AYGM

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Environmental and Social Impact Assessment



70069878-ESIA
DECEMBER 2021

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AIR QUALITY

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6 AIR QUALITY

6.1.1. This chapter reports the findings of the assessment of the potential air quality effects of the Project during both the construction and operational phases. For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to minimise these described.

6.1.2. A glossary of terms used in this report is provided in **Appendix C**.

6.2 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

6.2.1. This section outlines the legislation, policy and guidance considered as part of the assessment, this includes international guidance, EBRD performance requirements applicable EU legislation, and national standards.

INTERNATIONAL GUIDANCE AND STANDARDS

6.2.2. World Health Organisation (WHO) air quality guidelines, revised in 2005, for particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide (NO_2) and sulphur dioxide are designed to offer guidance in reducing the health impacts of air pollution. They are based on expert evaluation of current scientific evidence relating to the health impacts of air pollution. The guidelines are intended to inform policymakers and to provide appropriate targets for a broad range of policy options for air quality management in different parts of the world.

6.2.3. The EBRDs Environmental and Social Policy[25] focuses on ten performance requirements that must be met to ensure correct operation and construction of any facility. The Environmental and Social Policy (2014), Performance Requirement 3 (PR3), 'Resource Efficiency and Pollution Prevention and Control', outlines a project-level approach to climate impacts and greenhouse emissions, resource management and pollution prevention and control following a 'polluter pays' principle.

6.2.4. PR3 states the requirement for projects to meet the relevant EU substantive environmental standards, where these can be applied at the project level. Projects must also be designed to comply with applicable national law. When national regulations differ from the levels and measures presented in EU requirements or other identified appropriate environmental standards, projects will be expected to meet whichever is more stringent.

European Air Quality Regulations

6.2.5. The Air Quality Directive 2008/50/EC sets limit values for the concentration of pollutants in air for the protection of human health, vegetation and ecosystems. Compliance with the limit values for pollutants is mandatory in EU member states that have ratified the Directive and incorporated it into their national legislation. Turkey has committed to harmonising its legislation with the EU acquis in preparation for accession to the EU. In the case of human exposure, the limit values apply everywhere in the external environment. Although not a member state, they apply to the Project, as

[25] EBRD (2014). Environmental and Social Policy.

there is an intention to seek international financing, which is likely to require substantive EU requirements to be implemented (as per the EBRD Environmental and Social Policy). EU limit values for NO_2, PM_{10} and $PM_{2.5}$ are given in **Table 6-1** and will be used as the threshold limits for this assessment. Air quality parameters not referenced above, (such as SO_2), have been considered on a qualitative basis and it has been concluded that any such effects arising from the Project would be insignificant and have therefore not been considered further in the assessment.

6.2.6. The Turkish air quality standards considered for this Project, are in all cases equal to the equivalent EU standards, with the exception of hourly mean NO_2 which is less stringent than the equivalent EU standard. The assessment has been undertaken against EU Air Quality standards as per PR3 of EBRD's Environmental and Social Policy (2014) as these represent the worst case or are equivalent to Turkish air quality standards. A summary of the European and WHO air quality standards (limit values) is available in **Table 6-1**.

Table 6-1 - WHO and EU Air Quality Standards

WHO Guideline				EU Air Quality Standards			
Short-term Limit ($\mu g/m^3$)		Long-term Limit ($\mu g/m^3$)		Short-term Limit ($\mu g/m^3$)		Long-term Limit ($\mu g/m^3$)	
Nitrogen Dioxide (NO_2)							
200	Hourly (1-hour) mean	40	Annual mean	200	Hourly (1-hour) mean (no more than 18 exceedances per year)	40	Annual mean
Particulates Less than 10 Micrometres in Diameter (PM_{10})							
50	Daily (24-hour) mean	20	Annual mean	50	Daily (24-hour) mean, not to be exceeded more than 35 times a calendar year	40	Annual mean

Local Air Quality Management Review and Assessment Technical Guidance

6.2.7. As there is no applicable national guidance, the UK Department for Environment, Food and Rural Affairs (Defra)[26] guidance, referred to in this document as LAQM.TG(16), has been used where

[26] Defra (2018). Part IV: The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG (16).

appropriate in the assessment presented herein. This guidance abides by EU regulations and forms part of best practice for conducting air quality assessments.

Guidance on the Assessment of Dust from Demolition and Construction

6.2.8. As there is no applicable national guidance, this guidance[27] published by the Institute of Air Quality Management (IAQM) provides a suitable method to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified. This guidance abides by EU regulations and the assessment approach is considered part of best practice.

Design Manual for Roads and Bridges (DMRB), Sustainability and Environment Appraisal LA105 Air Quality 2019[28]

6.2.9. As there is no applicable national guidance, Highways England technical guidance on how to assess, report and mitigate anticipated air quality impacts arising from highways schemes has been used to assess the air quality effects arising from modal shift from road to rail, as a result of the Project. The air quality assessment presented in this Chapter uses this guidance as advice for the operational phase.

NATIONAL STANDARDS

Turkish Air Quality Standards

6.2.10. Since 2019 Turkey has adopted a set of framework principles in its Environmental Law which set out to preserve and improve air quality through a variety of regulations.

6.2.11. The Regulation on the Assessment and Management of Air Quality (2008, Official Gazette No: 26898) is based on EU Directives 96/62/EC, 99/30/EC, 2000/69/EC, 2002/3/EC and 2004/107/EC, establishing the main principles and procedures for the preservation of air quality.

6.2.12. The Regulation on the Control of Air Pollution from Heating Sources (2005, Official Gazette No: 25699) and the Regulation on the Control of Industrial Air Pollution (2009, Official Gazette No: 27277) are sector-specific regulations governing air pollution with a focus on the activity it originates from.

6.2.13. The Regulation on the Control of Industrial Air Pollution (2014, Official Gazette No: 29211) sets forth the principles for the control of soot, smoke, dust, gas, steam and aerosol emissions as a result of industrial and energy production. Environmental permits are mandatory for the establishment and operation of enterprises with air emissions and are issued subject to the Permit and Licence Regulation.

[27] Institute of Air Quality Management (Version 1.1 Updated June 2016). Guidance on the Assessment of Dust from Demolition and Construction.
[28] Highways England (2019). Design Manual for Roads and Bridges (DMRB), Sustainability and Environment Appraisal LA105 Air Quality.

6.3 ASSESSMENT METHODOLOGY

SCOPE

6.3.1. The scope of the assessment reflects the potential impacts of the Project, and the availability of relevant high quality and reliable data.

6.3.2. The primary focus of the assessment is the construction phase, given the potential for significant dust generation during construction. The Project is likely to result in a modal shift in journeys away from road-based trips (i.e. cars and buses) towards rail-based trips, which will be powered by electricity generated by the national grid, resulting in an overall decrease in vehicular NOx and PM_{10} emissions.

6.3.3. The operational effects upon air quality arising from the Project are expected to be limited, due to the likely overall decrease in road-based emissions and the limited localised emissions that will arise from the increase in grid-powered rail journeys. The impact of the Project on greenhouse gas emissions arising from the increased load to the electricity grid are discussed in **Chapter 14: Climate Change**.

6.3.4. As such, this assessment has adopted a quantitative approach to assessing the impacts arising during construction of the Project, whereas the operational effects are assessed qualitatively.

6.3.5. The scope of the assessment includes consideration of the potential impacts on local air quality resulting from:

- Construction activities, in the form of:
  - Dust and particulate matter generated by on-site activities during the construction phase; and
  - Increases in pollutant concentrations as a result of exhaust emissions arising from construction traffic and plant.
- Operational activities, in the form of:
  - Decreases in overall pollutant emissions as a result of modal shift from road traffic to rail traffic; and
  - Changes in human exposure to dust generated by rail and brake wear as a result of rail alignment.

6.3.6. The assessment will comprise:

- A desk-based assessment of existing industrial activity along the Project with the potential to emit PM_{10};
- Monitoring of baseline PM_{10} at 4 locations on the Project, where increased PM_{10} emissions are likely;
- A review of existing air quality data for the area surrounding the Project, including data from Turkish Government and the National EIA for the Project (2017);
- An IAQM construction dust assessment along the Project, including the indicative construction compounds;
- Desk study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality, and a review of the alignment for the Project to establish the location of new sensitive receptors;

- Analysis of the traffic data generated for the Project as well as the Turkish emissions factors, including workup of emissions savings;
- Project-wide emissions calculation of pollutants with and without the Project during operation; and
- Receptor counts across a range of exposure intervals.

METHODOLOGY

6.3.7. The focus of this assessment are impacts arising due to the generation and increased dispersion of construction dust. Despite their potential to significantly increase ambient pollutant concentrations (of PM_{10} in particular), the effects will be temporary in nature and concentrations will likely return to ambient levels upon completion of the construction works.

6.3.8. Due to the substantial spatial extent of the study area it was important to consider different impacts at different locations along the Project.

6.3.9. The primary source of NO_2 is anticipated be construction vehicle and plant equipment emissions, of which sources will be focused around construction compounds, this is discussed further in Section 6.5.32. Similarly, PM_{10} emissions will likely increase around these construction compounds as construction works and vehicle movements will generate dust (PM_{10}) through demolition, excavation, construction and trackout[29]. Demolition would only be required at the construction compounds when they are being set up, demolition would be otherwise be restricted to expropriation corridor. Emissions from construction activities are temporary, it has been assumed that stockpiles of excavated material would remain onsite for periods less than 3 months, with stockpile dust release also unlikely to extend beyond this. Therefore, ambient concentrations are expected to return to existing levels after completion of the construction phase.

6.3.10. The primary effect of the Project during operation is expected to be modal shift of vehicles from road-based journeys to rail-based journeys, leading to a reduction in car, bus and Heavy-Duty Vehicles (HDVs) journeys and therefore emissions, particularly concerning PM_{10} and NO_2 along local road links.

6.3.11. The secondary effects of the Project during operation include changes in human exposure to PM_{10} and heavy metals, caused by rail and brake wear and increased rail activity associated with the Project, including locations where the new alignment in not adjacent to the existing railway. However, since electrified rail contributes near negligible amounts of PM_{10} and releases of heavy metals from wear are also likely to be insignificant during the operational phase, this is unlikely to result in a significant air quality effect.

6.3.12. A negligible increase in PM_{10} is anticipated along the length of the Project once it has been completed. A decrease in PM_{10} is expected along the existing railway, which is expected to offset negligible increase along the length of the Project. The Project will require an increase in load to the electrical grid, which itself will be associated with emissions to air. Due to the electrical power contributions being sourced from across the electrical grid, of which some generation sources are outside the study area, it is not possible to directly assess the impact of this additional load on

[29] the movement of dust and dirt from a construction onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.

pollutant concentrations with the study area. The climatic impact of the Project is discussed further in **Chapter 14: Climate Change**.

