

Nakkas Basaksehir Highway, Türkiye

Habitat Restoration Plan

17 July 2023

Project No.: 0580559

Rönesans Holding

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Nakkas Basaksehir Highway, Türkiye: Habitat Restoration Plan



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DISCLAIMER

Applicability of the Restoration Plan

This Habitat Restoration Plan has been drawn up for sole use by Rönesans Holding International (REC) for Section 8 of the Nakkaş-Başakşehir Motorway (NMM), Istanbul, Türkiye. Neither its guidelines/recommendations nor background information may be used in any form without prior permission from REC.

This Plan must not be amended without prior consultation and approval from REC. All changes must be formally motivated and supplemented with additional information as necessary.

Setting of Precedents: use of the plan for informing other projects

Given that biodiversity offsets are still relatively new in terms of their conceptualization and implementation internationally, with consultants and implementers still dealing with many unknowns and complexities around offsets in general, it may be that information contained in this Habitat Restoration Plan could be used to inform the development of other similar biodiversity offset plans and ecological restoration projects in Türkiye and more broadly potentially. Whilst the Plan is essentially a publicly available document and may be referred to when developing plans for similar offset projects, it will be important to acknowledge the context specifics, particular process followed, and the decisions arrived to during the stakeholder consultation phase of a specific offset or ecological restoration planning project and not to simply rely on the outcomes of the offset planning and decisions arrived at for the NMM Project.

Ultimately, this document and the planning information contained within should not be seen as precedent setting given the complexities and site-specific nature of offset and ecological restoration projects in general.

CONTENTS

Applicability of the Restoration Plan iv
Setting of Precedents: use of the plan for informing other projects iv
Purpose of the Plan x
Objectives, Goals and Targets x
Key Actions x

1. INTRODUCTION 1

1.1 Background 1
1.1.1 Project 1
1.1.2 ESIA Requirements 1
1.2 Purpose 2
1.3 Scope 4
1.4 Associated Plans 4
1.5 References to Key Legislation and Guidelines 4
1.5.1 National Legislation 4
1.5.2 International Standards and Guidelines 5
1.5.3 Good Practice International Guidelines 5

2. CONTEXT OF THE RESTORATION PLAN 6

2.1 Habitats 6
2.2 Applying the Mitigation Hierarchy 10
2.3 Residual Impacts to Habitat 12

3. VISION, GOALS & OBJECTIVES 15

3.1 Vision 15
3.2 Restoration Targets 15
3.3 Goals/Objectives 20

4. IMPLEMENTATION PLAN 22

4.1 Habitat Rehabilitation / Restoration for Temporary Works Areas 22
4.1.1 Locations 22
4.1.2 Methods 22
4.1.3 Timing 23
4.2 Habitat Restoration / Recreation for Permanent Residual Impacts 24
4.2.1 Locations 24
4.2.2 Opportunities & Constraints Analysis 25
4.2.3 Methods 26
4.2.4 Controlling Invasive Alien Plants 31
4.2.5 Other Management Requirements 32
4.2.6 Considerations for Wildlife Corridors & Crossings 32

5. INSTITUTIONAL ARRANGEMENTS 34

5.1 Land acquisition 34
5.2 Securing protection of offset / restoration sites 35
5.3 Long-term commitments 35
5.4 Costs 35
5.5 Materials and Resources 35
5.6 Training 36
5.7 Implementation Programme 36
5.8 Roles & Responsibilities 37
5.9 Auditing & Reporting 39

6. MONITORING 39

6.1 Introduction 39
6.2 Monitoring Plan 40
6.2.1 Purpose, Aim and Objectives 41
6.2.2 Monitoring Approach 42

6.2.3 Monitoring Indicators 42
6.2.4 Monitoring Period 42
6.2.5 Responsibilities 43
6.2.6 Funding 43
6.2.7 Monitoring Strategy 43
6.2.8 Monitoring Programme 45
6.2.9 Data Collection & Storage 45
6.2.10 Data Analysis & Reporting 45
6.2.11 Key Performance Indicators (KPIs) 47
6.2.12 Using Monitoring Outcomes to inform further Action 48
6.2.13 Review of the Monitoring Plan 49

7. CONTINGENCY MEASURES 50

8. CONCLUDING REMARKS 51

9. REFERENCES 53

10. APPENDICES 55

10.1 Appendix A. Literature Review 55
10.1.1 What is the typical climax vegetation community / communities in Türkiye? 55
10.1.2 What are the lead causes of ecosystem/habitat degradation in Türkiye? 55
10.1.3 What are the key ecological drivers of ecosystems and habitats in the Mediterranean Region / Türkiye? 55
10.1.4 How can one work with ecological drivers to assist with restoration of habitat? 56
10.1.5 What is the importance of ecological succession in ecological restoration projects? .. 56
10.1.6 What are the main obstacles / constraints to restoration of habitat in the Mediterranean/Türkiye and how should these inform restoration projects? 56
10.1.7 How can one ensure successful restoration occurs? 56
10.1.8 What are the key interventions / measures involved in restoring different habitat types?57
10.1.9 What are the main approaches to ecological restoration? 58
10.1.10 Guidance on planting, seeding, soil preparation 58
10.1.11 What are key species traits to take into consideration in restoration and species selection for planting/seeding? 60
10.1.12 Habitat management/restoration in Türkiye 61
10.2 Appendix B: Monitoring Data Collection Forms 63
10.3 Appendix C: Budgeting Sheet 68

List of Tables

Table 1-1 National Legislation 4
Table 1-2 International Standards and Guidelines 5
Table 1-3 Alignment of the Restoration Plan with SER Principles 6
Table 2-1 Habitat types associated to the Project area (*PBF habitats indicated) 6
Table 2-2 Permanent habitat loss predicted for the project 12
Table 3-1 Habitat Losses & Targets Calculations 17
Table 4-1 Opportunities & Constraints 25
Table 5-1 Preliminary implementation programme 36
Table 6-1 Habitat Restoration Indicators 42
Table 6-2 Strategy and proposed methods for restoration monitoring. 44
Table 6-3 Monitoring Programme. 45
Table 6-4 Rating scheme used in monitoring management effectiveness. 46
Table 6-5 KPIs for Habitat Restoration 47
Table 7-1 Contingency measures for key risks 50

List of Figures

Figure 1-1 Sections of the Northern Marmara Motorway 3
Figure 2-1 Habitat distribution in the Study Area 9
Figure 2-2 The 'Mitigation Hierarchy' 11
Figure 3-1 Decision Tree for Reference Ecosystems (adapted from SER) 18
Figure 3-2 Diagram showing the process of natural succession from open grassland to closed forest 19
Figure 4-1 Locations for recommended wildlife crossings 33
Figure 6-1 Diagram illustrating the monitoring process (after DWAF, 2006). 40
Figure 6-2 Diagram showing the adaptive management cycle (after Ramsar Convention Secretariat, 2010). 49

List of Acronyms and Abbreviations

AIIB	Asian Infrastructure Investment Bank
BAP	Biodiversity Action Plan
BBOP	Business and Biodiversity Offsets Programme
CESMP	Construction Environmental and Social Management Plan
CHA	Critical Habitat Assessment
CH	Critical Habitat
DEFRA	Department of Environmental, Food and Rural Affairs
EBRD	European Bank for Reconstruction and Development
(EBRD) PR	(EBRD) Performance Requirement
ECoW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
EO	Environmental Officer
EPC	Environmental, Procurement and Construction
ERM	Environmental Resources Management
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
E&S	Environmental and Social
EUNIS	European Nature Information System
GIIP	Good International Industry Practice
GIS	Geographical Information System
GPS	Geographical Positioning System
HA	Hectares
HSE	Health, Safety and Environment
IAS	Invasive Alien Species
IAP	Invasive Alien Plant
IFC	International Finance Corporation
(IFC) PS	(IFC) Performance Standard
IFI	International Financial Institutions
IUCN	International Union for the Conservation of Nature
KGM	Karayolları Genel Müdürlüğü (General Directorate of Highways in Türkiye)
KM	Kilometres
KPI	Key Performance Indicator
NCR	Non Compliance / Conformance Report
NG	Net Gain (of biodiversity)
NMM	Northern Marmara Motorway
NNL	No Net Loss (of biodiversity)
OHSP	Occupational Health and Safety Plan
PBF	Priority Biodiversity Feature
PPE	Personal Protective Equipment
REC	REC (Rönesans Holding) International

RoW	Right of Way
SEPA	Scottish Environmental Protection Agency
SPV	Special Purpose Vehicle

SUMMARY

Purpose of the Plan

Towards the realisation of the habitat restoration requirements for the Northern Marmara Motorway Section 8 PPP Project (NMM-Nakkaş-Başakşehir Motorway) in Istanbul, Türkiye, ERM identified the need for a 'Habitat Restoration Plan' to guide implementation of the required interventions and associated activities required to restore temporary habitat disturbance caused by road construction as well as to compensate for permanent residual impact on biodiversity (in the form of a biodiversity offset within the road corridor).

Objectives, Goals and Targets

The residual environmental liability for the project includes physical permanent habitat loss and ecological habitat loss. Project components are located mostly on modified habitat; thus, a no net loss requirement applies to the loss of **83.59 ha** occupied by the Project footprint over natural habitats (where in addition, *Cirsium polycephalum* was identified for net gain). This overall area of habitat loss is distributed across three different habitat types as follows:

- Maquis (0.11 ha)
- Black Sea Garrigue (76.46 ha)
- *Spartium junceum* fields (7.01 ha)
- Coniferous plantations (1.54 ha)

The target/goal that would be realistically possible for the Project is to establish a **dense shrubland habitat resembling Black Sea Garrigue and/or Maquis**. With time, through natural successional processes, it is anticipated that these areas will densify with woody vegetation and trees and transition towards an early or seral forest type that should mature with time. A target has been applied of 106 ha of Black Sea Garrigue and/or Maquis habitat to be restored to a state compositionally and structurally similar to the naturally occurring habitat types in the study.

The main goals of the restoration are as follows:

- Reinstatement of habitats disturbed by construction activities but which are not totally transformed (i.e. no permanent infrastructure that precludes the opportunity to restore these areas), will take place in a phased manner through restoration / rehabilitation of temporary works areas and temporary infrastructure once these have been decommissioned and removed from the site upon the completion of construction activities.
- The restoration efforts will also include enhancing degraded habitats located within the expropriation corridor, even if these areas are not directly impacted by the road construction. This approach ensures a more comprehensive ecological rehabilitation, addressing not only the immediate effects of the project but also improving the overall health and functionality of the surrounding environment. By restoring these degraded areas, the project aims to support long-term biodiversity and ecosystem resilience within the broader landscape. Temporary disturbance footprints that are no longer required for operational purposes are to be returned to the previous land use, or to a land use in accordance with landholder needs and regulatory requirements.
- Restoration will work with the successional patterns and mechanisms of the ecosystem(s) involved.

Key Actions

The Plan has been prepared in alignment with the SER (Society for Ecological Restoration) 'International principles and standards for the practice of ecological restoration'), which provides the most comprehensive and robust international framework available to date for ecological restoration projects. Through the detailed plan for implementation as well as the stringent monitoring and evaluation programme included, this plan seeks to address the requirements for the NMM-Nakkaş-Başakşehir Motorway towards meeting no net loss

of biodiversity objectives for natural habitat losses associated with the project, and net gain for critical habitat impacts.

There are in essence two scenarios that will be addressed through habitat restoration activities:

- **Addressing temporary habitat disturbance:** *Sites where there has been significant disturbance through temporary works and temporary infrastructure (such as worker camps, material and equipment laydown areas, temporary access roads, etc.), which once removed from the site after construction has been completed can be reinstated to natural habitat (at least to the pre-development state if not better).*

- **Addressing permanent habitat loss:** *Within the road project expropriation corridor, and not subject to direct intervention of the project, there is an estimated 89.72 ha of modified habitat intense unmixed crops, that once expropriated shall be used to reintroduce the affected natural habitats that support the PBF habitats and critical habitat trigger species, notably Cirsium polycephalum.*

  In addition, once the construction has finished, there will be a surface of 156.31 ha formed by newly created embankments, that shall also be used to host the required offset through habitat restoration and recreation.

  The combination of both areas guarantees the sufficient surface to address the identified requirements within the boundaries of the project, constituting in this way, a restoration to ensure at least no net loss and preferably net gain.

An appropriate framework has also been developed to inform and guide the long-term monitoring of habitats and associated biodiversity (flora and fauna) at the selected restoration sites associated with the NMM-Nakkaş-Başakşehir Motorway project. Monitoring will be required to demonstrate the effectiveness of restoration activities in conserving, restoring, rehabilitating and/or improving the status quo of the various habitats and to inform the successful and effective management and safeguarding of these areas against any significant decline in condition and/or functioning.

1. INTRODUCTION

1.1 Background

1.1.1 Project

Several motorways were constructed in the Marmara Region with the aim to decrease the traffic load around Istanbul, including the “Northern Marmara Motorway” (NMM). The NMM was originally comprised of seven sections in total connecting Asia and Europe with an uninterrupted traffic flow and is considered an alternative route to the European Road 80 (E 80 also known as Trans European Motorway (TEM). The first seven sections of the NMM have already been completed and are under operation, with Section 8 to be completed (see **Figure 1-1** on the next page). Based on the tender process held on 30 June 2020 and the agreement following on 13 April 2021, the 1st Regional Directorate of Karayolları Genel Müdürlüğü (KGM) (General Directorate of Motorways in Türkiye) involved an additional section within the scope of NMM which is called “Section 8 – Nakkaş-Başakşehir Motorway” (hereafter called the “Project").

The Project is a new 4-lane dual toll road with a total length of 30.64 km including connection road and 1619 m long Sazlıdere Cable Stayed Bridge. Nakkaş Otoyol Yatırım ve İşletme A.Ş. (Nakkaş Otoyol A.Ş) - a Special Purpose Vehicle (SPV) under a Build, Operate and Transfer (BOT) contract signed with Turkish Ministry of Transport, General Directorate for Highways (KGM) in 2020 - is responsible for the construction and operation of the Project. The construction of Nakkaş - Başaksehir Motorway (Section 8) started in August 2021 and planned completion is estimated to be early 2025.

1.1.2 ESIA Requirements

Nakkaş Otoyol A.Ş is planning to finance the investment costs of the Project by debt and equity under a Project Finance structure involving the European Bank for Reconstruction and Development (EBRD), Asian Infrastructure Investment Bank (AIIB) and Atradius. As a major, long-term infrastructure, the Project is considered as ‘Category A’ by the Lenders and is subject to full Environmental and Social Impact Assessment (ESIA). Therefore, Nakkaş Otoyol A.Ş appointed ERM GmbH (ERM) to conduct the ESIA in line with Lender’s standards.

ESIA studies have examined negative and positive, biophysical and socio-economic effects of all components of the Project. During the Impact Assessment, design decisions have been made taking account of the need to avoid, minimise and reduce any negative environmental and social impacts. Where potential adverse impacts have been identified, the ESIA has examined the extent to which these impacts would be mitigated through the adoption of good practice methods of working in line with international standards.

As a part of the ESIA Package for the Project, a Biodiversity Action Plan (BAP) was compiled to comply with the requirements of the European Bank of Reconstruction and Development (EBRD) Performance Requirement (PR) 6: *Biodiversity Conservation and Sustainable Management of Living Natural Resources*. The BAP consolidates the biodiversity and ecosystem service mitigation actions on specific biodiversity features as recommended in the ESIA and informed also by the findings of a Critical Habitat Assessment (CHA) and ESIA for the Project and (ERM, 2022). The BAP details the justification of the on-site restoration activities (considered within the mitigation hierarchy) to obtain non-significant residual impacts on Critical Habitat (CH) and to propose additional/complementary actions to aim towards reaching a net gain (NG) on some of those CH features and no net loss (NNL) of Priority Biodiversity Features (PBFs). Key actions recommended in the BAP towards delivering the required NNL and NG to biodiversity include:

- Compensate for permanent loss of rare/endemic plants of conservation importance (PBF and CH features) through plant translocation and/or propagation and replanting;
- Enhance and manage the available habitat; and
- Establish (restore and recreate) and enhance habitat quality for the management period.

Towards the realisation of the habitat restoration and recreation requirements for the Project, ERM identified the need for a 'Habitat Restoration Plan' to guide implementation of the required interventions and associated activities required to restore temporary habitat disturbance caused by road construction as well as to compensate for permanent residual impact on biodiversity (in the form of a biodiversity offset within the road corridor).

1.2 Purpose

The purpose of this plan is to guide the restoration of habitat temporarily disturbed by the construction RoW (Right of Way) for the Northern Marmara Motorway Section 8 PPP Project (NMM-Nakkaş-Başakşehir Motorway) as well as the restoration of habitat to form the biodiversity offset which compensates for permanent (residual) impacts to natural habitats.



Figure 1-1 Sections of the Northern Marmara Motorway

1.3 Scope

Towards the realisation of the habitat restoration and recreation requirements for the Project, this 'Habitat Restoration Plan' has been developed to guide implementation of the required interventions and associated activities.

Habitat restoration in this context aims at manipulating and accelerating natural ecological succession[1] processes by introducing target species that form the final community, at an early stage.

1.4 Associated Plans

The following plans should be read in conjunction with the 'Habitat Restoration Plan' for context and supporting information and measures:

- Biodiversity Action Plan (BAP) (ERM, 2025)
- Construction Environmental and Social Management Plan (CESMP) (ERM, 2023)
- Environmental and Social Management & Monitoring Plan (ESMMP) (ERM, 2023)
- Landscape Management Plan (REC-ÇYS-KMO-PL-17)
- Occupational Health and Safety Plan (OHSP)
- Pollution Prevention Plan (REC-ÇYS-KMO-PL-19)
- Soil Management Plan (REC-ÇYS-KMO-PL-10)
- Waste Management Plan (REC-ÇYS-KMO-PL-02)
- Surface Water and Groundwater Management Plan (REC-İSG-ÇYS-KMO-PL-09)

1.5 References to Key Legislation and Guidelines

1.5.1 National Legislation

Table 1-1 National Legislation

Title	Reg. , Gaz. Date
Environment Law	2872, 11/09/1983
Soil Protection and Land Use Law	5403, 19/07/2005
Regulation on Waste Management	29314, 02/04/2015
Regulation on Control of Soil Pollution and Point Source Polluted Fields	27605, 08/06/2010
Regulation on Health and Safety Conditions Regarding Use of Work Equipment	28628, 25/04/2013

REC and its contractors are responsible for reviewing relevant local legislation and requirements to capture all requirements.

[1] Ecological succession is defined by Walker *et al.* (2007) as the change in species composition and associated substrate changes that take place over time. Since natural succession is not an entirely predictable process, adaptive management is typically required throughout the process.

1.5.2 International Standards and Guidelines

Table 1-2 International Standards and Guidelines

Source	Document Title
IFC (2012)	IFC Performance Standards (PS) and Guidance Notes (GN) and in particular IFC PS3 and GN3: Resource Efficiency and Pollution Prevention
IFC (2007a)	IFC General EHS Guidelines: including Environmental, Occupational Health and Safety, Community Health and Safety, and Construction and Decommissioning
IFC (2007b)	IFC General EHS Guidelines: for Construction Materials Extraction Construction and Decommissioning
IFC (2007c)	IFC General EHS Guidelines: for Toll Roads
EBRD (2019)	EBRD Environmental and Social Policy that includes the Performance Requirements and in particular: Performance Requirement (PR) 3: Resource Efficiency and Pollution Prevention and Control
EBRD (2010)	EBRD Sub-sectoral Environmental and Social Guidelines: Building and Construction Activities
WHO (2019)	WHO recommended classification of pesticides by hazard and guidelines to classification, 2019 edition. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.

REC and its contractors are responsible for reviewing relevant international standards, guidelines and requirements to capture all requirements.

1.5.3 Good Practice International Guidelines

The SER (Society for Ecological Restoration) 'International principles and standards for the practice of ecological restoration' (contained in Gann *et al*., 2019), have been referred to here as a comprehensive and robust international framework available for restoration projects, intended to support the development of ecological restoration plans, assist implementers with achieving intended goals, while addressing key challenges and navigating trade-offs associated with land management priorities and decisions.

The SER establish **eight (8) principles** that underpin ecological restoration:

1. Engage stakeholders
2. Draw on many types of knowledge
3. Informed by native reference ecosystems, while consulting environmental change
4. Support ecosystem recovery processes
5. Assessed against clear goals and objectives using measurable indicators
6. Seek the highest level of recovery possible
7. Part of a continuum of restorative activities
8. Gains cumulative value when applied at large scales

The habitat restoration plan has been aligned, as far as possible, with the eight SER principles for ecological restoration (**Table 1-3**).

Table 1-3 Alignment of the Restoration Plan with SER Principles

SER's Eight Ecological Restoration Principles (after Gann *et al*., 2019)	**Alignment of the Habitat Restoration Plan with SER Principles**
1 Engage stakeholders	*Stakeholders engaged include environmental authorities as well as local biodiversity experts.*
2 Draw on many types of knowledge	*Conventional knowledge was drawn upon, based on a comprehensive review of literature and lessons learned from local/regional projects and case studies, as well as alternatives approached.*
3 Informed by native reference ecosystems, while consulting environmental change	*Native ecosystems have been sampled in field, taking into consideration anthropogenic impacts and also leaning on lessons learned from other projects.*
4 Support ecosystem recovery processes	*Habitat restoration seeks to improve not only biodiversity, but a range of ecosystem goods and services, forming part of the broader biodiversity offset for the development project.*
5 Assessed against clear goals and objectives using measurable indicators	*Clear goals and objectives have been articulated in the plan. Monitoring will aim to include measurable indicators such as habitat extent, vegetation cover, species composition, faunal observations, etc.*
6 Seek the highest level of recovery possible	*The highest practical level of recovery has been sought as the end point of the restoration plan, taking into consideration practical and ecological constraints and opportunities identified.*
7 Part of a continuum of restorative activities	*The restoration plan forms only part of the broader biodiversity offset for the project and includes various habitat and biodiversity enhancement components and activities.*
8 Gains cumulative value when applied at large scales	*The habitat creation and restoration plan forms part of the broader biodiversity offset for the project.*

2. CONTEXT OF THE RESTORATION PLAN

2.1 Habitats

The proposed route for the Project mainly consists of residential and agricultural habitats. Areas of natural and semi-natural habitats of Mediterranean climate are also scattered along the proposed route. Wheat farming is the predominant activity in the agricultural areas. Natural and semi-natural areas consist of meadows, riparian habitats, Garrigue habitats, and *Spartium junceum* (Spanish broom) communities. Natural and semi-natural habitats on the motorway route are non-continuous.

