 2. Location of the Alpaslan II Dam and reservoir area

4.1.1 Baseline Conditions

Alpaslan II Dam – HEPP planned by the Alpaslan II, Energy Production and Mining Industry Inc. is located on the Murat River, which is located in the sub-basin of the Euphrates River Basin and far away 30 km from the Mus city center. Mus plain is located at downstream of the project area. Project area is located within the boundaries of Central and Varto districts of the Mus province. At the maximum water level 54,69 km2 water surface area will be formed. Grasslands are the major land cover at the project area. There are agricultural lands, meadows, non-agricultural areas and some forested areas. Residential areas, especially village settlements are scattered in the project area. General topographical view of the project area is presented in photo 1.

Photo 1. General topographical view of the project area

4.1.1.1. Soil and sediment description

Alluvial soils, coluvial soils, chestnut soils, non-calcerous brown forest soils, basaltic soils, vertisols, non-calcerous soils and regesols are the major great soil groups in the Mus province. Distribution of the great soil groups is presented in Table xx. As seen from the Table 6, chestnut great soil groups shows the largest spread with a 76.83% (3838.54 ha) area coverage. There are total of 27.42 ha (0.55%) settlement in the project area.

Table 6 Distribution of the great soils group in the project area.

Büyük Toprak Grubu	**Area ha**	**Area %**
Alluvium Soils	695,73	13,89
Chestnut soils	3848,54	76,83
Coluvial soils	28,80	0,58
Basaltic soils	260,69	5,20
Total	4833,76	96,49
Other land uses		
River	135,84	2,71
Bare rock	12,30	0,25
Settlements	27,42	0,55
TOTAL		3,51
GROOS TOTAL	**5009,32**	**100.00**

Distribution of the land use classes of the project area is presented in Table 7.

Table 7 Distribution of the land use classes

Land use	Area ha	Area %
Meadow	514,80	10,28
Bare rocks	12,30	0,25
Shrubs	126,43	2,52
River beds	135,84	2,71
Dry farming (Fallow)	117,64	2,35
Grassland	3557,32	71,01
Irrigated agriculture	517,66	10,33
Settlements	27,42	0,55
Total	**5009,32**	**100,00**

It can be seen the Table yy the most common land use is grassland in the project area (3557,32 ha, %71.01). There are total of 517,66 ha (%12,68) agricultural (dry and irrigated) land in the project area.

Distribution of the land use capability classes of the project area is presented in Table 8. It can be seen that Class I, II, II and IV lands, which are suitable for cultivation, have 1688.9 ha area coverage, which is 33.71% of the project area. Most of the cultivated area in Class III lands. There are very limited first (I) class lands 237.87 ha (5.47%).

Table 8 Distribution of the land use capability classes of the project area soils

Land use capability classes	Area ha	Area %
I	273,87	5,47
II	421,86	8,42
III	863,26	17,23
IV	129,91	2,59
Sub total	**1688,90**	**33,71**
VI	1535,06	30,64
VII	1609,80	32,14
VIII	12,30	0,25
River beds	135,84	2,71
Setlements	27,42	0,55
GROSS TOTAL	**5009,32**	**100,00**

4.1.1.2. Climate

There is continental climate, characterized with cold and snowy winters and cold and short summers in Mus province which is located in the Eastern Anatolia. Because of the quick transition between summer and winter, falls and springs have very short seasonal periods.

To evaluate the climate of the project area, Varto Climate Station data, which is the closest climate station to project area, were used.

According to the data, Varto Meteorological Station bulletin for many years (1976-2010), the highest average temperature is in July recorded as 22.0 ºC in the region, while the lowest average temperature is in January recorded as -8.2 ºC. The maximum temperature of 40.5 ºC was measured in July 2000 and the minimum temperature of -33.4 ºC was measured in February of 1985.

According to the Varto Meteorological Station data, the project area receives highest rainfall in April with the average rainfall of 87.3 mm, and receives the lowest rainfall in August with the average rainfall of 7.7 mm. Long years annual total precipitation is 595.7 mm.

According to the Varto Meteorological Station data, January has the highest snowing day's number with 9.1 days average. The average annual number of snowy days is 39.4 days.

According to the Varto Meteorological Station data, region 1st degrees of the prevailing wind direction is west south-west (WSW), 2nd degrees of the prevailing wind direction is south-west wind direction (SW). Maximum wind speed of 28.5 ft / s, the direction of the south-west (SW), was recorded in March.

4.1.1.3. Topography and Geology

Landscape character of the Alpaslan II Dam Area mainly consisting of conjuction of 2 different surface waters, and in this sense has a character of the structure effected from 2 different shaped valleys. These two surface waters are Bingöl and Muratlı Rivers. There is plant community, water pillow and poplar trees in general, on the small island, where Bingöl and Muratlı rivers are merged. Bingöl River valley is located more wide and level topography compare to Muratlı River valley. Here, the topography has wide corridor and around small hills are elevated.

There are Cenozoic (Tertiary) and Quaternary geological units in the project area.

CENOZOIC (Tertiary)

Solhan Formation; Pliocene aged Solhan Formation, is composed from basalt, andesite, and of volcano-sediments. Stratigraphic thickness of the formation is approximately 1000 m in the region which is seen with all lithological levels in the region. Solhan formation units emerged on the water surface of the lake area, but can not found at the Zorova axle area.

Zırnak formation; Zırnak formation consists of marl, tuff, marl, lacustrine limestone, sandstone, conglomerate, siltstone, tuff, tuffite, travertine, limestone, clay-tuff, and kalkarenitte. Formation includes volcanic fragments (agglomerate, tuff, lapilli, volcanic breccia) lava (typically basalt, andesite, trachyte types), and intercalated coal from place to place. Zırnak Formation (Tz) has a 400-600 m stratigraphic thickness. There is no consensus about the age of the formation in the region among researchers have done work before. In some studies Upper Miocene age and in some studies Lower Pliocene age is given. Drilling wells at the Zorova axle, carried out during the feasibility studies, some sandstone, claystone, siltstone and basalt levels were observed with no lateral and vertical direction continuity, and they show a chaotic structure, which is clayey limestone, basalt, sandstone, siltstone and marl of the blocks in the clayey matrix in general. Zırnak formation, which overlies the Adilcevaz formation with angular discordance, has lateral transition with Solhan Formation.

Adilcevaz Formation; Upper-Oligocene to Lower Miocene aged formation has approximately 1000 m stratigraphic thickness. Yellow-reddish-brown siltstone and conglomerate were the members of the top levels. Upper layers were formed from intermediate and bluish-green limestone showing layering of claystone, siltstone and sandstone. Sub-members of the formation are emerged at the upper elevation of the left site slopes of the dam area. It is emerged at the upper elevations of the slopes at the dam axle area. Formation is composed of levels of greenish, greenish-gray sandstone, coarse sandstone, siltstone, claystone, marl and fine-grained conglomerate at the am site.

QUATERNARY

Alluvium and terraces; Alluvium has been observed along the Murat River dam site. In general, the thickness of the alluvium bed, consisting of pebbles of basalt and limestone blocks, ranges from 2-4 m. Bench terraces were also observed in a limited area, at the Murat River bed near the left shore of the dam site

Slope Debris; Two different structures at the dam slope debris covering the main rock outcrops. First of them is called as Qym(i), which is formed from clay and gravel, silt mixture and the second of them is called as Qym(2) which is formed from block, gravel, and small amounts of clay, silt mixture.

Landslide Material; According the information derived from drilling wells opened at the both the right and the left side of the dam axle, landslide material has thickness of 15.5 – 22.5 m, and consists of an irregular mixture of silt and clay. There are claystone and sandstones of Adilcevaz formations under the landslide material

Photo 2. General topography and geological structure

4.1.1.4. Vegetation Cover

The project area is located in the Mus provincewhich is under the influence of continental climate of in Eastern Anatolia. Mus province in terms of plant geography, is located in the Iran-Turan phytogeography. However, throughout the province, by Euro-Siberian and Mediterranean flora species also can be found.

Plateaus (37.9%), mountains 34.9%' and plains (27.2%) are the major landforms in Mus province territory. General floristic composition is formed of herbaceous plants which have step characters in the Mus province. However, on the high lands, forest vegetations seen which is dominated by oak species.

Mus, vegetation is often dominated by steppe plant community. In the province, in moist habitats, Equisetum arvense, Trifollum pretense var. pratense, Medicago sativa, Salix alba, Tamarix tetranda, Thypa latifolia, and Juncus inflexus species are seen. Widespread tree species are Pinus sylvestris, Salix alba, Populus alba, Quercus petraea and Quercus libani. In addition, many cultivars are also possible to come across due to large agricultural fields. Common cultural plants are Beta vulgaris plants. altissima, Cucurbita pepo, Cucurnis melo, Citrullus lanatus, Zea mays, Triticum sativum, and Hellanus annuus.

According to the Provincial State of Environment Report, the provincial land area has approximately 7% forested area. During the last 10 years, 150 ha plantation were carried out in Province. Provincial forests consist of trees, mostly oak species

In Mus province, most of the forests (90%) have damaged characters. In Mus, there are very little productive forest areas. There are 1280.5 hectares of productive forest preserve only in the central district, 597.5 ha damaged forest area and 4039 ha productive coppice forest area out of the total 57,147 ha of forest area in the county. Distribution of damaged forest acoording to the districts are in central district 33,683.5 ha, Malazgirt 2702.5 ha, Hasköy 4730.5 ha, Bulanık 4785 ha, Korkut 3711.5 ha, Varto 1617 ha.

Photo 3: Vegetation cover at the ALP-HEPP area

Photo 4: Construction site of the main body of the ALP-D-HEPP

Photo 4 shows the current undisturbed state of the construction site of the main body of the ALP-D-HEPP. In this area land disturbances are going to be performed by cut/fill activities to a given extent. Thus, during construction activities an increase in potential sediment transports by splash and sheet erosion processes and material fall-downs and slides to the river is expected from these disturbed areas.

If the required measures were not taken, as it is seen above in the photo, erosion-originated sediments reach directly to the river. Therefore, there is a need not only for adequately storing excess cut materials but also for taking the ESC measures in the site. Especially, diversion structures (diversion canals or ditches) to be built at the toes of the cut slopes, (ALP-EC6) are significant to contain runoff water. Herein, the runoff water should be securely diverted to the natural water courses. Additionally, at these sites, since all land disturbances are being performed at the near-river steep slopes, establishing temporary diversion ditches and grass stands (hydroseeding) is required for preventing the river pollution from the materials possible to arise during the land disturbances for vegetation clearance and cut/fill activities.

Most of all, parallel temporary geo-textile silt fences (ALP-SC1) should be laid at the faces of the slopes on contours with predetermined intervals to catch up the down moving finer materials. Regular maintenance of the silt fence is here very crucial not to contaminate the river with the construction materials, to avoid failures in silt fence installation and to keep them operating. Periodic inspections, especially immediately following runoff events, promptly repair or replacement of damaged components and removal of sediments that have accumulated upstream of the fences are very crucial for this site. Geo-textile silt fences located parallel to one another and perpendicular to the slope to regularly trap and hold on the slumping material from upside help very much till the permanent actions come into place. Given fill slopes are nearby the river, in some cases, breast wall defenses at the toe of slopes could be vital (ALP-EC8) along the stream. In this way, it could be possible to contain the larger materials like debris and rock fragments and to check slopes sliding down. With diversion structures (ALP-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 those to be constructed at the toes of the above-road cuts, the runoff water should also be securely diverted to the natural water courses.

Photo 5: Opposite bank of the construction site of the main body of the ALP-D-HEPP

The photo given above (Photo 5) depicts the undisturbed and intact state of the site for the main body of the ALP-D-HEPP at the opposite bank of the river. The topographical conditions of the location reveal the needs for taking the ESC measures in the site. Much as the fact that the soil is shallow reduces the risk of polluting the river with soils and sediments or their flows into the river, given the construction cuts will be implemented on the slopes, which are nearby the river, it is necessary to stabilize the downslope site 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. Therefore, 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 (ALP-EC7 or ALP-EC8). Additionally, diversion structures (diversion canals or ditches) to be built at the toes of the above-road cuts, (ALP-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 (ALP-SC1 and ALP-SC3). After construction, this natural or pre-construction pattern of the slopes should be taken into consideration during LRP works (ALP-LR1, ALP-LR2, ALP-LR3 and ALP-LR4).

Photo 6: Construction site for the inlet of the derivation tunnel of the ALP-D-HEPP

Construction works for the inlet of the derivation tunnel of the ALP-D-HEPP are going to be implemented in the site given above photo (Photo 6).During civil works, it could be necessary to contain material fall-downs and slides from the surfaces of the slopes and to check slopes sliding down (ALP-EC8). Additionally, it is expected that rill and gully erosion processes could occur place to place. Thus, during the construction such ESC measures as temporary geo-textile silt fences (ALP-SC1), diversion structures (diversion canals or ditches) (ALP-EC6) and temporary hydroseeding (ALP-EC4) should be effectively used to prevent sediment-laden surface runoff to reach the river. When required, by the diversion structures (ALP-EC6) both at the top and at the toes of the re-contoured slopes, 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 (ALP-EC6 and ALP-SC3), by means of permanent seeding (hydroseeding) and tree plantation (ALP-EC4 & ALP-LR2), the cut slopes for the access road construction should be stablized.

Finally, construction site for the inlet of the derivation tunnel of the ALP-D-HEPP will be a location of intense vehicle traffic to transfer the materials from undergroung tunnel boring to the storage area. Thus, dust could originate from rock and soil surfaces, material storage piles and construction materials or from vehicles and equipments entering and leaving the project site. In order to prevent or alleviate the sediment transport caused by dust (wind erosion), application of water or other dust palliatives must be performed (ALP-SC4).

Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport (ALP-SC5).

Photo 7: Construction site for the dam axis of the ALP-D-HEPP and the sites to be submerged at the source after dam build-up

Construction site for the dam axis of the ALP-D-HEPP and the sites to be submerged at the source after dam build-up are pictured at the Photo 7. Particularly, because the construction works will be implemented on the slopes, which are nearby the river, there is a need for for taking the ESC measures in the site not to contaminate the river with cut/fill or construction materials. Thus, during the construction such ESC measures as temporary geo-textile silt fences (ALP-SC1), diversion structures (diversion canals or ditches) (ALP-EC6) and temporary hydroseeding (ALP-EC4) should be effectively used to prevent sediment-laden surface runoff to reach the river. By the diversion structures (ALP-EC6) both at the top and at the toes of the re-contoured slopes, 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 (ALP-EC6 and ALP-SC3), by means of permanent seeding (hydroseeding) and tree plantation (ALP-EC4 & ALP-LR2), the cut slopes for the access road construction should be stablized.