Construction Phase

6.3.13. An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology published by the IAQM; the available information for the Project provided by the Client and Project Team; and, professional judgement.

6.3.14. The IAQM methodology assesses the risk of potential dust and PM_{10} impacts from the following four sources: demolition; earthworks; general construction activities and track-out. It accounts for the nature and scale of the activities undertaken for each source, and the sensitivity of the area to an increase in dust and PM_{10} levels, to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined.

6.3.15. In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to site access routes. Impacts could occur immediately around routes used by vehicles to access the Project and in the vicinity of the Project. Specific numbers of vehicles and plant associated with the construction phase has not yet been determined. Therefore, a qualitative assessment of the impact of construction vehicles and plant on local air quality has been undertaken using professional judgement, and consideration of the following:

- The number and type of construction traffic and plant likely to be generated by this phase of the Project;
- The number and proximity of sensitive receptors to the Project and along the likely routes to be used by construction vehicles; and
- The likely duration of the construction phase and the nature of the construction activities undertaken.

6.3.16. The IAQM dust risk assessment is typically undertaken where there are: ‘human receptors’ within 350m of the Project, or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the construction camp entrance(s); and/or ‘ecological receptors’ within 50m of the Project, or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the construction camp entrance(s). It is within these distances that the impacts of dust soiling and increased particulate matter in the ambient air will have the greatest impact on local air quality at sensitive receptors.

Operational Phase

Calculation of Overall Emissions

6.3.17. The Project impacts overall emissions of NOx and PM_{10} due to the modal shift of passenger and freight movements from road-based travel (car or bus and HDV movements for passenger and freight respectively) to rail-based travel. Emissions from road-based travel occur at the source (i.e. from the petrol or diesel combustion within vehicle engines), whereas the electrified rail network draws power from the national grid. Project-wide emissions were calculated using the Project traffic

data, assumptions on vehicle emission rates, and assumptions on emission rates arising from electricity generation.

Traffic Data

6.3.18. Traffic data comprising the transport of passengers and freight were produced for "with Project" and "without Project" scenarios. The data is set out in **Appendix D**, and covers:

- For the "without Project" scenario (data projected from current observations to Project opening year):
  - Expected future rail passenger travel using the existing railway in terms of passenger-km travelled;
  - Bus passenger travel as vehicle-km travelled;
  - Car passenger travel as vehicle-km travelled;
  - HDV freight as vehicle-km travelled;
  - Rail transport of freight as Net Tonne-Km (NTK); and
  - Total rail-based energy load to the national grid in GigaWatt hours.
- "With Project" scenario forecasts were based upon the predicted use of new railway by passengers and freight. This predicted use was as a consequence of potential benefits of rail over non-rail alternatives, including improved journey time and subsequent improved rail services over non-rail, For the "with Project" scenario (data projected from current observations to Project opening year, with the reduction in bus, car and HDV trips due to the modal shift to rail, and the inclusion of rail and freight travel on the Project):
  - Bus passenger travel as vehicle-km travelled;
  - Car passenger travel as vehicle-km travelled;
  - HDV freight as vehicle-km travelled;
  - Rail passenger travel in terms of passenger-km travelled;
  - Rail transport of freight as Net Tonne-Km (NTK); and
  - Total rail-based energy load to the national grid in GigaWatt hours.

Vehicle Emission Rates

6.3.19. Car based vehicle emission rates were calculated using road emissions data and car-based travel data for the whole of Turkey in 2018. The data used in determining vehicle emission rates, set out in **Appendix D**, were taken from the air pollutant emissions dataviewer[30] (for regional emissions from road transport), and passenger travel data for Turkey[31&32]. All datasets represent the latest available data for Turkey (2018 emissions and travel statistics).

[30] European Environment Agency (2020). Air Pollutant Emissions Data Viewer (Gothenburg Protocol, LRTAP Convention) 1990-2018. Available at: https://www.eea.europa.eu/data-and-maps/dashboards/air-pollutant-emissions-data-viewer-3 (Accessed 06/07/20).
[31] OECD (2020). Passenger Transport. Available at: https://data.oecd.org/transport/passenger-transport.htm (Accessed 06/07/20).
[32] KNOEMA (2019). Modal Split of Passenger Transport. Available at: https://knoema.com/tran_hv_psmod/modal-split-of-passenger-transport?geo=1032720-turkey (Accessed 06/07/20).

6.3.20. There were no data available for bus and HDV emissions/travel statistics, therefore an alternative approach to the estimation of vehicle emission rates was undertaken using the Emissions Factor Toolkit (EFT) version 9.0 (published in May 2019) available on the Defra website[33]. The data was selected to align with Turkeys timescale for adoption of relevant EU standards, as detailed in 6.3.12 and 6.3.22. The EFT allows for the calculation of emission factors arising from all vehicle types for all years between 2017 and 2030 for the UK, including a breakdown of the traffic by Euro class. For the predictions of future year emissions, the toolkit takes into account factors such as anticipated advances in vehicle technology and changes in vehicle fleet composition, such that vehicle emissions are assumed to reduce over time.

6.3.21. As set out in a white paper published by the International Council on Clean Transportation (ICCT)[34]:

"For heavy-duty vehicles, it can be seen that Turkey has followed the EU standards timeline with only a one year delay, i.e. the Euro VI standard, which was implemented in the EU in 2014, has applied for new trucks and buses in Turkey since 2015. For light-duty vehicles, i.e. passenger cars and light commercial vehicles, the latest Euro 6 standard is mandatory for all new registrations in the EU since September 2015 and will become mandatory for all new vehicles in Turkey from 2017 onwards."

6.3.22. The EFT was produced for use in the United Kingdom, who adopted Euro 6/VI in line with the rest of the EU. As such, in accordance with the ICCT white paper, the EFT was used with a one-year delay for HDVs and buses to represent vehicle emission rates in Turkey, for example, 2018 emissions for Turkey have been estimated using 2017 emissions from the EFT.

National Grid Emission Rates

6.3.23. Emissions for the national grid were calculated using regional emissions data and power generation, including the contribution from all sources (fossil fuels, hydro, solar, wind, etc.) data for the whole of Turkey in 2018. The data used in determining these emission rates are set out in **Appendix D** and were taken from the air pollutant emissions dataviewer[7] for 2018.

Assessment of Change in Human Exposure

6.3.24. The methodology for the assessment of change in human exposure to PM_{10} from brake and rail wear during the operation of the Project follows the methodology for construction dust set out in DMRB LA105[28]. The guidance sets out the sensitivity of all receptors (human and designated ecological habitats) within 200m of all construction activity, based on the dust risk potential of the Project. The resulting receptors are assigned a sensitivity rating, based on their proximity to the Project, as pollution concentrations in general decrease exponentially with distance from the source of the pollution.

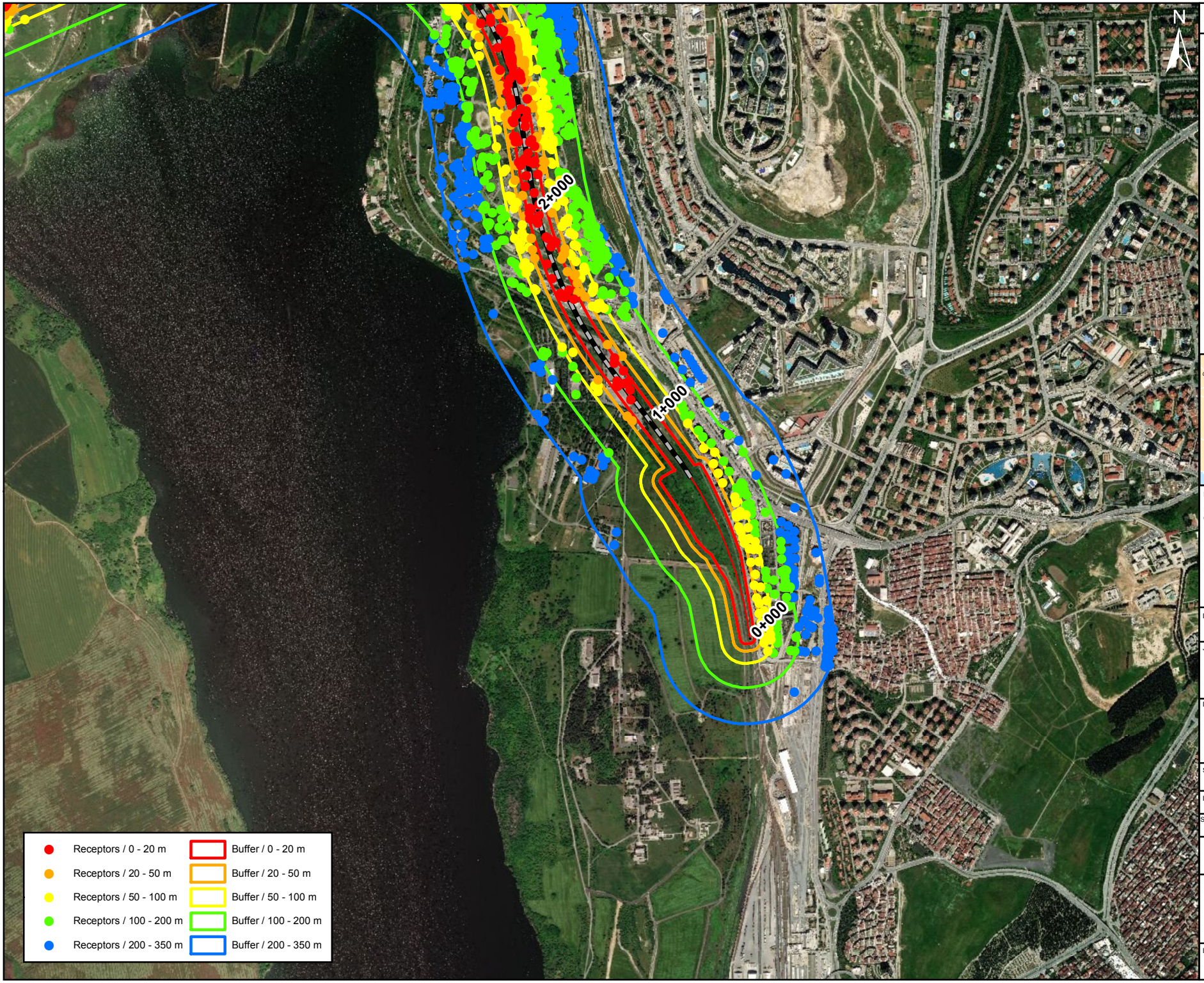
[33] Defra (2019). Emissions Factor Toolkit. Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html (Accessed 06/07/20).
[34] Peter Mock (2016). The Automotive Sector in Turkey: A Baseline Analysis of Vehicle Fleet Structure, Fuel Consumption and Emissions, ICCT White Paper.