Table 2-1 presents all the habitats identified within the Study Area and classified according to the European Nature Information System (EUNIS), including natural and modified habitats and habitats associated with Priority Biodiversity Features (PBFs). The map in **Figure 2-1** presents the distribution of the different habitats in the study area.

Table 2-1 Habitat types associated to the Project area (*PBF habitats indicated)

Habitat type	PBF?	Comments
C3.2: Water-fringing reedbeds and tall helophytes	Yes	■ Considered to be a modified habitat which has formed artificially as a result of the excavation and straightening/canalization of a natural watercourse present before the construction of a dam.

Habitat type	PBF?	Comments
other than canes		■ The dominant species of this habitat are bulrush (*Typha latifolia*), common reed (*Phragmites australis*), fat duckweed (*Lemna gibba*), soft rush (*Juncus effusus*), common club-rush *(Schoenoplectus lacustris),* Gypsywort *(Lycopus europaeus), Bidens tripartita* and *Senecio aquaticus.*
E2.252 - Moeso-Thracian mesophile hay meadows	Yes	■ Not considered representative of natural hay meadows or grasslands which would be sustained naturally by several environmental and climatic drivers and is rather considered a secondary grassland type, and therefore a modified habitat. ■ This habitat type is grazed heavily by cattle and goats/sheep with the dominant species being soft rush (*Juncus effusus*), *Ranunculus constantinopoliatanus,* ribwort plantain (*Plantago lanceolata*), hemlock (*Conium maculatum*), blessed thistle (*Silybum marianum*), radish (*Raphanus raphanistrum*), cutleaf teasel (*Dipsacus laciniatus*), alfalfa (*Medicago sativa*), cat grass (*Dactylis glomerata*), and Bermuda grass (*Cynodon dactylon*).
F5.2 Maquis		■ Habitat with a degree of modification as all similar Mediterranean habitat by human management (grazing, fires, etc) dominated by the common Kermes oak (*Quercus coccifera*). ■ Important plant species include *Cirsium polycephalum*, a regionally endemic species classified globally as Critically Endangered (CR) by IUCN, and *Ferulago confusa*, (Vulnerable), which are both distributed throughout the habitat. ■ This habitat can be considered as Critical Habitat (CH) due to its support for the species *Cirsium polycephalum*.
F5.4 *Spartium junceum* Fields		■ The dominant species of this natural habitat with a degree of modification as all similar Mediterranean habitat by human management (grazing, fires, etc.) is Spanish broom (*Spartium junceum*) with other species present including cat grass, bracken (*Pteridium aquilinum*), dog rose (*Rosa canina*), osyris (*Osyris alba*), butcher's broom (*Ruscus aculeatus*), smilograss (*Piptatherum miliaceum*) and yellow jasmine (*Jasminum fruticans*). ■ The regionally endemic *Cirsium polycephalum* can also be found within this habitat. ■ This habitat can be considered as Critical Habitat (CH) due to its support for the species *Cirsium polycephalum*. ■ The regional endemic snowdrop (*Galanthus x valentinei*) can be found within this habitat, this species is assessed as VU.
F6.4 Black Sea Garrigue		■ Habitat with a degree of modification as all similar Mediterranean habitat by human management (grazing, fires, etc., where the dominant species are pink rock rose (*Cistus creticus*), sage-leaved rock rose (*Cistus salviifolius*), green olive tree (*Phillyrea latifolia*), Türkiye oak (*Quercus cerris*) and tree heath (*Erica arborea*). ■ Important plant species include *Cirsium polycephalum* (Endemic and CR) and *Ferulago confusa*, (VU), which are both distributed throughout the habitat.
G1.3 Mediterranean Riparian	Yes	■ Considered as a modified habitat due to the high level of modification that has taken place as a result of historical channel straightening and

Habitat type	PBF?	Comments
Woodland (PBF*)		excavation. Main species include field elm (*Ulmus minor*), holy bramble (*Rubus sanctus*) and *Juncus heldreichianus.* ■ The regional endemic snowdrop (*Galanthus x valentinei*) can be found within this habitat, this species is assessed as VU.
G3.F Highly Artificial Coniferous Plantations		■ Modified habitat formed by plantations of black (*Pinus nigra*) and maritime pine (*Pinus pinaster*). Individuals of *Cirsium polycephalum* (CR) can be found in this habitat.
I1.1 Intensive Unmixed Crops		■ Modified habitat formed by crops.
J1.1 Residential Buildings of City and Town Centres (urban and industrial)		■ Modified habitat dominated by the presence of human made infrastructures.
Plantations		■ Modified habitat of non-coniferous plantations in the study area that have been artificially established.
Transitional Weeds		■ Modified habitat formed by areas of land clearly disturbed, with signs of tillage from previous agricultural practices associated with crop cultivation, that now appear in a very early successional state.
Water body		■ Open water bodies largely void of any emergent vegetation (apart from aquatic vegetation fringing water body edges and algal blooms in the water column), most notably Sazlidere dam. This is an artificial reservoir supplying water to Istanbul and provides habitat for waterbirds and fish mainly. Considered as a modified habitat.

Key: PBF = Priority Biodiversity Feature (as defined in terms of EBRD PR6)

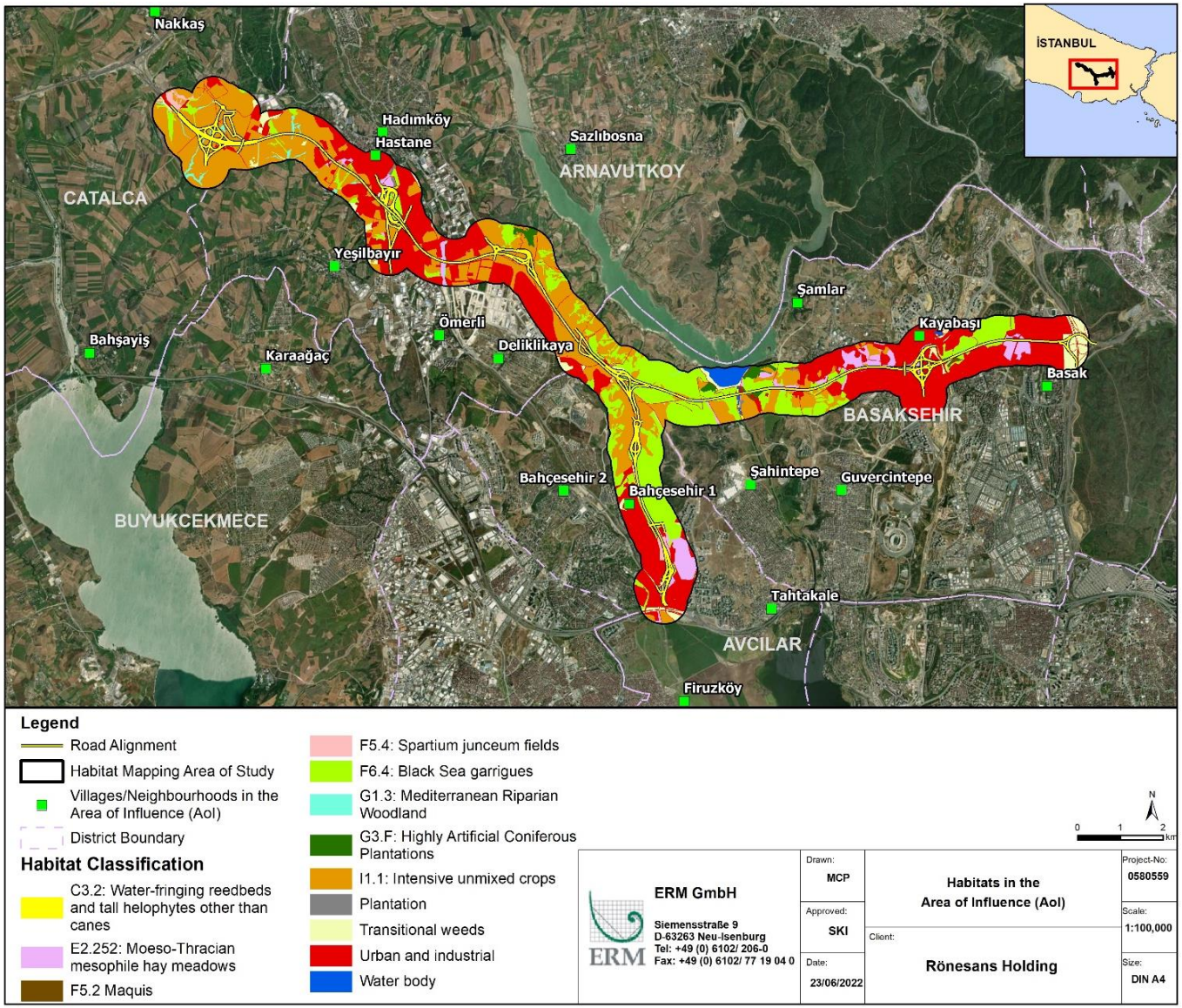


Figure 2-1 Habitat distribution in the Study Area

Cirsium polycephalum is observed across various habitat types. In some areas, despite being severely degraded due to intense anthropogenic pressures, the mere presence of this species has led to their classification as Critical Habitat (CH). However, such areas may have largely lost their ecological integrity and may have limited potential to contribute to long-term biodiversity conservation goals. Therefore, the CH designation process should be based not only on the presence of the species but also on the ecological functionality of the habitat and its capacity to support other species.

Cirsium polycephalum is recognized as a CH trigger species under Criteria 1 and 2 of PR6, and technically, the presence of even a single individual may be sufficient for an area to qualify as CH. However, the species' relative importance within the ecosystem—such as its distribution, functional role, and conservation priority—should play a decisive role in CH assessments. In line with the objective of achieving Net Gain, the focus should not be placed on all areas where the species occurs, but rather on those habitats that offer the most suitable, ecologically functional, and sustainable conditions for its long-term conservation and recovery. In this context, prioritizing garrigue/maquis habitats within the scope of the project would be a more appropriate strategy, as it would support both the conservation of *Cirsium polycephalum* and overall biodiversity.

2.2 Applying the Mitigation Hierarchy

The protection of ecosystems and biodiversity generally begins with the avoidance of adverse impacts, and where such avoidance is not feasible, to apply appropriate mitigation in the form of practical actions that minimize or reduce impact magnitude. Mitigation requires proactive planning that is enabled by following the '**mitigation hierarchy'** (see **Figure 2-2**). The application of the mitigation hierarchy is intended, firstly, to avoid disturbance and/or loss of ecosystems and associated biodiversity, and where avoidance is not possible, to minimise, rehabilitate, and then finally offset any remaining significant residual impacts. The mitigation hierarchy is inherently proactive, requiring the on-going and iterative consideration of alternatives in terms of project location, siting, scale, layout, technology and phasing until the proposed development can best be accommodated without incurring significant negative impacts to the receiving environment. In the case of particularly sensitive ecosystems, where ecological impacts can be severe, the guiding principle should generally be "*anticipate and prevent*" rather than "*assess and repair*".

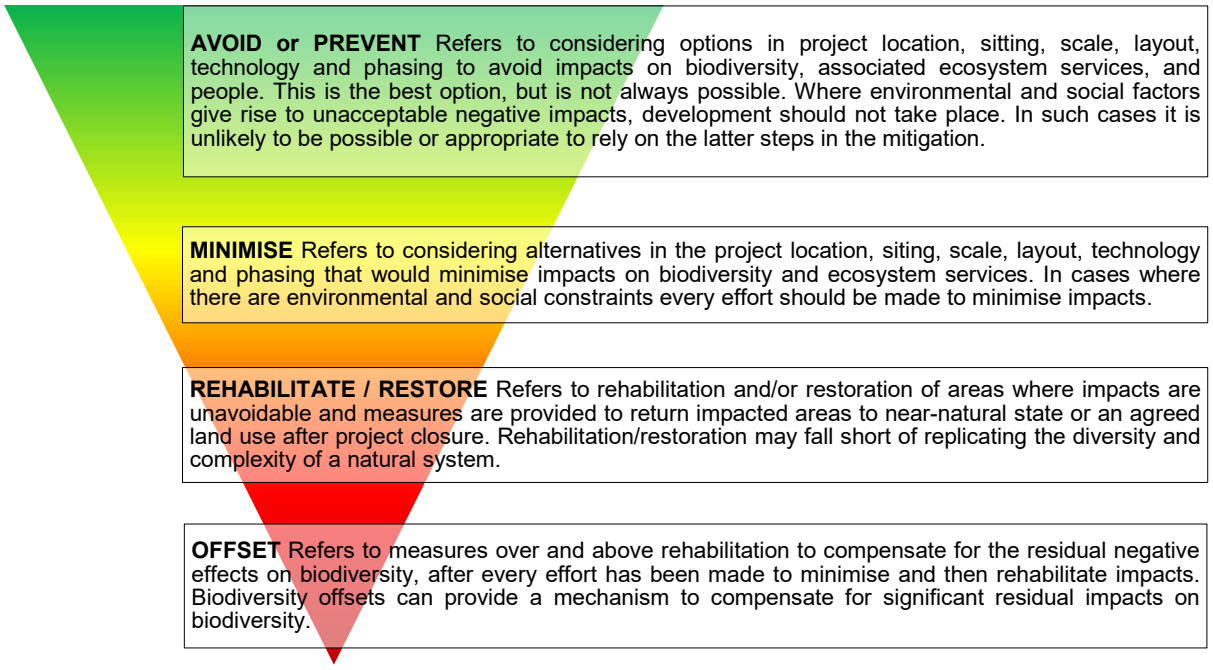


Figure 2-2 The 'Mitigation Hierarchy'

The mitigation hierarchy was applied to the Türkiye Motorway project, with the assessment of alternatives, application of preventative measures and recommendations to minimise impacts through a range of practical mitigation measures is reflected in the project ESIA as well as various plans, including the ESMMP and CESMP. This includes step 3 of the mitigation which seeks to rehabilitate habitats temporarily disturbed or degraded during road construction, but which will not be permanently transformed by the project.

Despite efforts to avoid, minimise and reduce impacts, the project will still result in residual impacts of low to moderate significance; most notably being the permanent transformation resulting in the loss of natural habitats (*see Section 2.3 that follows on the next page).*

2.3 Residual Impacts to Habitat

According to BBOP (2012), what sets a biodiversity offset apart from other forms of ecological compensation is that the project's residual impact on biodiversity is quantified and used to determine the amount, nature and scale of conservation outcome realistically required to offset that impact.

The residual environmental liability includes physical permanent habitat loss (**Table 2-2**) and ecological habitat loss. Project components for the Türkiye Motorway development are located mostly on modified habitat; thus, a no net loss requirement applies to the loss of **83.59 ha** occupied by the Project footprint over natural habitats (where in addition, *Cirsium polycephalum* was identified for net gain). This overall area of habitat loss is distributed across three different habitat types as follows:

- Maquis (0.11 ha)
- Black Sea Garrigue (76.46 ha)
- *Spartium junceum* fields (7.01 ha)
- Coniferous plantations (1.54 ha)

Table 2-2 Permanent habitat loss predicted for the project

Type of habitat	Project Works	Total area (ha)
Modified habitat Including: Water-fringing reedbeds and tall helophytes other than canes, Mediterranean Riparian Woodland, Coniferous Plantations, Intensive unmixed crops, other plantations, transitional weed, and urban and industrial	**Permanent**	
	Road alignment	162.15
	Embankment areas	117.83
Natural habitat Including: Maquis, *Spartium junceum* fields and Black Sea garrigue	**Permanent**	
	Road alignment	45.11
	Embankment areas	38.48

A description of each these habitat types follows below.

F5.2 Maquis

This habitat type was found only at one location in the Project area. These dense shrubland habitats are considered to be secondary vegetation communities in the Mediterranean region, forming from the partial or complete destruction of primary forests. They may represent pre-forest communities, the replacement stages of primary climax forests or permanent communities on more arid slopes and xeric sites.

Structurally, these habitats have typically closed canopy structure comprised mainly of dense arrangements of shrubs and low trees, lacking tall trees typical of forest habitats. The main woody tree components are resistant to fire, typically regenerating from root stocks, and hence these communities generally appear stable in karstic landscapes such as those in Istanbul. Livestock grazing and fire are important drivers of these habitats that typically depend on low to moderate disturbance at an acceptable frequency. With increasing summer aridity, overgrazing and human pressure, maquis can begin to resemble the more open garrigues as they become low and sparse.

Compositionally, these habitats were found to dominated by the common Kermes oak (*Quercus coccifera*) with subdominant species being Türkiye oak (*Quercus cerris),* Green olive tree (*Phillyrea latifolia*), Aleppo oak (*Quercus infectoria*), Prickly juniper (*Juniperus oxycedrus*) and Blackthron (*Prunus spinosa*). Typical species have deep rooting system, sustaining growth even on shallow soils in rocky areas.

Important plant species include *Cirsium polycephalum*, a regionally endemic species classified globally as Critically Endangered (CR) by IUCN, and *Ferulago confusa*, which is rare but not endemic species classified on the national IUCN scale as Vulnerable (VU), which are both distributed throughout the habitat.



Photo 1. Maquis habitat

F6.4 Black Sea Garrigue

These low-growing relatively open shrublands form as secondary vegetation communities following the destruction/degradation of primary forests, typically arising in areas where the natural equilibrium has been disrupted and on completely burnt areas. Garrigues are in essence the result of retrogressive succession after degradation of primary evergreen Mediterranean forest and maquis vegetation and are generally maintained as more open, sparse shrubland through grazing and fire.

Structurally, these habitats comprise xerophyllous vegetation that is slightly shorter than maquis and comprised of more open habitat with scattered shrublets (see Plate 5-6). They are characterized by low, thorny formations mainly of hemispherical shrubs that are deciduous during the dry season. Compositionally, the dominant species include pink rock rose (*Cistus creticus*), sage-leaved rock rose (*Cistus salviifolius*), green olive tree (*Phillyrea latifolia*), Türkiye oak (*Quercus cerris*) and tree heath (*Erica arborea*). In addition, *Iris sintenisii*, *Dactylorhiza iberica*, Mediterranean lineseed (*Bellardia trixago*), Yellow glandweed (*Parentucellia viscosa*), *Onosma thracica*, pink butterfly orchid (*Orchis papilionacea)*, Long-lipped Tongue-orchid (*Serapias vomeracea*), Small-flowered Tongue Orchid (*Serapias parviflora*) are found in this habitat.

Important plant species include *Cirsium polycephalum*, a regionally endemic species classified globally as Critically Endangered (CR) by IUCN, *Ferulago confusa*, which is rare but not endemic species classified on the national IUCN scale as Vulnerable (VU) and *Euphorbia amygdaloides var. robbiae,* a Near Threatened species globally which are distributed throughout the habitat.

The habitat is not corresponding to any of the Annex I habitat types of the Directive 92/43/EC.



Photo 2. Black Sea garrigue habitat

F5.4 Spartium junceum Fields

This habitat type is frequently found along the road route. It is a secondary habitat resulting from the destruction of deciduous oak forests and usually represents arid slopes. This habitat type of transitional woodland / low closed shrubland was found located mainly near the middle of the proposed motorway route. The dominant species of this habitat is Spanish broom (*Spartium junceum*) with other species present including cat grass, bracken (*Pteridium aquilinum*), dog rose (*Rosa canina*), osyris (*Osyris alba*), butcher's broom (*Ruscus aculeatus*), smilograss (*Piptatherum miliaceum*) and yellow jasmine (*Jasminum fruticans*).

The regionally endemic *Cirsium polycephalum* can also be found within this habitat. Consultation with local experts indicate this species is considered to be Critically Endangered.

***Notes on Spartium junceum**: this is a fast-growing shrub, widely introduced as an ornamental and also for erosion control. It has escaped from cultivation and become an aggressive invader in many tropical, subtropical and temperate regions of the world. S. junceum is a prolific seed producer, with abundant and persistent seed banks, high rates of germination and seedling establishment. It also has adaptations to grow in a wide range of habitats and soil types with tolerance to severe drought conditions. Seed germination is triggered by soil disturbance and fire. Once established, S. junceum forms dense, monospecific thickets that are impenetrable and unpalatable to most wildlife. These dense thickets outcompete and displace native species and increase fuel load for fires. The species is also nitrogen-fixing and capable of altering soil fertility, nutrient cycling and successional patterns.*



Photo 3. *Spartium junceum* fields habitat

3. VISION, GOALS & OBJECTIVES

3.1 Vision

The vision provides a general summary that explains the overarching purpose of the plan and the desired condition achievable through the restoration project. In this instance, the habitat restoration plan's vision is as follows:

Vision:

To restore habitats within the road reserve to resemble their semi-natural state and contribute towards meeting offset targets.

In practice, biodiversity gains can be achieved in several ways according to the Business and Biodiversity Offsets Programme (BBOP, 2012), such as:

- ***Undertaking positive management interventions to restore an area or stop degradation**: improving the conservation status of an area of land by restoring habitats or ecosystems and reintroducing native species. Where proven methods exist or there are no other options, reconstructing or creating ecosystems. Also, reducing or removing current threats or pressures by, for instance, introducing sustainable LIVELIHOODS or substitute materials.*
- ***Averting risk**: Protecting areas of biodiversity where there is imminent or projected loss of that biodiversity; entering into agreements such as contracts or covenants with individuals in which they give up the right to convert habitat in the future in return for payment or other benefits now.*
- ***Providing compensation packages for local stakeholders** affected by the development project and offset, so they benefit from the presence of the project and offset and support them.*

In this instance, the most feasible and practical solution would be to restore habitats temporarily impacted and target areas that have been converted to agricultural use in the road corridor for habitat restoration/recreation to compensate for the loss of habitat due to the road development.

Restoration in this context, according to SER, creates and enlarges habitats and connects fragmented landscapes, thereby improving biodiversity quality and the ecological conditions for biota (fauna and flora).