There are a great amount of river terrace soils in the valley and will be completely submerged. The fertile top soil on these sites, to the depth of solum (A plus B horizons), should be scraped and later conserved by properly stocking to be used for landscape and reinstatement works (ALP-LR1 & ALP-LR4).

Besides, at these sites it could be planned to clear vegetation and trees. The clearance of the existing vegetation should be done within a given timing frame (ALP-EC1). Untimely cutdowns and clearance operations of the vegetation would raise the risk of erosion and sedimentation. Small plants, which are easily pulled out with their roots, could be used to reinstate or restore the disturbed areas and slopes in the fall months (ALP-LR2).

Photo 8a: The storage area-I of the ALP-D-HEPP

The photo given above shows the storage site of the ALP-D-HEPP (Photo 8a). It will be built over partially flat aluvial areas (river terraces) found in the river left shore. First of all, the fertile top soil, to the depth of solum (A plus B horizons), should be scraped and later conserved by properly stocking (ALP-LR1 and ALP-LR4). Besides, the degraded loose cut materials should be packed here with a particular cross-sectional area in this site. Again, given the fill area is nearby the river, rock-lined walls (riprap) at the toe of slopes could be vital (ALP-EC7) along the stream. In this way, it could be possible to contain the larger materials like debris and rock fragments and to check slopes sliding down.

During storage activities, an increase in potential sediment transports by splash and sheet erosion processes to the river is expected from these stored or filled loose materials. If the required measures were not taken, as it is seen above in the photo, materials reach directly to the river. The prevention of surface water entry from uphill to the fill slope faces by diversion structures (ALP-EC6) should be implemented. In the Photo 8a there are many small wadis or gullies and streambeds at the upper part of the storage location. Depending upon the properties of the deposits in the site, continous material flows could be a problem; in the rainy season the streams to be concentrated through these incisions should be prevented to flow through the fill area. These streams should be conveyed down to the site securely so that they could cause no streambed carving and eroding. Natural waterway passages, if it is necessary during construction, culverts should be laid down not to disturb the natural drainage and to avoid the possible damages at the downward slopes. In addition, the check dams (ALP-SC3) inside the wadis should be built; flow velocity and energy should be taken under control.

Also, the storage areas of the ALP-D-HEPP and its vicinity will be locations of intense vehicle traffic to transfer the materials obtained in the course of land disturbances by construction activities to the storage area. Thus, dust could originate from rock and soil surfaces, material storage piles and construction materials or from vehicles and equipments entering and leaving the project site. In order to prevent or alleviate the sediment transport caused by dust (wind erosion), application of water or other dust palliatives must be performed (ALP-SC4). Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport (ALP-SC5).

Photo 8b: The storage area-II of the ALP-D-HEPP

The storage site-II of the ALP-D-HEPP is pictured at the above-given photo (Photo 8b), as well. Compared to the area of the storage I of the ALP-D-HEPP, this site to be built in the river right shore will reside in much flatter and broader aluvial terraces. Even though both storage areas will be inundated after the dam construction, the fertile topsoil should be reclaimed (ALP-LR1 ve ALP-LR4). Again, during the construction the ESC measures should be effectively used to prevent sediment-laden surface runoff and dusts to be transported by the air streams to reach the river (ALP-EC6; ALP-EC7; ALP-SC3; ALP-SC4 and ALP-SC5).

Photo 9a: Riverbed excavation sites for providing permeable materials (sand)

Photo 9b: Riverbed excavation sites for providing permeable materials (sand)

Photo 9a and 9b depict the sand-take places from riverbed required for the construction of the ALP-D-HEPP. During pulling off the sand materials, sediments contaminations are very much anticipated to take place as results of the riverbed excavations and disturbances. Therefore, there is a requirement to build a basin (ALP-SC6). By this way, the sediment-disturbed river streams by excavation activities should be diverted to a temporarily constructed sediment basin and detained under quiescent conditions, allowing sediment to settle out before being discharged back to the running riverbed.

Photo 10a: The rock pit area of the ALP-D-HEPP

Photo 10b: The rock pit area of the ALP-D-HEPP

The rock pit areas of the ALP-D-HEPP are shown at the Photo 10a and 10b. Notwithstanding the fact that the site is not nearby the river, there is a risk of material transports from these disturbed areas to the river through the sediments arriving to the natural water ways by the processes of splash, sheet and rill erosion. The prevention of surface water entry to the slope faces and the disturbed places of the rock pit area by diversion structures (ALP-EC6) of uphill should be implemented. Or, by constructing check dams within the wadis (gullies) (ALP-SC3), the velocity of the concentrated downslope flows should be reduced and sedimentation should be promoted in the dams.

Additionally in this site, in order to prevent or alleviate the dust-originated problems (wind erosion) to be occuring in the course of rock-take activities from the pits, application of water or other dust palliatives must be performed (ALP-SC4). Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport (ALP-SC5). Later, when the contruction works are completed, this site requires be stabilized by establishing permanent grass stands (hydroseeding) and tree plantation (ALP-EC4 & ALP-LR2) after recountoring it in accordance with the topography

Photo 11a: Road relocations in the construction area of the ALP-D-HEPP

Photo 11b: The topography (slopes) and vegetation cover in the road relocation sites in the construction area of the ALP-D-HEPP

Within the scope of the the ALP-D-HEPP construction, village and town roads will be submerged to a certain extent. Because of this, substaintial land disturbances will be implemented to relocate the main arterial roads. Photo 11a and 11b pertrays the topography (slopes) and vegetation cover in the road relocation sites in the construction area of the ALP-D-HEPP. As a result, there is a need for taking ESC measures.

The slopes should not be steeper than 2H/1V (2 horizontal and 1 vertical) for sustaining seeding and planting works properly and be concordant with the existing topography. Particularly, with diversion structures (diversion canals or ditches) (ALP-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 (ALP-EC4 & ALP-LR2), the cut slopes for the access road construction should be stablized.

When required, in the cases of the land slides to be caused the slope cuts, constructing a rock breast wall or a rock-lined wall (riprap) against the base of the slope is critical (ALP-EC7 or ALP-EC8). Thereby, preventing the natural waterways and finally the river pollution from cut/fill materials or the larger materials like debris and rock fragments could be doable.

Again in these sites, in order to prevent or alleviate the dust-originated problems (wind erosion) to be occuring in the course of road cut and fill activities, application of water or other dust palliatives must be performed (ALP-SC4). Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport (ALP-SC5).

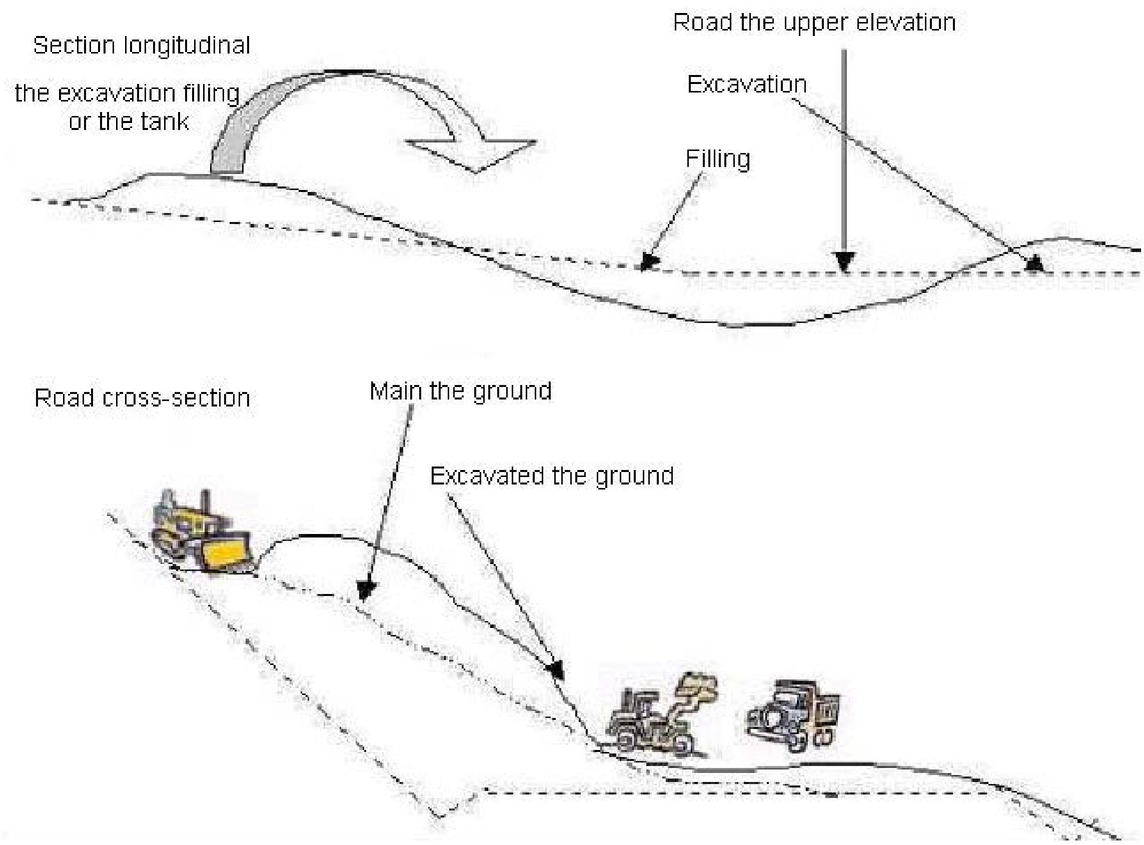

Figure 3. Road slope trenches

If necessary, construction of sliding walls or building rock riprap molding can be vital measures where land slide dangers can be seen (ALP-EC7 veya ALP-EC8). Thus, contamination of the natural waterways and rivers will be prevented from the construction source excavation / filliing or debris materials or big rock fragments.