6.3.25. A count of the number of sensitive receptors within 0-50m, 50-100m, and 100-200m increments, of both the existing rail alignment and the Project was undertaken. Each receptor was assigned a sensitivity rating to changes in PM_{10} concentrations arising from the Project.

6.3.26. Sensitive human receptors are places where the public may be exposed to pollutants resulting from activities associated with the Project. These include locations sensitive to changes in dust deposition and PM_{10} exposure as a result of changes to rail activity as a result of the Project. **Figure 6-1** below summarises the identified human receptors sensitive to PM_{10}. The detailed figure is shown in **Figure 6-1**.

6.3.27. The risk of dust generation from operation of the Project is considered to be Small (as per Table 2.58a of LA105), as emissions are limited to brake and rail wear. As such, the environmental sensitivity of sensitive receptors is as follows (Table 2.58b of LA105):

- Receptors within 0-50m – High sensitivity to operational impacts;
- Receptors within 50-100m - Low sensitivity to operational impacts; and
- Receptors within 100-200m – Low sensitivity to operational impacts.

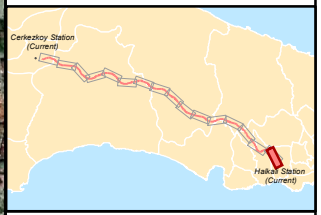


Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 6-1 - Construction Dust and Affected Receptors.mxd

THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Legend

- Proposed Railway Route
- Tunnel (TBM - Double Tube)



Note:

Information shown based on OpenStreetMap data, HOTOSM data, ESRI Imagery and Google Imagery.

Drawing Status

FINAL

Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

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AD	JW	DG	19/03/2021

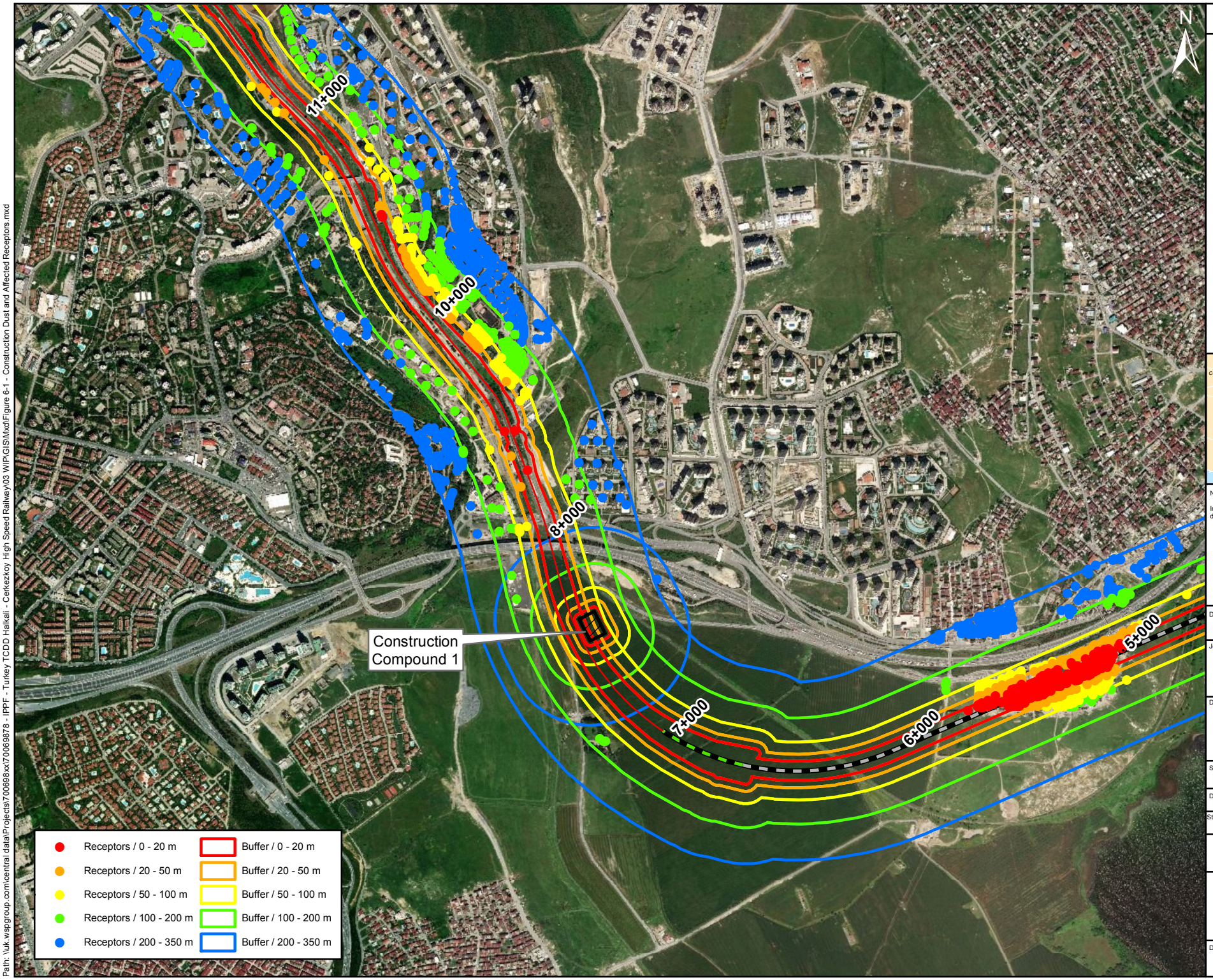
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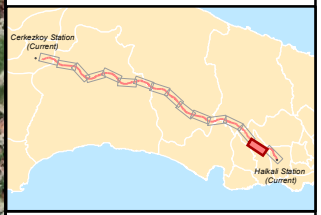
Figure 6-1 (1 / 17)



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Legend

- Proposed Railway Route
- Tunnel (TBM - Double Tube)
- Tunnel (Cut - Cover)
- Possible Construction Compounds



Note:

Information shown based on OpenStreetMap data, HOTOSM data, ESRI Imagery and Google Imagery.

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 6-1 - Construction Dust and Affected Receptors

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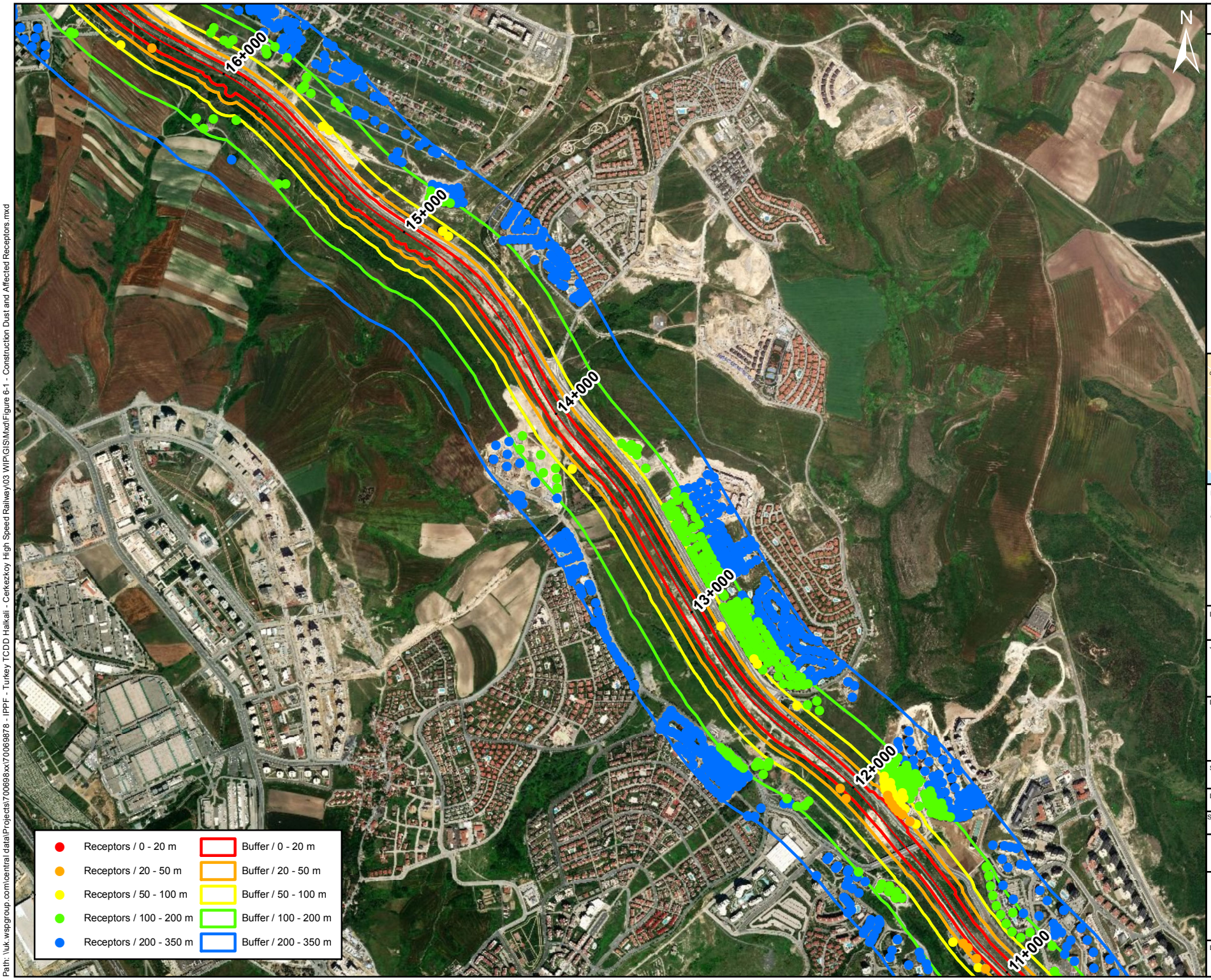
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Legend

Proposed Railway Route



Note:

Information shown based on OpenStreetMap data, HOTOSM data, ESRI Imagery and Google Imagery.

Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

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Figure 6-1 - Construction Dust and Affected Receptors

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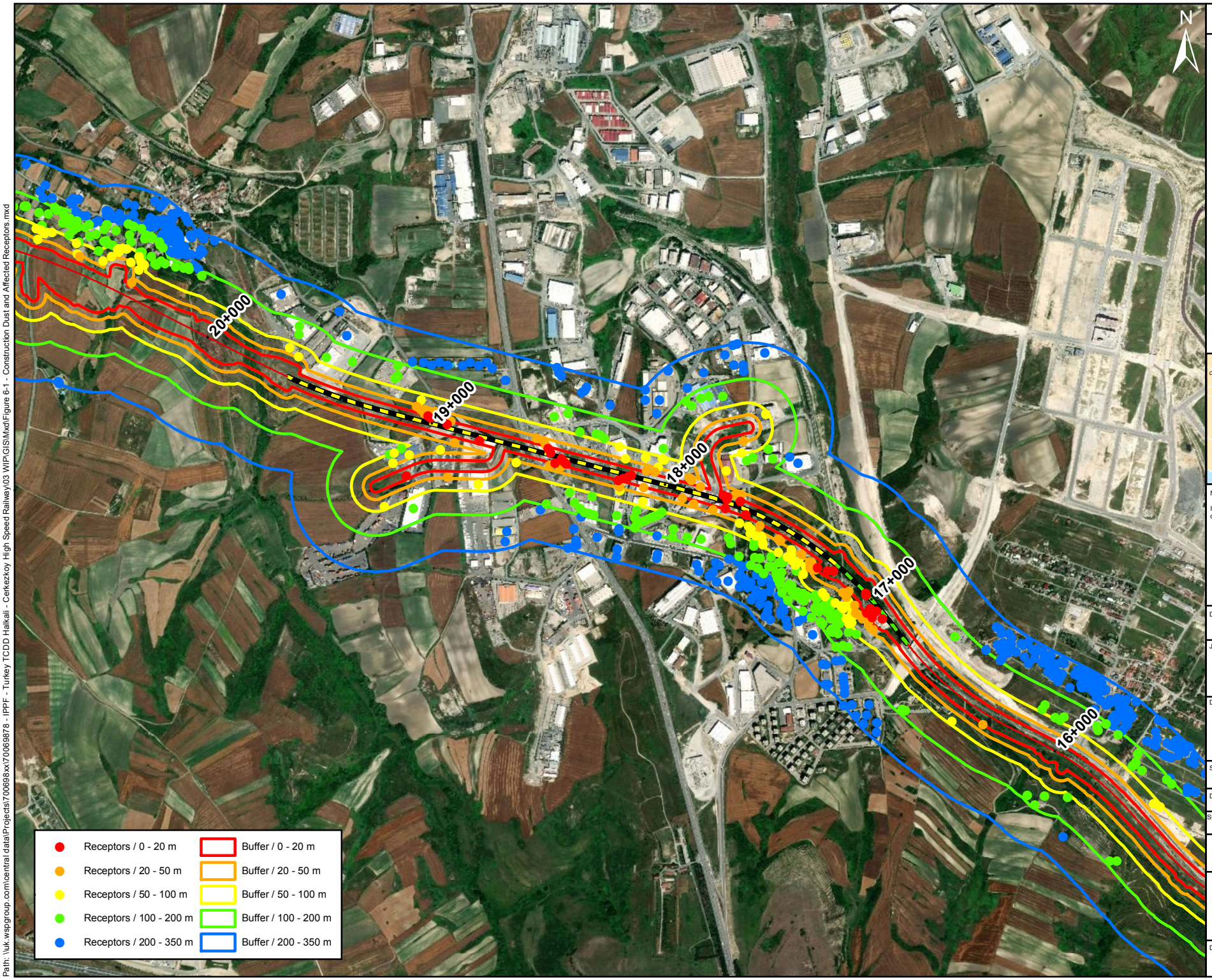
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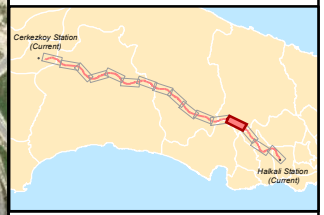
Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 6-1 - Construction Dust and Affected Receptors.mxd



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Legend

- Proposed Railway Route
- Tunnel (NATM)
- Tunnel (Cut - Cover)



Note:

Information shown based on OpenStreetMap data, HOTOSM data, ESRI Imagery and Google Imagery.

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Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 6-1 - Construction Dust and Affected Receptors

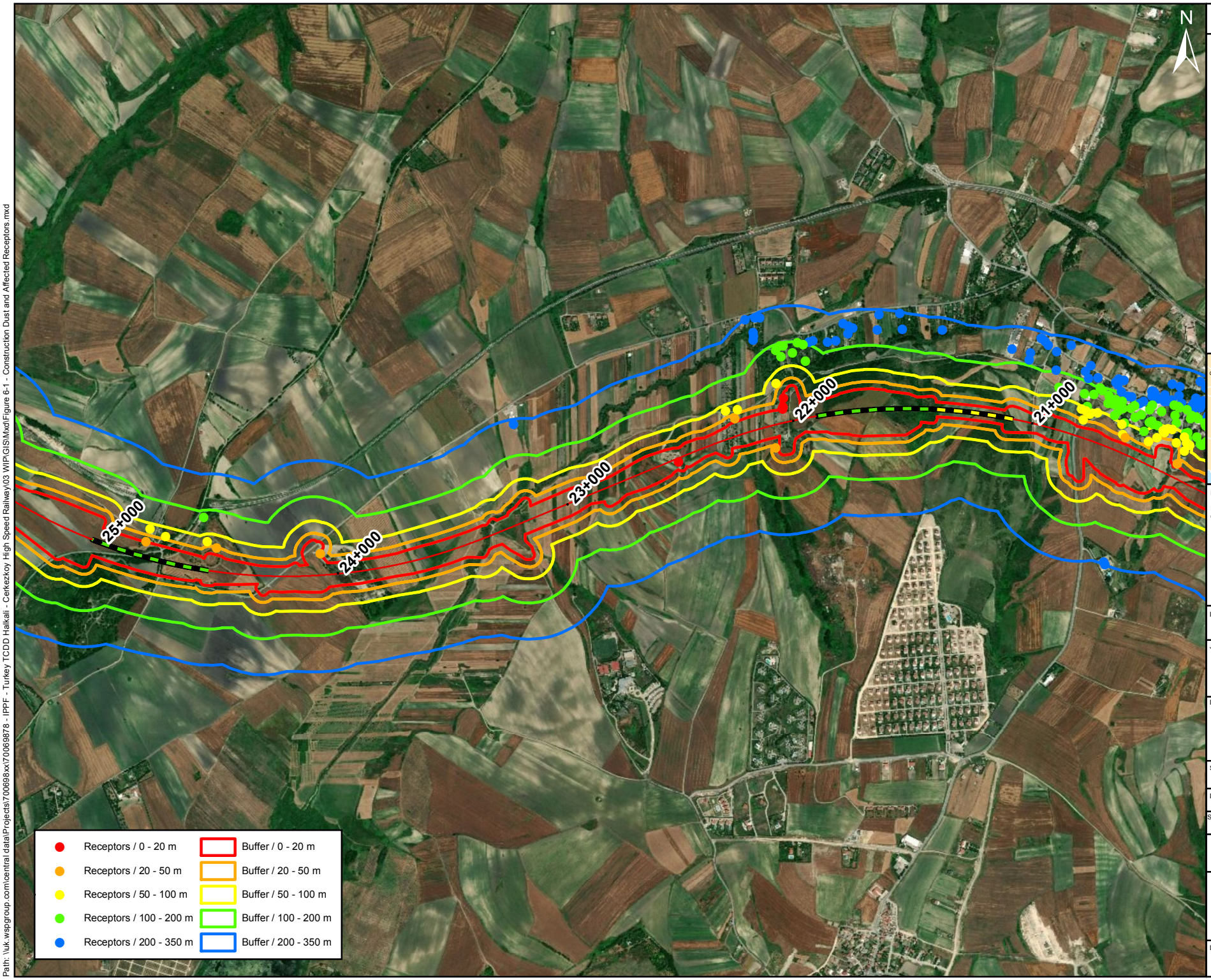
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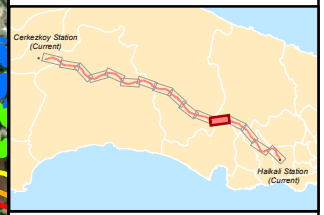
Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 6-1 - Construction Dust and Affected Receptors.mxd



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Figure 6-1 - Construction Dust and Affected Receptors

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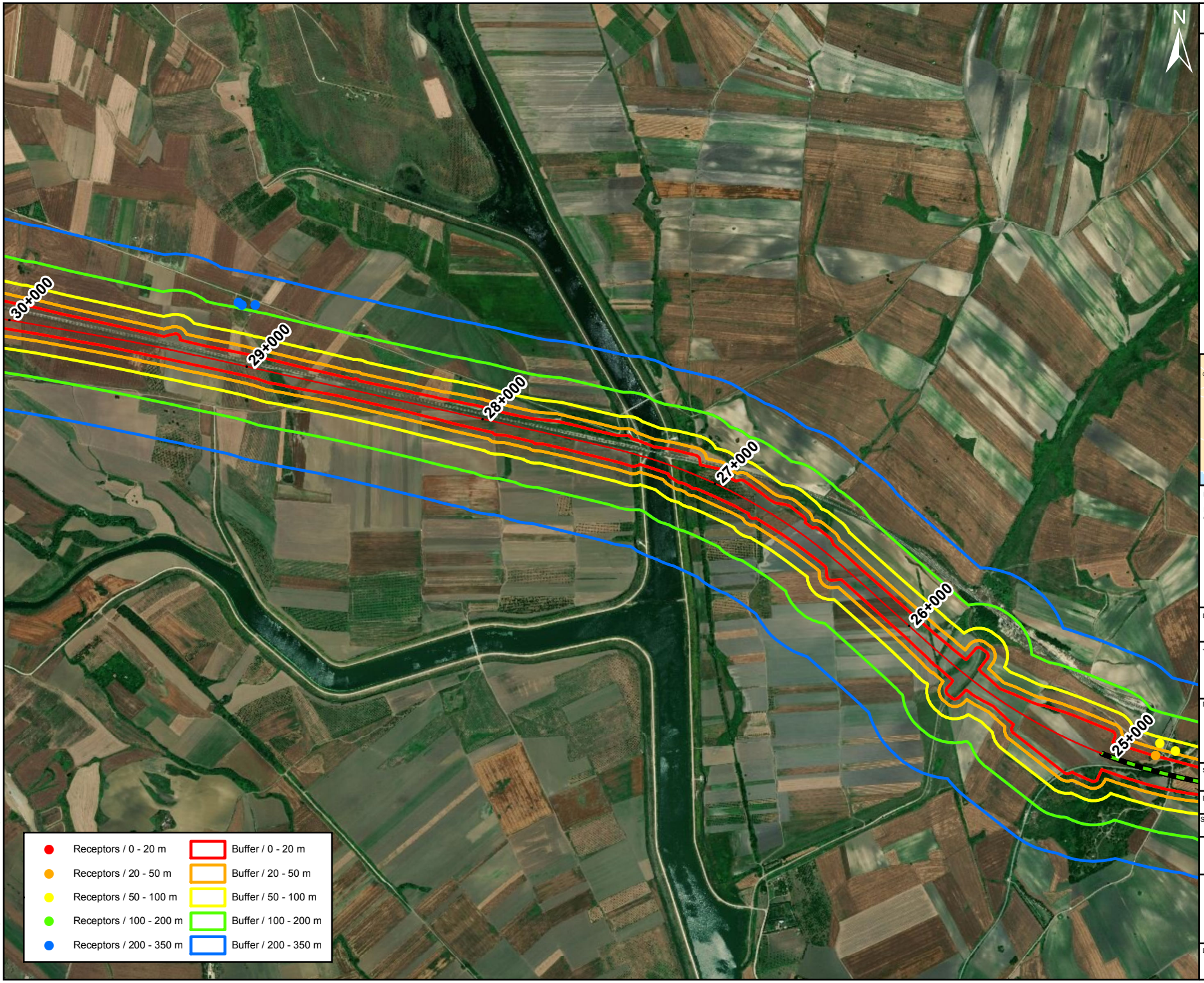
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Figure 6-1 (5 / 17)

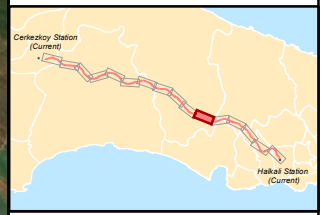
Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 6-1 - Construction Dust and Affected Receptors.mxd



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Legend

- Proposed Railway Route
- Tunnel (Cut - Cover)



Note:

Information shown based on OpenStreetMap data, HOTOSM data, ESRI Imagery and Google Imagery.