3.2 Restoration Targets

Targets refer to measures that identify the habitats to be restored at a site along with any ecological (and/or social) outcomes or constraints expected for the project. In this case, habitat targets to meet no net loss requirements for the project (in the form of an 'offset') are as follows:

Targets:

106 hectares of Black Sea Garrigue and/or Maquis habitat within transformed/degraded habitats in the road reserve

to a state representative of / or as similar as possible to the naturally occurring habitat types in the study area (structurally and compositionally)

BBOP (2012) recommends that biodiversity offsets should demonstrate additional, measurable CONSERVATION OUTCOMES that at least balance or go beyond redressing biodiversity losses associated with a project. Establishing clear goals and targets for the biodiversity offset will be a critical step towards informing offset planning and implementation.

The underlying theoretical assumption is that the offset should address all residual losses for all affected biodiversity, but BBOP (2012) mention that it is rarely either possible or practical to document and quantify losses for every component of biodiversity or for all dimensions of structure and function. Most approaches therefore demonstrate no net loss using METRICS for no net loss calculations based on SURROGATES or PROXIES for the entirety of biodiversity which can be measured realistically, which is a practical and widely accepted approach. HABITAT is one such proxy for biodiversity that is widely accepted and used in offset calculations.

The residual environmental liability includes physical permanent habitat loss of **83.59 ha** occupied by the planned Project footprint. This overall area of habitat loss is distributed across three different habitat types as follows:

- Maquis (0.11 ha)
- Black Sea Garrigue (76.46 ha)
- *Spartium junceum* fields (7.01 ha)

Residual impacts on natural habitat requires the achievement of no net loss, whilst critical habitat impacts require the achievement of a net gain in biodiversity values.

The residual Critical Habitat[2] (CH) and Priority Biodiversity Feature[3] (PBF) habitat liabilities are presented in the BAP (ERM, 2025), where a biodiversity metric was used based on the Habitat Hectares approach. The calculation accounted for the quality of the habitat lost to identify the minimum quantum of quality hectares (assuming a target condition of '1' being good condition) required to achieve no net loss for PBF qualifying habitat features and net gain for Critical Habitat (i.e. *Cirsium polycephalum*). From this analysis (see **Table 3-1**Table 2-2), the required range of areas to achieve a no-net-loss of biodiversity values is as follows:

Habitat	Estimated Extent to be Lost
1 Maquis	0.15 ha
2 Spartium junceum fields	1.5 ha
3 Black Sea garrigue	104.4 ha
4 Coniferous plantations	0.4 ha
Total	**106 ha**

[2] In terms of Critical Habitat (CH): *"Based on the no net loss definition, a biodiversity net gain means that the measures taken to protect and restore biodiversity values significantly exceeds the loss." (IFC PS6, 2012).*

[3] In terms of Priority Biodiversity Features (PBF): *"No net loss means a target for a development project in which the impacts on biodiversity caused by the project are balanced or outweighed by measures taken to avoid and minimise the project's impacts, to undertake on-site restoration and finally to offset the residual impacts, so that no loss remains." (IFC PS6, 2012).*

Table 3-1 Habitat Losses & Targets Calculations

Habitat Type	Habitat Loss (ha)	Quality ha metric applied	Area of habitat x Quality	Justification of habitat quality	Difficulty of restoration[4]	Justification of restoration difficulty	Years to Target condition[5]	Jusification	Overcompensation required to mitigate restoration/creation risk[6]	Ratio
Maquis	0.11	0.75	0.08	The habitat is a successional phase with a relative degree of disturbance but hosts significant numbers of the trigger species	0.33	Native species that grow naturally and constitute a successional phase of local forests, and therefore adapted to grow in disturbed areas	0.49	Restoration of such habitat requires some years to attain similar quality levels	0.15	1.82
Spartium junceum fields	7.01	0.15	1.05	Fast-growing shrub, widely introduced as an ornamental and also for erosion control. It becomes an aggressive invader that forms dense, monospecific thickets and can displace native flora.	0.1	Fast growing habitat that adapts easily to disturbed areas.	0.343	It is a fast-growing habitat	1.51	1.443
Black Sea Garrigues	76.46	0.75	57.34	The habitat is a successional phase with a relative degree of disturbance but hosts significant numbers of the trigger species	0.33	Native species that grow naturally and constitute a successional phase of local forests, and therefore adapted to grow in disturbed areas	0.49	Restoration of such habitat requires some years to attain similar quality levels	104,36	1.82
Coniferous Plantations	1.54	0.15	0.23	It is a modified habitat (artificial plantation) that hosts relatively low number of individuals of the species *Cirsium polycephalum*	0.1	Coniferous plantations are widely used given their facility to colonize areas in restoration.	0.7	10 years at least to have sufficiently grown trees	0.414	1.8

[4] Difficulty of restoration (Easy 0.1, 0.33 , 0.67,1 hard))

[5] Years to Target condition (1=0.343, 5=0.490, 10=0.700, 20=0.837, 30=0.965)

[6] Sum of the values of difficulty of restoration and years to target condition

The target/goal that would be realistically possible for the Project is to establish a **dense shrubland habitat resembling Black Sea Garrigue and/or Maquis**. With time, through natural successional processes, it is anticipated that these areas will densify with woody vegetation and trees and transition towards an early or seral forest type that should mature with time. In arriving at this decision, the 'Decision Tree for Reference Ecosystems' (SER) was used (**Figure 3-1**).

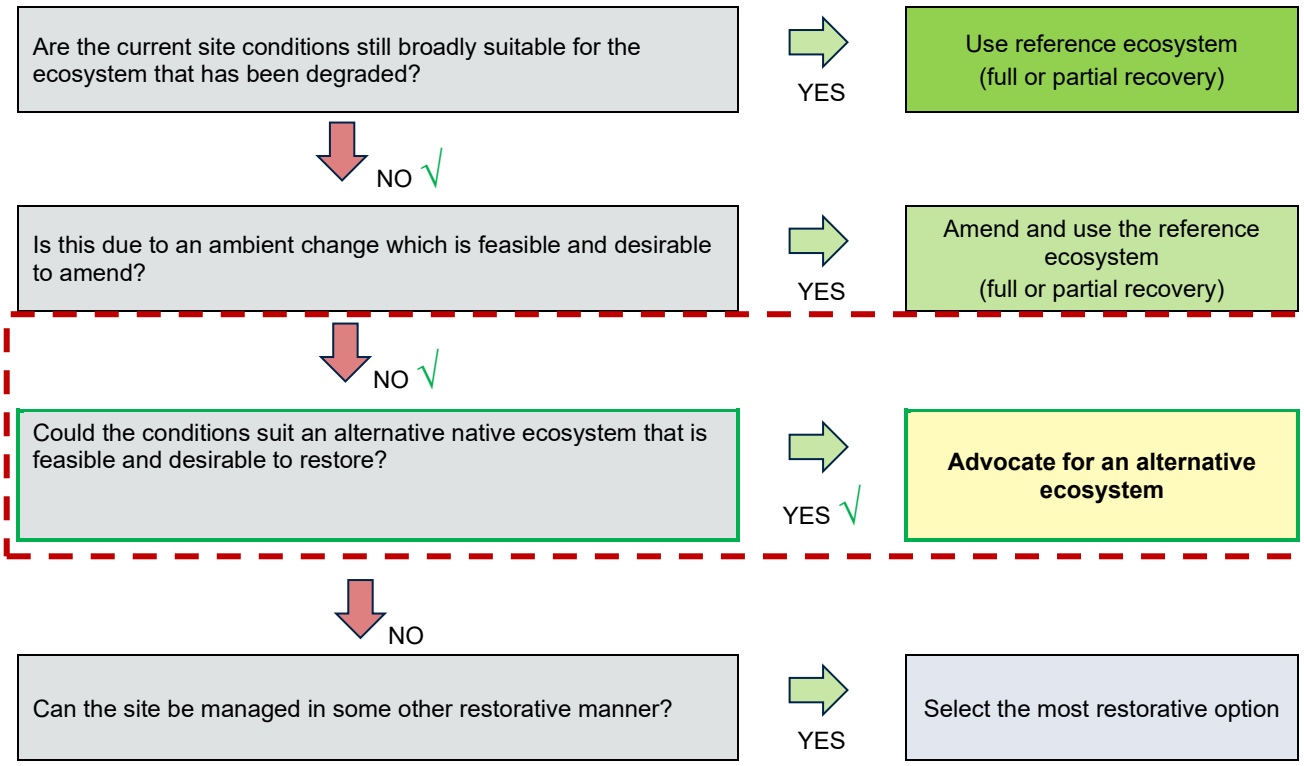


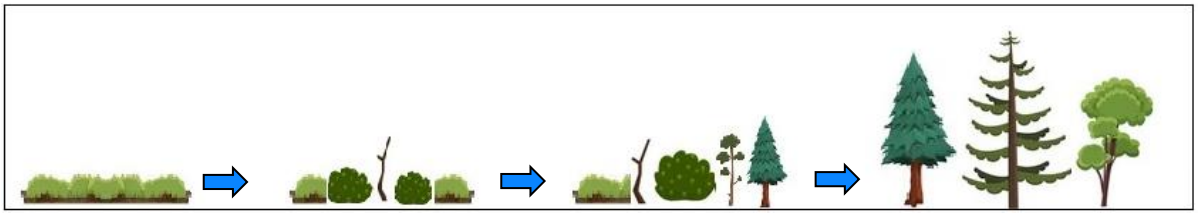
Figure 3-1 Decision Tree for Reference Ecosystems (adapted from SER)

JUSTIFICATION:

Whilst open grassland classified as 'Moeso-Thracian mesophile hay meadows' and other shrublands dominated by *Spartium junceum* ('*Spartium junceum* Fields') (as well as coniferous plantations) are present in the study area and will be affected by the development, reinstating these habitats is not considered desirable or practical, and therefore it is **recommended rather that Garrigue or Maquis habitats be established to compensate for the loss of these habitats**. This also aligns with the generally acceptable offset planning and design principle of 'trading-up' towards a more important or higher conservation category of habitat in this case (BBOP, 2012). The rationale behind this decision is as follows:

- Typical climax vegetation in Türkiye is evergreen oak woodland or forest, however under disturbance/exploitation the vegetation degenerates towards Maquis, harboring many plants that occur in forest but prefer more open habitat and eventually given sufficient disturbance, open herbaceous dominated Garrigue vegetation communities form with low shrubs and flowering plants. This type commonly occurs in abandoned fields and heavily degraded habitats with a governing disturbance regime but is also the first stage of succession in recently burnt areas (see ecological succession process diagram, in **Figure 3-2** and the literature review contained in **Appendix A**).
- Most late-successional Mediterranean species do not create a permanent seed bank (Vallejo *et al.,* 2012), thus restoration would require an intensive and costly re-seeding process, unless natural successional processes can be more passively directed.

Diagram showing the process of natural succession from open grassland to closed forest



Open grassland / meadow	Garrigue	Maquis	Forest
			
• Open low grassland structure • Dominated by short grasses and herbs	• Low-growing relatively open shrublands • Grass cover with scattered shrublets	• Dense evergreen shrublands with a typically semi-open to closed canopy structure • Dense arrangements of shrubs and low trees	• Dense woody vegetation forming largely contiguous vegetation communities • Structured with typically closed tree canopy
Ecological processes: • Secondary vegetation • Maintained by grazing / fire	Ecological processes: • Secondary vegetation • Maintained by grazing / fire	Ecological processes: • Secondary vegetation • May represent pre-forest communities, the replacement stages of primary climax forests or permanent communities on more arid slopes and xeric sites • Main woody tree components are resistant to fire, regenerating from root stocks	Ecological processes: • Primary vegetation • Climax vegetation communities • Absence of fire

Figure 3-2 Diagram showing the process of natural succession from open grassland to closed forest

- Moeso-Thracian mesophile hay meadows are secondary open grassland communities, formed as a result of the clearance of Garrigue or as a result of overgrazing by livestock which has diminished the woody vegetation component and maintained the short herbaceous/grass cover. Given its secondary nature and the assumption that this habitat would not naturally be sustained should unnatural fire and grazing regimes cease, it is recommended instead that Black Sea Garrigue or Maquis be considered as a suitable replacement type for this habitat loss.
- *Spartium junceum* fields are considered secondary habitats and *S. junceum*[7] is considered an introduced species in Türkiye, which has naturalised and adapted to the site, with seed germination and proliferation of this plant triggered by disturbance of soils and fire. It is thought that irregular fire

[7] ***Notes on Spartium junceum****: this is a fast-growing shrub, widely introduced as an ornamental and for erosion control. It has escaped from cultivation and become an aggressive invader in many tropical, subtropical and temperate regions of the world. S. junceum is a prolific seed producer, with abundant and persistent seed banks, high rates of germination and seedling establishment. It also has adaptations to grow in a wide range of habitats and soil types with tolerance to severe drought conditions. Seed germination is triggered by soil disturbance and fire. Once established, S. junceum forms dense, monospecific thickets that are impenetrable and unpalatable to most wildlife. These dense thickets out-compete and displace native species, and increase fuel load for fires. The species is also nitrogen fixing and capable of altering soil fertility, nutrient cycling and successional patterns.*

frequency and grazing pressures as well as other human disturbances has led to the invasion of grassland and Garrigue habitats by his species, which typically forms monospecific thickets. It is not recommended, from an ecological perspective, to establish mono-specific *S. junceum* thickets of reduced plant diversity and therefore limited biodiversity support value, and instead Black Sea Garrigue or Maquis is recommended as a suitable replacement type for this habitat loss.

- Coniferous plantations are artificially planted wooded areas comprising non-native tree species. The reinstatement of such habitat is generally not advised given the non-native nature of species which conflicts in general with biodiversity conservation objectives, and therefore it was decided rather that Black sea Garrigue or Maquis be considered as a suitable replacement type for this habitat loss as it is a superior 'natural' habitat type which can also support the rare plant species (*Cirsium polycephalum*) found to occur within coniferous plantations in the study area.

3.3 Goals/Objectives

Goals or objectives are formal statements of the medium to long-term outcomes along the trajectory of ecological recovery and relate to the desired level of recovery of the ecosystems/habitats sought. In order to achieve the vision and targets set for the restoration project, the following objectives have been formulated:

Objective 1:	Align the plan with the latest offset and ecological restoration good-practice guidelines by reviewing and aligning the offset and restoration strategy with the most recent international and national good-practice guidelines (e.g. BBOP, IUCN, IFC PS6) to ensure methodological robustness in implementation.
Objective 2:	Identify and quantify residual impacts to biodiversity (habitat loss) by assessing and quantifying residual biodiversity impacts, particularly permanent habitat loss, fragmentation, or degradation, using standardized metrics (e.g. hectares, condition scores).
Objective 3:	Quantify habitat offset targets that need to be met by determining measurable habitat offset targets based on a like-for-like or better approach, including the area, habitat condition, and long-term sustainability objectives to be achieved.
Objective 4:	Identify and motivate for the target habitat offset / restoration receiving area by identifying and justifying the selection of the habitat offset / restoration receiving site, supported by ecological baseline data, feasibility assessments, and long-term land tenure considerations.
Objective 5:	Identify and describe proposed offset activities by describing the suite of proposed offset/restoration activities in detail, including site preparation, soil and hydrology management, planting and propagation of target species, invasive species control, and habitat enhancement techniques.
Objective 6:	Ensure that offset targets are adequately met through the suite of offset activities by demonstrating how the selected activities will achieve offset targets, including habitat condition improvement, species recovery potential, and temporal loss compensation (e.g. time lags, multipliers).
Objective 7:	Define key commitments, taking into account opportunities and constraints by defining key project commitments and constraints, such as funding availability, permitting, long-term land security, and implementation risks, and reflecting these in the operational planning.
Objective 8:	Define roles and responsibilities by assigning clear roles and responsibilities among project implementers (e.g. contractors, ecological experts, monitoring bodies, landowners) with defined lines of accountability.
Objective 9:	Compile an implementation plan, together with key actions, timeframes and work programme by developing a comprehensive implementation plan that includes key

	actions and milestones, timelines and phasing, resource allocation, procurement of services, and risk mitigation measures.
Objective 10:	Compile an appropriate plan for monitoring and auditing the offset by establishing a monitoring and auditing framework with baseline and target condition indicators, data collection methodology, monitoring frequency and responsibilities, independent audits, and adaptive management triggers.
Objective 11:	Engage with various stakeholders to ensure a transparent and collaborative approach implementing a stakeholder engagement strategy that ensures inclusive consultation, feedback integration, and transparent decision-making throughout planning and implementation.
Objective 12:	Identify and describe key assumptions, limitations and data deficiencies by documenting key assumptions, limitations, and data gaps, including species/habitat data uncertainties, climate or land-use change projections, monitoring technology limitations, and areas where expert judgment or precautionary principles were applied.
Objective 13:	To achieve No Net Loss (NNL) for the Küçükçekmece Basin IBA/KBA and Net Gain (NG) for the West Istanbul Pastures IPA through the development and implementation of site-specific, measurable and practical actions; including habitat restoration, aquatic habitat enhancement and species-specific conservation measures for the IBA/KBA, and a pragmatic approach focused on flora species reintroduction and conservation for the IPA, with all actions clearly defined and supported by a structured implementation framework and timeline.

4. IMPLEMENTATION PLAN

4.1 Habitat Rehabilitation / Restoration for Temporary Works Areas

GOALS:

- Reinstatement of habitats disturbed by construction activities but which are not totally transformed (i.e. no permanent infrastructure that precludes the opportunity to restore these areas), will take place in a phased manner through restoration / rehabilitation of temporary works areas and temporary infrastructure once these have been decommissioned and removed from the site upon the completion of construction activities.
- Temporary disturbance footprints that are no longer required for operational purposes are to be returned to the previous land use, or to a land use in accordance with landholder needs and regulatory requirements.
- Restoration will work with the successional patterns and mechanisms of the ecosystem(s) involved.

4.1.1 Locations

Sites where there has been significant disturbance through temporary works and temporary infrastructure (such as worker camps, material and equipment laydown areas, temporary access roads, etc.), which once removed from the site after construction has been completed can be reinstated to natural habitat (at least to the pre-development state if not better).

4.1.2 Methods

Planning

- A service provider will be secured and appointed to support the Project team with logistics in terms of the seed collection, transportation and propagation processes.
- A visual plan/drawing will be developed showing the individual areas that are to be restored / replanted.
- Sensitive vegetation to be retained will be fenced or sign-posted before work commences on site, and as much vegetation as possible will be retained to maintain the integrity of the landscape and the visual screening already present.
- Temporary working areas required to support restoration activities will be as small as practically possible, and areas chosen for the storage of materials and equipment will avoid areas of high visual impact to nearby residents/viewers and areas of high ecological value/sensitivity. The areas outside of the Project's expropriated construction borders will not be occupied.

Site Preparation

- The amount of bare disturbed soil should be kept to a minimum, and these areas must be re-vegetated quickly (as soon as construction works have been completed and temporary work areas vacated, temporary infrastructure has been removed, sites stabilized and prepared for planting) to prevent conditions promoting weed establishment.
- Stabilization works will be undertaken at sites where slopes/soils are identified as lacing stability, such as abandoned camp areas, waste disposal sites and other project locations that may pose a health and safety hazard to the community.
- Contamination of land or waste materials on site will need to be removed and/or treated prior to proceeding with the reinstatement process.
- Where there is a risk of contaminated land occurring, such as mechanical workshops within construction camps, laydown areas, or other areas where significant hydrocarbons have been stored, these will be carefully managed.
- The site will be kept tidy and free of litter and debris as far as possible.
- *Correctly preserved topsoil resources can provide a viable source of seed-stock, biological life and nutrient conditions that assist with soil productivity and fertility, and thereby vegetation establishment.* The

reinstatement of topsoil and subsoil retained during the construction RoW stripping and clearing phase will be done:

- Reinstate soils in the reverse order (subsoil, then topsoil). Maintain the original soil layering and do not mix topsoil and subsoil layers.

- Topsoil that is stripped and stored as part of construction activities is to be re-spread as part of stabilization and reinstatement activities.

- Avoid compaction of soils, for example though excessive vehicle tracking, and rip soils where compacted to allow for vegetation growth.

- Protect the reinstated bare soil surface with a physical barrier, such as a thin layer of mulch or geotextile/erosion control matting for steeper embankments.

- Soil erosion features will be stabilised via backfilling as appropriate.
- Implement contour terracing on slopes for increased soil moisture and protection from erosion.
- Only weed-free mulch recycled from the slashing and clearing on the site will be used:

  - Any fallen trees may be chipped into mulch and stockpiled and composted for use as mulch on planting areas.

  - Stripped grass may provide mulch and a source of grass seed to aid revegetation.

Seeding

- Natural regeneration is the preferred method for re-reinstating native vegetation where short-term disturbances are proposed, and a viable native seed bank is available.
- Encourage rapid re-vegetation through re-seeding using rapid growing, indigenous runner grasses (e.g. *Cynodon dactylon, native fescues (Festuca spp.), native bents (Agrostis spp.)* or a suitable indigenous grass seed mix that is commercially available).
- Seeding/planting will occur outside of the dry season and avoiding adverse conditions such as prolonged drought periods.

Access controls

- Temporary fencing or other appropriate barriers to prevent entry to the area may be implemented in the short to medium term, to prevent grazing or allow vegetation re-growth in order to stabilise the soil surface.
- The reinstated areas will also be permanently fenced, being part of the road corridor/reserve and in this way the site will be conserved and unauthorized access by the public and grazing livestock avoided.

4.1.3 Timing

- A phased development and restoration approach will be considered such that as each temporary activity is completed at one section, areas shall be stabilised and reinstated.
- Rehabilitation and/or restoration activities will take place alongside construction, such that as soon as temporary works are removed from the site and after construction has been completed, the rehabilitation of habitats in areas temporarily disturbed or degraded by construction activities shall commence.

4.2 Habitat Restoration / Recreation for Permanent Residual Impacts

GOALS:

- Within the expropriation area, suitable natural habitat will be restored and recreated to mitigate (compensate for) overall habitat loss and degradation associated with the Project and towards achieving NNL and NG biodiversity objectives.
- Fill embankments and the road corridor/reserve[8] including services area will be reinstated to a form of indigenous grassland and/or mixed low shrubland (resembling Garrigue / Maquis) type habitat rather than monotypic grass or conifers.