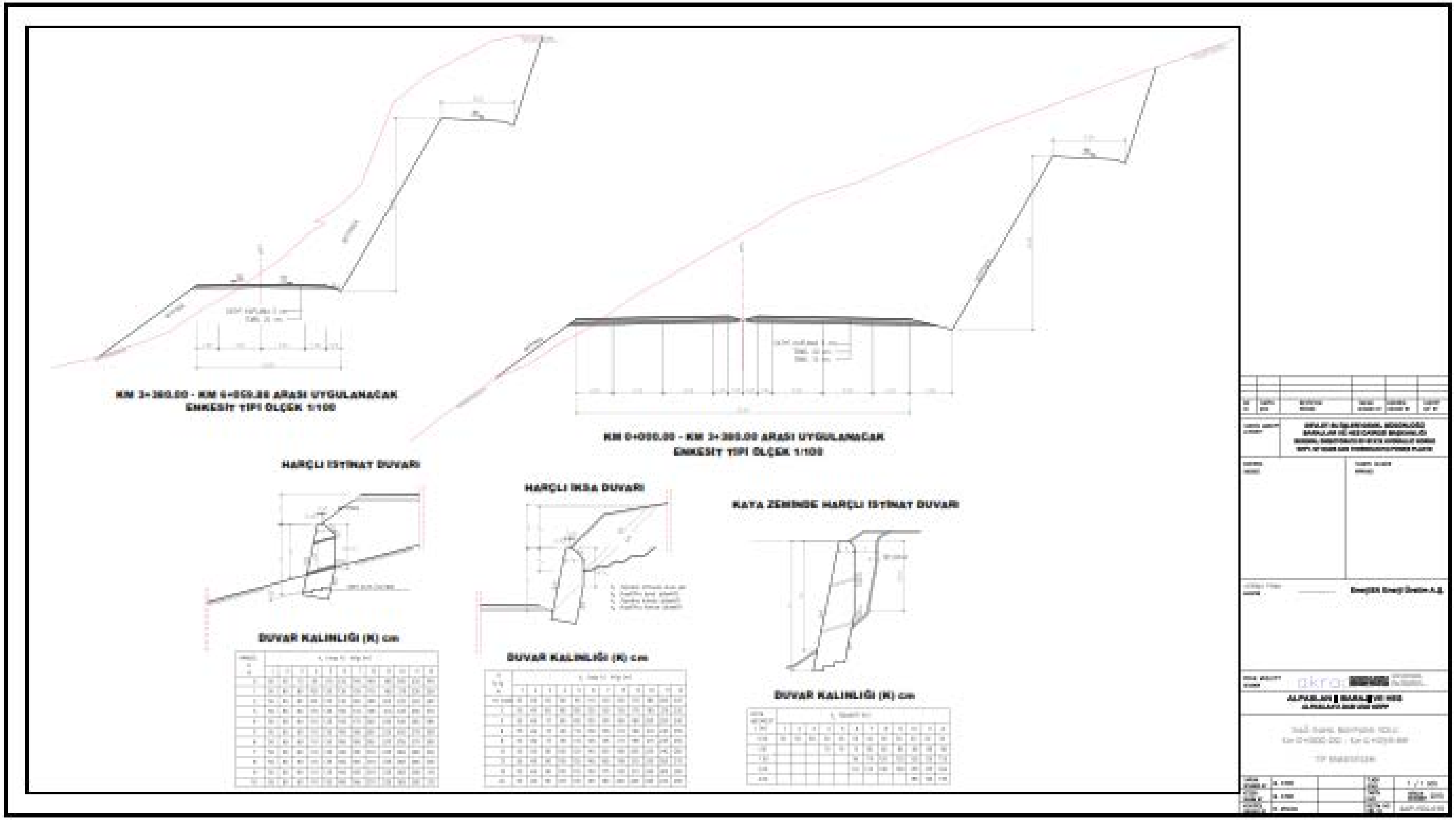

Figure 4. Right bank (coast) types of cross sections (Drawing # ALP-YOL-019

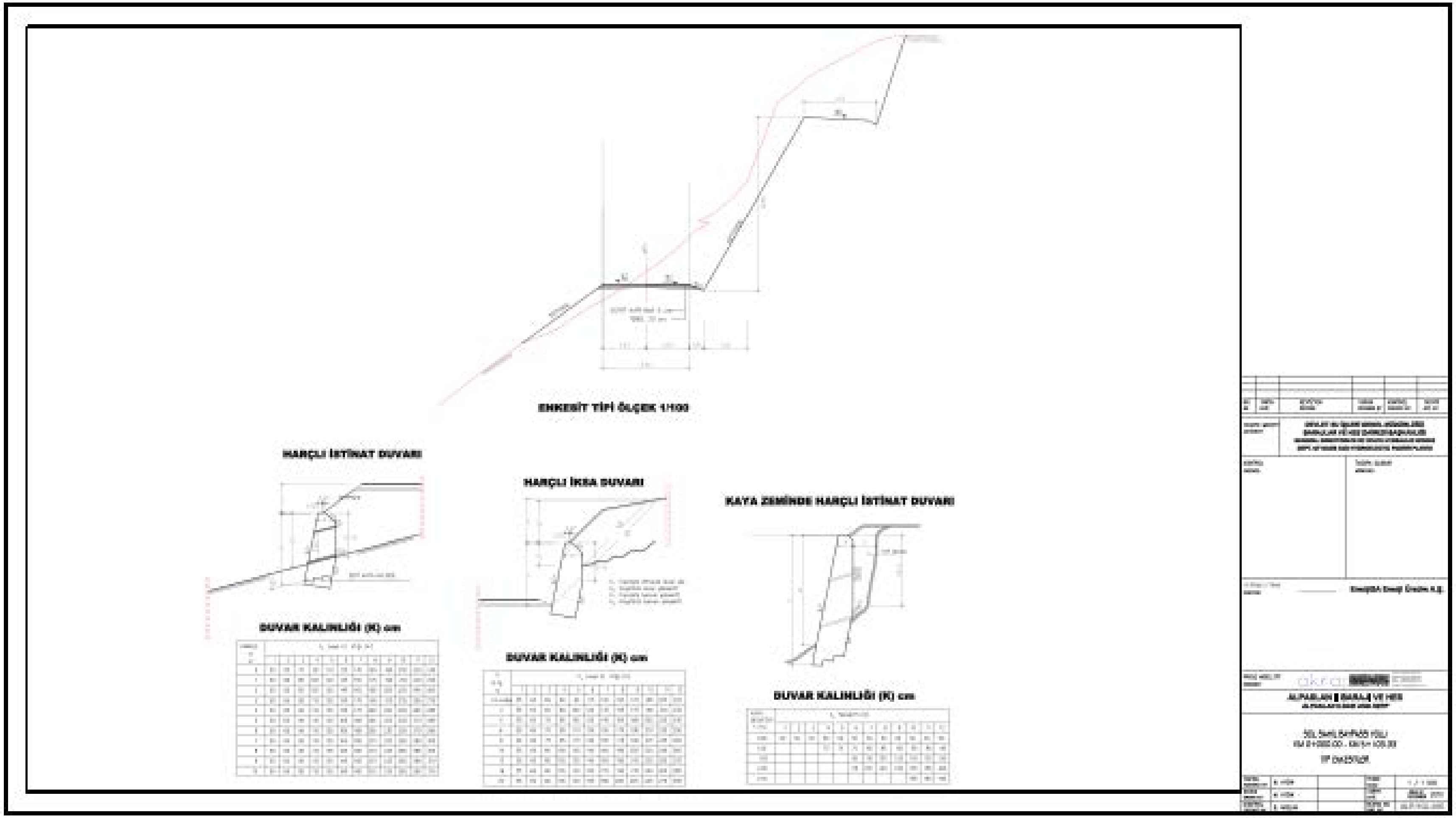

Figure 5. Left bank (coast) types of cross sections (Drawing # ALP-YOL-005)

Photo 12: Sites, having fertile topsoils, to be inundated after the ALP-D-HEPP dam lake's water (Tepekoy area)

Photo 12 shows the sites which have fertile topsoils and will be inundated after the ALP-D-HEPP dam is built. Following the vegetation cover clearance, the fertile top soils, lying in colluvial and alluvial flat areas of the catchment basin, should be scraped to the depth of solum (A plus B horizons), and later conserved by properly stocking (ALP-LR1 and ALP-LR4).

The clearance of the existing vegetation should be done within a given timing frame (ALP-EC1). Untimely cutdowns and clearance operations of the vegetation would raise the risk of erosion and sedimentation. During construction activities, an increase in potential sediment transports by splash and sheet erosion processes to the river is expected from these disturbed areas. Small plants, which are easily pulled out with their roots, could be used to reinstate or restore the disturbed areas and slopes in the fall months (ALP-LR2).

4.1.3 Recommendations

Locations of potential EC, SC, and LR practices are shown in Figure 6 and 7 to summarize and evaluate existing situation necessary to understand existing physical and operational features within ALP-W-HEPP site associated with the existing construction activities. A general statement should be included to emphasize that this is a living document which could be revised and updated according to construction activities and site conditions.

In Figure 6 and 7 EC, SC and LR measures are revealed in the 1:5000 scale maps and these are also prepared as digital files.

EC, SC and LR measures and practices shown in Figure 6 and 7 are for potential risk areas and during construction activities only some of them might practically appear relevant and feasible for the areas that emerge to be critically protected. Therefore, depending on the proceeding of the construction activities in the site, the EC, SC and LR practices will be beforehand taken where and when necessary.

Followings are site by site evaluation of locations that are in need for EC, SC and LR measures. In these observations, the EC, SC and LR specifications are given by measure or practice number given in Table 2, 3 and 4, respectively, together with the photo of the site and short explanation. Details of the EC, SC and LR practices are specified in the fact sheets that are added to the report.

For each facility, “Field Survey Form” (FSF) was filled in and included the following data (Table 9).

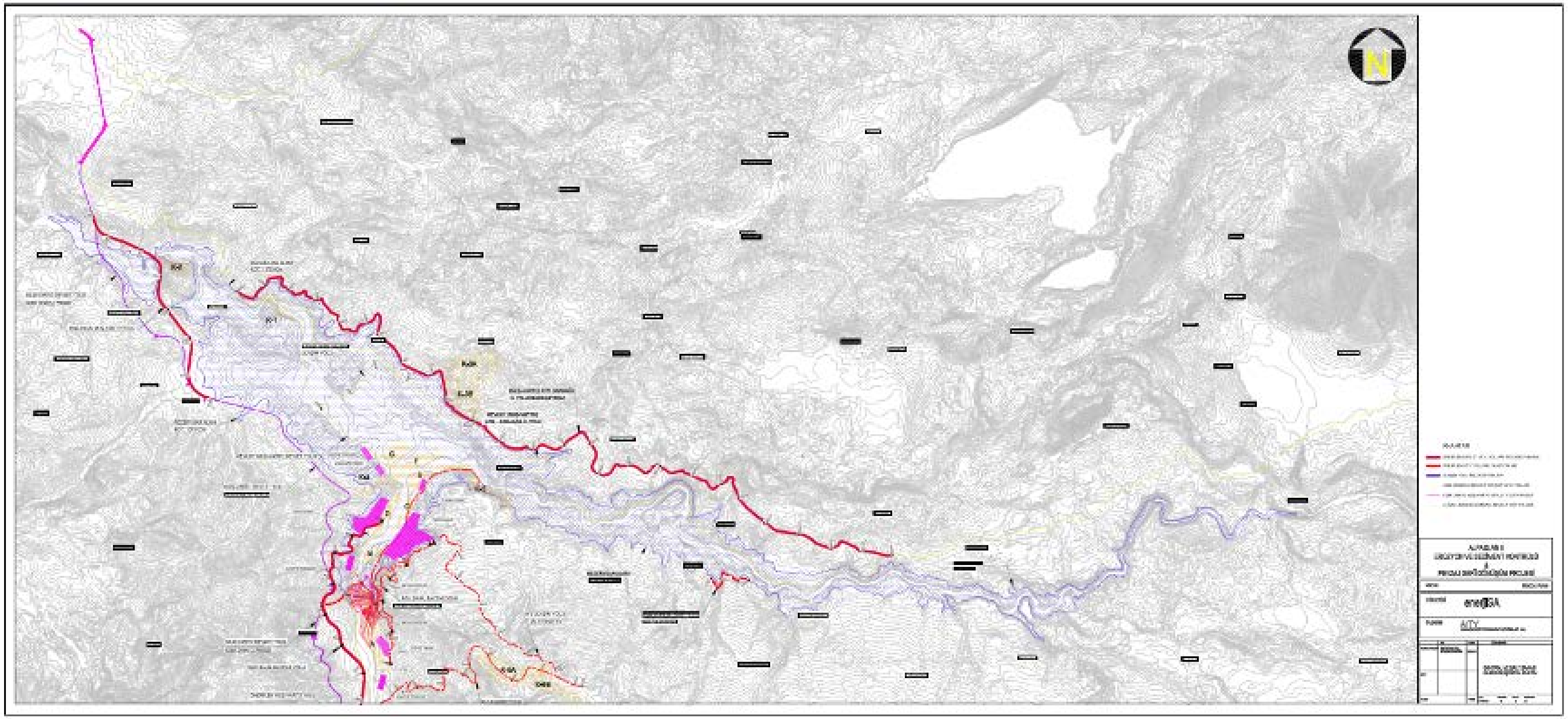

Figure 6. The dam area of the ALP-HEPP, locations of potential EC, SC, and LR practices

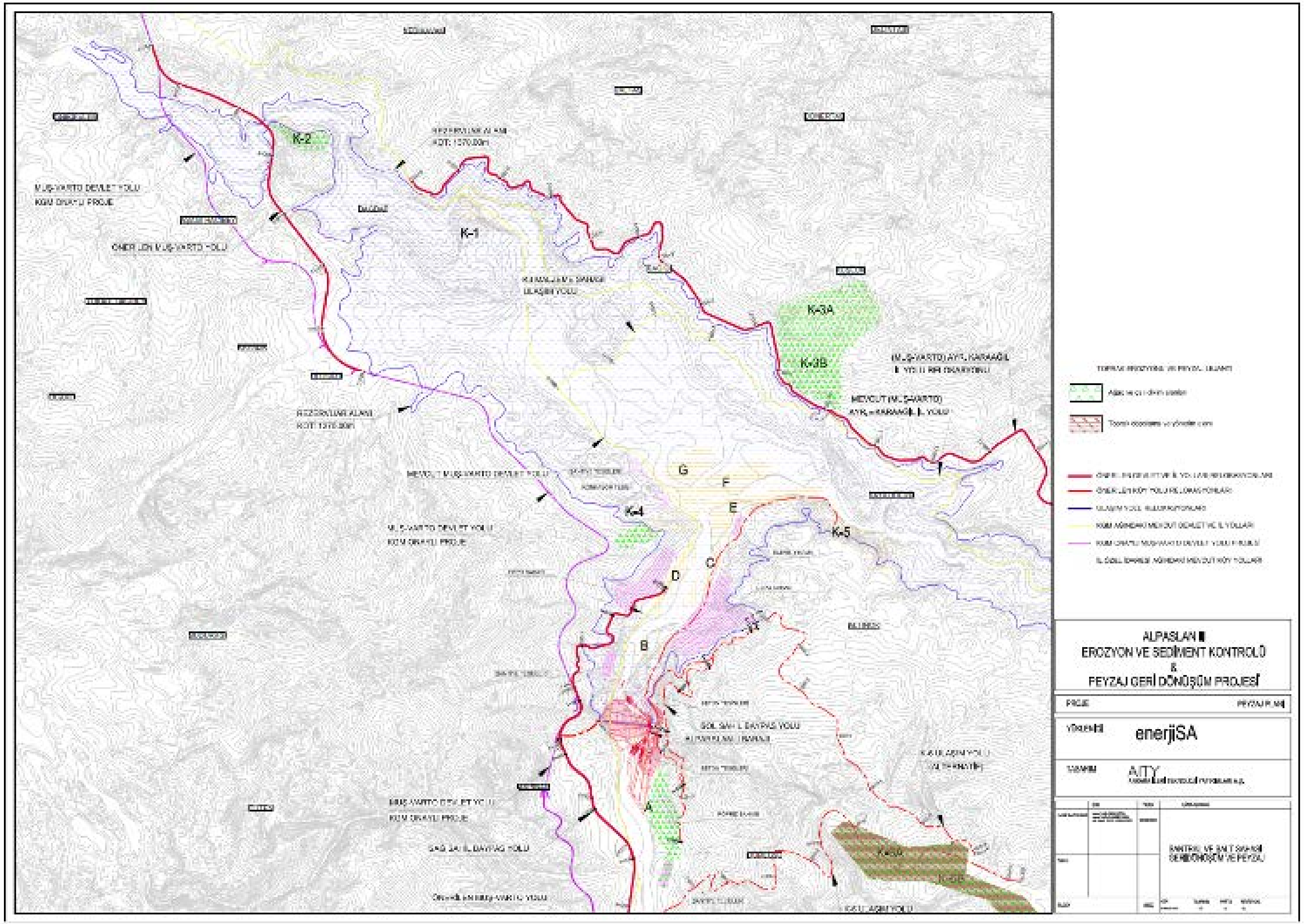

Figure 7. The dam and storage area of the ALP-HEPP, locations of potential EC, SC, and LR practices

"**Table 9**: Field Survey Observations and Recommendations

#	Site	Observations	Recommendations	
			ALP-EC & ALP-SC	**ALP-LR**
1	Construction site of the main body of the ALP-D-HEPP	Especially, diversion structures (diversion canals or ditches) to be built at the toes of the cut slopes are significant to contain runoff water. Herein, the runoff water should be securely diverted to the natural water courses. Most of all, parallel temporary geo-textile silt fences should be laid at the faces of the slopes on contours with predetermined intervals to catch up the down moving finer materials. Given fill slopes are nearby the river, in some cases, breast wall defenses at the toe of slopes could be vital along the stream. In this way, it could be possible to contain the larger materials like debris and rock fragments and to check slopes sliding down. With diversion structures 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 those to be constructed at the toes of the above-road cuts, the runoff water should also be securely diverted to the natural water courses.	EC6, SC1, EC8	
2	Opposite bank of the construction site of the main body of the ALP-D-HEPP	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. Additionally, diversion structures (diversion canals or ditches) 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, EC8 SC1, SC3	LR1, LR2, LR3 LR4