Drawing Status

FINAL

Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

1:20,000

Drawn			
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Stage 1 check	Stage 2 check	Originated	Date
AD	JW	DG	19/03/2021

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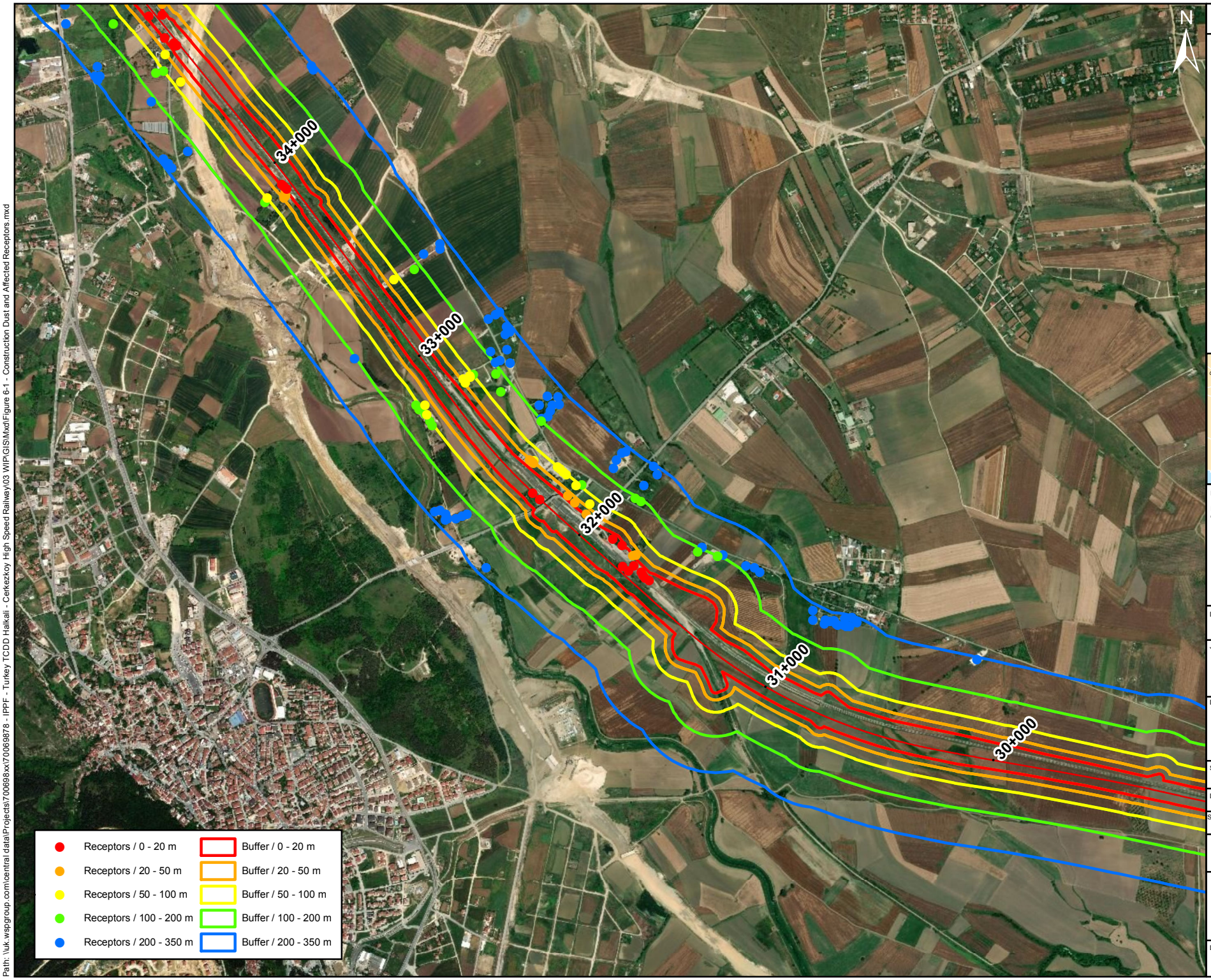
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Drawing Number

Figure 6-1 (6 / 17)

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Legend

Proposed Railway Route



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Drawing Status

FINAL

Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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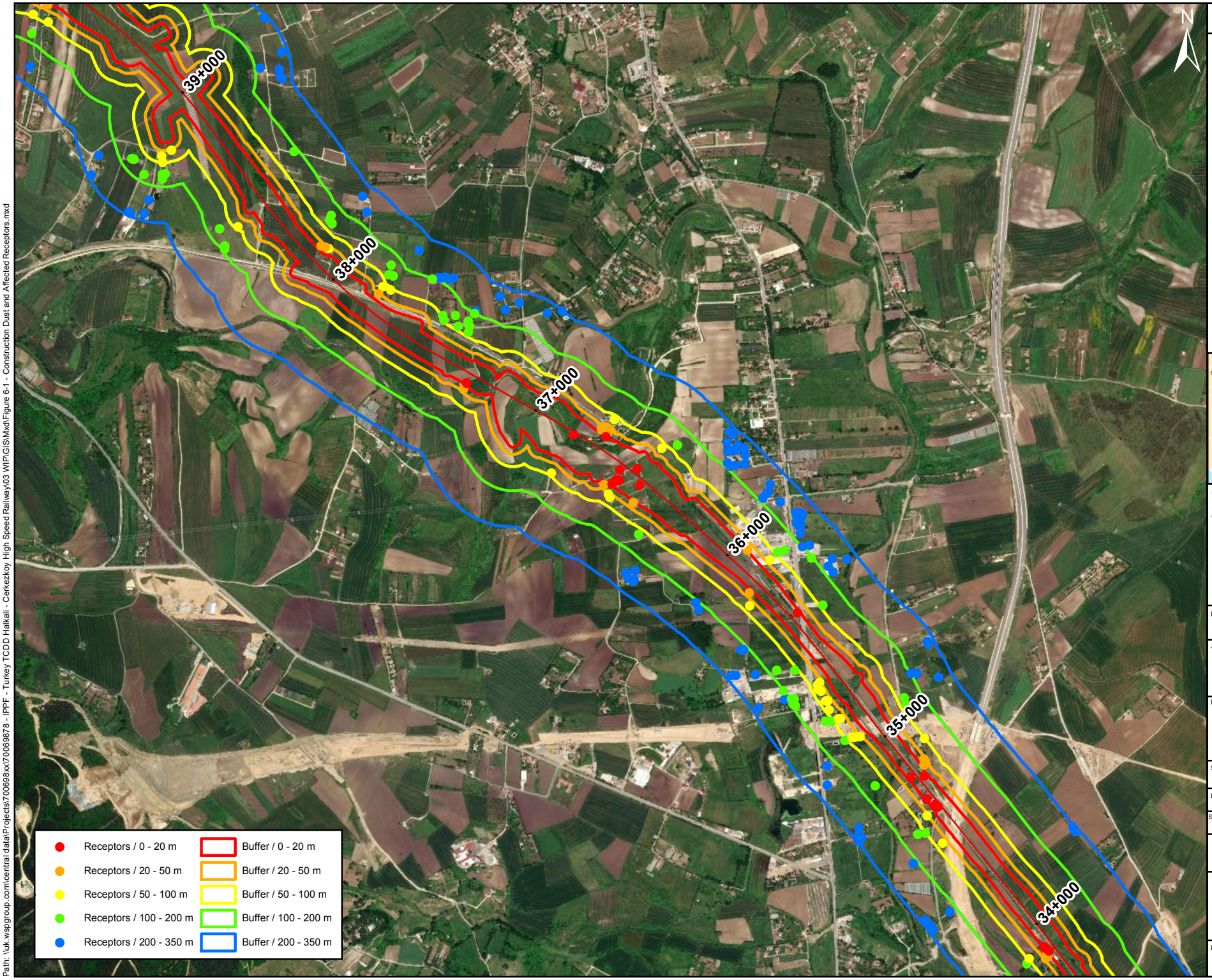
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Figure 6-1 (7 / 17)

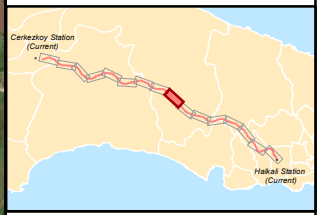
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Legend