4.2.1 Locations

Within the road project expropriation corridor, and not subject to direct intervention of the project, there is an estimated 89.72 ha of modified habitat intense unmixed crops, that once expropriated shall be used to reintroduce the affected natural habitats that support the PBF habitats and critical habitat trigger species, notably *Cirsium polycephalum.*

In addition, once the construction has finished, there will be a surface of 156.31 ha formed by newly created embankments, that shall also be used to host the required offset through habitat restoration and recreation. The combination of both areas guarantees the sufficient surface to address the identified requirements within the boundaries of the project, constituting in this way, a restoration to ensure at least no net loss and preferably net gain.

The restoration of habitat for *Cirsium polycephalum* is critical to ensure long-term sustainability and support biodiversity in the area. To achieve this, the identification and preparation of specific receptor sites for planting and translocation of this species will be a priority. These receptor sites will be selected based on their ecological suitability, ensuring that they meet the species' habitat preferences and provide optimal conditions for growth and survival. It should be clarified that the on-site translocation previously undertaken involved approximately 150 individuals of *Galanthus x valentinei*, which were relocated within the project area as an impact avoidance and immediate mitigation measure prior to or during construction. This action is separate from and not related to the planned habitat restoration and replanting measures described herein, which specifically target *Cirsium polycephalum* and are intended to achieve long-term habitat restoration and permanent Net Gain for this critical habitat trigger species.

To secure permanent Net Gain (NG) for *Cirsium polycephalum*, it is essential to establish monitoring and adaptive management measures. A comprehensive monitoring plan will be implemented to track the success of planting and translocation efforts, as well as to assess the long-term viability of the species in its new habitat. Monitoring will include regular assessments of population density, health, and reproductive success, as well as the condition of the habitat in which the species is planted.

Adaptive management will be an integral part of this process, allowing for adjustments in management actions based on monitoring results. This may include supplementary planting, habitat restoration activities, or the introduction of additional protection measures to mitigate any unforeseen challenges. Regular reviews of the restoration plan will ensure that the actions taken continue to support the long-term success of *Cirsium polycephalum* and contribute to the overall biodiversity goals of the project.

In line with the restoration plan, detailed information on receptor sites, planting strategies, and monitoring protocols will be provided to ensure that all measures necessary for achieving permanent NG for this species are fully addressed.

[8] Within the expropriation corridor, and not subject to direct intervention of the project, there are 89.72 ha of the modified habitat intense unmixed crops, that once expropriated could be used to reintroduce the affected natural habitats that support the critical habitat trigger species, *Cirsium polycephalum*. In addition, once the construction has finished, there will be a surface of 156.31 ha formed by newly created embankments, that could be used to host the required offset site. The combination of both areas guarantees the sufficient surface to address the identified requirements within the boundaries of the project, constituting in this way, a restoration to ensure no net loss.

At this stage of the Project, the specific areas where restoration activities will take place have not yet been determined. These areas will be identified based on evaluations and analyses conducted under the BAP. Therefore, it is not currently possible to map these areas. The detailed layout of the restoration areas and activities will be determined and monitored as the BAP is implemented, and the relevant maps will be provided once this process is completed.

4.2.2 Opportunities & Constraints Analysis

Restoration projects need to take local conditions and land use history into account to plan and manage activities accordingly. An opportunities & constraints analysis was undertaken to identify and define key opportunities that can be used to inform habitat restoration / recreation implementation and leverage these opportunities as best as possible, and to also highlight key constraints, risk and threats, both internally and externally with respect to the development planned and how these may affect the restoration objectives and goals. Measures to reduce risks and work within constraints have been provided where possible. These are summarised below in **Table 4-1**.

Table 4-1 Opportunities & Constraints

Opportunities Analysis		
Opportunities Identified	**Description**	**Comments / Recommendations**
1 Location of restoration/offset receiving area is close to Project impact site	The target restoration / offset receiving areas are located within the road development corridor, close to the impact footprint.	*Restoration opportunities are positioned as close to the impacted habitat, not only to ensure that impacts are compensated for but also to maximise management and maintenance efficiencies.*
2 Land already owned by applicant	Land within the road reserve will be expropriated and will then be under ownership of the project developed / applicant.	*There is no need to purchase additional land. Ownership of the land makes implementation of restoration/offset activities relatively straight forward as no landowner permissions or agreements are required.*
3 All relevant habitats represented at the offset site	The impacted vegetation and habitat types are all well-represented within the offset receiving area.	*Offset targets can be realised within the chosen offset receiving area. Comparable ecosystem services are therefore likely to be associated with these habitat types secured through the offset.*
4 Several parcels of previously cultivated land within the offset area	The rehabilitation / restoration potential for previously cultivated and transformed land is significant.	*These cultivated lands are almost totally void of any indigenous vegetation, providing a clean template to start restoration activities.*
5 Seed sources for planting	The existing established grassland and woody shrubland plant communities in the study area provide a viable source of seed.	*A viable seed source will support harvesting and collection of seed for habitat creation as part of offset activities.*
Constraints, Risks & Threats Analysis		
Constraints Identified	**Description**	**Comments / Recommendations**
1 Burning restrictions imposed on adjacent land due to risk of fire/explosion	Stringent controls and restrictions on vegetation / veld burning on adjacent land due to risk of fire/explosion.	*These constraints may make it difficult to maintain fire-adapted ecosystems and vegetation communities such as grasslands and shrubland in many key areas.*
2 Succession is not easy to predict entirely and can be	Since natural succession is not an entirely predictable process, adaptive management is typically	*Develop an adaptive management programme. Maintenance management or adaptive management, i.e. the continued*

Opportunities Analysis		
Opportunities Identified	**Description**	**Comments / Recommendations**
limited by several environmental factors	required throughout the process. Usually, succession as well as restoration is limited by environmental constraints that include plant dispersal, germination, growth, species turnover and ecosystem resilience.	*manipulation of succession, is essential throughout the restoration process to achieve persistence of the preferred habitat. Unassisted succession would be an option only for small sites surrounded by natural vegetation, which is often not the case.*
3 Semiarid conditions can limit plant growth	Semiarid conditions can cause heat stress and reduced water availability highly affect and limit seed dispersal and plant growth.	*Considering the establishment of mosaics of vegetation for physical heterogeneity, that mimic natural landscapes, contributes to plantation success in arid conditions. Using several growth forms helps to ensure that extreme events will not destroy all species. Structural variation provides resilience by permitting cores of survivors even if catastrophes occur.*
4 Existing disturbance regime can limit seed availability	Depending on the degree of human disturbance, presence of seeds of grassland/shrubland species in the soil (i.e. the seedbank) may be limited.	*Using local seeds for restoration is important, not only for conservation of local genotypes, but they are usually better adapted to local environmental conditions than non-local genotypes and thus more likely to contribute to successful restoration.*
5 Soil suitability may inhibit plant growth	Suitability of soils within areas that have been historically or presently cultivated (considering topsoil disturbance and residual chemicals from pesticides/herbicides).	*The required restoration measures very much depend on the degree of degradation and the initial conditions. In highly degraded ecosystems, restoration of physical and/or chemical environmental conditions might be required. In only slightly degraded ecosystems, removing the stressors might be sufficient to recover the functionality of the system*
6 Competition caused by invasive/alien plant species	To avoid competition with native species, alien species development should be controlled.	*The establishment of alien species on a restoration site depends to a large extent on the presence of such species in the surrounding landscape. If a large pool of alien species is present, e.g. in urban wasteland, sowing or planting of native species may prevent invasion*

4.2.3 Methods

Planning (for all habitats)

- A service provider will need be secured and appointed to support the Project team and the NGO (Istanbul Botanical Gardens) with logistics in terms of the seed collection, transportation and propagation processes.
- A visual plan/drawing will need to be developed showing the individual areas that are to be restored / replanted.
- Sensitive/natural vegetation is to be retained will be fenced or sign-posted before work commences on site, and as much vegetation as possible will be retained to maintain the integrity of the landscape and the visual screening already present.
- Planning must take into consideration the location and maintenance requirements of existing and planned wildlife corridors and interventions to facilitate wildlife crossings (*see Section 7.9.2 and Annex 13.4 of the CESMP*).

- Temporary working areas to support restoration activities will be as small as practically possible, and areas chosen for the storage of materials and equipment will avoid areas of high visual impact to nearby residents/viewers and areas of high ecological value/sensitivity. The areas outside of the Project's expropriated construction borders will not be occupied by workers, equipment, temporary site camps, etc.

General Site Preparation (for all habitats)

- The purpose of site preparation is to improve deep penetration of roots, increase soil infiltration of water, increase nutrient availability and to reduce water runoff and evaporation.
- The amount of bare disturbed soil should be kept to a minimum, and these areas must be re-vegetated quickly (as soon as construction works have been completed and temporary work areas vacated, temporary infrastructure has been removed, sites stabilized and prepared for planting) to prevent conditions promoting weed establishment.
- Stabilization works will be undertaken at sites where slopes/soils are identified as being of poor stability, such as abandoned camp areas, waste disposal sites and other project locations that may pose a health and safety hazard to the community. This will be undertaken as per the **Soil Management Plan** (REC-ÇYS-KMO-PL-10) and the **Landscape Management Plan** (REC-ÇYS-KMO-PL-17).
- Contamination of land or waste materials on site will need to be removed and/or treated prior to proceeding with the reinstatement process. This will be undertaken as per the **Waste Management Plan** (REC-ÇYS-KMO-PL-02).
- Where there is a risk of contaminated land occurring, such as mechanical workshops within construction camps, laydown areas, or other areas where significant hydrocarbons have been stored, these will be carefully managed as per the **Pollution Prevention Plan** (REC-ÇYS-KMO-PL-19)
- Within areas selected for planting characterised by former agriculture (cropland), there may be residual chemicals in the topsoil associated with herbicides or pesticides used, which could inhibit or stunt plant growth in these areas. It is therefore recommended that soils be tested and treated where necessary prior to planting taking places per the **Soil Management Plan** (REC-ÇYS-KMO-PL-10.
- Sites will be re-shaped to a safe and stable landform, with surface drainage lines and topsoil profile re-instated. Methods to reshape the landform will vary depending on the level of disturbance:

  - Where practical, sites will be reshaped to a natural landform.

  - For planting with topsoil and mulch, 1:3 gradient is the maximum slope recommended.

  - If it is not practical to reshape sites where cut and fill operations have occurred on slopes, or within highly dispersive soils. In these instances, a stable landform will be reinstated by surface re-profiling, contouring, or benching.

- The reinstatement of topsoil and subsoil retained during the construction RoW stripping and clearing phase will be done. Reinstate soils in the reverse order (subsoil, then topsoil). Maintain the original soil layering and do not mix topsoil and subsoil layers. Refer to the **Soil Management Plan** (REC-ÇYS-KMO-PL-10).
- Topsoil that is stripped and stored as part of construction activities is to be re-spread as part of stabilization and reinstatement activities. [*Correctly preserved topsoil resources can provide viable source of seed-stock, biological life and nutrient conditions that assist with soil productivity and fertility, and thereby vegetation establishment.*] **Soil Management Plan** (REC-ÇYS-KMO-PL-10).
- In several areas, topsoil availability may be limited. This will pose a major constraint to restoration in these areas. Where possible, topsoil from areas stripped prior to construction will be transported to the restoration sites to replace lost topsoil and adequately compacted. Alternatively, suitable topsoil would need to be sourced and imported from elsewhere.
- Soil erosion features will be stabilised via backfilling as appropriate.
- Implement contour terracing on slopes for increased soil moisture and protection from erosion.
- Only weed free mulch recycled from the slashing and clearing on the site will be used:

  - Any fallen trees may be chipped into mulch and stockpiled and composted for use as mulch on planting areas.

  - Stripped grass may provide mulch and a source of grass seed to aid revegetation.

- These areas will then be grassed with a pioneer grass species mix (indigenous runner grass for example) to stabilise the soils prior to planting with tree saplings.
- Avoid compaction of soils, for example though excessive vehicle tracking, and rip soils where compacted to allow for vegetation growth.
- Protect the reinstated bare soil surface with a physical barrier, such as a thin layer of mulch or geotextile/erosion control matting for steeper embankments.
- Seeding of legumes (*Leguminosae)* will assist in increase nitrogen concentration and organic matter in the soil and this is recommended where this has been depleted due to agricultural practices.
- Adding fertilizer to soil is also recommended as a means of enhancing the growth rate of plants, particularly where the soil has been depleted in essential nutrients due to agricultural practices.
- Organic matter may also be utilised to improve soil fertility and would be dug into the planting area soils prior to planting.
- Make use of subsoiling (i.e. deep ripping to 50–70 cm soil depth), mechanical terracing (2–3 m wide in combination with subsoiling) and mechanical and manual holes for planting (ca. 40 x 40 x 40 cm).
- On steep slopes, and especially in loose soils, where rainfall erosion tends to produce gullies, it is recommended to construct fascines with organic material (rolled biodegradable textiles, logs, bundles of branches). This technique suits also in rocky slopes for trapping and holding soil, creating a suitable place for natural plant establishment as well as for out-planting. Refer to the **Soil Management Plan** (REC-ÇYS-KMO-PL-10).
- Permanent erosion and runoff control features will be regularly inspected, remediated and maintained.

Specific measures for ‘Garrigue (shrubland)’ habitat restoration:

- In areas where long-term disturbances have occurred or where natural regeneration through ecological succession is deemed as ineffective (informed by monitoring), assisted revegetation will be required to ensure that disturbed areas are rehabilitated with species richness representative of the adjacent land use or best examples of similar natural areas (i.e. Black Sea Garrigue).
- Encourage rapid re-vegetation through re-seeding using rapid growing, indigenous runner grasses (e.g. *Cynodon dactylon* or a suitable indigenous grass seed mix that is commercially available).
- Seeding/planting will occur outside of the dry season and avoiding adverse conditions such as prolonged periods of drought or extreme rainfall/flooding.
- A more customized planting solution may also need to be considered for steeper slopes, using proprietary products such as biodegradable coconut fibre matting or hydroseeding/hydromulching.
- Plantings may be installed as tube stock or via hydroseeding to increase plant survival.
- Revegetation will use only native plant species or seeds which are weed free.
- Plant beds shall be maintained as weed free and mulched annually to suppress weed growth and retain moisture content within the soil.
- Planting, where necessary shall be undertaken by hand or small machinery to minimize disturbance to the local soils.
- These areas will also be the main receiving sites for rescued plants and seed used to propagate and replace threatened/endemic species (e.g. *Cirsium polycephalum*).

Specific measures for ‘Riparian’ habitat restoration:

- Where clearing of riparian vegetation is unavoidable, the objective will be to reinstate the creek banks and riparian vegetation as soon as practical post construction.
- The surface will typically be lightly scarified before the spreading of the topsoil, to promote regeneration of native vegetation and prevent loss of topsoil.
- To minimize erosion and destabilization of creek banks, erosion controls will be constructed or installed, where necessary. Establishing structures to prevent soil erosion and recovering bank vegetation in the short-term will be critical (e.g. live vegetation, live fascines, living wattle fence, living brush mattress, vegetated log cribwall, live staking, textile cover until vegetation cover is established).
- Other shrubby or woody riparian species plants are also commonly installed in the second row vegetation along the banks and in floodplains (as for instance ash, alder or elms in riparian habitat), cultivated in containers and planted as 1-2 year old seedlings.

Guidance on species selection for planting:

- Identify indigenous species for planting and suitable sources for seed and plants as appropriate.
- Propagule sources in close vicinity are important for the establishment of late-successional species that usually have poor dispersal abilities.
- Generally, the selection of species in restoration and reforestation programs is recommended to be as close as possible to the natural vegetation of the area and according to the specific site conditions.
- The introduction of species in a restoration project requires the technical knowledge of the species cultivation requirements, planting techniques (including planting windows), and its plasticity in tolerating fluctuating environmental conditions.
- Selection of woody species for restoration should be based, as much as possible, on the natural late-successional vegetation of the area, and on the environmental characteristics of the site.
- Seeding woody species is an attractive technique to re-introduce target species owing to its low cost, the low impact of field operations and improved possibilities for treating remote areas through aerial seeding.
- Generally, the selection of species in restoration and reforestation programs is recommended to be as close as possible to the natural vegetation of the area and according to the specific site conditions.
- Analyse what native species are suitable for the habitat to be restored from field observations or reference studies on area phytosociology.
- The main elements of Garrique vegetation are as follows (to guide plant/seed selection): *Cistus salviifolius, Cistus creticus, Cistus parviflorus, Coridothymus capitatus, Erica verticillata, Fumana arabica, Fumana thymifolia, Genista acanthocloda, Micromeria nervosa, Majorana syriaca, Phlomis viscosa, Phlomis cretica, Salvia triloba, Sarcopoterium spinosum, Satureja thymbra, Thymbra spicata, Teucrium divaricatum* and *Teucrium creticum*. The leading garrigue element is *Poterium spinosum*, which is common on abandoned lands and degraded habitats.
- For riparian areas, cuttings of easy-to-root riparian native tree species, such as Poplars, Willows or Tamarisk are typically recommended, and which could be collected from nearby donor sites.
- Select drought tolerant species of native origin.
- The quality of the seedlings produced at nurseries plays a very important role in Mediterranean restoration programs, as the most critical period for seedling survival is the first year after planting.
- Identify commercial sources of seed / plants from local nurseries for example.

Other considerations:

- In the early stages of spontaneous succession there are a number of physical, chemical, and dispersal barriers to species establishment. As succession proceeds, these barriers are likely to decrease in importance and be replaced by barriers imposed by competition from developing vegetation. With a technical solution the aim is to remove some or all of these barriers artificially.
- Seeding/planting will need to occur outside of the dry season and avoiding adverse conditions such as prolonged periods of drought or extreme rainfall/flooding.
- A more customized planting solution may also need to be considered for steeper slopes, using proprietary products such as biodegradable coconut fibre matting or hydroseeding/hydromulching.
- Plantings may be installed as tube stock or via hydroseeding to increase plant survival.
- Adding fertilizer may help to stimulate the growth of any shrubland plants already present. An application of slow-release fertilizer may be required at the time of planting. Only approved fertilizers that are not highly hazardous to the environment are to be used, in accordance with EU and WHO classifications. Natural/organic fertilizer to be used where possible (see also KGM's Technical Specification for landscaping of Highways, published in 2008).
- Avoid planting in narrow isolated areas which are difficult to access or maintain.
- One of the main challenges in dryland restoration is to overcome drought at the seedling stage, as generally low amounts and uneven spatial and temporal distribution of precipitation are the main abiotic limitations in this climate. Watering can dramatically decrease seedling mortality but irrigation by other sources than rainfall is barely used on management scale due to high costs. Drought stress is the main cause of seedling mortality in Mediterranean. Preconditioning or drought preconditioning by submitting seedlings at the nursery to controlled drought conditions is considered to be an effective method to

increase seedling survival in the field for certain species, especially woody plans (trees, shrubs). The main objectives of preconditioning are:

- to manipulate seedling morphology and to induce dormancy
- to acclimate seedlings to the natural environment
- to develop stress resistance mechanisms
- to improve seedling survival and growth after outplanting

- Field techniques to improve seedling establishment commonly prioritize the increase in root-able soil volume, nutrient availability, runoff collection and water conservation, while controlling competition with extant vegetation. Among them, good site preparation is probably the most powerful technique to improve seedling water status.
- Water harvesting has a very long tradition in arid and semi-arid areas around the globe. It aims to intercept runoff and redirect water to the planted target seedling, increasing water availability and thus seedling survival. For instance, planting holes with their associated microcatchments act as microdams, allowing runoff capture and a higher water storage capacity while at the same time reducing runoff erosivity by creating sinks along the slope.
- Often topsoil use provides a more diverse flora than seeds alone because the soil contains a greater species diversity. It is also possible to either use transplanted turfs or nursery-grown plants.
- Revegetation of plants in a container as they cope more easily with harsh conditions compared to bare-root or direct seeding.
- A simple tree shelter can consist just of 2 or 3 sticks and a mesh and only aiming at the physical protections of the seeds or planted seedling whereas more complex ones with ventilation provide shade and avoid excessive warming. The latter are used to modify the physical environment of planted tree seedlings and if designed properly, they can help reduce seedling transpiration and improve overall performance by acting as mini – greenhouses and reduce seedling transpiration, while at the same time providing protection against herbivory.
- The presence of trees or shrubs, so called nurse plants, greatly modifies microclimate and biological conditions both above and below the ground. In the field of dryland reforestation, nurse plants may buffer non-optimal environmental conditions. Shade reduces soil water evaporation, lowers soil and air temperature, and decreases the amount of radiation reaching the plants, thus protecting seedlings from the damaging effects of extreme temperatures and low humidity in arid environments and may reduce frost injuries in cold areas. Furthermore, through hydraulic lifting, roots of certain species lift water stored in deep soil layers and release it near the soil surface, making it available for other plants. Nutrients are enhanced through litter and sediment accumulation, higher mineralization rates and larger microorganism populations. Positive root interactions between facilitator and facilitated plants allow nitrogen transfer between legumes and non-leguminous plants, increase ectomycorrhizal infection, and facilitate the exchange of nutrients and carbon via mycorrhizal fungi.
- Combining the sowing of seeds and planting of shrubland plants may help to rapidly restore shrubland vegetation as well as increasing colonization by the seedlings of shrubland plants.
- Planting shrubs in clusters may result in an alteration of microclimatic conditions which favour their survival and growth.
- Spreading clippings may help to increase the colonization of shrubland plants as a result of introducing seed. Plant clippings may also help to increase organic material in the soil.
- Adding mulch may help to retain moisture in soil at shrublands in arid sites, as well as reducing the germination of problematic/invasive species.
- Irrigation may help to promote the growth of shrubland plants, particularly in arid shrublands.
- Building bird perches in degraded shrublands may help to encourage birds to perch on them. As a result, the number of droppings deposited by birds at the site may increase, increasing the probability that the site will be colonized by plants.
- Inserting brush piles parallel to land contours serves to act as sinks of resources (soil, water, and nutrients) and seeds, providing favourable microenvironments for the recovery of vascular plants and biological soil crusts.