3	Construction site for the inlet of the derivation tunnel of the ALP-D-HEPP	During civil works, it could be necessary to contain material fall-downs and slides from the surfaces of the slopes and to check slopes sliding down. Additionally, it is expected that rill and gully erosion processes could occur place to place. Thus, during the construction such ESC measures as temporary geo-textile silt fences, diversion structures (diversion canals or ditches) and temporary hydroseeding should be effectively used to prevent sediment-laden surface runoff to reach the river. After slope face flows and natural water courses are controlled, by means of permanent seeding (hydroseeding) and tree plantation, the cut slopes for the access road construction should be stablized. In order to prevent or alleviate the sediment transport caused by dust (wind erosion), application of water or other dust palliatives must be performed. Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport.	EC4, EC6, EC8, SC1, SC3, SC4, SC5	LR2
4	Construction site for the dam axis of the ALP-D-HEPP and the sites to be submerged at the source after dam build-up	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. By the diversion structures both at the top and at the toes of the re-contoured slopes, runoff water should also be securely diverted to the natural water courses. After slope face flows and natural water courses are controlled, by means of permanent seeding and tree plantation, the cut slopes for the access road construction should be stablized. There are a great amount of river terrace soils in the valley and will be completely submerged. The fertile top soil on these sites, to the depth of solum, should be scraped and later conserved by properly stocking to be used for landscape and reinstatement works. Besides, at these sites it could be planned to clear vegetation and trees. The clearance of the existing vegetation should be done within a given timing frame. Untimely cutdowns and clearance operations of the vegetation would raise the risk of erosion and sedimentation. Small plants, which are easily pulled out with their roots, could be used to reinstate or restore the disturbed areas and slopes in the fall months.	EC1, EC4, EC6, SC1, SC3	LR1, LR2, LR4

5	The storage areas of the ALP-D-HEPP	First of all, the fertile top soil, to the depth of solum, should be scraped and later conserved by properly stocking. Again, given the fill area is nearby the river, rock-lined walls (riprap) at the toe of slopes could be vital along the stream. The prevention of surface water entry from uphill to the fill slope faces by diversion structures should be implemented. In addition, the check dams inside the wadis should be built; flow velocity and energy should be taken under control. In order to prevent or alleviate the sediment transport caused by dust (wind erosion), application of water or other dust palliatives must be performed. Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport.	EC6, EC7, SC3, SC4, SC5	LR1, LR4
6	Riverbed excavation sites for providing permeable materials	There is a requirement to build a basin. By this way, the sediment-disturbed river streams by excavation activities should be diverted to a temporarily constructed sediment basin and detained under quiescent conditions, allowing sediment to settle out before being discharged back to the running riverbed.	SC6	
7	The rock pit area of the ALP-D-HEPP	The prevention of surface water entry to the slope faces and the disturbed places of the rock pit area 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. Additionally in this site, in order to prevent or alleviate the dust-originated problems (wind erosion) to be occuring in the course of rock-take activities from the pits, application of water or other dust palliatives must be performed. Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport. Later, when the contruction works are completed, this site requires be stabilized by establishing permanent grass stands and tree plantation after recountoring it in accordance with the topography.	EC4, EC6, SC3, SC4, SC5	LR2

8	The topography (slopes) and vegetation cover in the road relocation sites in the construction area of the ALP-D-HEPP	The slopes should not be steeper than 2H/1V (2 horizontal and 1 vertical) for sustaining seeding and planting works properly and be concordant with the existing topography. Particularly, with diversion structures (diversion canals or ditches) 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, the cut slopes for the access road construction should be stablized. In the cases of the land slides to be caused the slope cuts, constructing a rock breast wall or a rock-lined wall (riprap) against the base of the slope is critical. Thereby, preventing the natural waterways and finally the river pollution from cut/fill materials or the larger materials like debris and rock fragments could be doable. Again in these sites, in order to prevent or alleviate the dust-originated problems (wind erosion) to be occuring in the course of road cut and fill activities, application of water or other dust palliatives must be performed. Street sweeping, entrance/outlet tire wash, stabilization of the construction entrance/exit, and stabilization of the construction roadway might be among the measures for controlling tracking and vehicle-generated sediment transport.	EC4, EC6, EC7, EC8, SC3, SC4, SC5	LR2

5. MITIGATION MEASURES AND REINSTATEMENT ACTIVITIES

The purpose mitigation measures and reinstatement activities in the ALP dam site is to remove, minimize, and/or compensate for adverse effects of construction activities. Implementable mitigation measures and reinstatement activities are developed to address potentially adverse impacts identified in the Observation section and in Figures 6 and 7 construction activities, where there is doubt regarding the impact, a risk-averse approach will be adopted and appropriate monitoring and emergency plans will be put in place. In the following section types of measures and common mitigations classified in EC, SC and LR methods and given in Table 2, 3 and 4, respectively are shown in detail

5.1 Erosion Control

ALP-EC1	Scheduling
ALP-EC2	Preservation of Existing Vegetation
ALP-EC3	Hydraulic Mulch
ALP-EC4	Hydroseeding
ALP-EC5	Geotextiles & Mats
ALP-EC6	Earth Dikes and Drainage Swales
ALP-EC7	Riprap
ALP-EC8	Rock Breast Wall

EC

(Erosion Control)

DESCRIPTION AND PURPOSE

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control 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.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

SCHEDULING EC1

SEPTEMBER – 2011						
MONDAY	TUESDAY	WENDESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
31	1 Install EC & SC measures	2	3 Land clearing & Topsoiling	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21 Access road construction	22	23	24	25 Grading	26	27
28	29	30	1	2	3	4

IMPLEMENTATION

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates to soil disturbing and re-stabilization activities.
- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control
  - Sediment control
  - Tracking control
  - Wind erosion control
  - Waste management and materials pollution control
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

SCHEDULE FOR MITIGATION AND REINSTATEMENT ACTIVITIES

* Time (months) / DMC Reinstatement activity	2011					2012											
	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Top and Subsoil removal	■										■	■	■				
Erosion control	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Sediment control	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Biorestoration and reinstatement		■	■	■				■	■	■	■			■	■	■	
Tracking control	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Wind erosion control	■	■									■	■	■	■			
Waste management & pollution control	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC1 (SCHEDULING DETAILS)

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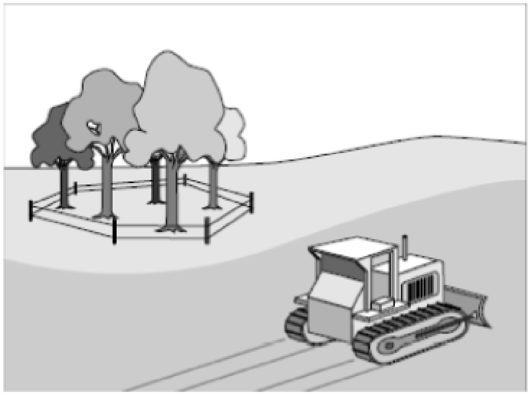

DESCRIPTION AND PURPOSE

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

SUITABLE APPLICATIONS INCLUDE THE FOLLOWING:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

DESIGN AND LAYOUT

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  * Orange colored plastic mesh fencing works well.
  * Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

IMPLEMENTATION

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

INSPECTION AND MAINTENANCE

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  * Fertilize stressed or damaged broadleaf trees to aid recovery.
  * Fertilize trees in the late fall or early spring.
    - Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.
- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC2 (PRESERVATION OF EXISTING VEGETATION DETAILS)

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HYDRAULIC MULCH

DESCRIPTION AND PURPOSE
Hydraulic mulch consists of applying a mixture of shredded wood fiber 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.

Suitable Applications
Hydraulic mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

IMPLEMENTATION
- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking shall only be used where other methods are impractical.
- To be effective, hydraulic matrices require 24 hours to dry before rainfall occurs.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Hydraulic mulches
Wood fiber mulch can be applied alone or as a component of hydraulic matrices. Wood fiber applied alone is typically applied at the rate of 2,000 to 4,000 lb/acre. Wood fiber mulch is manufactured from wood or wood waste from lumber mills or from urban sources.

Hydraulic Matrices
Hydraulic matrices include a mixture of wood fiber and acrylic polymer or other tackifier as binder. Apply as a liquid slurry using a hydraulic application machine (i.e., hydro seeder) at the following minimum rates, or as specified by the manufacturer to achieve complete coverage of the target area; 2,000 to 4,000 lb/acre wood fiber mulch, and 5 to 10% (by weight) of tackifier (acrylic copolymer, guar, psyllium, etc.)

WOOD MULCHING

DESCRIPTION AND PURPOSE
Wood mulching consist of applying a mixture of shredded wood mulch, bark or compost to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Suitable Applications
Wood mulching is suitable for disturbed soil areas requiring temporary protection until permanent stabilization is established.

IMPLEMENTATION
Mulch Selection
There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned or future uses.

Application Procedures
Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such as a punching type roller or by track walking. The construction application procedures for mulches vary significantly depending upon the type of mulching method specified. Two methods are highlighted here:

* Green Material: This type of mulch is produced by the recycling of vegetation trimmings such as grass, shredded shrubs, and trees. Methods of application are generally by hand although pneumatic methods are available.
- Green material can be used as a temporary ground cover with or without seeding.
- The green material should be evenly distributed on site to a depth of not more than 2 in.

* Shredded Wood: Suitable for ground cover in ornamental or revegetated plantings.
- Shredded wood/bark is conditionally suitable. See note under limitations.
- Distribute by hand or use pneumatic methods.
- Evenly distribute the mulch across the soil surface to a depth of 2 to 3 in.

* Avoid mulch placement onto roads, drainage channels, existing vegetation, etc.

STRAW MULCH

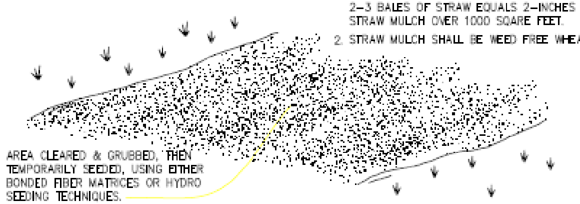
DESCRIPTION AND PURPOSE
Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a tackifier stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications
Straw mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch is typically used for erosion control on disturbed areas until soils can be prepared for permanent vegetation. Straw mulch is also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

IMPLEMENTATION
- Straw shall be derived from wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw shall be used.
- A tackifier is the preferred method for anchoring straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track walking may also be used to incorporate strawmulch into the soil on slopes. Track walking shall only be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.

Application Procedures
- Apply straw at a minimum rate of 4,000 lb/acre, either by machine or by hand distribution.
- Roughen embankments and fill rills before placing the straw mulch by rolling with a crimping or punching type roller or by track walking.
- Evenly distribute straw mulch on the soil surface.
- Anchor straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating). Alternatively, use a tackifier to adhere straw fibers.
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
  - On small areas, a spade or shovel can be used to punch in straw mulch.
  - On slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife blade roller or a straight bladed coulter, known commercially as a "crimper".
  - On small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes as described in EC-7, Geotextiles and Mats.
  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place. A tackifier is typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.

STRAW MULCHING:
1. FOR AREAS OF SITE WITH LESS THAN 30% SLOPE; 2–3 BALES OF STRAW EQUALS 2–INCHES OF STRAW MULCH OVER 1000 SQARE FEET.
2. STRAW MULCH SHALL BE WEED FREE WHEAT STRAW.



DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC3 (HYDRAULIC MULCH, STRAW MULCH, WOOD MULCHING DETAILS)

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HYDROOSEEDING

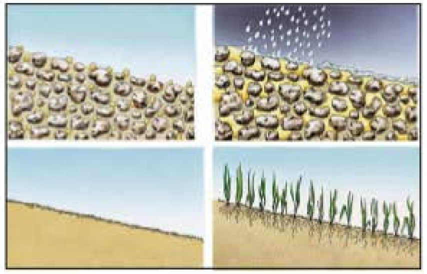
Hydro-seeding is a method of distributing and planting seed by spraying seed with water. Hydro-mulching is an improved method of hydro-seeding. Hydro-seeding becomes hydro-mulching when mulch is added to the mixture, and when the application on the ground is thick enough to hold the seed in place, resist soil erosion, and help retain soil moisture. A special blend of mulches, water, seed, fertilizer and binders (tackifiers) are mixed into a slurry and then sprayed onto a seed bed. Properly specified and applied the mulch protects the soil from erosion and aids in moisture retention assisting seed germination.

SITE PREPARATION FOR HYDROMULCHING

Soil at dam is capable of supporting vegetation growth for hydromulching to be successful. Once the constructed areas have been re-contoured and compacted, topsoil should be spread over the entire disturbed areas from where it was stored prior to hydromulching. Because subsoil is to be compacted, the area also requires scarifying prior to re-distribution of the topsoil. When the topsoil is replaced over the constructed areas, a slightly rough, loosely consolidated texture must be achieved in order to assist in plant establishment. A rough planting surface improves water infiltration, and this may be achieved by scarifying the surface with a comb blade on the grader. On this site because growth is required immediately, it is recommended that the slope be watered to achieve a saturated profile before hydromulching. Additional watering regimes will be designed to meet evaporation and transpiration levels.

DESCRIPTION OF THE HYDROMULCH

Wood-fiber has much longer and stronger fibers than paper mulch and has better moisture retention. However, much of the wood fiber used is imported and can be quite expensive. Therefore, a mix with other locally produced organic mulches such as hay and straw is recommended over wood fiber due to cost constraint. Organic mulches can separately be applied using a blower after hydro-seeding. In most cases, for the selected species to emerge evenly and consistently, it is necessary to hold the seed in place and have moisture for germination. The key to good, consistent plant growing results is a good mulch application.



Seed Mix: Most seed types can be applied through hydromulch with seed selection being varied to suit local soil and climatic conditions. It is advisable to use some form of fast germinating cover crop to give protection to the soil and the permanent species as they establish. This cover species should not overly compete with the other plants and should allow the original species to re-colonize the area, and therefore, application rates should be carefully monitored. Cover species will vary depending on the time of year that planting takes place. Native seeds can also be applied in hydromulch. Many of the native species are difficult to source and have low germination rates. Finally, the species selected for long-term growth shall reflect the variety and distribution pattern of the pre-construction flora. In other words, Species to be utilized for re-seeding and the seed mix is to be in sympathy with the pre-existing vegetative cover. For this purpose the seed mix might be selected to be formed by seed collection from the original vegetation cover at the site that is available from the steep slope and from the neighbouring habitat. However, considering the amount of the seed required for the composition of the hydromulch. The collection of the seeds from the adjacent habitats is not only tedious but also not practical also with respect to time concern.

Therefore, in order to provide enough seed that is 50 kg/da seeds native species with commercially available seeds are selected. The species are specifically chosen for their ability to resist drought and cold climates. Additionally, the species are known to be practically used in problematic area such as areas sloping lands and lands with erosion risk. The selected seed mix was also approved by the specialist (botanist) subcontractor. The advantageous characteristics of the selected species and the details of seed mix content and proper application times are September-October, March-April.