Proposed Railway Route



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Drawing Status

FINAL

Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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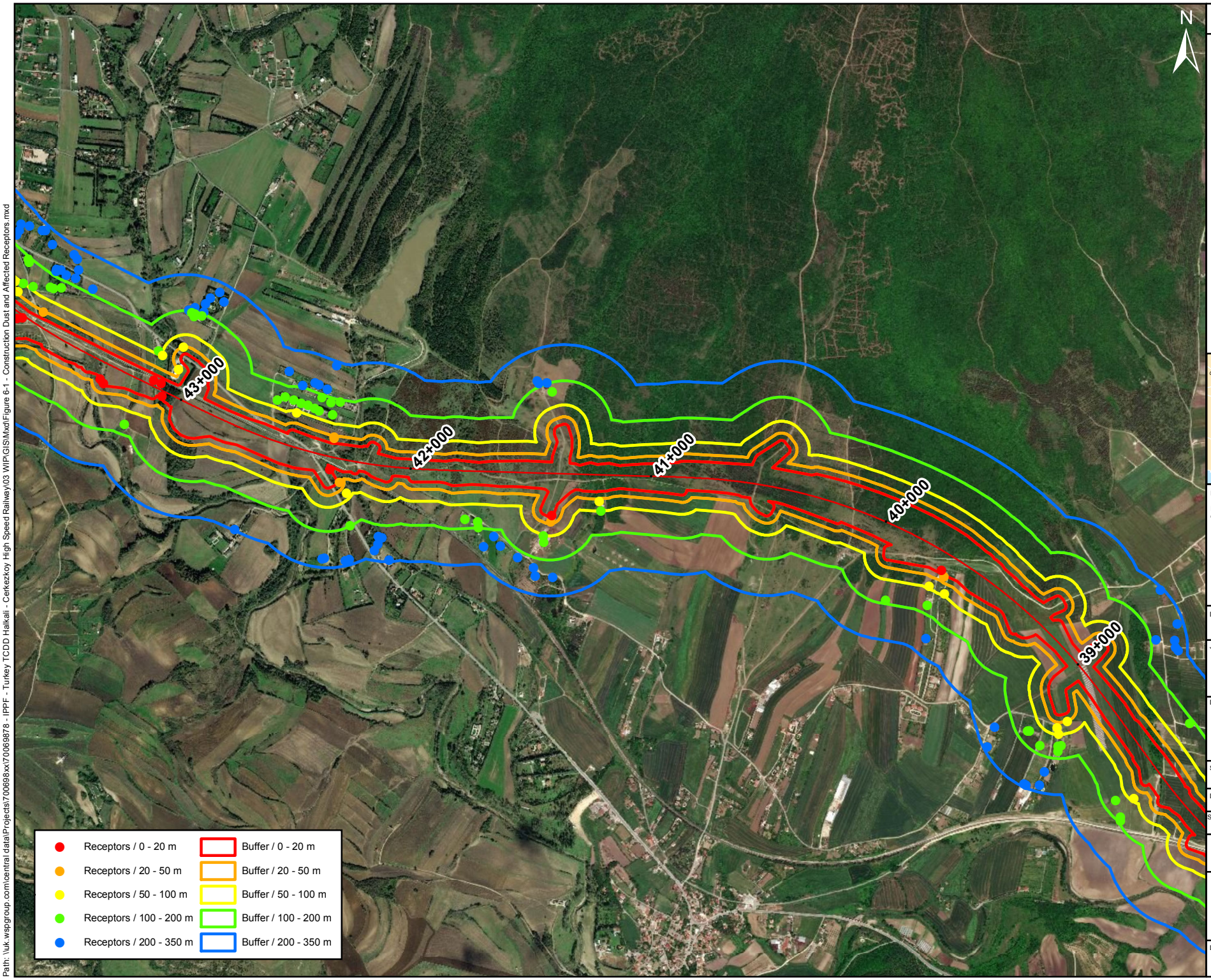
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Drawing Number

Figure 6-1 (8 / 17)

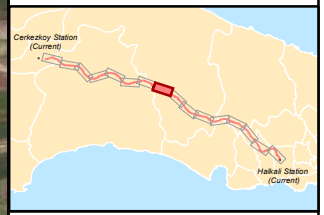
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Proposed Railway Route



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Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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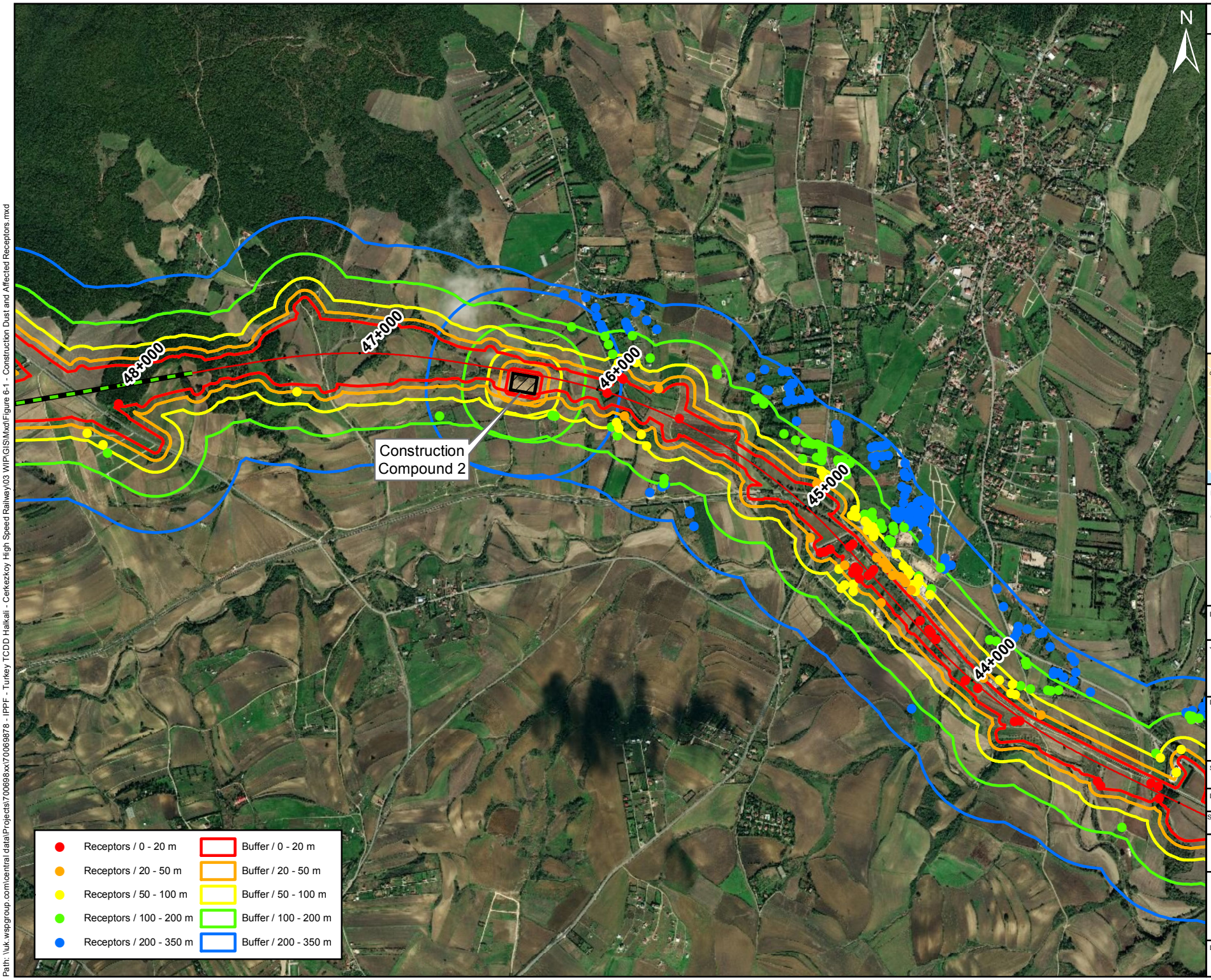
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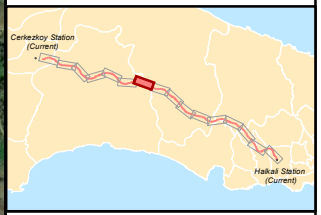
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Legend

- Proposed Railway Route
- Tunnel (Cut - Cover)
- Possible Construction Compounds



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Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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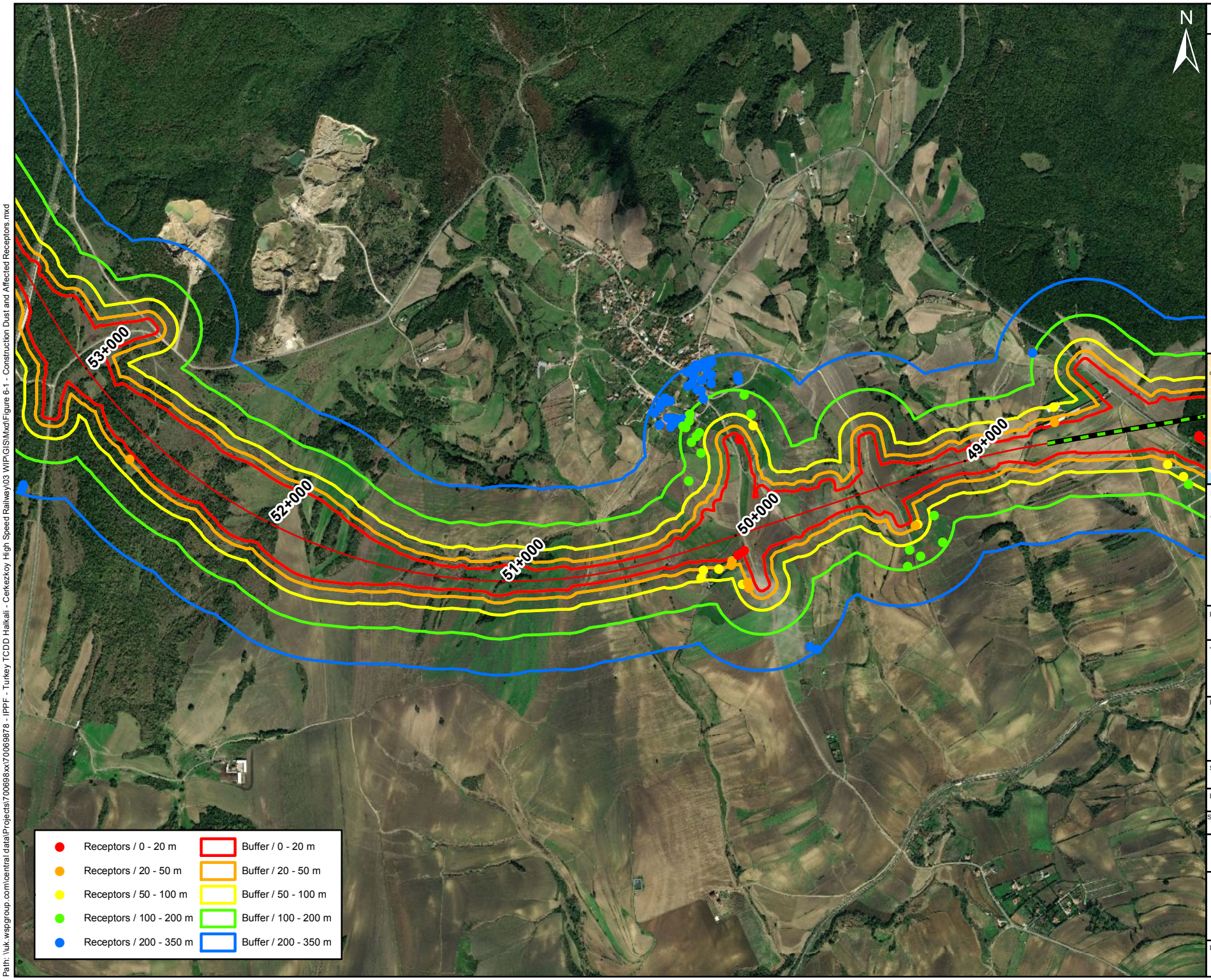
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Drawing Number