Access controls

- Temporary fencing or other appropriate barriers to prevent entry to the area may be implemented in the short to medium term, to prevent grazing or allow vegetation re-growth in order to stabilise the soil surface.
- The reinstated areas will also be permanently fenced, being part of the road corridor/reserve and in this way the site will be conserved and unauthorized access by the public and grazing livestock avoided.

Specific actions about *Circium polycephalum*

- **Seed Collection and Translocation:**
  - Collection: Seeds of the *Cirsium polycephalum* species were successfully collected during the seed season. This process was carried out to preserve the genetic diversity and health of the species.
  - Translocation: The collected seeds will be temporarily translocated to a designated interim storage or nursery site. This temporary translocation process supports the conservation of the species and ensure proper management until permanent habitat restoration areas are ready.
- **Delivery of Seeds to the Gene Bank:**
  - BAP and CESMP Compliance: The seeds have been delivered to the seed gene bank in accordance with the standards set by the Biodiversity Action Plan (BAP) and the Construction Environmental and Social Management Plan (CESMP). This aims to preserve the genetic material of the species and ensure accessibility for future restoration efforts.
  - Gene Bank: The seeds are stored in a gene bank to ensure long-term conservation of the species. The gene bank maintains the quality and viability of the seeds, making them available for future use if needed.
- **Net Gain Principle and Offset Areas:**
  - Net Gain Principle: The restoration process will apply the net gain principle, which involves compensating for environmental impacts and improving conditions by creating similar ecosystems (offset areas).
  - Offset Areas: In this context, Flora Experts will collect seeds necessary for creating offset areas and preparing these areas for restoration.
- **Seed Translocation:**
  - Collection Timing: Seeds will be collected by Flora Experts during August and September, taking advantage of suitable seasonal conditions. This timing is chosen to ensure optimal seed quality and viability.
  - Translocation Process: Collected seeds will be used for translocation activities during the appropriate seasonal conditions. This aims to ensure that seeds successfully establish in new habitats by providing the necessary conditions.
- **Process Management under BAP:**
  - Process Management: Seed collection and translocation activities have been meticulously planned and executed within the framework of the BAP. This plan provides a roadmap for all restoration processes and ensures effective management.
  - Plan Compliance: These activities will be carried out in accordance with the goals and standards set by the BAP. All processes will be executed according to the timelines and methods outlined in the plan.
- For details, please refer BAP Chapter 6.3 and CESMP Chapters 7.8 and 7.25.

4.2.4 Controlling Invasive Alien Plants

The control of invasive alien plants (IAP) and weeds during habitat restoration and maintenance phases is considered critical to this project, as these species will tend to outcompete native flora. Where required,

weed management will be needed to enable the regeneration of pre-disturbance land uses and to ensure that the disturbance does not allow for the introduction of new species or invasive species to an area or increase the localized population of a species. The following will be undertaken:

- Earthmoving equipment should be cleaned before entering the site to minimise weed and pathogen spread, especially where equipment has been used near noxious weeds.
- Refer to the Invasive Alien Species/Weed control protocol contained in **Section 7.24 of the CESMP** for this purpose.
- Consider mechanical controls measures such as thinning or mowing to control non-target species before considering the use of herbicides.
- Only use registered or approved agro-chemicals, and ensure they are properly labelled and adhere to the guidelines on pesticide/herbicide use and management as per EBRD PR 3 (EBRD, 2019). Select applicable technologies and practices designed to reduce unintentional drift or runoff
- Store herbicide chemicals appropriately by following the hazardous materials storage and handling management practices (see Section 7.16 'Hazardous Materials Management' in the CESMP).

4.2.5 Other Management Requirements

- Topsoil management will be guided by the **Soil Management Plan** (REC-CYS-KMO-PL-10).
- The site will be kept tidy and free of litter and debris as far as possible.
- Waste management will be guided by the **Waste Management Plan** (REC-CYS-KMO-PL-02).
- Pollution prevention will be guided by the **Pollution Prevention Plan** (REC-CYS-KMO-PL-19)
- For fertilizing the landscaping in the Right of Way, only natural fertilizer will be used as required in **KGM's Technical Specification for landscaping of Highways**, published in 2008.
- Controlling and managing weeds will be a major factor for both vegetation establishment and its ongoing management.
- Earthmoving equipment should be cleaned before entering the site to minimise weed and pathogen spread, especially where equipment has been used near noxious weeds.
- Where required, pest and weed management will be needed to enable the regeneration of pre-disturbance land uses and to ensure that the disturbance does not allow for the introduction of new species or invasive species to an area or increase the localized population of a species.
- Refer to the Invasive Alien Species/Weed control protocol contained in *Section 7.24 of the CESMP* for this purpose.
- Store herbicide/pesticide chemicals appropriately by following the hazardous materials storage and handling management practices (*see Section 7.16 'Hazardous Materials Management' in the CESMP*).
- Only use registered or approved agro-chemicals, and ensure they are properly labelled and adhere to the guidelines on pesticide/herbicide use and management as per EBRD PR 3 (EBRD, 2019).
- If pest infections are detected the competent authority needs to approve the respective pesticide/biocide for pest control.
- Complying with Turkish regulations on pesticide use. If pest infections are detected the competent authority needs to approve the respective pesticide/biocide for pest control. Pesticides of WHO Type 1a and 1b will not be used (WHO 'Recommended Classification of Pesticides by Hazard and Guidelines to Classification' - 2019).

4.2.6 Considerations for Wildlife Corridors & Crossings

Several wildlife crossings are planned to be implemented, as per the **CESMP** (Section 7.9.2 and Annex 13.4). The location of the planned wildlife crossings is shown on the map below in **Figure 4-1**. The habitat restoration activities will need to specifically link to the wildlife crossings design guidelines as per the CESMP, particularly with respect to:

- Fencing requirements;
- Vegetation requirements; and
- Maintenance requirements.

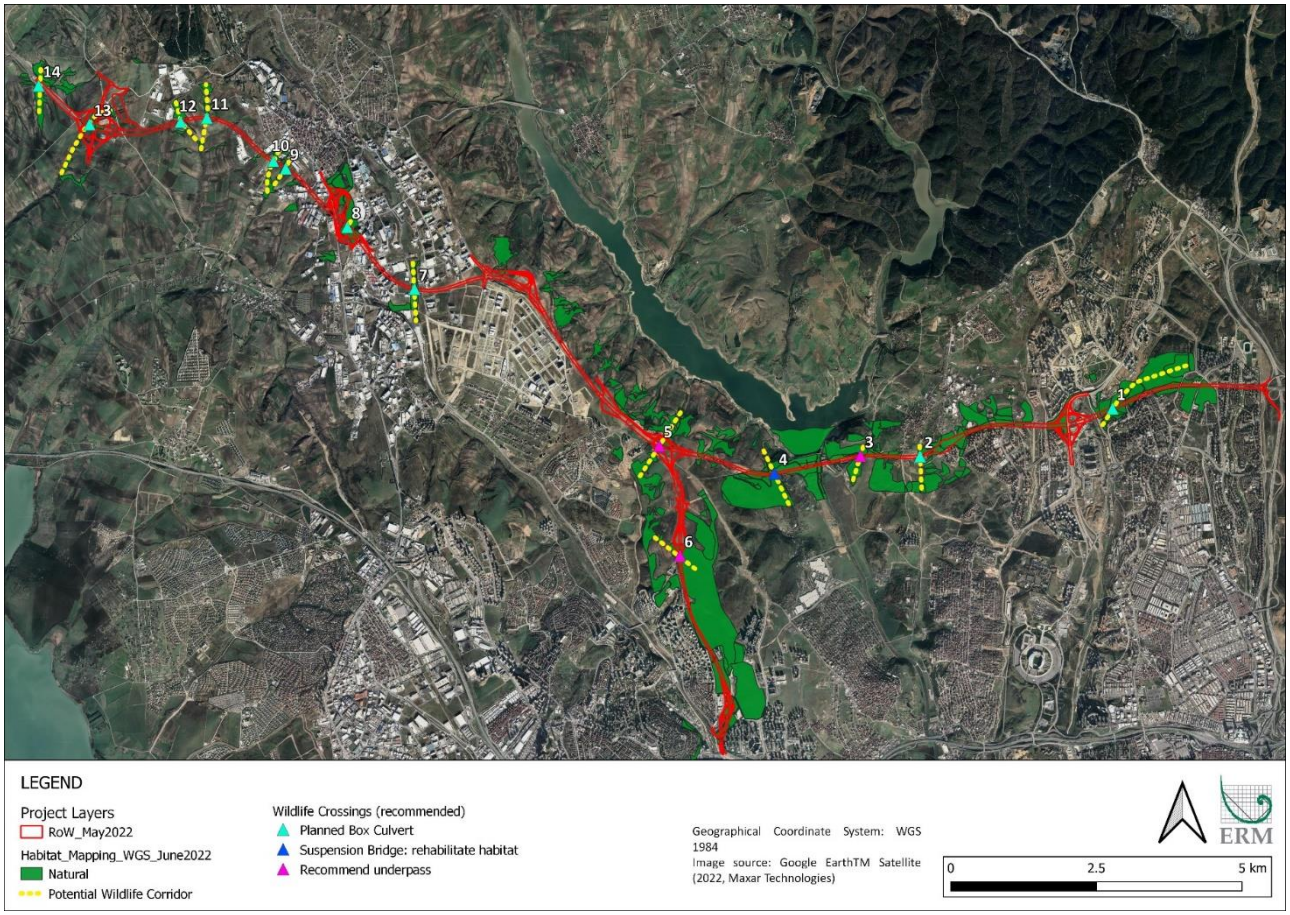


Figure 4-1 Locations for recommended wildlife crossings

4.2.7 IBA/KBA and IPA Specific Restoration and Conservation Actions

In line with the requirements of the Biodiversity Action Plan (BAP), the Habitat Restoration Plan (HRP) has been updated to include clear, practical, and implementable actions for the Küçükçekmece Basin IBA/KBA and the West Istanbul Pastures IPA. These actions have been specifically designed to support the achievement of No Net Loss (NNL) and Net Gain (NG) objectives, respectively. The actions presented below not only define the types of interventions to be implemented, but also clearly describe how, where, and to what extent these interventions will be carried out on site. Furthermore, they have been fully integrated into the overall implementation framework of the HRP, ensuring consistency with project-wide biodiversity management objectives.

4.2.7.1 Actions under the Küçükçekmece Basin IBA/KBA

Within the scope of the Küçükçekmece Basin IBA/KBA, a phased and integrated approach aligned with the mitigation hierarchy has been adopted, focusing on habitat restoration, ensuring ecological connectivity, and improving aquatic habitats. The main implementation actions are presented below:

- Habitat Restoration and Re-creation: Modified habitats located within the expropriation corridor that are not directly impacted (e.g., road reserves, interchange areas), as well as newly formed embankment slopes, will be restored to mimic Maquis, Garrigue, and natural grassland habitats. In this context, soil preparation, the use of native species, and avoidance of monoculture planting will be the key principles.
- Improvement of Aquatic and Semi-Aquatic Habitats: Opportunities for the protection, enhancement, and restoration of habitats used by waterbirds within the basin will be assessed. In particular, Sazlıdere Dam and its surroundings will be considered as a priority area.
- Water Quality Improvement: Water quality will be improved through the implementation of vegetated buffer zones, sediment and nutrient retention systems, and, where appropriate, constructed wetlands.

- Integration with Existing Management Plans: The alignment of actions developed under the HRP with existing or updated IBA/KBA management plans will be evaluated, and opportunities for collaboration with relevant stakeholders (e.g., BirdLife International / Doğa Derneği) will be explored.

These actions will be prioritised based on feasibility, ecological benefit, and long-term sustainability criteria.

4.2.7.2 Actions under the West Istanbul Pastures IPA

Considering the degraded condition of the West Istanbul Pastures IPA and the limited scale of project impacts, a pragmatic approach focusing on species-based conservation, rather than large-scale habitat restoration, has been adopted. Within this scope, the following actions will be implemented:

- Identification of Priority Flora Species for Conservation: Flora species that contributed to the designation of the IPA will be identified, and their habitat preferences and ecological requirements will be defined.
- Propagation and Conservation Programme: Programmes for the propagation and conservation of target species will be developed in collaboration with expert institutions such as the Istanbul Botanic Garden and/or other specialized organizations.
- Reintroduction: Suitable habitats restored or protected under the HRP will be used as receptor sites for the reintroduction of flora species. Depending on species-specific requirements, methods such as seed sowing, seedling planting, or natural regeneration will be applied.
- Integration with Habitat Restoration: The reintroduction of flora species will be implemented only after habitat restoration has been completed and suitable ecological conditions have been established.
- Long-term Monitoring and Adaptive Management: The establishment success, growth performance, and habitat suitability of the species will be regularly monitored, and adaptive management measures will be implemented where necessary.

This approach aims to deliver measurable and realistic Net Gain (NG) outcomes for the IPA.

4.2.7.3 Integration with the HRP Implementation Framework

All KBA and IPA actions defined above have been fully integrated into the overall implementation structure of the Habitat Restoration Plan (HRP) and are directly linked to the following sections:

- Section 4.2.1 – Locations: Identification of restoration areas
- Section 4.2.3 – Methods: Technical implementation details
- Section 5.7 – Implementation Programme: Timeline and scheduling
- Section 6 – Monitoring: Performance indicators and evaluation

Through this integration, the actions have been transformed from conceptual measures into practical, implementable, monitorable, and auditable components within the HRP.

5. INSTITUTIONAL ARRANGEMENTS

5.1 Land acquisition

Land ownership is key consideration in offset planning as this affects the costs of securing an offset site and has implications for long-term management and legal arrangements. As such, it is considered preferable to identify offset receiving areas located on land already owned by the applicant.

➡ Habitat restoration sites (contributing to offsets) are restricted to the road reserve area owned by the applicant. Therefore, there are no specific additional land acquisition requirements apart from the expropriation to take place for the road development.

5.2 Securing protection of offset / restoration sites

The need to ensure that sites where restoration activities take place are secured is acknowledged. There must therefore be a firm commitment around management of site by virtue of the fact that this would be a form of compensatory (offset) mitigation.

➡ The restoration sites will be secured and fenced as part of the road reserve.

5.3 Long-term commitments

Conservation efforts around habitat offsets typically need to be secured in perpetuity, regardless of whether the term onsite mitigation, restoration or offset is used. This must be a firm commitment around management of site by virtue of the fact that this would be a form of compensatory mitigation.

➡ Long-term management will be addressed by virtue of the securing and fencing of the restoration sites within the road reserve.

5.4 Costs

Indicative costs for the restoration will need to be estimated by REC and/or the appointed contractor and included in the Project budget.

ERM has compiled a simple budgeting sheet (see **Appendix C**) as a guide for estimating restoration activities implementation, management and monitoring costs for the Project.

5.5 Materials and Resources

The following is a list of materials and resources likely to be required for the habitat restoration project:

- Human resources - labour to undertake the work
- Restoration Ecologist support
- Site supervisor
- Commercial seed supplier / nursery
- Onsite nursery (optional)
- Support from NGO horticulturalists/botanists in plant propagation
- Seed bank (Ankara) for receiving harvested seed and supplying seed for planting
- Construction plant such as excavator, bulldozer, back-hoe for landscaping, rapping of soils, closing of agricultural furrows/drains and delivering topsoil to restoration sites
- Temporary equipment and materials storage area and worker camp
- Seed and plant material, including mulch
- Approved fertilizer
- Approved pesticide / herbicide
- All equipment and materials for preparing soils (shovels, spades, rakes) and planting seeds
- Equipment for removing invasive alien plants/weeds (slashers, bush knives, etc.)
- Supply of water for hydroseeding
- Hydroseeder

5.6 Training

Training is to be implemented as per **Chapter 9 'Training' contained in the CESMP** for the project.

5.7 Implementation Programme

A programme for implementation of the habitat restoration plan has been prepared (**Table 5-1** on the next page) that includes activities as set out in Chapter 4. This includes indicative timelines and associated responsibilities for the initial short-term management phase which would cover an initial 10-year planning horizon (commencing with approval of the plan).
The implementation programme also incorporates the restoration and conservation actions specific to the Küçükçekmece Basin IBA/KBA and the West Istanbul Pastures IPA, as defined in Section 4.2.7. These actions have been designed to be fully aligned with the Habitat Restoration Plan and will be implemented within the same phased timeline presented in Table 5-1. This approach ensures consistency between the commitments defined under the BAP and the implementation of the HRP.

This programme will need to be reviewed annually.

Table 5-1 Preliminary implementation programme

			SHORT-TERM					LONG-TERM
Action	**Primary responsibility**	**Supporting Role**	**Year 1**	**Year 2**	**Year 3**	**Years 4 - 5**	**Years 6-10**	**Year 10+**
1 Institutional & Financial Arrangements								
1.1 Agree on content of Plan	REC	SPV, EBRD, ERM						
1.2 Update financial estimates for implementation	REC	SPV, ERM						
1.3 Formalize funding mechanisms for long-term offset management commitments	REC	SPV, EBRD						
1.4 Securing protection of restoration sites	REC	SPV, NGO						
2 Initial Restoration Phase								
2.1 Baseline monitoring & reporting	REC	Botanist / Faunal Ecologist						
2.2 Protected Plant Rescue & Translocation / Seed Collection	REC	NGO						
2.3 Short-term restoration activities	REC	NGO						
3 Management/Maintenance Phase								
3.1 Site management	REC	ECoW						→
3.2 Long-term management & maintenance activities	REC	ECoW NGO						→
3.3 Long-term monitoring & reporting	REC	Botanist / Faunal Ecologist						→

5.7.1. Institutional & Financial Arrangements

5.7.1.1. Agree on content of Plan

At this stage, consensus will be reached among all stakeholders on the scope and content of the restoration plan. REC will coordinate the plan, ERM will provide technical and financial contributions, while SPV will offer operational and legal support.

5.7.1.2. Update financial estimates for implementation

The necessary financial resources for the implementation of the plan will be updated and planned. REC will manage this process, ERM will provide support in budgeting and financial analysis, and SPV will contribute to the organization of financial operations.

5.7.1.3. Formalize funding mechanisms for long-term offset management commitments

At this stage, the aim is to establish and formalize the mechanisms necessary for the long-term financing of the restoration projects. REC will offset management commitments while SPV will oversee the process and support the financing processes.

5.7.1.4. Securing protection of restoration sites

The necessary legal and physical measures to ensure the long-term protection of the restoration areas should be identified and addressed. REC will manage these processes, while NGOs will contribute to site protection activities, and SPV will provide legal and operational support.

5.7.2. Initial Restoration Phase

5.7.2.1. Baseline monitoring & reporting

At the beginning of the restoration process, the condition of the areas and the impact of the restoration activities will be monitored and reported. REC will manage this process, while a Botanist and a Faunal Ecologist will carry out the technical monitoring activities.

5.7.2.2. Protected Plant Rescue & Translocation / Seed Collection

REC will ensure seed collection efforts are conducted to rescue and relocate protected plant species to suitable areas and NGOs might play supportive role.

5.7.2.3. Short-term restoration activities

In the early stages of the restoration plan, specific restoration activities are carried out to achieve short-term goals. REC is responsible for the implementation of these processes, and NGOs might play supportive role.

5.7.3. Management/Maintenance Phase

5.7.3.1. Site management

The management of the restoration areas and ongoing maintenance activities are addressed at this stage. REC ensures site management, and REC ECoW (Environmental Clerk of Works) is responsible to ensure environmental standards are maintained.

5.7.3.2. Long-term management & maintenance activities

Long-term management and maintenance strategies are developed and implemented to ensure the sustainability of the restoration areas. REC manages this process, while REC ECoW participate in the implementation and monitoring activities. NGOs might play supportive role.

5.7.3.3. Long-term monitoring & reporting

Long-term monitoring and reporting of the restoration process are essential. While REC coordinates this process, the Botanist and Faunal Ecologist conduct the monitoring activities and report the findings under the supervision of REC.

5.8 Roles & Responsibilities

REC Project Manager

- Ensures that adequate resources are established to successfully implement the Habitat Restoration Plan.
- Ensures that all NMM managers and contractors understand and fulfil their plan-related responsibilities.

- Responds to monitoring findings and ensures implementation of remedial works as required.
- Responsible for initialising lines of communication between all relevant parties and members.

Deputy Project Managers

- Participates in site inspections to plan and confirm the detailed design of site measures.
- Participate in site inspections of works completed.
- Reviews and approves detailed contractor plans and method statements incorporating HSE measures in accordance with this Plan.
- Ensures that all personnel involved, including contractors, are adequately trained and informed of the requirements of the Plan.
- Reviews and approves HSE reports.
- Audit contractor/subcontractor performance.
- Responsible for ensuring communication between all relevant parties and members.
-

ECow (Environmental Clerk of Works) / Site Manager

- Responsible for the implementation and control of the Habitat Restoration Plan.
- Ensures that all measures are taken according to this Plan.
- Participates in site inspections to plan and confirm the design of site-specific measures.
- Ensures that all non-compliances are resolved in a timely manner.
- Liaising with the restoration ecologist where required.
- Provide day-to-day support and guidance to the contractor(s) and NGO.
- Monitor progress according to a program provided by the contractor.
- Keep a site diary.
- Ensure site instructions are followed.
- Contact the restoration ecologist if problems occur on site or if the contractor is unsure of any task.
- Sign-off on the restoration activities where these have been implemented to acceptable standards as per the restoration plan.
- Undertake or support with site inspections/ecological monitoring as required.

Contractors/Subcontractors

- Implementing the various restoration activities and interventions according to this Plan.
- All Contractors (and Sub-contractors) will be required to comply with all specifications contained in the CESMP, supporting plans and the Restoration Plan.
- Contractors are answerable to the Site Manager for non-compliances.
- An expert company, in local flora and possesses the necessary knowledge and experience required for the successful execution of the restoration efforts, was appointed for the Project for seed collection and plant propagation processes in 2022. The Project is committed to appoint a qualified company prior to any environmental restoration need.

NGO (Istanbul Botanical Gardens)

- Responsible for supporting REC with the implementation of the Habitat Restoration Plan, including but not necessarily limited to the following:
  - Seed collection
  - Plant storage, transportation and propagation
  - Advising on methods and approach to planting and maintenance.