HYDROMULCHING SPECIFICATIONS	
Mulch	260 kg/da
Water	9lt/m²
Seed mix	40 kg/da
Fertilizer	40 kg/da of 10-10-10 (N, P, K)

SEED MIX OF THE HYDROMULCH			
	Graminea species	Unit	Quantity
1	Lolium perenne Captain	%5	
2	Lolium perenne Cheops	%5	
3	Festuca arundinacea Apache	%20	
4	Festuca ovina Chrystal	%10	
5	Bronius inermis	%10	
6	Dactylis glomerata	%10	
	Leguminasa species		
7	Trifolium repens	%10	
8	Trifolium pratense	%10	
9	Medicago sativa	%5	
10	Lotus cornicuatum	%15	

Post-Hydromulching Maintenance: During hydromulching water will soften the seed-coat, which begins the germination process. The seed should not be allowed to dry out after initial watering. It is vital that post installation watering takes place. Application rates should be varied to suit local conditions. Generally, watering should take place every day until germination and then gradually reduced to harden off the plants. Applying maintenance fertilizer to the site after six weeks will provide the best results.

DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC4 (HYDROOSEEDING DETAILS)

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DESCRIPTION AND PURPOSE

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 vegetation is established.

- Channels to be vegetated
- Stockpiles

Suitable Applications

Mattings are commonly applied on short, steep slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks where moving water at velocities between 3 ft/s and 6 ft/s are likely to wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. Matting may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). Erosion control matting should be considered when the soils are fine grained and potentially erodible. These measures should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- Slopes where the erosion potential is high
- Slopes and disturbed soils where mulch must be anchored
- Disturbed areas where plants are slow to develop
- Channels with flows exceeding 3.3 ft/s

IMPLEMENTATION

Material Selection

Organic matting materials have been found to be effective where re-vegetation will be provided by re-seeding. The choice of matting should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

Geotextiles

- Material should be a woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec-1 in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

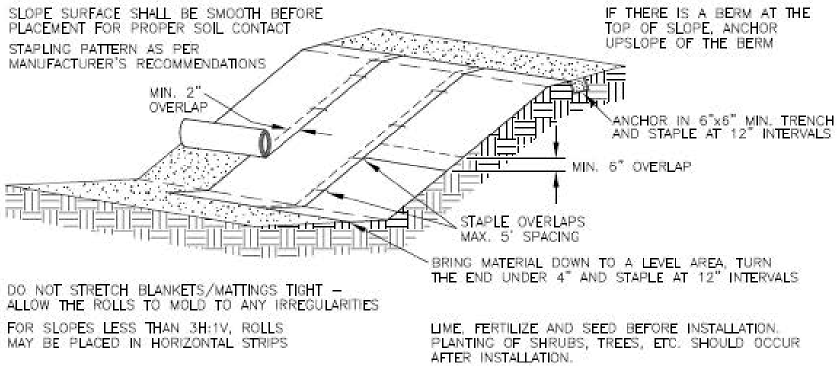
- Plastic sheeting should have a minimum thickness of 6 mils, and must be keyed in at the top of slope and firmly held in place with sandbags or other weights placed no more than 10 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil.
- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

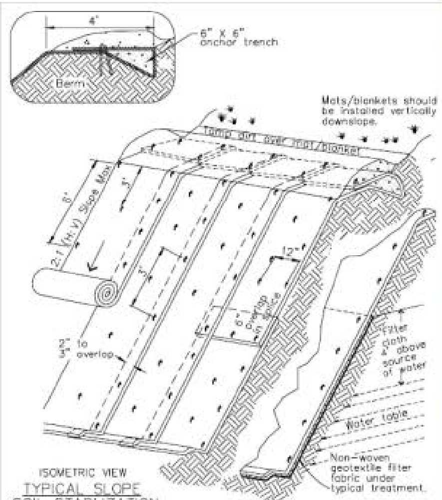
- Biodegradable rolled erosion control products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order for an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable.
  - Jute is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. It is designed to be used in conjunction with vegetation and has longevity of approximately one year. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.
  - Plastic netting is a lightweight biaxially oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must be secured with Ushaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 2 to 3 in. of topsoil.

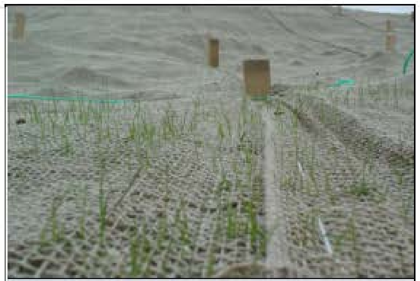


SLOPE PROTECTION DETAIL



TYPICAL SLOPE SOIL STABLIZATION
NTS

WET SLOPE LINING
NTS



DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC5 (GEOTEXTILE & MATS DETAILS)

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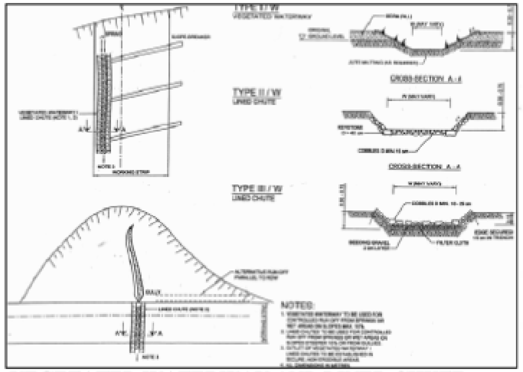
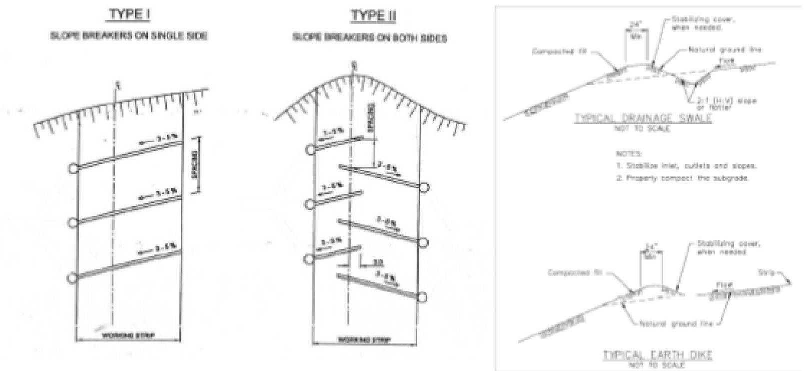
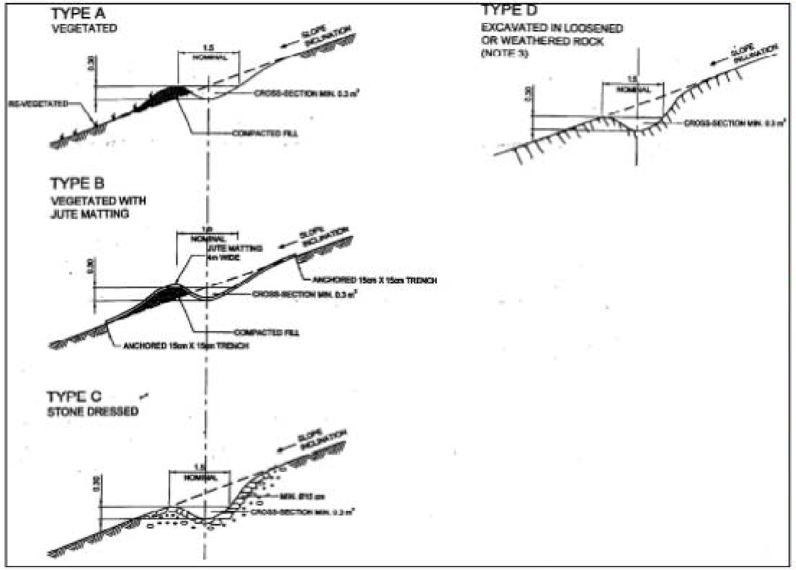


VEGETATED WATERWAY AND LINED CHUTE



DRAINAGE SWALE AND EARTH DIKE DETAIL



SLOPE BREAKER DETAIL

DESCRIPTION AND PURPOSE

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, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC6 (EARTH DIKES & DRAINAGE SWALES DETAILS)

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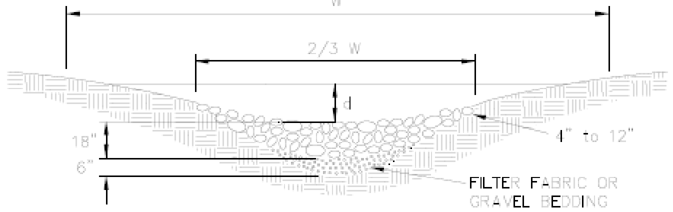
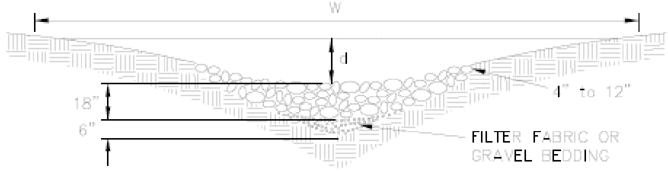


PARABOLIC–SHAPED WATERWAY WITH STONE CENTER DRAIN



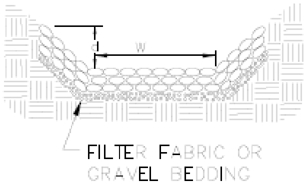
V–SHAPED WATERWAY WITH STONE CENTER DRAIN

Rock riprap, properly designed and placed, is an effective method of streambank protection. The cost of quarrying, transporting, and placing stone and the large quantity of stone that may be needed must be considered. Gabion baskets, concrete cellular blocks, or similar systems can be an alternative to rock riprap under many circumstances.

Applications and effectiveness;

- Provides long-term stability.
- Has structural flexibility. It can be designed to selfadjust to eroding foundations.
- Has a long life and seldom needs replacement, low maintenance.
- Is inert so does not depend on specific environmental or climatic conditions for success.
- May be designed for high velocity flow conditions.
- Typically only recommended for toe protection (up to baseflow line).

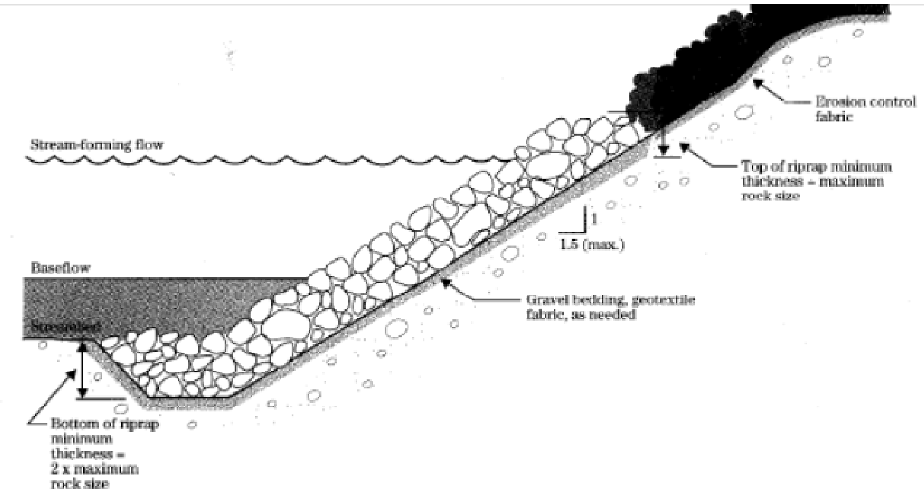
TYPICAL RIP RAP CHANNEL



TRAPEZOIDAL

NOTE:
TO BE USED WHERE EXCESSIVE STORMWATER VELOCITIES PROHIBIT VEGETATIVE LININGS.
SIZE OF STONE MUST BE DETERMINED BY APPROPRIATE DESIGN PROCEDURE.
DIMENSIONS FOR d & W VARIES ACCORDING TO DESIGN.

RIPRAP LINED CHANNELS



ROCK RIPRAP DESING DETAIL

DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC7 (RIPRAP DETAILS)

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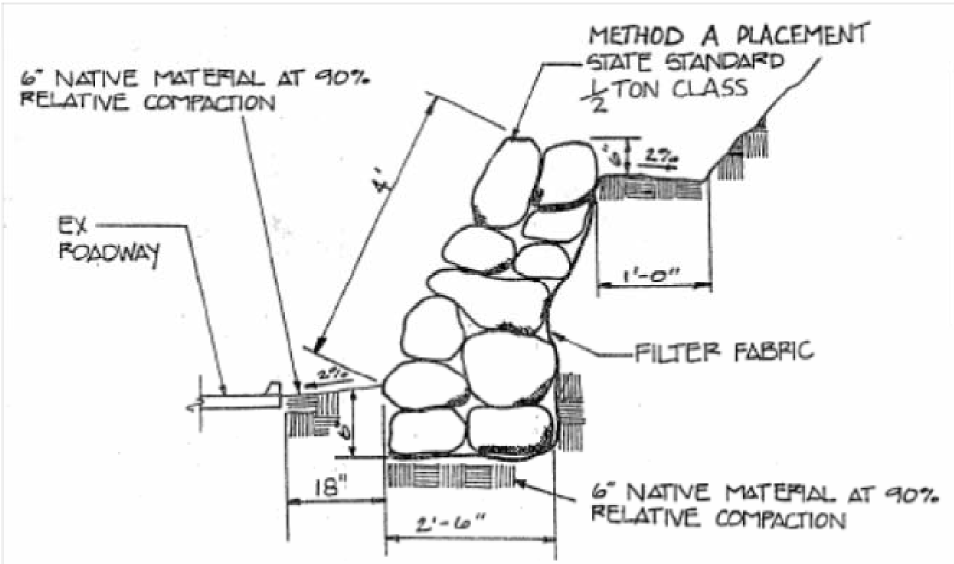
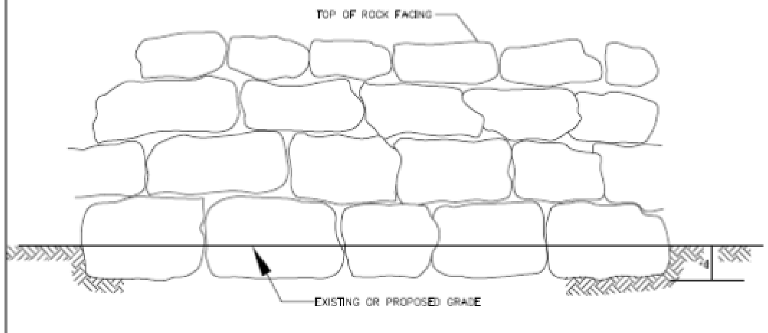
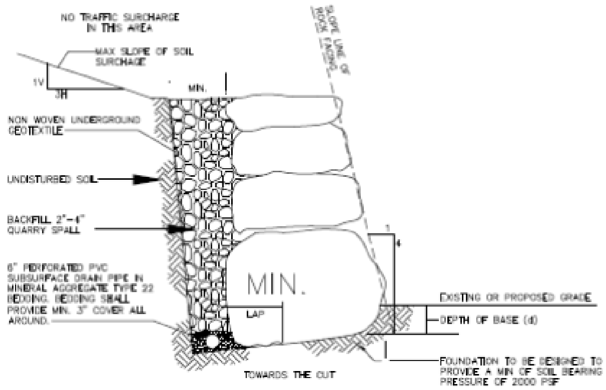


DESCRIPTION: A rock breast wall is a low retaining wall (usually 10 feet or less in height) constructed against the base of a slope. The wall is usually built by stacking rocks atop one another in a single, one-rock width course.