Figure 6-1 (10 / 17)

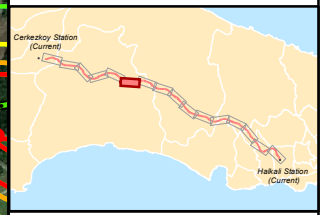
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Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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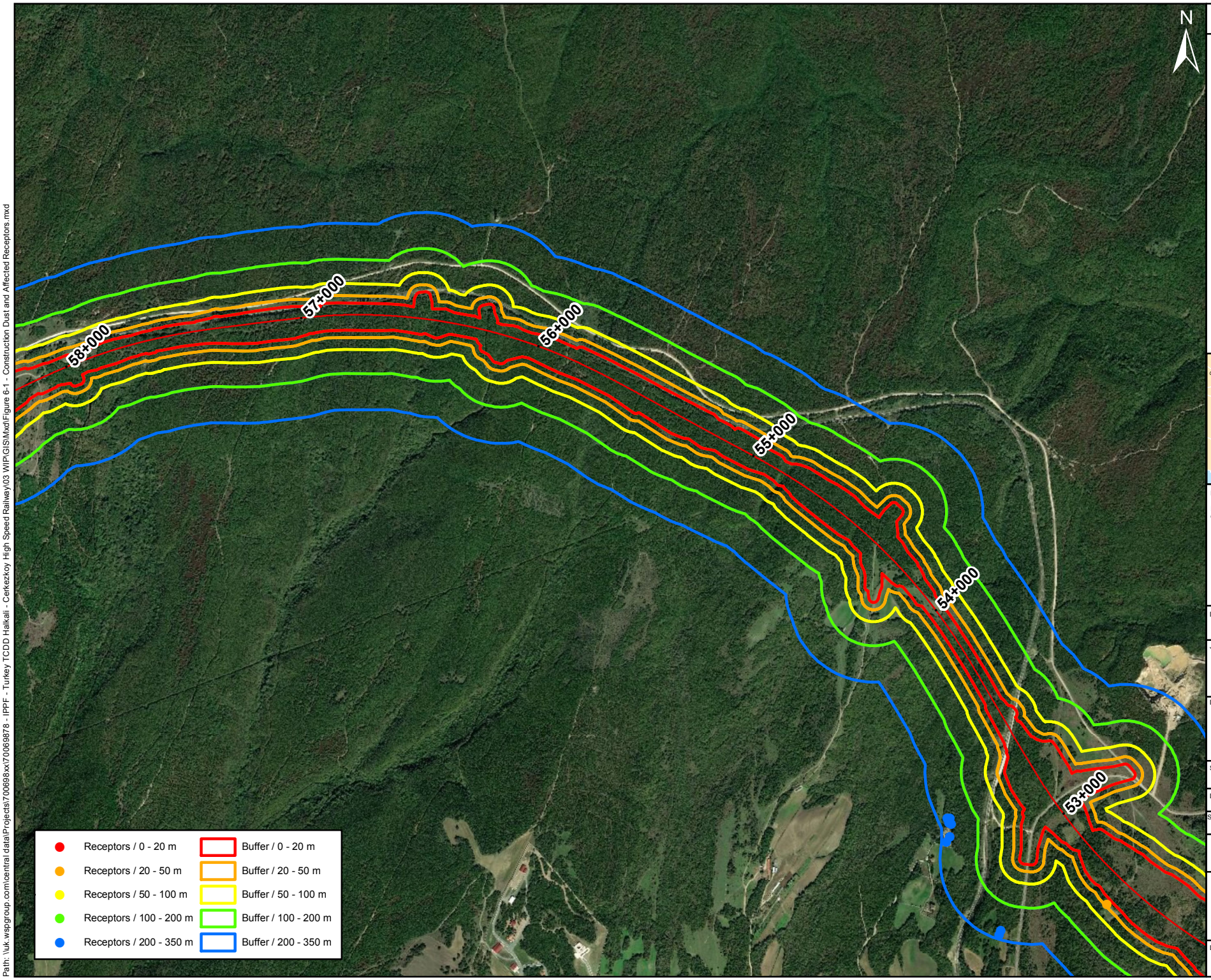
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Figure 6-1 (11 / 17)

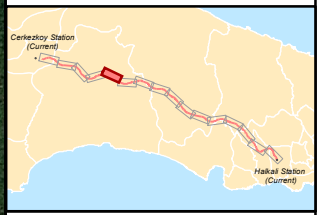
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Legend

Proposed Railway Route



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Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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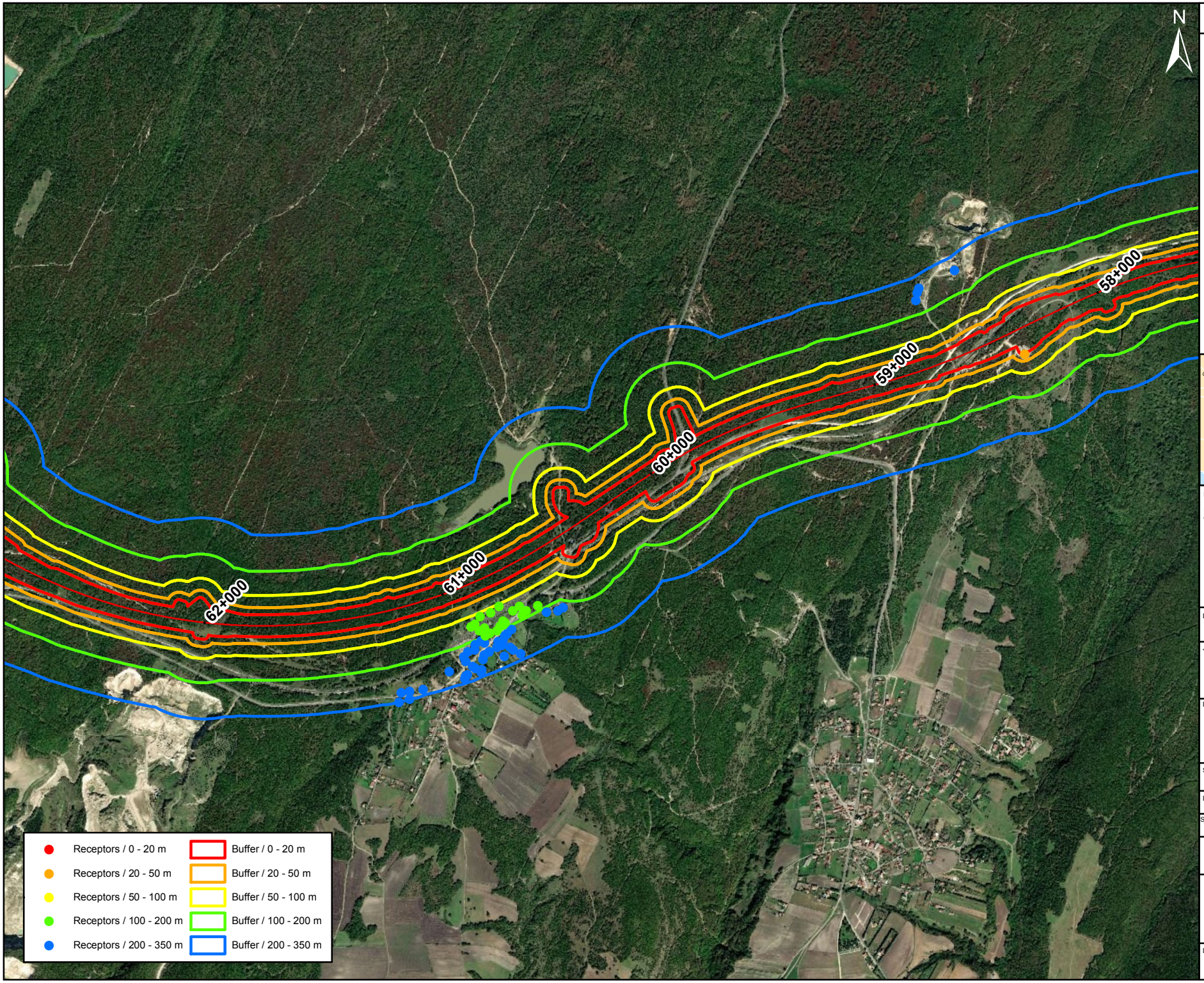
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Drawing Number

Figure 6-1 (12 / 17)

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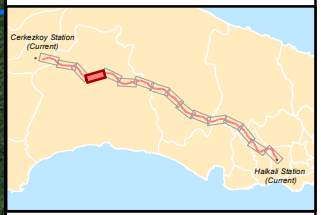