Restoration Ecologist

- To advise on an ad hoc basis on Plan implementation and any revisions required based on site conditions or any difficulties encountered.
- Provide general oversight and overall supervision for the duration of the contract.
- Provide telephonic and email support.

- Undertake or support with site inspections/ecological monitoring as required.

E&S Manager

- Support the Deputy Project Manager with ensuring that all personnel including contractors are adequately trained and informed on the requirements of this Plan.
- Lead site inspections with contractors.
- Audit contractor/subcontractor E&S Performance.
- Manages grievance mechanism regarding E&S subjects.

5.9 Auditing & Reporting

Annual audits will need to be undertaken internally by REC and reviewed by an independent party appointed by REC and using an appropriate best-practice auditing framework to capture and report back on the progress of habitat restoration activities in terms of both the content and recommendations provided in this Plan, taking into consideration any relevant conditions of the ESIA, the BAP and the CESMP.

Reporting on the implementation of the Habitat Restoration Plan is essential to allow the relevant authorities and stakeholders to be updated with the progress being made. It is recommended that annual reports be provided to the Lender's and any other identified stakeholders, detailing the following:

- An overview of offset management activities undertaken;
- Brief summary of monitoring results;
- Any revisions to the plan recommended or required, with rationale provided; and
- Recommendations for ongoing / long-term management.

6. MONITORING

6.1 Introduction

Monitoring, and specifically environmental/ecological monitoring, forms the basis for evaluating the performance of ecological restoration projects and biodiversity offsets and the specific interventions aimed at conserving, maintaining and/or restoring natural habitats, ecosystems and functions. Without appropriate monitoring, it would not be possible to gauge the performance of individual interventions, nor the level of success of the offset project in terms of achieving project aims and objectives (Kentula et al., 2014). Furthermore, natural ecosystems are known to be inherently dynamic and may not always respond predictably to management measures, rehabilitation and/or restoration interventions. In the face of this uncertainty, monitoring can be an extremely useful means for evaluating the state and functioning of ecosystems over time in order to evaluate and refine offset interventions, as necessary. It is also important to recognize that ecosystem restoration should be viewed as a "process", driven by ecological knowledge and research rather than simply the "product" of specific management and/or rehabilitation actions and activities (Cooke and Johnson, 2002). In this context, monitoring can assist greatly in identifying any potential unforeseen problems that may occur during the implementation of restoration interventions, actions and activities.

Monitoring plans and support the various habitat restoration / management actions that have different primary objectives, with the detailed features of monitoring programmes tending to be very site-specific. As a result, there is no single uniform procedure that can be followed when defining and implementing a monitoring programme; however, there are a number of general principles that should be followed to ensure that the data and information that are collected are appropriate and reliable (after DWAF, 2006):

- The objectives of the management actions that drive the monitoring plan must be clearly defined, together with the data and information requirements that support these objectives;
- A detailed design of the monitoring plan must be undertaken, including the location of all monitoring points, the type of data to be collected, as well as the data collection protocol/procedure/methodology, frequency of monitoring and parameters determined, quality control and assurance, management and reporting procedures;

- The monitoring plan and programme should be implemented according to the detailed design, according to procedures that will ensure representative samples and data;
- The results from the monitoring should be representative of the actual situation, which requires that the monitoring plan cover the relevant area in sufficient detail with a sufficient amount of appropriate monitoring points;
- A well-defined data management system is required to ensure that data is used optimally and is accessible to all the relevant users; and
- The monitoring plan must include quality control measures and audits to ensure that the collected data are meeting the defined objectives.

The process of developing and implementing a successful monitoring plan can be divided into four (4) primary phases as shown in **Figure 6-1**. The process follows a logical sequence from designing the monitoring, through implementation and managing the programme to auditing (DWAF, 2006). The process is a continuous one, where recommendations from the auditing need to be incorporated by repeating the process from Phase 1, namely the design aspects of the monitoring.

The monitoring process in Figure 6-1 is also aligned with the concept of 'adaptive management', whereby monitoring findings are used to inform the adaptation, revision of plan or recommendation of further actions where necessary.

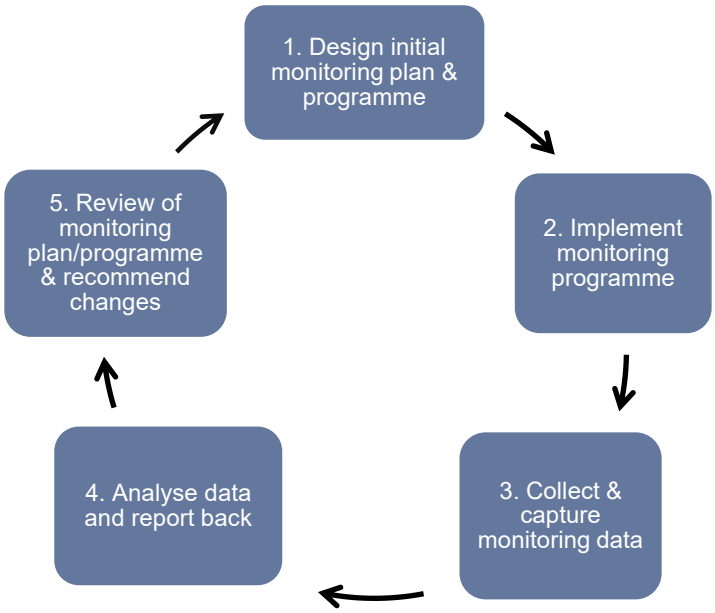


Figure 6-1 Diagram illustrating the monitoring process (after DWAF, 2006).

6.2 Monitoring Plan

The Monitoring Plan has been structured as follows:

- Provides details on the receiving aquatic environment/resource particulars (location, extent, type, land ownership, etc.);
- Defines the purpose and objectives of the monitoring plan;
- Defines the key roles and responsibilities for undertaking the required monitoring;
- Sets out the steps and methods involved in monitoring the site;
- Provides guidance on the proposed frequency and timing of monitoring activities; and
- Provides a summary of any baseline analyses performed for reference and comparison purposes.

6.2.1 Purpose, Aim and Objectives

The monitoring 'Aim' defines the overarching goal of the monitoring plan and the list of 'objectives' set out the specific measures or tasks to be undertaken, in order to achieve the aim. These are essential in defining what is required in terms of ecosystem monitoring at the site and how this will be implemented and achieved.
The monitoring aim and objectives were defined through an assessment of the key ecological restoration interventions and anticipated outcome and the potential risks in relation to the location, extent, integrity, importance and sensitivity of ecosystems and habitats comprising the offset site.

In accordance with these requirements, the following 'Aim' for the offset monitoring plan has been formulated, which essentially defines the overarching intent of the monitoring plan:

Aim:

To provide an appropriate framework for the long-term monitoring of habitats and associated biodiversity (flora and fauna) at the selected restoration sites associated with the Türkiye Motorway development project, to demonstrate the effectiveness of restoration activities in conserving, restoring, rehabilitating and/or improving the status quo of the various habitats and to inform the successful and effective management and safeguarding of these areas against any significant decline in condition and/or functioning.

The monitoring plan provides for the appropriate monitoring of the habitats that comprise the offset/restoration sites, with the intention of providing useful information that can be used to assess the quality and condition of the habitats and vegetation over time, during all phases of the planned restoration activities. This will serve to inform the successful and effective management and safeguarding of the associated habitats.

The following key ecological monitoring objectives have been developed in order to achieve the desired 'Aim' of the monitoring plan:

1. Develop and implement an appropriate strategy and protocol to monitor the condition and functioning of habitats within the offset target area;
2. Identify and understand any key threats and pollution pathways;
3. Select the most applicable and relevant methods and techniques for ecological monitoring;
4. Identify suitable sites/locations to undertake the monitoring, based on the selected monitoring methods/techniques and the topographical layout of the properties and selected environments;
5. Select key variables/parameters to include in the monitoring (sampling and analyses);
6. Undertake baseline sampling and analyses to inform the reference condition/state of ecosystems (biota/habitat) and report on the baseline findings to inform future comparisons of monitoring results;
7. Undertake regular (annual or seasonal) monitoring, involving relevant sampling and analytical procedures, in order to detect and report on spatial and temporal trends in water quality, biological response and ultimately the ecological state of terrestrial ecosystems;
8. Use monitoring results in an appropriate manner to identify key impacts/threats to natural habitats/ecosystems, as well as any emerging problems or risks posed to ecosystem health and/or functioning;
9. Identify mitigation procedures and/or remedial actions needed to address key impacts/threats to ecosystems in accordance with those presented in the existing CESMP for the project;
10. Distribute findings of the monitoring undertaken to all relevant stakeholders and authorities, as necessary;
11. If and where necessary, update and expand on the suite of variables and sampling sites; and
12. Update and revise the Monitoring Plan through an 'Adaptive Management Cycle' approach as more data becomes available, as new threats are identified or as new targets are set.

6.2.2 Monitoring Approach

The approach to ecological monitoring adopted in this document provides a means of monitoring changes to the habitats where conservation, restoration and rehabilitation interventions are planned. The monitoring programme is intended to be proactive in terms of managing impacts/threats to biodiversity and assessing the outcomes of planned restoration and rehabilitation interventions. This should be achieved by using the outcomes of monitoring to inform the management of related activities through the development of proactive management strategies designed to maintain the biodiversity and biological integrity of natural areas. The approach includes both rapid assessment techniques that rely mainly on visual observations of changes/impacts to natural areas as well as more detailed technical monitoring undertaken at less frequent intervals. Experience in compiling monitoring plans for other biodiversity offset and rehabilitation projects was used in conjunction with available best-practice guidelines for developing monitoring plans, in order to develop a practical and comprehensive monitoring programme.

6.2.3 Monitoring Indicators

Indicators are measures that show progress towards meeting the intended targets of the habitat restoration plan. Indicators selected for the project, as this relates to habitat restoration, are as per **Table 6-1**.

Table 6-1 Habitat Restoration Indicators

Indicator	Measurement	Method
1 Overall restored habitat extent	Extent in hectares	Visual assessment in field (transect), GIS analysis
2 Vegetation structure	Qualitative rating: closed, semi-open, open	Visual assessment in field, botanical surveys (transect)
3 Total vegetation cover	% vegetation cover vs bare soil	Visual assessment in field, botanical surveys (transect)
4 Habitat condition	Qualitative rating: poor, fair, good	Visual assessment in field, habitat surveys (transect)
5 Habitat connectivity	Qualitative rating: poor, fair, good	Visual assessment in field, GIS analysis
6 Plant species composition	% native vs alien, % herbaceous vs woody plants, relative % cover by grasses, herbs, shrubs, trees	Vegetation / botanical plot survey or transect
7 Faunal species diversity	Species diversity/richness expressed as number of different species of mammals, reptiles, birds per habitat type	Faunal field survey (transect)

6.2.4 Monitoring Period

Monitoring will generally be required during all phases of the offset/restoration project, including the long-term/lifespan of the motorway project, in order to ensure that habitats and biodiversity are not negatively impacted and to gauge the level of success of the planned habitat restoration activities.

No set end point to monitoring has been provided, as this will in actual fact need to be undertaken for the duration of the offset portion of the restoration project (potentially in perpetuity, or at least until a stable state has been attained and at the discretion of the ecologists responsible for monitoring and recommending further actions as necessary).

Some aspects of the monitoring may require revision as the project develops, also as new information and monitoring advances surface, thus the need to review and update the monitoring plan on a regular basis will be crucial.

6.2.5 Responsibilities

The ultimate responsibility for the implementation of this ecological monitoring plan lies with the REC. They will be tasked with overseeing the monitoring and appointing a suitably qualified/experienced external ecologist or range of specialists to undertake the relevant specialist ecological monitoring tasks and procedures (*see **Section 5.8** also*). There may be some basic monitoring tasks (such as habitat survey, extent and GIS analysis) which a generalist or the ECoW could undertake.

6.2.6 Funding

Funding for monitoring will be the responsibility of the REC. A detailed budget including costing of all activities detailed and equipment costs will need to be compiled.

6.2.7 Monitoring Strategy

Vegetation & Habitat Monitoring

Restored/recreated Garrigue (short shrubland) habitat which will comprise the offset site, will be the focus of regular surveys to estimate and track changes in vegetation and habitat condition. The objective of rapid and frequent disturbance surveys will be to correlate changes in habitat condition to offset activities and key land use impacts and threats. These monitoring results will then be used to identify possible causes of habitat degradation, and where this is related to the motorway project operation, other external land uses / activities or as unintended impacts associated with ecological restoration / rehabilitation interventions, the information will need to inform site management and any recommended mitigation requirements.

The rapid surveys will be supplemented by more detailed vegetation sampling which will include vegetation plots or transects that will be performed less frequently. The objective of the more detailed vegetation sampling is to record changes in vegetation and habitat condition over longer term timescales to provide an indication of whether conservation, restoration and rehabilitation interventions have been effective and whether any correlations can be drawn between changes in habitat condition and interventions.

Alien Plants

Alien plant monitoring is intended to identify problematic species of alien plants/weeds occurring in and to evaluate changes in the levels of alien plant infestation over time. This is intended to inform the general management of invasive alien plants (IAPs), and more specifically, targeting natural habitat where any related disturbance caused by adjacent activities may result in an increase in alien plant levels within natural or restored habitats. The proposed approach will take the form of regular visual surveys to identify dominant species of alien plants within pre-defined assessment units, documenting the maturity of individual species and estimating the overall extent of alien plants which can then be compared over a period of time in order to monitor any significant changes.

Soil Erosion

Soil erosion is a risk largely associated with steep embankments and storm water outfalls. In order to monitor erosion/sedimentation, a rapid visual survey will be carried out within the relevant habitats located immediately downstream of planned road drainage and stormwater outfalls, which are likely to be most at risk of erosion/sedimentation. The identification of potential sources/causes of erosion or sedimentation will ensure that road storm water management functions to avoid the degradation of natural areas downslope.

Faunal Monitoring

It is proposed that faunal monitoring focus on the following (faunal groups informed by the Critical Habitat Assessment, BAP and focal PBF species), and that these surveys also be aligned with vegetation monitoring plots as far as possible, to ensure consistency in the data collected and interpretation of monitoring findings:

- Small mammals
- Birds (avifauna)
- Reptiles
- Amphibians

A summary of the proposed monitoring methods for each monitoring activity has been included in **Table 6-2**, below.

Table 6-2 Strategy and proposed methods for restoration monitoring.

MONITORING ASPECT	LEVEL	MONITORING ACTIVITES	METHODS
Habitat Disturbance Survey	Rapid	Undertake rapid visual disturbance survey	This is intended to be a rapid qualitative assessment of the habitat condition for restored habitats. For the Disturbance Survey, the assessor will need to generate a field map showing the proposed vegetation/habitat assessment units to be monitored. Using the field checklist/datasheet provided in **ANNEXURE B1,** the assessor will need to visually identify and rate the extent of impacts to edge habitat and interior habitat within the assessment units defined by walking through the habitat unit. Further details on this assessment method can be found in **ANNEXURE B1.**
Invasive alien plants	Rapid	Visual survey of alien plants to identify species and relative densities	The assessor will need to generate a field map showing proposed alien plant assessment units (these should ideally be the same as that used for the habitat / disturbance survey). Using the field checklist/datasheet in **ANNEXURE B2**, the assessor will need to visually identify the individual alien species occurring within each discrete assessment unit and rate the overall level of infestation. Maturity levels are also recorded to track changes in infestation levels and, the emergence of new alien plants which could be linked with disturbance.
Erosion/ sedimentation	Rapid	Visual survey to document erosion/deposition points and identify source(s) of erosion/ sedimentation	This is intended to take the form of a visual assessment of erosion points and deposition of sediment generated by storm water management activities (or other disturbance adjacent to offset habitats). This is a rapid assessment aimed at identifying and describing erosion/deposition features, as well as any additional sites identified where erosion may be of concern. The field datasheet in **ANNEXURE B3** shall be used to capture field data for this assessment.
Fixed point photos	Rapid	Photos taken at fixed points in a fixed direction to document habitat visually	Photos of habitat will be taken at fixed locations and directions in the landscape in order for visual comparison over time (see method in **ANNEXURE B4**).
Vegetation Plot Survey/Transect	Detailed	Vegetation survey within predefined forest plots to monitor species composition and other important data such as invasive alien plant composition (representative sample)	A formal vegetation survey is to be undertaken for the rehabilitated and created forest habitats (and a limited number of reference sites) by a suitably qualified specialist with knowledge of the local flora of the area. Predefined vegetation plots (2m x 2m) will be provided to the assessor on a map with GPS coordinates of preliminary plot locations. A survey of the vegetation occurring within each plot will be undertaken with the following data to be captured: • An estimate of aerial cover of different species of plants, bare ground, leaf litter. • Record any existing impacts noted.

MONITORING ASPECT	LEVEL	MONITORING ACTIVITES	METHODS
			This information will then need to be captured and interpreted in an appropriate manner.
Faunal surveys	Detailed	Specialist faunal surveys	Specialist small mammal, bird, reptile and invertebrate surveys will need to be undertaken with oversight by a suitably qualified faunal ecologist, zoologist or team thereof. Methods will be specific to the fauna being sampled but would generally be in the form of transects through the selected habitats.

6.2.8 Monitoring Programme

The monitoring programme has been included in **Table 6-3**. This includes the relevant location, timing, frequency and responsibilities for the individual monitoring activities.

Table 6-3 Monitoring Programme.

MONITORING ASPECT	RESPONSIBILITY	TIMING/FREQUENCY
Rapid Disturbance Survey	ECoW	Baseline, then annually until restoration has been completed, then every 3-5 yrs for maintenance phase
Rapid Invasive Alien Plants Survey	ECoW	Baseline, then annually until restoration has been completed, then every 2-3 yrs for maintenance phase
Erosion/ sedimentation (rapid visual survey)	ECoW	Monthly three times a year (start, middle and end of wet/rainy season) until restoration has been completed, then every 3-5 yrs for maintenance phase
Vegetation plots/transects	Ecologist / Botanist	Baseline, then every 3-5 yrs for maintenance phase
Faunal survey	Faunal ecologist / Zoologist	Summer & spring, Baseline study, then every 3-5 yrs for maintenance phase

6.2.9 Data Collection & Storage

Once the relevant data has been collected, it is important to ensure that the data is stored in a suitable central database system that is flexible enough to cater for anticipated future requirements and future additions/refinements to the monitoring programme. Suitably qualified persons must be identified to enter the data and appropriate control mechanisms must be defined to ensure that no errors occur. Any statistical requirements need to be defined upfront, in consultation with the end users, and taken into consideration when the data management system is developed.

6.2.10 Data Analysis & Reporting

Monitoring data will need to be collected and stored/maintained in a central database. A **monitoring summary report** will need to be compiled and should include a summary of the monitoring results, discussions and conclusions arising from the interpretation of monitoring outcomes and any recommendations to inform the management of mining and rehabilitation activities that may be impacting on sensitive natural areas in order to maintain the biodiversity and biological integrity of natural areas on the site. The monitoring report will need to coincide with the proposed frequency of monitoring (bi-annual monitoring report recommended). The following key guidelines should be considered when compiling monitoring performance reports:

- Reporting needs to be objective, concise and easy to understand in order to be successfully interpreted by a broad target audience.

- Reporting needs to highlight problem areas/critical issues reflected in the monitoring results and provide appropriate recommendations on how to remedy problems.
- The spatial representation of data using maps/GIS where possible/relevant is highly recommended, as this allows for review in a quick and meaningful way. Maps and locations of sampling sites where monitoring has been undertaken will need to be included.
- The statistical representation of data should generally be avoided as this tends to complicate the interpretation of results and would be of little use to the broader spectrum of users.
- A description of the methods used, indicators and variables sampled/analysed, etc. should be included where this differs markedly from the methods and techniques outlined in the monitoring plan (this document).
- Details of the specialist(s) involved in monitoring, including qualifications and relevant training and experience to be included.
- Suggestions for further monitoring, future monitoring requirements and any revisions to the monitoring plan/programme to streamline and/or improve the monitoring should be presented where relevant. A monitoring performance review template for potential use for monitoring in the long-term has been included as **Box 1**.
- It should be made clear as to whether further monitoring will be required, whether monitoring has picked up critical issues that need addressing or the need for further management interventions that will be required to successfully fulfil the management/rehabilitation objectives for the site. The evaluation of monitoring outcomes and recommended actions could be undertaken using a management effectiveness rating scheme, such as the one outlined in **Table 6-4** (*on the next page*).

Table 6-4 Rating scheme used in monitoring management effectiveness.

Level of Management Effectiveness	Outcome of Monitoring	Recommended Action(s)
5: Excellent	*Management, restoration and/or rehabilitation is generally progressing as expected.*	**No action required**
3: Good	*Management, restoration and/or rehabilitation progress is slower than expected but will probably meet the objectives within a reasonable amount of time. Additional intervention may be required to keep management/rehabilitation on course.*	**Maintenance of objectives**
2: Poor	*Significant changes in parts of the implemented management plan might be needed. These might entail revisiting the overall plan as well as considering changes in the design of individual components and types of intervention planned.*	**Modifications to management plan elements**
1: Very Poor	*Monitoring might indicate that management/restoration/rehabilitation is not progressing towards meeting the objectives but is progressing toward a system that has other desirable functions or goods and services. In this case, the most cost-effective action may be to modify the management objectives rather than to make extensive intervention changes to meet the original objectives.*	**Modification of objectives**
0: Non compliance	*Monitoring indicates that management, restoration and/or rehabilitation activities are not currently fulfilling the management objectives. Revisiting the overall plan as well as considering changes in the design of individual components and types of intervention planned will be necessary.*	**Assess and refine management plan**

Box 1. Monitoring Performance Review Template
(adapted from USACE, 2008)

1. **Overview of Monitoring Requirements:**
   - Description of monitoring undertaken, timing and frequency.
   - Map showing the location of interventions and monitoring points (where applicable)
   - Photographic record of the site with accompanying map showing location of fixed-point photos.