PURPOSE: 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.



ELEVATION



SECTION

DAM
SOIL EROSION AND LANDSCAPE PROJECT
EC8 (ROCK BREAST WALL DETAILS)

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5.2 Sediment control

ALP-SC1	Silt Fence
ALP-SC2	Safety Fence
ALP-SC3	Check Dam
ALP-SC6	Sediment Basin

SC

(Sediment Control)

DESCRIPTION AND PURPOSE

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.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They should also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion. Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows. Silt fences are most effective when used in combination with erosion controls. Suitable applications include:

- Along the perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Below other small cleared areas.

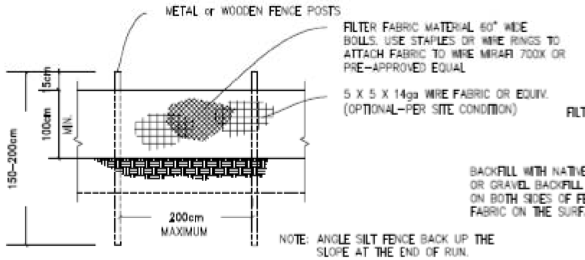
IMPLEMENTATION

General

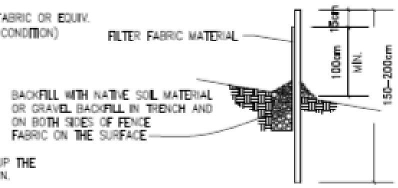
A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap sediment by intercepting and detaining small amounts of sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

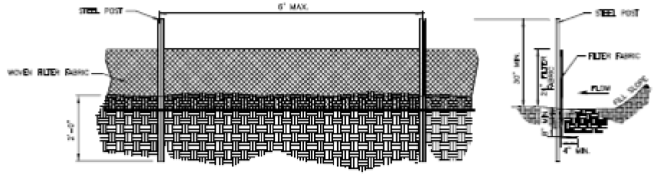
The following layout and installation guidance can improve performance and should be followed:

- Use principally in areas where sheet flow occurs.
- Don't use in streams, channels, or anywhere flow is concentrated. Don't use silt fences to divert flow.
- Don't use below slopes subject to creep, slumping, or landslides.
- Select filter fabric that retains 85% of soil by weight, based on sieve analysis, but that is not finer than an equivalent opening size of 70.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- The maximum length of slope draining to any point along the silt fence should be 200 ft or less.
- The maximum slope perpendicular to the fence line should be 1:1.
- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft2 of ponding area should be provided for every acre draining to the fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
- Silt fences should remain in place until the disturbed area is permanently stabilized.



NOTE: ANGLE SILT FENCE BACK UP THE SLOPE AT THE END OF RUN.





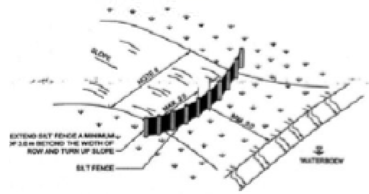
TEMPORARY SILT FENCE

NOTES:

1. WOVEN FILTER FABRIC BE USED WHERE SILT FENCE IS TO REMAIN FOR A PERIOD OF MORE THAN 30 DAYS.
2. STEEL POSTS SHALL BE 5'-0" IN HEIGHT AND BE OF THE SELF-FASTENER ANGLE STEEL TYPE.
3. TURN SILT FENCE UP SLOPE AT ENDS.
4. ORANGE SAFETY FENCE IS REQUIRED AT BACK OF SILT FENCE WHEN GRADING IS ADJACENT TO SWIM BUFFERS, STREAMS OR WETLANDS (REFER TO SWIM BUFFER GUIDELINES). THE COLOR ORANGE IS RESERVED FOR VISUAL IDENTIFICATION OF ENVIRONMENTALLY SENSITIVE AREAS.
5. DRAINAGE AREA CANNOT BE GREATER THAN 1/4 ACRE PER 100 FT OF FENCE.
6. SLOPE LENGTHS CANNOT EXCEED CRITERIA SHOWN IN TABLE 6/63A NORTH CAROLINA EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.
7. DO NOT INSTALL SEDIMENT FENCE ACROSS STREAMS, DITCHES, WATERWAYS OR OTHER AREAS OF CONCENTRATED FLOW.

MAINTENANCE NOTES:

1. FILTER BARRIERS SHALL BE INSPECTED BY THE FINANCIALLY RESPONSIBLE PARTY OR HIS AGENT IMMEDIATELY AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. ANY REPAIRS NEEDED SHALL BE MADE IMMEDIATELY.
2. SHOULD THE FABRIC DECOMPOSE OR BECOME INEFFECTIVE PRIOR TO THE END OF THE EXPECTED USABLE LIFE AND THE BARRIER STILL IS NECESSARY, THE FABRIC SHALL BE REPLACED PROMPTLY.
3. SEDIMENT DEPOSITS SHOULD BE REMOVED WHEN DEPOSITS REACH APPROX. HALF THE HEIGHT OF THE BARRIER. ANY SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE SILT FENCE IS REMOVED SHALL BE DRESSED TO CONFORM TO THE EXISTING GRADE, PREPARED AND SEEDED.



DAM
SOIL EROSION AND LANDSCAPE PROJECT
SC1 (SILT FENCE DETAILS)

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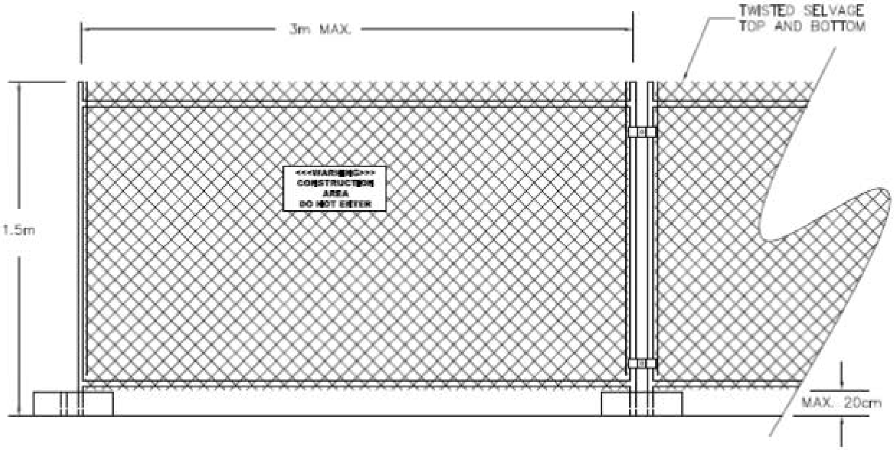
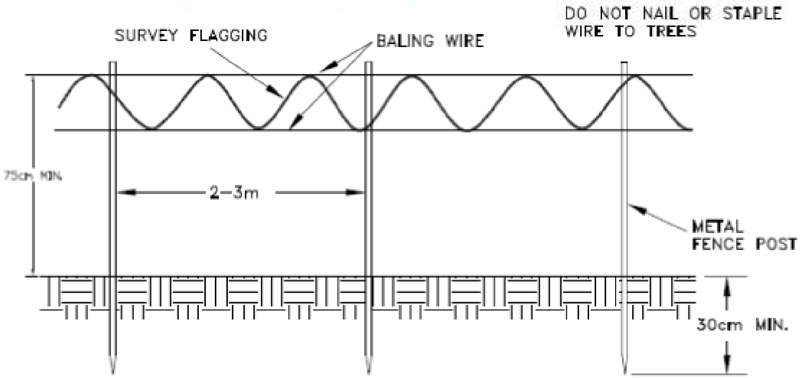


NOTES:
1. CHAIN LINK FABRIC TO BE MIN. 11 GAUGE, GALVANIZED. NO RUSTED OR EXCESSIVELY MALFORMED FABRIC.
2. FENCE BASES SHALL BE OF SUFFICIENT WEIGHT and/or SPREAD TO ADEQUATELY SUPPORT EACH PANEL.
3. PANEL–TO–PANEL CONNECTIONS SHALL BE MADE AT A MIN. TWO LOCATIONS PER CONNECTION UNLESS OTHERWISE APPROVED.
4. PROVIDE CONSTRUCTION WARNING SIGNAGE 50'O.C. ALONG FENCING INSTALLATION.



STAKE BARRIER DETAIL

DESCRIPTION AND PURPOSE

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.

When you're responsible for the safety of workers and the public, you carry a heavy responsibility. You need to provide safety fencing products that deliver both superior protection and superior value, products that go up fast, and are highly visible, durable, and easy to use. You need the quality and value of Tensar Safety Fences, proven in thousands of installations. Tensar fences are made by a state of the art process, which delivers:

- Superior sag resistance due to low creep
- Unmatched strength with up to 6,000lbs of tensile strength for a four foot width
- Higher strength to weight ratio
- No weak junctions to fail under load, since a Tensar fence is drawn from a continuous sheet
- Superior durability and UV resistance because of its unique, high quality composition

DAM
SOIL EROSION AND LANDSCAPE PROJECT
SC2 (SAFETY FENCE DETAILS)

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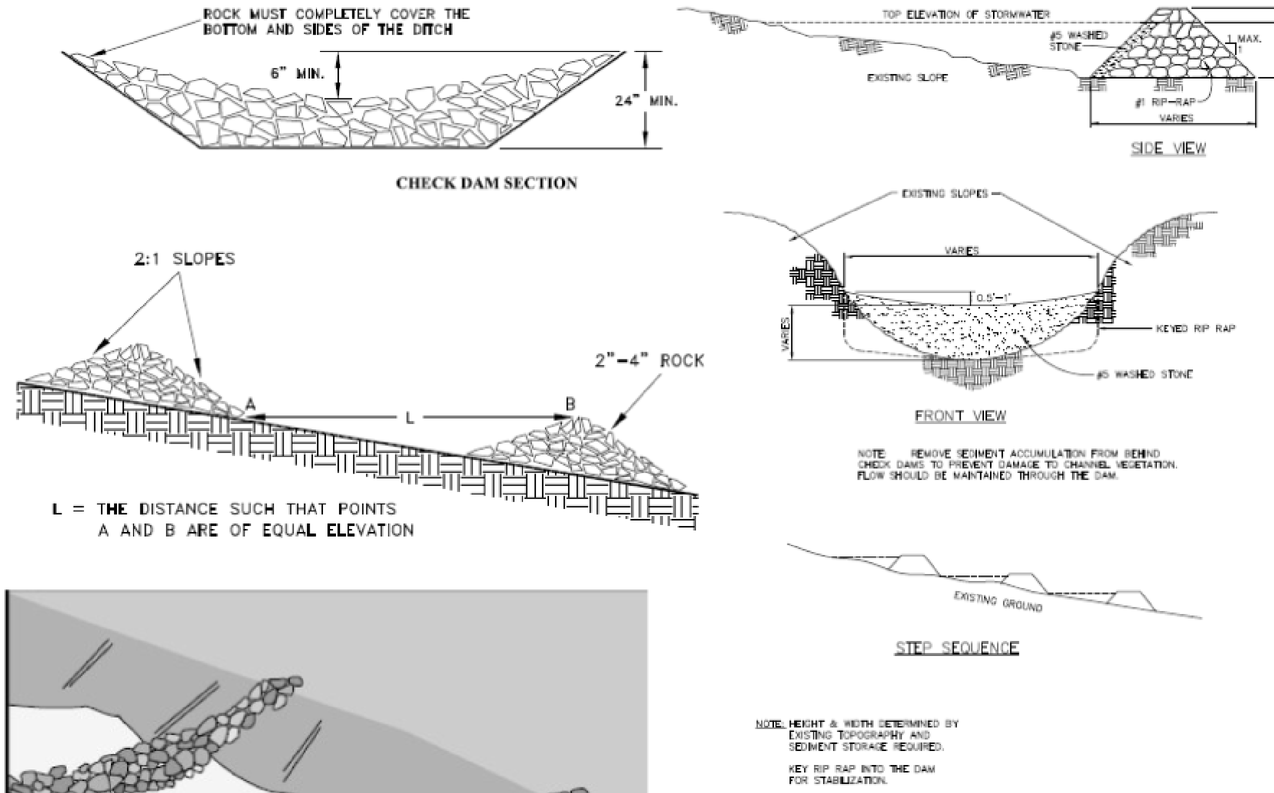
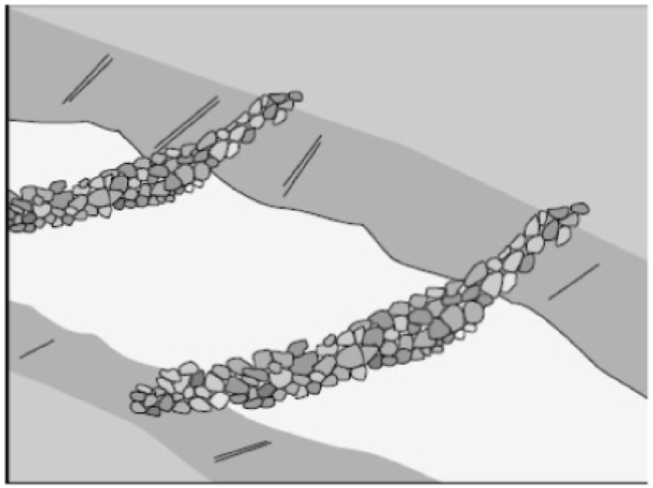
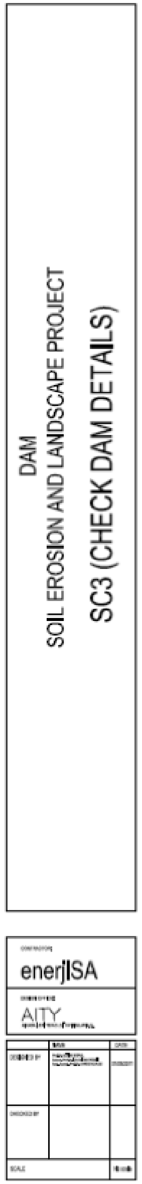
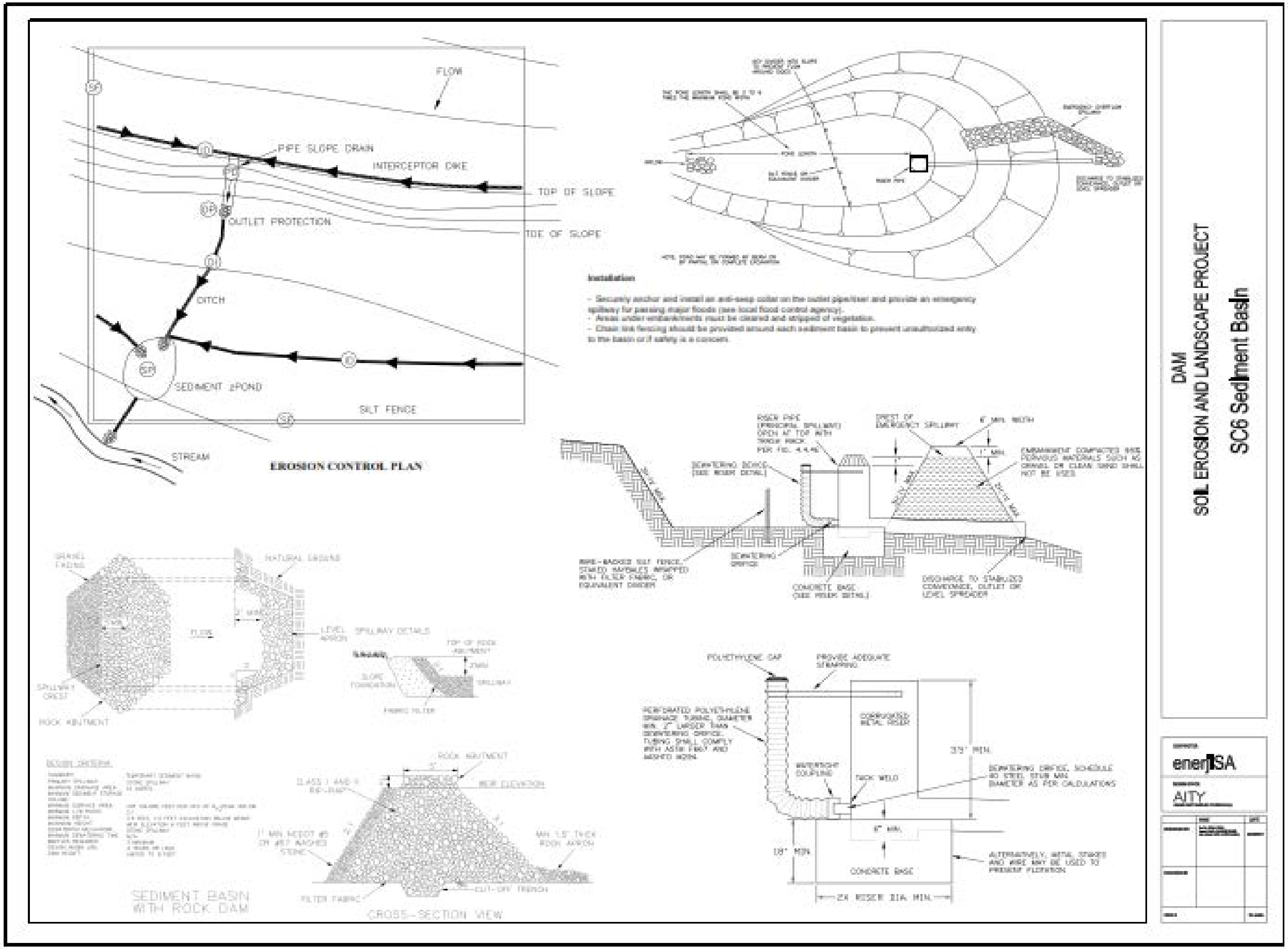




Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section. Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Fiber rolls and straw bales must be trenched in and firmly staked in place.




FLOW
PIPE SLOPE DRAIN
INTERCEPTOR DIKE
TOP OF SLOPE
OUTLET PROTECTION
TOE OF SLOPE
DITCH
SEDIMENT POND
SILT FENCE
STREAM
EROSION CONTROL PLAN
Installation
NATURAL GROUND
ROCK ABUTMENT
SEDIMENT BASIN
WITH ROCK DAM
CROSS-SECTION VIEW
POLYETHYLENE CAP
CONCRETE BASE
DAM
SOIL EROSION AND LANDSCAPE PROJECT
SC6 Sediment Basin
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5.3 Landscape and Reinstatement

ALP-LR1	Soil Spreading
ALP-LR2	Tree or Shrub Plantation
ALP-LR3	Permanent Seeding
ALP-LR4	Topsoil Stockpile Management

LR

(Landscape and Reinstatement)

PURPOSE & APPLICATIONS

Topsoiling is the spreading of topsoil of a suitable quality over an area to be stabilized by establishing vegetation. Topsoil is the surface layer of the natural soil profile, generally characterized as being darker than the subsoil due to the presence of organic matter. It is the major zone of root development, containing nutrients available to plants, and supplying a large amount of the water to plants. Vegetative growth is more rapid on sites with at least 4 inches of topsoil, and the health and quality of the vegetation is better than on sites with little or no topsoil. Topsoiling is applicable in the following situations:

- Where the use of topsoil is determined to be the most effective method of providing a suitable growth medium.
- Where high-quality turf is desirable to withstand intensive use or meet aesthetic requirements.
- Where the subsoil's texture, pH, or nutrient balance of the available soil cannot be modified by reasonable means to provide an adequate growth medium (sands, gravels, clays).
- The subsoil material is too shallow to provide an adequate root zone and to supply necessary moisture and nutrients for plant growth.
- The subsoil contains substances potentially toxic to plant growth.
- On slopes that are 2 to 1 (2 horizontally to 1 vertically) or flatter.

CONSIDERATIONS

- Stockpile and reuse existing native topsoil from the site.
- Consider using topsoil substitutes as an alternative to mining prime farmland soils.
- In site planning, the option of topsoiling should be compared with that of preparing a seedbed in subsoil. Limed and fertilized subsoils with proper seedbed preparation may provide an adequate growth medium if moisture is not limiting. Another option may be to use topsoil substitutes or soil amendments such as compost in lieu of natural topsoil.
- Topsoiling is a required procedure when establishing vegetation on shallow soils, soils containing potentially toxic materials, and soil with a pH of 4 or below (high acid).

SPECIFICATIONS

If topsoiling is to be done, the following items should be considered;

- Determine the volume of available topsoil exists on the site. Topsoil should be spread at a minimum compacted depth of 4 inches.
- Stockpile topsoil so that it meets specifications and does not interfere with work on the site.
- Allow sufficient time in scheduling for topsoil to be spread and bonded with the subsoil prior to seeding, sodding or planting.

Stripping: Stripping shall be confined to the immediate construction areas. A 4 to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All perimeter dikes, basins, and other sediment controls shall be in place prior to stripping.

Stockpiling: Topsoil shall be stockpiled in such a manner that natural drainage is not obstructed and no off-site sediment damage shall result.

TOPSOIL MANAGEMENT

← TOPSOIL STORAGE

TOPSOIL STRIPPING AND TOPSOIL MANAGEMENT

Measured topsoil depth for all construction sites is greater than 300 mm. As mentioned in the EIA report 300 mm of topsoil will be stripped then stored in designated places.

- The topsoil shall be carefully stripped and stored separately.
- Topsoil shall not be stripped from areas that will only be used for storing topsoil as it is shown in the lay out.
- Topsoil shall be stored where it will not be compacted by vehicles or contaminated and shall be stored in a manner that will minimise its loss and/or degradation. Only a shape will be given with a vehicle. Demarcation will be done on the topsoil area to prevent any damage.
- Stripped topsoil shall be kept free from the passage of vehicles and plant. Topsoil stacks shall be placed to ensure that they are free draining for that reason ditches or ducts will be placed near the storage areas.
- Topsoil shall be stored in a stockpile not more than 2m high with side slopes <45°, drained with open ditches. The surface of the stockpile shall be lightly compacted to reduce rainfall penetration but not enough to promote anaerobic conditions. Where necessary, the stockpile shall be protected from flooding by placing berms around the outside.
- Topsoil shall not be mixed with subsoil.
- Topsoil shall not be handled during excessively wet conditions.
- Topsoil shall not be used for material in the dam, and topsoil from unstripped /undisturbed areas shall not be used to cover adjacent disturbances. For that reason topsoil will be placed on the right hand and subsoil will be placed on the left hand especially on Loading Line.
- When the topsoil is replaced over the area, a slightly rough, loosely consolidated texture shall be achieved in order to promote vegetation growth.
- After giving a final form to the area, which is now used for the disposal of the excess soil, will be used as a topsoil storage area.

← TOPSOIL STRIPPING

DAM
SOIL EROSION AND LANDSCAPE PROJECT
LR1 (TOPSOIL STRIPPING, STOCKPILING SOIL SPREADING DETAILS)

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BIORESTORATION

It is recognised that vegetation, by intercepting rainfall and binding the soil, reduces soil erosion and sediment. The long-term cover will be the native flora with the exception of areas that were planted with crops or other non-native species prior to construction. The bio-restoration strategy will be based on supplementing the seed of local species that will remain in the topsoil when it is replaced.

Forestation of the DM will occur wherever a forest existed after construction of the dam. Ecological characteristics of the plants were considered in plant selection with regard to each landscape strategy. All selected plants are available from commercial plant in Turkey. Therefore no substitution was recommended. In the case of unavailability of the plants due to lack of the plant stock in nurseries during planting, the substitute plant should be selected by a landscaping expert. At the table locations of plants can be seen from Locations of potential EC, SC, and LR practices.

DESCRIPTION AND PURPOSE

This practice includes the planting of appropriate species of trees or shrubs on bare slopes (such as the road cut or fill slope), along a ditch or channel, or adjacent to streams.

Helping provide long-term stabilization of slopes through the plants' roots and leaf litter. Providing shade and riparian cover near streams to provide better aquatic habitat. Trees may eventually contribute large woody debris (LWD) to the stream for instream benefits.

- Correct choice of plant species and proper planting technique are critical to good plant survival.

- Obtain container-grown or bare-root stock of native species found in the vicinity of the planting site from a nursery in the region. Large quantities (>100 plants of 1 species) may need to be special ordered (grown under contract) with the nursery at least 6-12 months in advance.

- Handle seedlings carefully and ensure they are kept sufficiently watered (soil mixture is damp, not dry or soggy) and shaded until site is ready to plant. In cool, damp weather, seedlings are vulnerable to mold. Plant willow sprigs same day as cut.

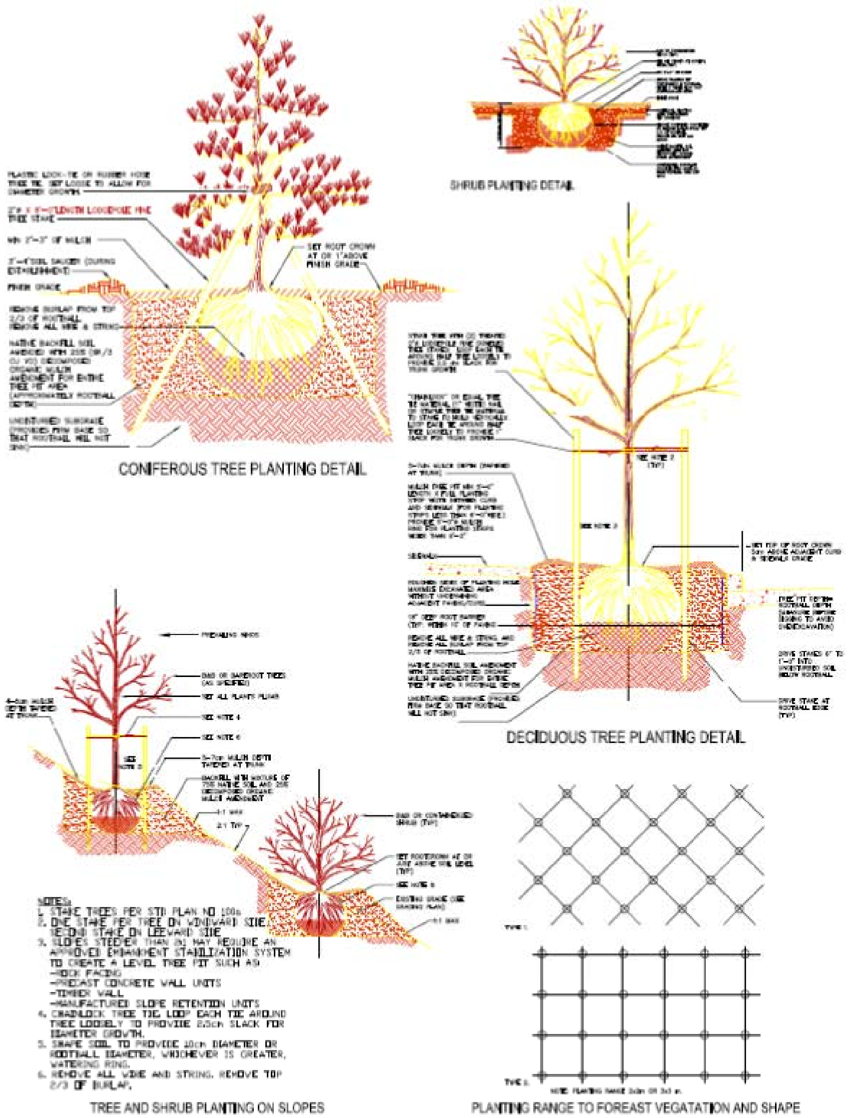
- Clear away loose organic material, such as leaves and grasses, from the planting spot to expose mineral soil.

- Dig hole with shovel or hoedad to be deep and wide enough for the roots to be fully extended. Fill hole, being sure soil falls around roots, and tamp soil firmly around base of plant with heel. Willow sprigs need to be 75-80% buried into the soil.

- Add slow-release fertilizer tablet into hole, especially on poor soils.

- Water site - If possible - Immediately after planting and weekly during dry periods of the first year. An attachment from a water truck can be used to hand irrigate near roads.