2. **Summary of Monitoring Results:**
   - List of performance indicators and success standards.
   - Table of monitoring results compared with baseline data (where applicable).
   - Summary of success standards including an evaluation of whether management is successfully achieving these standards or trending towards success. Examples of key questions to ask include:
     - Were the **outputs of wetland rehabilitation** achieved or completed to specification and in the appropriate time?
     - Were any **problems during implementation** of rehabilitation and site management identified and corrective actions appropriately implemented?
     - To what degree **were success standards met**?
     - Were the **outcomes in relation to the defined management objectives** achieved?
     - Was **project risk** dealt with adequately?
     - To what degree were **existing and potential future threats** identified and were these threats catered for in the management of the site (i.e. were they monitored and accounted for)?
   - Summary of any problems or significant events that occurred on the site that may affect the long-term success of wetland management.

3. **Describe Management Interventions/Remedial actions**:
   - Concisely describe any management/remedial actions done during the implementation and post-implementation phase monitoring to meet the success standards – actions such as removing debris, replanting, controlling invasive plant species, etc.

6.2.11 Key Performance Indicators (KPIs)

A Key Performance Indicator (KPI) is a measurable value that can be used to demonstrate or evaluate how effectively a company or organization is achieving key business objectives. In this instance, KPIs have been developed to evaluate the performance of the Project in terms of achieving the objectives of the habitat restoration plan.

Table 6-5 summarizes the KPIs and associated targets as well as monitoring that will be used to assess the progress and success of implementation of the habitat restoration plan.

Table 6-5 KPIs for Habitat Restoration

KPI	Target	Measurement / Indicator	Period of Monitoring
1 Habitat restoration plan	A post-construction habitat restoration plan has been compiled.	Audits	Annually
2 Baseline surveys	Baseline habitat, flora and fauna surveys have been completed	Audits	Annually
3 Status of temporary infrastructure	100% of temporary works have been decommissioned, removed and these	Site inspections	Monthly

KPI	Target	Measurement / Indicator	Period of Monitoring
	areas closed once construction has been completed.		
4 Appropriate drainage systems	Construction of the road drainage system has preceded restoration activities.	Site inspection / audit	Monthly
5 Exposure of open areas and soils to erosion	100% of open/exposed soils are to be revegetated. This excludes natural rock outcrops.	Site inspection / audit	Monthly
6 Rehabilitation / restoration of disturbed areas	Post-construction, implement and monitor the success of all habitat rehabilitation activities and sites in accordance with all the relevant measures of the plan.	Site inspections / Audits	Annually
7 Origin of vegetation used in revegetation	Verified 100% native plant species are sourced and used in planting.	Audits	Annually
8 Vegetation cover	>90% coverage by indigenous vegetation is achieved within a reasonable timeframe, with no major areas of bare soil. This excludes natural rock outcrops.	Site inspections / Audits	Annually
9 Stability of final areas	Zero signs of moderate to major soil erosion / collapse of banks, 100% of erosion features (rills/gullies) are stabilised.	Site inspections	Annually
10 Success of plant translocation / replacement actions	30% success rate	Site inspections	Annually
11 Non-Compliance with Plan	Zero NCRs reported per year.	Audit	Annually
12 Employee training	100% of employees accessing the site (including short-term and long-term employees and visitors) have received the necessary induction and/or generic training (and any specialised training) as required.	Audit	Annually
13 Pollution events	100% monitored and communicated, spill response implemented as per the Plan requirements.	Site inspections / Audits	Annually
14 *Cirsium polycephalum* population trend	Demonstrable increase or stabilization of *Cirsium polycephalum* population over the monitoring period within offset/restoration sites achieving a minimum net gain target of 2:1 (i.e. approximately +100% net gain relative to residual impacts	Field-based population census using quadrats/transects and flowering/reproduction data, compared to baseline	Annually

6.2.12 Using Monitoring Outcomes to inform further Action

Ultimately, the ecological monitoring outcomes undertaken should be used to inform any revisions or refinements to the offset plan and relevant actions, as well as any necessary management actions to deal with potential sources of pollution/contamination and other forms of ecological degradation affecting the offset site.

Impact mitigation or remediation would need to be informed by the nature of the impacts and thus the source of contamination/disturbance. Following this principle, a specific activity or land use would need to be identified and isolated as the impact/contaminant source and the relevant "polluter" would be liable to address that impact through management actions. In particular, mitigation and management measures pertaining to the management of storm water and surface/ground water quality, waste/pollution management and soil erosion and sedimentation are applicable and the relevant guidelines and recommendations contained in the CESMP should be referred to in the majority of instances, with any additional site-specific impact mitigation/remediation to be motivated for through the provision of a clear and scientifically-based rationale, including timeframes for implementation, to be developed by the person(s) responsible for undertaking ecological monitoring at the site.

6.2.13 Review of the Monitoring Plan

It is recommended that the Monitoring Plan contained in this document be reviewed bi-annually and updated where necessary to incorporate any changes in the restoration activities, risk profile and changes in legislative and/or business requirements, in line with the principle of 'Adaptive Management' which involves a systematic approach for improving resource management and monitoring protocols through learning's gained during implementation (see **Figure 6-2**, below).

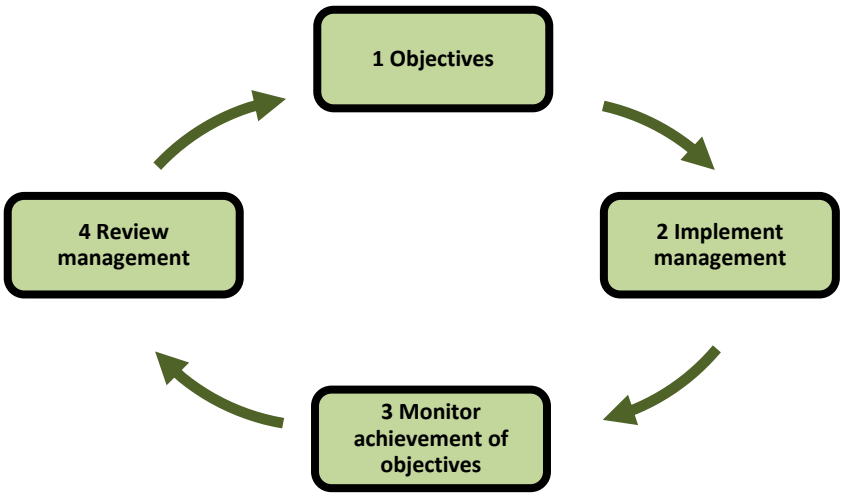


Figure 6-2 Diagram showing the adaptive management cycle (after Ramsar Convention Secretariat, 2010).

A review of monitoring requirements is left at the discretion of the REC/ECoW, relevant service provider(s) and/or ecologist(s) appointed to undertake the monitoring. The purpose of undertaking a regular review of the monitoring plan will be to:

i. Determine how effectively the monitoring has been implemented;
ii. Assist in determining and adapting the focus for monitoring and the setting/revising of appropriate time frames, monitoring frequency and budgets; and
iii. Enable effective adaptive management by identifying changes and modifying monitoring and management accordingly.

The review process should include:

a) Any recommended minor amendments to the plan that do not affect the substance of the aim and objectives. This may include the addition or removal of sampling sites and variables or adapting the sampling frequency where deemed necessary;

b) The results of an evaluation of the effectiveness and any additional monitoring needs/recommendations as these present themselves; and

c) Any proposed significant changes to the monitoring plan that are likely to result in amendment to the aim, objectives, monitoring requirements/protocols, frequency and timing of monitoring, etc., which must be evaluated against the requirements and conditions of the conditions of authorisation for the project.

After the initial review of the Monitoring Plan, the need for future reviews and the frequency of reviews should be re-evaluated by an ecologist.

7. CONTINGENCY MEASURES

Table 7-1 summarizes the contingency measures recommended to address key risks to the habitat restoration plan implementation that may arise.

Table 7-1 Contingency measures for key risks

Risks	Proposed contingency measures
Inadequate weed control leading to widespread failure of revegetation	• Review weed control measures and consult with specialists as required to amend measures where necessary. • Review and updated timing and frequency of control measures implemented.
Poor construction of landscaped sites, including inadequate or insufficient topsoil	• Relevant personnel to be made aware of key landscaping requirements. • Review topsoil management and replacement requirements and consult with specialists as required to amend measures where necessary.
Low or unsustainable nutrient levels in soils	• Consider the use of organic mulches or growth mediums. • Consider importing topsoil.
Wind and/or water erosion of landscaped areas	• Rapidly stabilise topsoil. • Sow soils with sterile annual cover species to provide rapid stabilisation and erosion control while native species are still being introduced.
Lack of follow up maintenance	• Review maintenance and follow-up requirements and frequency.
Limited rainfall / drought	• Plant local native species adapted to the local climatic conditions. • Plant/sow seed during the growing season at the commencement of spring.
Insect attack/disease	• Encourage natural predators (spiders, insects, frogs, lizards and insectivorous birds and bats) by providing suitable micro-habitat and food resources such as nesting boxes, logs, rocks, etc.
Failure plantings	• Detect failure in annual inspections. • Assess reasons for failures, including extreme weather, fire, grazing impacts, and species-specific failure. • Undertake soil fertility / nutrient level tests. Soils should also be analysed by a soil laboratory for the following properties at a minimum: pH, Salinity (electrical conductivity), Cation exchange properties and exchangeable cations, major and minor nutrients and Organic matter (%). • Fertilising and composting are not critical maintenance activities except where there are obvious deficiencies but should be assessed on an annual basis by observation and leaf analysis. • The most common amendments used to bring soils up to a standard suitable for plant growth are: - Lime or dolomite to make acid pH soils more alkaline; - Lime or Gypsum to enhance exchangeable calcium and eliminate sodicity; - Gypsum to make clay soils more friable; - Composts and/or manures to improve organic matter and nutrients levels;

Risks	Proposed contingency measures
	- Single or complete fertilisers often with trace elements to correct a particular deficiency or multiple deficiencies. • Refine planting species and seed mixes as necessary. • Ameliorate identified adverse conditions and replant areas with refined list of suitable species. • Where die-back of plant material has been identified new plants will be planted as soon as possible. • Pruning to be carried out on shrubs and trees that require it according to species to remove the dead and damaged branches and to retain natural shape and to improve health and vigour.

8. CONCLUDING REMARKS

The Habitat Restoration Plan contained in this document has been compiled by ERM to guide the restoration of habitat temporarily disturbed by the construction RoW (Right of Way) for the Northern Marmara Motorway Section 8 PPP Project (NMM-Nakkaş-Başakşehir Motorway), as well as the restoration of habitat to form the biodiversity offset which compensates for permanent (residual) impacts to natural habitats.

Through the detailed plan for implementation as well as the stringent monitoring and evaluation programme included, this plan seeks to address the requirements for the NMM-Nakkaş-Başakşehir Motorway towards meeting no net loss of biodiversity objectives for natural habitat losses associated with the project, and net gain for critical habitat impacts.

Importantly, the plan will need to be reviewed and revised annually, or as necessary, to ensure the plan remains current.

To ensure clarity and operational effectiveness, the implementation strategy has been structured into distinct phases, each outlining precise actions, responsible parties, and timelines. These phases integrate key thematic elements from the Habitat Restoration Plan, including site selection, restoration techniques, monitoring protocols, and adaptive management considerations.

The table below presents a step-by-step framework to guide the successful delivery and evaluation of restoration and offset measures across the project lifecycle.

Table 8-1 Enhanced Implementation Phases Table with Detailed Key Activities

Phase	Timing	Key Activities	Responsible Party
0. Site Monitoring for Implementation	During construction (Months -12 to -6)	- Identify and preliminarily assess candidate receptor sites - Use remote sensing, historical land use data, and field visits - Record vegetation types, habitat quality, and disturbances - Compile baseline data on flora and fauna for reference	Flora Consultant, REC
I. Preparation	6 months prior to construction completion	- Finalize receptor site selection through ground validation - Develop a propagation and seed collection calendar - Procure or begin propagation of native species - Coordinate logistics and schedule with contractors - Engage local stakeholders for awareness and collaboration	REC, Flora consultants (such as ENVA or Nezahat Gökyiğit Botanical Garden)

II. Restoration Launch	Upon construction completion	- Prepare soil through decompaction, erosion control, and nutrient enhancement - Remove invasive species using manual or mechanical methods - Install fencing and signage to protect restoration areas - Execute seeding and planting using native species appropriate to habitat type - Implement initial irrigation where needed	Contractor, Environmental Clerk of Works (ECoW)
III. Monitoring & Maintenance	Years 1–5 post-construction	- Conduct monthly inspections of plant survival and growth - Manually remove invasive species or apply targeted control methods - Implement infill planting where survival rates are low - Adjust irrigation or protection measures based on weather patterns - Maintain photographic records from fixed points	Biodiversity Expert, Monitoring Team
IV. Performance Monitoring	Years 1–5 post-construction	- Collect data using KPIs (vegetation cover, species richness, etc.) - Perform seasonal faunal monitoring (e.g., birds, insects) - Map restored areas using GIS tools for comparison with baseline - Score habitat quality and track trends over time - Provide technical feedback for adaptive management	Monitoring Team, Independent Consultant
V. Annual Review	Annually during operations	- Synthesize data from monitoring activities - Compare outcomes against targets and thresholds - Identify challenges and propose adaptive solutions - Report on success/failure of invasive plant control measures - Assess functionality of wildlife corridors and habitat continuity - Submit findings to lenders and update restoration strategy if needed	REC, SPV, Independent Consultant

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10. APPENDICES

10.1 Appendix A. Literature Review

10.1.1 What is the typical climax vegetation community / communities in Türkiye?

Climax vegetation in Türkiye is typically evergreen oak woodland or forest. Atalay *et al*. (2008) indicate that under exploitation the vegetation degenerates towards Maquis, typically 1-3 m high, and harboring many plants that occur in forest but prefer more open habitats (e.g. tree heath, buckthorn, holly oak, strawberry tree, myrtle, and juniper). Further exploitation leads to a more open, herbaceous dominated Garrigue vegetation community with low shrubs and flowering plants typically less than 1 m in height. This type commonly occurs in abandoned fields and heavily degraded habitats with a governing disturbance regime but is also the first stage of succession in recently burnt areas (Atalay *et al*., 2008).

10.1.2 What are the lead causes of ecosystem/habitat degradation in Türkiye?

The primary causes of ecological / habitat degradation in Türkiye are associated with the following (according to Marzo *et al*., 2015 and Göbkulak *et al*., 2018):

- Over grazing and land use tradition
- Browsing
- Rapid increase in population and livestock
- Harsh topographical land characteristics and semiarid conditions
- Over extraction of woody plants as firewood
- Mining
- Recreational activities

10.1.3 What are the key ecological drivers of ecosystems and habitats in the Mediterranean Region / Türkiye?

Several factors including climate and rainfall pattern, fire and grazing pressure drive ecological changes in the vegetation and habitat structural and compositional characteristics of Türkiye and the Mediterranean Region at large, which in turn has effects on flora and fauna species.

Climate:
The climate in Mediterranean ecosystems, including Türkiye, plays an important role as an abiotic driver of ecosystems, with hot and dry summer months with low amounts of rainfall and high evapotranspiration rates being limiting factors that constrain the types of habitats and vegetation (Göbkulak *et al*., 2018, Marzo *et al*., 2015, Vallejo *et al*., 2012a).

Fire:
Fire is also an important driver of ecosystems. While wildfires are considered a natural ecological process, over the last few centuries the mismanagement of fire regimes has contributed to habitat degradation, lowered species richness, reduced nutrient availability, and adversely affected plant and animal communities. A change in the intensity and frequency of fires due to anthropogenic influences will have an effect on the structuring of woody vegetation communities (absence of fire is typical for woody communities such as woodland and forest), favouring more open grassland and shrubland communities.

Grazing:
Over grazing and soil erosion put additional pressure on terrestrial habitats in the Mediterranean, favoring the formation of secondary grassland, pasture and more open structured vegetation communities with lower species diversity (Göbkulak *et al*., 2018, Marzo *et al*., 2015, Vallejo *et al*., 2012a).

10.1.4 How can one work with ecological drivers to assist with restoration of habitat?

For successful habitat restoration, understanding and working with the above-mentioned ecological drivers is considered crucial.

A first step to halting further degradation in most cases is the reduction of grazing by reducing number of livestock, shortening the period during which livestock can graze or preventing grazing by using fences. Depending on the desired outcome, grazing and the type of livestock can be used to control different types of vegetation (i.e. grass, shrubs or trees) (Martin *et al*., 2017). Grazing may also be replaced entirely by mowing, to better control vegetation development (Walker *et al*., 2007).

To prevent uncontrolled wildfires, prescribed burning might be applied to suppress fuel loads in shrublands (Martin *et al.,* 2017). Further modification of ecological drivers includes managing water availability, soil properties and sedimentation control (Walker *et al*., 2007).

10.1.5 What is the importance of ecological succession in ecological restoration projects?

The success of restoration depends on the knowledge of successional patterns of an ecosystem, with Walker et al. (2007) defining succession as the change in species composition and associated substrate changes over time. Restoration aims at manipulating and accelerating natural succession by introducing target species that form the final community, at an early stage.

Since natural succession is not an entirely predictable process, adaptive management is typically required throughout the process. Usually, succession as well as restoration is limited by environmental constraints that include plant dispersal, germination, growth, species turnover and ecosystem resilience (Walker *et al*., 2007).

10.1.6 What are the main obstacles / constraints to restoration of habitat in the Mediterranean/Türkiye and how should these inform restoration projects?

There are several factors specific to the Mediterranean that have the potential to constrain restoration activities in the region:

- Firstly, semiarid conditions can cause heat stress and reduced water availability highly affect and limit seed dispersal and plant growth (Göbkulak et al., 2018, Mendez et al., 2008).
- Secondly, human land use that has been ongoing for thousands of years in the region contributed to soil depletion, erosion and over grazing. Rapid human and livestock population are leading to even more land use (Göbkulak et al., 2018). Depending on the degree of human disturbance, presence of seeds of shrubland species in the soil is limited (Martin et al., 2017). Soil erosion might have reduced soil depth, water-holding capacity and nutrient content (Atalay et al., 2008).

Restoration projects therefore need to take local conditions and land use history into account to plan and manage activities accordingly.

10.1.7 How can one ensure successful restoration occurs?

Successful habitat restoration depends on various factors:

- **Degree of degradation**. The required restoration measures very much depend on the degree of degradation and the initial conditions. In highly degraded ecosystems, restoration of physical and/or chemical environmental conditions might be required. In only slightly degraded ecosystems, removing the stressors might be sufficient to recover the functionality of the system (Marzo et al., 2015).

- **Seed provenance**. Using local seeds for restoration is important, not only for conservation of local genotypes, but they are usually better adapted to local environmental conditions than non-local genotypes and thus more likely to contribute to successful restoration.
- **Maintenance management**. Maintenance management or adaptive management, i.e. the continued manipulation of succession, is essential throughout the restoration process to achieve persistence of the preferred habitat. Unassisted succession would be an option only for small sites surrounded by natural vegetation, which is often not the case. Manipulation applied at different times of the growing season may have very different and often opposing effects. For example, dominant grasses can be maintained by cutting late in the season, when reserves have been translocated to underground organs, or suppressed if the cutting is applied early in the season (Prach et al., 2007).
- **Small-scale heterogeneity**. Considering the establishment of mosaics of vegetation for physical heterogeneity, that mimic natural landscapes, contributes to plantation success in arid conditions (Prach et al., 2007, Walker et al., 2007). Using several growth forms helps to ensure that extreme events will not destroy all species. Structural variation provides resilience by permitting cores of survivors even if catastrophes occur (Walker et al., 2007). Through hydraulic lifting, roots of certain species lift water stored in deep soil layers and release it near the soil surface, making it available for other plants (Vallejo et al., 2012b).
- **The surroundings**. The surrounding landscape plays a major role in the restoration of a site. It contributes propagules that could augment or inhibit restoration. The pool of potential colonists in fragmented landscapes may be drastically different from that of intact landscapes. Target species may be missing or isolated and their low probability of colonization can produce unpredictable results (Walker et al., 2007).
- **Alien species**. To avoid competition with native species, alien species development should be controlled (Marzo et al., 2015). The establishment of alien species on a restoration site depends to a large extent on the presence of such species in the surrounding landscape. If a large pool of alien species is present, e.g. in urban wasteland, sowing or planting of native species may prevent invasion (Walker et al., 2007).
- **Other factors for successful restoration**. Setting specific restoration goals with measurable targets to be achieved at a certain time (Walker et al., 2007). Considering limiting environmental factors (Vallejo et al., 2012a). Complex vegetation requires a certain minimum area (Walker et al., 2007).

10.1.8 What are the key interventions / measures involved in restoring different habitat types?

Shrublands (Martin *et al*., 2017):

- Using cutting/mowing to mimic grazing (e.g. to maintain plant species that depend on disturbance);
- Increase number of livestock;
- Using grazing to control trees and grass;
- Cutting of trees;
- Prescribed burning to control trees;
- Using fences to exclude large herbivores.

Riparian habitats:

- Establishing structures to prevent soil erosion and recovering bank vegetation in the short-term (e.g. live vegetation, live fascines, living wattle fence, living brush mattress, vegetated log cribwall, live staking, textile cover until vegetation cover is established) (Marzo et al., 2015);
- Invasive plant control: invasive species should be removed manually or mechanically as much as possible before planting (Marzo et al., 2015);
- Native species from local provenance should be selected for planting;
- Plant materials commonly include cuttings of easy-to-root riparian native species, such as Poplars, Willows or Tamarisk that could be collected from a nearby donor site;

- Other shrubby or woody riparian species plants are also commonly installed in the second row vegetation along the banks and in floodplains (as for instance ash, alder or elms in riparian habitat), cultivated in containers and planted as 1-2 year old seedlings.

10.1.9 What are the main approaches to ecological restoration?

Main active restoration approaches include (Marzo *et al*., 2015; Martin et al., 2017; Göbkulak *et al*., 2018; Mendez *et al*., 2008):

- Soil stabilization and erosion control, e.g. with erosion blankets/mats.
- Transplanting turf from an intact site to a degraded site will instantly restore shrubland at some parts and accelerate colonization of shrubland species at the rest of the site .
- Adding topsoil from shrublands to degraded shrubland sites may help to increase the number of seeds in the soil, thereby increasing the probability of shrubland plants becoming established.
- Stripping of topsoil may help to reduce fertility and remove seeds found in topsoils, therefore aiding shrubland plants.
- Contour terracing for increased soil moisture and protection from erosion.
- Water redistribution.
- Combining the sowing of seeds and planting of shrubland plants may help to rapidly restore shrubland vegetation as well as increasing colonization by the seedlings of shrubland plants.
- Planting shrubs in clusters may result in an alteration of microclimatic conditions which favour their survival and growth.
- Combining the planting or sowing of seeds of nurse plants with that of focal plants may help to increase focal plant survival and growth. Nurse plants are plants which are thought to aid the growth of other species by providing relatively benign conditions below their canopy. Examples of these altered conditions may include increases in moisture and nutrients and decreases in temperature and damage from herbivores.
- Spreading clippings may help to increase the colonization of shrubland plants as a result of introducing seed. Plant clippings may also help to increase organic material in the soil.
- Thinning or mowing to control non-target species.
- Adding mulch may help to retain moisture in soil at shrublands in arid sites, as well as reducing the germination of problematic/invasive species.
- Adding fertilizer may help to stimulate the growth of any shrubland plants already present.
- Irrigation may help to promote the growth of shrubland plants, particularly in arid shrublands.
- Weed control by mechanical methods.
- Fire prevention.
- Building bird perches in degraded shrublands may help to encourage birds to perch on them. As a result the number of droppings deposited by birds at the site may increase, increasing the probability that the site will be colonized by plants.
- Inserting brush piles parallel to land contours. Such artificially created patches would act as sinks of resources (soil, water, and nutrients) and seeds, providing favorable microenvironments for the recovery of vascular plants and biological soil crusts.

Passive restoration techniques are preferable where ecosystem structural and functional damage is limited, and resilience is high. Actions include:

- **Controlling grazing**, e.g. by using fences or constructing new watering facilities to provide better distribution of grazing animals (Göbkulak et al., 2018).
- **Assist secondary succession (**Prach et al., 2007).

10.1.10 Guidance on planting, seeding, and soil preparation

Actions for site preparation include (Marzo *et al*., 2015; Vallejo *et al*., 2012b)**:**

- Seeding Leguminosae, since they tend to increase nitrogen concentration and organic matter in the soil.
- Adding fertilizer to soil to enhance growth of plants.
- Subsoiling (i.e. deep ripping to 50–70 cm soil depth), mechanical terracing (2–3 m wide in combination with subsoiling) and mechanical and manual holes for planting (ca. 40 x 40 x 40 cm).
- implementing suitable techniques to improve water availability could help plants to overcome environmental constraints (e.g. traditional micro-catchments for harvesting and redirecting rainfall water).
- Drip irrigation is more expensive but it could be used for small surfaces if there is no budgetary constraint (but tends to increase salt content in soil).
- Runoff harvesting aims to intercept runoff and redirect water to the planted seedling, and can be performed by subsoiling (deep regolith drilling) or by the creation of small runoff collection areas up-slope to direct water to the plantation hole (micro-catchments).
- Subsoiling/ploughing has also been used for reducing soil compaction.
- Terracing has traditionally been used in Mediterranean countries for agricultural purposes and later for reforestation.
- In steep slopes, and especially in loose soils, where rainfall erosion tends to produce gullies, it is recommended to construct fascines with organic material (rolled biodegradable textiles, logs, bundles of branches). This technique suits also in rocky slopes for trapping and holding soil, creating a suitable place for natural plant establishment as well as for outplanting.
- Mulching has proven to be an efficient way to reduce the kinetic energy of raindrops, avoid soil crusting, promote water infiltration, lower evaporation rates, suppress competing vegetation and thereby increase seedling survival.
- The purpose of site preparation in Mediterranean areas is to improve deep penetration of roots, increase soil infiltration of water, increase nutrient availability and to reduce water runoff and evaporation.

Seeding and Planting guidance (Vallejo *et al*., 2012b; Göbkulak *et al*., 2018; Prach *et al*., 2007; Marzo *et al*., 2015):

- Drought stress is the main cause of seedling mortality in Mediterranean forest plantations during the first year after outplanting. Preconditioning or drought preconditioning by submitting seedlings at the nursery to controlled drought conditions is considered to be an effective method to increase seedling survival in the field for certain species. Main objectives of preconditioning are:
  - to manipulate seedling morphology and to induce dormancy
  - to acclimate seedlings to the natural environment
  - to develop stress resistance mechanisms
  - to improve seedling survival and growth after outplanting
- Field techniques to improve seedling establishment commonly prioritize the increase in rootable soil volume, nutrient availability, runoff collection and water conservation, while controlling competition with extant vegetation. Among them site preparation is probably the most powerful technique to improve seedling water status.
- One of the main challenges in dryland restoration is to overcome drought at the seedling stage, as generally low amounts and uneven spatial and temporal distribution of precipitation are the main abiotic limitations in this climate. Watering can dramatically decrease seedling mortality but irrigation by other sources than rainfall is barely used on management scale due to high costs.
- Water harvesting has a very long tradition in arid and semi-arid areas around the globe. It aims to intercept runoff and redirect water to the planted target seedling, increasing water availability and thus seedling survival. For instance, planting holes with their associated microcatchments, sometimes called negarim, act as microdams, allowing runoff capture and a higher water storage capacity while at the same time reducing runoff erosivity by creating sinks along the slope.

- Propagule sources in the close vicinity are important for the establishment of late-successional species that usually have poor dispersal abilities.
- Seeding of target species must be carried out in an appropriate “colonization window,” the duration of which depends on the species and sere.
- In the early stages of spontaneous succession there are a number of physical, chemical, and dispersal barriers to species establishment. As succession proceeds, these barriers are likely to decrease in importance and be replaced by barriers imposed by competition from developing vegetation. With a technical solution the aim is to remove some or all of these barriers artificially.
- Often topsoil use provides a more diverse flora than seeds alone because the soil contains a greater species diversity. It is also possible to either use transplanted turfs or nursery-grown plants.
- Revegetation of plants in a container as they cope more easily with harsh conditions compared to bare-root or direct seeding.
- Seeding of target species must be carried out in an appropriate “colonization window,” the duration of which depends on the species and sere.
- In areas with Mediterranean climate, season for plantings is fall to spring and can be sub-classified into early season (November), mid-season (January) and late season (March).
- Propagule sources in the close vicinity are important for the establishment of late-successional species that usually have poor dispersal abilities.
- A simple tree shelter can consist just of 2 or 3 sticks and a mesh and only aiming at the physical protections of the seeds or planted seedling whereas more complex ones with ventilation provide shade and avoid excessive warming. The latter are used to modify the physical environment of planted tree seedlings and if designed properly, they can help reduce seedling transpiration and improve overall performance by acting as mini – greenhouses and reduce seedling transpiration, while at the same time providing protection against herbivory.
- The presence of trees or shrubs, so called nurse plants, greatly modifies microclimate and biological conditions both above and below the ground. In the field of dryland reforestation, nurse plants may buffer non-optimal environmental conditions. Shade reduces soil water evaporation, lowers soil and air temperature, and decreases the amount of radiation reaching the plants, thus protecting seedlings from the damaging effects of extreme temperatures and low humidity in arid environments and may reduce frost injuries in cold areas. Furthermore, through hydraulic lifting, roots of certain species lift water stored in deep soil layers and release it near the soil surface, making it available for other plants. Nutrients are enhanced through litter and sediment accumulation, higher mineralization rates and larger microorganism populations. Positive root interactions between facilitator and facilitated plants allow nitrogen transfer between legumes and non-leguminous plants, increase ectomycorrhizal infection, and facilitate the exchange of nutrients and carbon via mycorrhizal fungi.

10.1.11 What are key species traits to take into consideration in restoration and species selection for planting/seeding?

- Drought tolerant species of native origin (Göbkulak et al., 2018).
- Mixture of native plant species from local provenances, selected by their relevant and complementary ecological role to promote natural interactions and biodiversity (Marzo et al., 2015).
- The main elements of garrique vegetation are *Cistus salviifolius, Cistus creticus, Cistus parviflorus, Coridothymus capitatus, Erica verticillata, Fumana arabica, Fumana thymifolia, Genista acanthocloda, Micromeria nervosa, Majorana syriaca, Phlomis viscosa, Phlomis cretica, Salvia triloba, Sarcopoterium spinosum, Satureja thymbra, Thymbra spicata, Teucrium divaricatum, and Teucrium creticum*. The leading garrigue element is *Poterium spinosum* it is common on abandoned, destroyed and poor habitats. (Atalay et al., 2008).
- Plant species selection and breeding has focused on several characteristics regarding water use efficiency (i.e. higher carbon fixation per unit of water consumed), promotion of traits related to

higher drought tolerance (i.e. antioxidant systems, vulnerability to cavitation), and root system characteristics required to optimize water uptake (Vallejo et al., 2012a).

- Re-sprouter species are considered more suitable for reforestation plans in fire-prone areas. These species have the capacity to quickly regenerate after disturbances, thus promoting ecosystem resilience (Vallejo et al., 2012a).
- Some guidelines for species selection can be summarized as follows:

  - Original species and community composition: Analyze what native species are suitable for the habitat to be restored from field observations or reference studies on area phytosociology.

  - Identification of critical site characteristics in degraded lands: soil limitations, microclimate conditions. Assess whether conditions for plant establishment can be readily modified (e.g. through soil amendment or use of nurse plants). (Vallejo et al., 2012a).

  - The introduction of species in a restoration project requires the technical knowledge of the species cultivation requirements, planting techniques (including planting windows), and its plasticity in tolerating fluctuating environmental conditions. (Vallejo et al., 2012a).

  - Selection of woody species for restoration should be based, as much as possible, on the natural late-successional vegetation of the area, and on the environmental characteristics of the site (Vallejo et al., 2012b).

  - Seeding woody species is an attractive technique to re-introduce target species owing to its low cost, the low impact of field operations and improved possibilities for treating remote areas through aerial seeding. (Vallejo et al., 2012b).

  - Generally, the selection of species in restoration and reforestation programs is recommended to be as close as possible to the natural vegetation of the area and according to the specific site conditions (Vallejo et al., 2012b).

- Most late-successional Mediterranean species do not create a permanent seed bank, thus seeding is an appealing technique for the reintroduction of those species in degraded landscapes (Vallejo et al., 2012b).
- The quality of the seedlings produced at nurseries play a very important role in Mediterranean reforestation programs, as the most critical period for seedling survival is the first year after plantation (Vallejo et al., 2012b).

10.1.12 Habitat management/restoration in Türkiye

In Türkiye, there is no specific and integrated national plan in relation with habitat restoration and rehabilitation. However, various projects have been carried out in response to specific needs across different ecosystems and sectors, making significant strides in habitat restoration and rehabilitation. These projects are implemented at local and regional levels to preserve ecological values in certain areas, improve degraded habitats, and enhance biodiversity. While these initiatives are not part of a national plan, they address environmental challenges in specific regions and contribute to the development of sustainable environmental management approaches. Below are some detailed examples of these important rehabilitation efforts conducted in Türkiye.

Rehabilitation efforts in Türkiye have been supported by significant projects aimed at the sustainable use of natural resources and environmental restoration. These initiatives address various environmental issues across different ecosystems and geographical areas. Projects such as the Nezahat Gökyiğit Botanical Garden in Istanbul focus on increasing biodiversity in urban areas and offer successful examples of local flora restoration and green space rehabilitation. Similarly, the Akyaka Coastal Wetlands Restoration Project (Muğla) has been implemented to protect coastal ecosystems and restore the ecological functions of wetlands, creating critical habitats for local fauna and flora.

The Göksu Delta Restoration Project (Mersin) and the Çamlıhemşin Forest Rehabilitation Project (Rize) stand out for their efforts to protect wetlands and forest ecosystems. The restoration work in Göksu Delta has provided essential habitats for migratory birds and aquatic species, while the forest rehabilitation in Çamlıhemşin focuses on the reintroduction of native tree species and the improvement of ecosystem services.

Rehabilitation projects aimed at mitigating the environmental impacts of mining activities also hold a significant place in Türkiye. The Soma Coal Basin Rehabilitation Project (Manisa) aims to restore the ecological balance in the region by covering degraded mining sites with topsoil and conducting afforestation efforts. The Zonguldak Coal Mines and Afşin-Elbistan Lignite Mine Rehabilitation Projects similarly focus on restoring areas damaged by mining activities to their natural state. Additionally, the Kazdağları Gold Mine Rehabilitation Project (Çanakkale) has taken critical steps to address the environmental damage caused by mining, in response to demands from local communities and environmental organizations.

These projects demonstrate the applicability and success of sustainable environmental management approaches in habitat management and post-mining land rehabilitation in Türkiye.

10.2 Appendix B: Monitoring Data Collection Forms

B1. Disturbance Survey: method and checklist

The disturbance survey datasheet has been provided below. The survey will need to be undertaken by providing the field assessor(s) with the relevant field datasheets and a map of the areas to be assessed. The assessor will need to walk through the habitat assessment unit and rate the extent and intensity of a range of potential impacts that could affect the habitat (as described in the datasheet below). The assessor should ideally assess impacts to edge habitat separately from interior habitat.

A. Interior habitat condition			
Disturbance/Impacts affecting interior	**Description**	**Rate Extent of Impact** (see Table A)	**Rate Intensity of Impact** (see Table B)
Clearing of vegetation	*Estimate the extent of natural vegetation that has been cleared partially or completely*		
Harvesting of plants, bark, timber, etc.	*Estimate the extent of habitat that has been subject to plant harvesting for building/medicinal purposes*		
Concentration of runoff	*Estimate the extent of artificial drains affecting the interior*		
Natural storm damage	*Are there signs of natural storm damage, estimate the extent of damage*		
Fire damage (forest habitat only)	*Are there signs of natural/artificial fire damage within the interior, estimate the extent of damage*		
Human tracks/paths	*Are there any human tracks/paths created, estimate the extent of habitat disturbed*		
Alien plants/weeds	*Are there any alien plants in the interior, estimate the extent*		
Overall Rating	*Rate the overall extent of impacts to the interior (average of ratings)*		
B. Edge habitat condition			
Disturbance/Impacts affecting edge	**Description**	**Rate Extent of Impact** (see Table A)	**Rate Intensity of Impact** (see Table B)
Harvesting of plants	*Estimate the extent of edge habitat that has been subject to plant harvesting for building/medicinal purposes*		
Fire damage (forest habitat only)	*Are there signs of natural/artificial fire damage along the edge of habitat, estimate the extent affected*		
Alien plants/weeds	*Are there any alien plants along the edge, estimate the extent*		

Overall Rating	*Rate the overall extent of impacts to the edge (average of ratings)*		

Table A. Rating of impact extent (proportion of the unit affected by each impact / disturbance type).

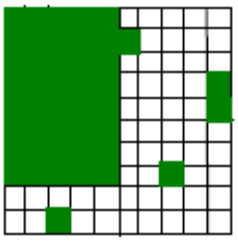
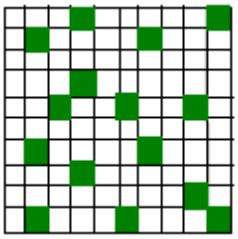
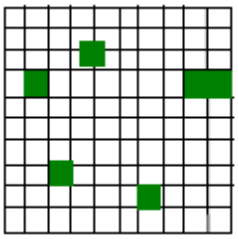
Extent of Impact	Rating	Description	Cover Estimate
High (H)	*5*	*The impact has affected the majority (more than 50%) of the habitat unit assessed*	
Moderate (M)	*3*	*The majority (>50%) of the habitat unit remains unaffected by the impact*	
Low(L)	*1.5*	*A small proportion of the habitat unit has been affected by the impact (<25%)*	

Table B. Rating of the intensity of impacts (the degree to which habitat characteristics have been altered within the affected area.

Intensity of impact	Rating	Description of affected areas
Very low	1	There is very little discernible impact.
Low	2	A slight impact on natural habitat is discernible but with very little effect on habitat condition.
Moderate	3	The impact is clearly evident but limited, resulting in moderate alteration of habitat condition.
High	4	The impact has a serious impact on affected areas, with little natural vegetation remnants remaining in affected areas.

B2. Alien plant survey: data capture sheet and table for assessing IAP cover

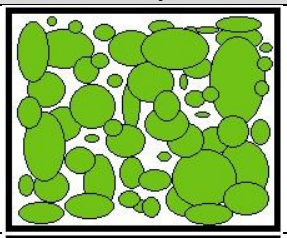
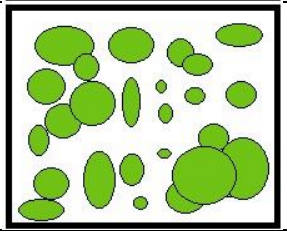
The alien plant survey is intended to be a rapid visual assessment of the extent of alien plants within predefined habitat units. The assessor captures species and density information and uses this to estimate overall alien plant density (expressed as % ground cover) using the rating classes in Table C, below.

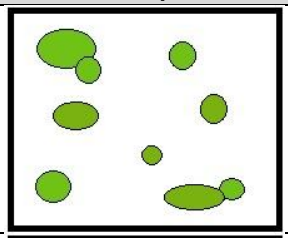
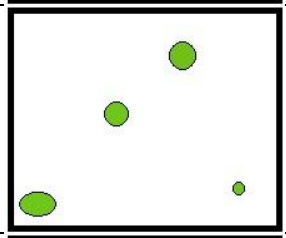
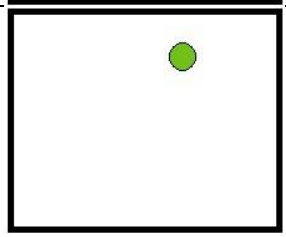
Reference to area/site assessed:	*Provide a reference code/number assigned to the area/site assessed for easy reference. Assessor to indicate the area assessed on field maps to be provided.*
Date:	*Date on which the assessment was undertaken.*
Assessor(s):	*Details of the person(s) responsible for the assessment.*
Overall extent:	*Estimate the overall extent of alien plants, expressed as a % cover based on visual observations*
Overall Extent Class	*Estimate the overall/combined extent of alien plants*

Assessment of IAPS:

Species Info:		**Maturity Level:** (Tick relevant box(es) below		
Species Name	**Extent** Class (see Table C)	**Mature**	**Young/Seedling**	**Coppice**
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Table C. Classes used to rate alien plant cover.

CLASS	Description	Ground Cover (%)	Example
Extreme	Areas with excessively high levels of alien vegetation, containing little natural vegetation.	>75%	
High	Areas with high levels of alien vegetation where the proportion of alien species exceeds that of indigenous species.	50 - 75	

CLASS	Description	Ground Cover (%)	Example
Moderate	Areas with high levels of alien vegetation but generally with a higher proportion of indigenous vegetation than alien vegetation.	30-50	
Low	Areas are dominated by natural vegetation with relatively low infestation levels.	5-30	
Very Low	Largely natural areas with very low infestation levels that could be cleared with very little effort.	<5	

B3. Visual survey of erosion/siltation: data capture sheet

The assessment of erosion/siltation is a visual survey done in the field and is intended to be undertaken per management unit/block. Each management block/unit will be assessed, and data captured using the data capture sheet below (all features within each management block/unit are to be captured on a single data capture sheet).

Site Reference:	*Quick reference to the management unit/site assessed*
Date:	*Date on which the assessment was undertaken.*
Assessor(s):	*Details of the person(s) responsible for the assessment.*
GPS Coordinates of erosion/deposition features:	*Provide GPS coordinates of any problem identified in the field*
Description of erosion/deposition features:	*Provide a brief description of the problem*
Photo:	*Include photograph of the feature(s) where possible*
Source of erosion/sedimentation:	*Attempt to identify the source and cause of the erosion/deposition of sediment (e.g. increased runoff from mining areas, discharge of water from mine)*

Additional Observations:	*Capture any additional visual observations at the site (e.g. reduced vegetation cover, etc.)*
Corrective/Management Recommendations:	*Include any recommendations to address erosion/sedimentation including rehabilitation requirements and actions to address the source of erosion/sedimentation*

B4. Methods for taking Fixed-Point Photos

The following guidelines should be followed when locating fixed-point photographs:

- Photo-points should be selected at various key locations that are likely to be impacted and at points that will be easily accessible at all times.
- Use the same camera, lens and zoom each time. If this is not possible, record the settings used. The camera should preferably be located on a tripod at a fixed height.
- Photographs should ideally be taken at roughly the same time of year and at the same time of the day, and under similar weather conditions.
- The compass orientation of the photo frame should be recorded.
- Record the geographical co-ordinates of each point, with a mapping grade Global Positioning System (GPS) - this provides any individual with the information required to navigate to the exact location of each photo point.
- Permanent field markers/pins may be placed in the ground at each point to ensure that photos are always taken from exactly the same point.
- A standard object, such as a soil auger or a standard metre rule should be included in the photograph as a reference for scale.

Record relevant information about factors that may influence features in the photograph (e.g. a recent fire, late or early rains, sedimentation or erosion), especially those relating to the visual appearance of the site.

10.3 Appendix C: Budgeting Sheet

Activity	Description	Unit	Quantity Required	Cost/ha	Total Cost Estimate
Land Acquisition	*Cost estimate to purchase the land required to secure the restoration site(s)*	Ha			
Project Oversight	*Environmental oversight by REC/ECoW*	Man hours			
Ecological Oversight	*Ecologist responsible for interim inspections and advice on offset implementation*	Man hours			
Soil fertility testing	*Testing of soils on agricultural sites for nutrient status and toxicants*	No. samples			
Site preparation	*Includes earthworks, landscaping, topsoiling, shaping*	Ha			
Vehicles	*Vehicles and fuel*	No.			
Topsoil	*Importing topsoil*	m^3			
Fertilizer, herbicide, pesticide	*Product purchase and application*	No. products			
Seed / plants	*Plants / seed for revegetation*	Plants / ha			
Invasive plant control	*Informed based on monitored levels of infestation*	Ha			
Follow-up maintenance	*Maintenance work*	Ha			
Annual monitoring	*Implement monitoring programme*	Item			
Auditing	-	Item			
Annual Reporting	-	Item			
Contingency	-	Item			

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