BİTKİ LİSTESİ VE BOYLARI			
Latince isim	Tipi	Boyu (cm)	Miktar
Pinus sylvestris	İbreli	30	
Crataegus monogyna	Yapraklı	100-150	
Robinia pseudoacacia	Yapraklı	100-150	
Rosa canina	Yapraklı	30-40	



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SOIL EROSION AND LANDSCAPE PROJECT
LR2 (TREE OR SHURB PLANTATION DETAILS)

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BIORESTORATION

DESCRIPTION AND PURPOSE

Description: Permanent seeding is a means of establishing permanent, perennial vegetative cover on disturbed areas. The purpose of permanent seeding is to prevent erosion, remove sediment from runoff, reduce the volume of runoff, and improve water quality.

Typical Uses: Permanent seeding is used to stabilize the ground after grading and land-disturbing activities have been completed, or whenever construction activities will be halted for a time period longer than temporary seeding can provide protection (i.e. one growing season). Permanent seeding consists of planting perennial vegetation on disturbed/denuded soil areas. Through seeding, a fibrous root system is established. This holds the soil in place and provides a canopy over the soil, protecting it from raindrop impact. The vegetation slows the velocity of the runoff, protecting the surface from sheet and rill erosion, while allowing suspended sediment to be removed. Vegetation also absorbs water from the soil, reducing the total volume of runoff.

Design considerations; Permanent seeding is the most commonly used method of providing permanent surface stabilization. It is an economical, long-term method of providing highly effective stabilization, and is aesthetically pleasing. However, in order to be effective, the designer must select the proper vegetation and recognize the practical limits of vegetation.

The following should be considered for all sites prior to permanent seeding:

1. Site stabilization. Steep slopes, which increase the erosion hazard, should be minimized. Vegetation alone is normally an effective method of stabilizing slopes that are 3:1 or flatter. For slopes steeper than 3:1, or for flatter slopes carrying runoff from upland areas, a rolled erosion control product may be required to provide slope stabilization until the vegetation is established. In addition, slopes which are very steep (2:1 or greater) and areas which receive intermittent concentrated flows may require application of a turf reinforcement mat to provide permanent reinforcement to the vegetation.

2. Sediment and water control devices. Measures should be taken to divert sheet and concentrated flows away from areas that are to be seeded until the vegetation is established.

3. Seeding methods. There are four seeding methods to consider:

a. Broadcast seed spreader/cyclone seeder

b. Mechanical drill or cultipacker

c. Hydroseeder in which the seed is intermixed with mulch and water to creates a slurry

d. Pneumatic seeder in which the seed is intermixed with compost or a compost/soil blend When hydroseeding and pneumatic seeding are utilized, the surface may be left with a more irregular surface, since these practices will fill small depressions and cover small bumps.These two types of seeding methods can be used in situations where slope and accessibility is a limiting factor and seedbed preparation is not possible, or where the application of seed, mulch and fertilizer (if necessary) in one operation is desirable. Hand broadcasting seed may be utilized for small or inaccessible areas; however it is not recommended for larger areas because of the difficulty in achieving a uniform distribution.

4. Seedbed preparation. Proper seedbed preparation is essential for the seed to germinate and develop into a dense, healthy stand of vegetation.

a. Subsoil preparation. Newly graded areas may be severely compacted by the weight of heavy earth-moving and construction equipment. Disking or tilling reduces compaction in the uppermost layer of the soil, providing an adequate growing bed for the seed; however, the soil below this level may remain severely compacted. This compacted layer acts as an impermeable barrier, slowing or preventing the infiltration of water into the ground. Infiltration of precipitation reduces runoff, and recharges groundwater supplies. Techniques for reducing ground compaction, such as deep tillage, are described in the soil quality restoration. While these techniques are not necessary for establishing permanent vegetation, they are an effective means of improving overall water quality, and the period prior to final stabilization is considered the ideal time to implement them.

b. Topsoil. In order to provide an adequate growing medium, a minimum of 6 inches of topsoil should be placed over the disturbed area prior to seeding. Deeper topsoil depths (20-30cm or greater) are desirable as they increase the organic matter available for use by the plants, allow for deeper root penetration and increase the moisture holding ability of the soil.

5. Seeding properties; Specifications provide a number of seed mixes that are acceptable for most general applications. These mixes and a description of their intended usage are shown in Tables.

HYDROMULCHING SPECIFICATIONS	
Mulch	260 kg/da
Water	9lt/m²
Seed mix	40 kg/da
Fertilizer	40 kg/da of 10-10-10 (N, P, K)

SEED MIX OF THE HYDROMULCH			
	Graminea species	Unit	Quantity
1	Lolium perenne Captain	%5	
2	Lolium perenne Cheops	%5	
3	Festuca arundinacea Apache	%20	
4	Festuca ovina Chrystal	%10	
5	Bronius inermis	%10	
6	Dactylis glomerata	%10	
	Leguminasa species		
7	Trifolium repens	%10	
8	Trifolium pratense	%10	
9	Medicago sativa	%5	
10	Lotus cornicuatum	%15	

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LR3 (PERMANENT SEEDING DETAILS)

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PURPOSE & APPLICATIONS

Materials

- Determine depth of topsoil on 10-metre spacing.
- The depth of material should be at least 7 centimetres. Soil factors such as rock fragments, slope, depth to water table and layer thickness affect the ease of excavation and spreading of topsoil.
- Keep topsoil separate from overburden, and store layers separately to ensure that material is restored in the same order that it was removed.
- Generally, the upper part of the soil that is richest in organic matter is most valuable.
- Organic soils such as muck and peat do not make good topsoil. They can be identified by their extremely light weight when dry.

Stripping

- Strip topsoil only from those areas that will be disturbed by excavation, filling, road building or compaction by equipment. A 1.0 to 1.5 metre stripping depth is common, but depth will depend on the soil profile at the site. Determine depth of stripping by taking soil cores at several locations within each area to be stripped. Topsoil depth generally varies along a gradient from hilltop to toe of slope. Put sediment basins, diversions and other controls into place to manage stormwater before stripping.

Stockpiling

- Select stockpile location to avoid slopes, natural drainage ways and traffic routes. At large sites, re-spreading is easier and more economical when topsoil is stockpiled in small piles near the areas where they will be used.
- Sediment barriers - use sediment fences or other barriers where necessary to retain sediment.
- Temporary seeding - protect topsoil stockpiles by temporarily seeding as soon as possible, within 30 days after the formation of the stockpile.
- Permanent vegetation - If stockpiles will not be used within 12 months they should be stabilized with permanent vegetation to control erosion and weeds.

Site Preparation

- Before spreading topsoil, establish erosion and sedimentation control structures such as diversions, berms, dikes, waterways and sediment basins.
- Maintain grades on the areas to be topsoiled according to the approved plan. Adjust grades and elevations for receipt of topsoil.
- Roughening - Immediately prior to spreading the topsoil, loosen the subgrade by disking or scarifying to a depth of at least 100 millimetres to ensure bonding of the topsoil and subsoil.
- Ensure that soil horizons are replaced in the same order that they were removed.
- Uniformly distribute topsoil to pre-mining thickness. If sufficient topsoil is available, a minimum compacted depth of a half metre on 3:1 slopes and one metre on flatter slopes is suggested. To determine the volume of topsoil required to various depths, use the table below. Do not spread topsoil while it is frozen or muddy.
- Compact the topsoil enough to ensure good contact with the underlying soil, but avoid excessive compaction, as it increases runoff and inhibits seed germination. Light packing with a roller is recommended where turf is to be established.
- On slopes and areas that will not be mowed, the surface may be left rough after spreading topsoil.

Live Topsoiling

- Live topsoiling is extracting topsoil from its place of origin and placing it directly onto an area that has already been mined, backfilled and graded for reclamation.
- This is the most desirable topsoil management option, as the topsoil is handled only once and does not compact during storage within stockpiles.
- Minimize erosion with timely planting of temporary or permanent vegetation.
- Ensure that temporary or permanent plantings are well watered until established.
- Inspect stockpiles regularly, especially after large storms. Stabilize any areas that have eroded.

Volumes of topsoil required for various depths

Depth (millimetres)	Cubic metres per 100 square metres	Cubic metres per hectare
25	2.5	250
50	5.0	500
75	7.5	750
100	10.0	1000
125	12.5	1250
150	15.0	1500

TOPSOIL MANAGEMENT

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LR4 (TOPSOIL STOCKPILE MANAGEMENT DETAILS)

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6. CONCLUSIONS

A report for “Erosion and Sediment Control & Landscape and Reinstatement Project” (ESC & LRP) was prepared to give detailed information about erosion and sediment control measures and landscape and reinstatement practices for the construction site of the ALP and HEPP. After the desk study and on-site visit, the potential risk areas were located and assessed. Finally, the report was completed by revealing ESC & LR specifications and developing recommendations and tools for ALP– ESC & LRP

References;

California Stormwater BMP Handbook (2003). California Stormwater Quality Association Stormwater Best Management Practice Handbook, Construction (www.cabmphandbooks.com).

Virginia Erosion and Sediment Control Handbook (1992). Third Edition (SWMESquestions@dcr.virginia.gov).

A Water Quality and Stream Habitat Protection Manual for County Road Maintenance in NorthWestern California Watersheds (2002).

BIBLIOGRAPHY

BIBLIOGRAPHY

- Hidro Dizayn Muhendislik, Musavirlik, Insaat ve Tic. Anonim Sti., January 2011. Alpaslan II Dam and HEPP Project Feasibility Report, Ankara.

- Insitu Jeoloji Jeoteknik Sandajcilik Ltd: Sti., May 2011, Alpaslan II Dam and HEPP Project, Final Project, Geotechnical Survey Report, Ankara.

- Ministry of Environment and Forestry, Mus Governorship, Mus Provincial Directorate of Environment and Forestry, 2009, Mus Environmental Status Report.

- Cankaya Cevre Olcum ve Analiz Laboratuvari, 2011. Alpaslan II Dam and HEPP Project Acoustics Report, Ankara.

- Cankaya Cevre Olcum ve Analiz Laboratuvari, 2011. Alpaslan II Dam and HEPP Project PM_{10} Measurement Report, Ankara.

- Ministry of Environment and Forestry, General Directorate of State Meteorology Affairs, 2011. 17778-Varto Measurement Stations, Data of 1976-2010, Ankara.

- Bogazici University Kandilli Observatory and Earthquake Research Institute, 2011. Assessment of Eartquake Hazard for Alpaslan II Dam Location, İstanbul.

- Civil Engineering Department of METU, 2010. Alpaslan II Dam and HEPP Project Seismic Hazard Analysis Report, Ankara.

- Ministry of Environment and Forestry, 2009. Mus Environmental Status Report, Ankara.

- Ministry of Environment and Forestry, 2009. Mus Environmental Status Report, Ankara.

- General Directorate of Forestry, Forestry Information System (ORBİS) 2009, Ankara.

- Ministry of Environment and Forestry, Regulation on the Control of Packaging Wastes, Official Gazette date: June 24, 2007, No: 26562.

- Ministry of Environment and Forestry, Regulation on the Control of Waste Batteries and Accumulators, Official Gazette date: August 31, 2004, No: 25569.

- Ministry of Environment and Forestry, Regulation on the Control of Waste Oils, Official Gazette date: July 30, 2008, No: 26952.

- Ministry of Environment and Forestry, General Basis of Waste Handling, Official Gazette date: July 5, 208, No: 26927.

- Ministry of Environment and Forestry, Regulation on the Control of Waste Vegetable Oils, Official Gazette date: April 19, 2005, No: 25791.

- Ministry of Environment and Forestry, Environmental Impact Assessment Regulation, Official Gazette date: July 17, 2008 and No: 26939.

- Ministry of Environment and Forestry, Regulation on the Assessment and Management of Environmental Noise, Official Gazette date: June 4, 2010, No: 27601.

- Ministry of Environment and Forestry, Directorate of nature conservation and national parks, Map Showing Hunting-Allowed Areas Ad and Hunting-Forbidden Areas for Year 2011, Ankara.

- Ministry of Environment and Forestry, Regulation on the Control of Excavation Materials, Construction and Demolition Wastes, Official Gazette date: March 18, 2004, No: 25406.

- Ministry of Environment and Forestry, The Regulation on Assessment and Management of Air Quality, Official Gazette date: June 6, 2008, No: 26898.

- Ministry of Labor and Social Security, Regulation on Occupational Health and Safety, Official Gazette date: December 9, 2003, No: 25311.

- Ministry of Environment and Forestry, Solid Wastes Control Regulation, Official Gazette date: March 14, 1991, No: 20814.

- Ministry of Environment and Forestry, Regulation on the Control of Waste Tires, Official Gazette date: November 25, 2006, No: 26357.

- Ministry of Environment and Forestry. Regulation on Air Pollution Control Sourced from Industry, Official Gazette date: July 3, 2009, No: 27277

- Ministry of Environment and Forestry, Water Pollution Control Regulation, Official Gazette date: December 31, 2004, No 25678

- Ministry of Environment and Forestry, Revision on the Water Pollution Control Regulation, Official Gazette date: February 13, 2008, No 26786

- Ministry of Environment and Forestry, Hazardous Wastes Control Regulation, Official Gazette date: March 14, 2005, No. 25755

- Ministry of Environment and Forestry, Regulation on the Control of Medical Wastes, Official Gazette date: July 22, 2005, No: 25883.

- Ministry of Environment and Forestry, Communiqué on Procedures and Principles regarding Production, Import, Transportation, Safekeeping, Storage, Sale, Usage, Destruction, Inspection of Explosive Materials Exempt from Monopoly, Hunting Materials and Other Similar Materials, Official Gazette date: September 29, 1987, No: 199589.

- Ministry of Environment and Forestry, Communiqué regarding Occupational Health and Safety Precautions in Mining and Stone Quarry Facilities and Tunnel Construction, Official Gazette date: October 22, 1984, No: 18553.

- Ministry of Environment and Forestry, Regulation regarding Transportation of Dangerous Materials by Highway, Official Gazette date: March 31, 2007, No: 26479.

- Cabinet Decision Ordinance on Precautions Required in Workplaces Working with Flammable, Explosive, Dangerous, and Harmful Substances, Official Gazette date: December 24, 1973, No: 14752.

- Ministry of Environment and Forestry, Regulation on Protecting Workers from Hazards of Explosive Environments, Official Gazette date: December 26, 2003, No: 25328.

- UCTEA Chamber of Mining Engineering, www.maden.org.tr

- www.epa.gov

- www2.bayar.edu.tr/somamyo/docs/dergi/sayi9/9sayi6.pdf

- www.cevreorman.gov.tr

- www.deprem.gov.tr

- www.havaizleme.gov.tr

- www.kultur.gov.tr

- www.tuik.gov.tr

- www.dpt.gov.tr

- www.mta.gov.tr

- www.dpt.gov.tr