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Proposed Railway Route



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Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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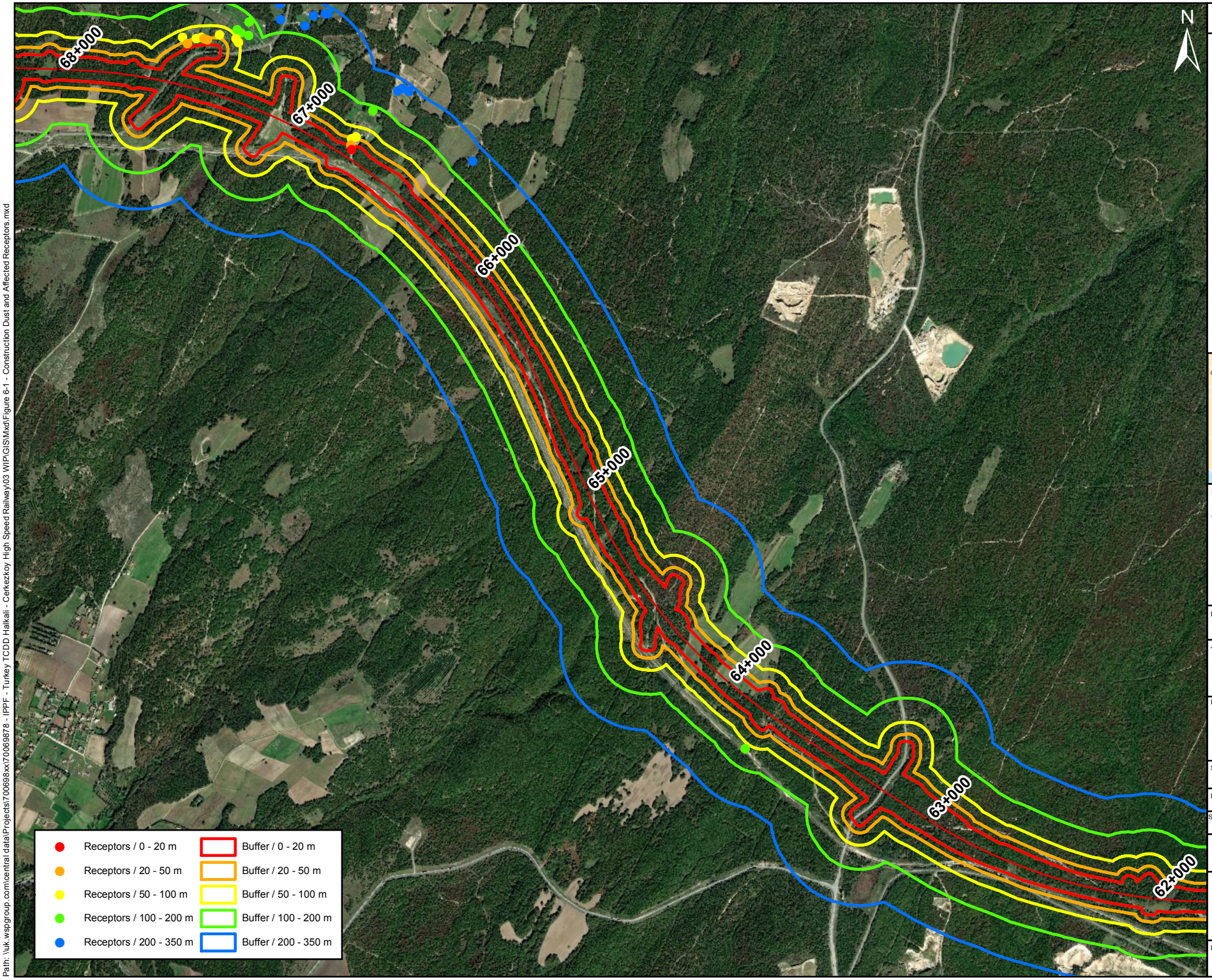
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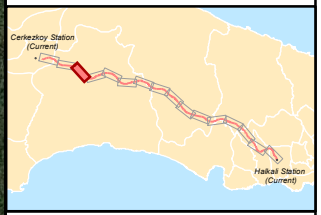
Figure 6-1 (13 / 17)



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Legend

Proposed Railway Route



Note:

Information shown based on OpenStreetMap data, HOTOSM data, ESRI Imagery and Google Imagery.

Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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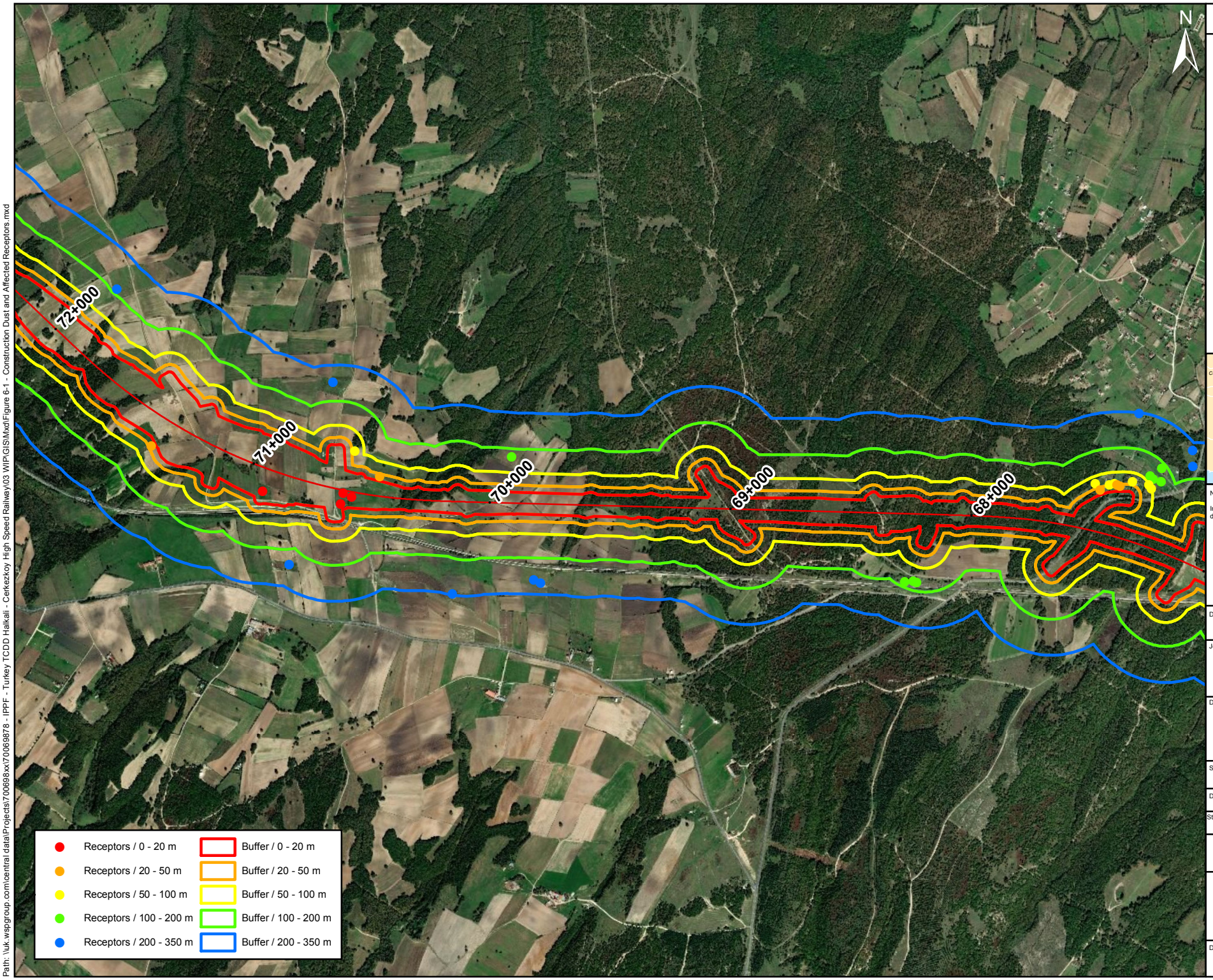
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Figure 6-1 (14 / 17)

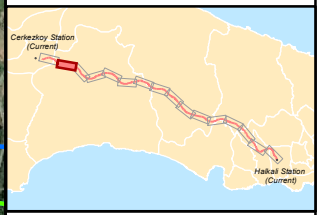
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Legend

Proposed Railway Route



Note:

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Drawing Status

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Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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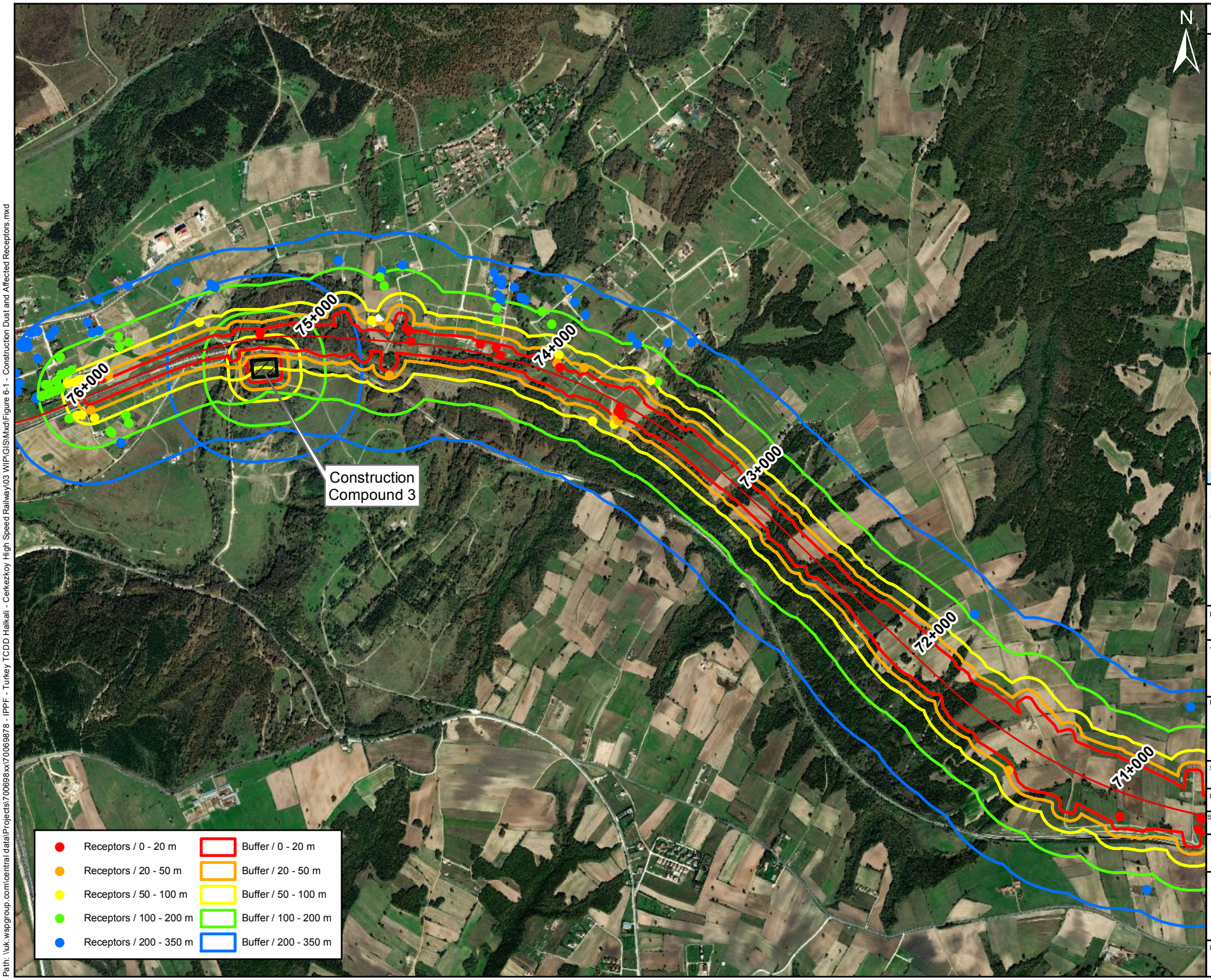
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Drawing Number

Figure 6-1 (15 / 17)

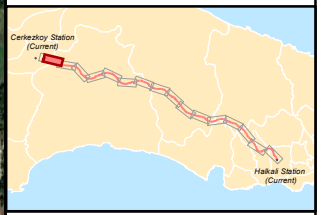
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Legend

- Proposed Railway Route
- Possible Construction Compounds



Note:

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Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 6-1 - Construction Dust and Affected Receptors

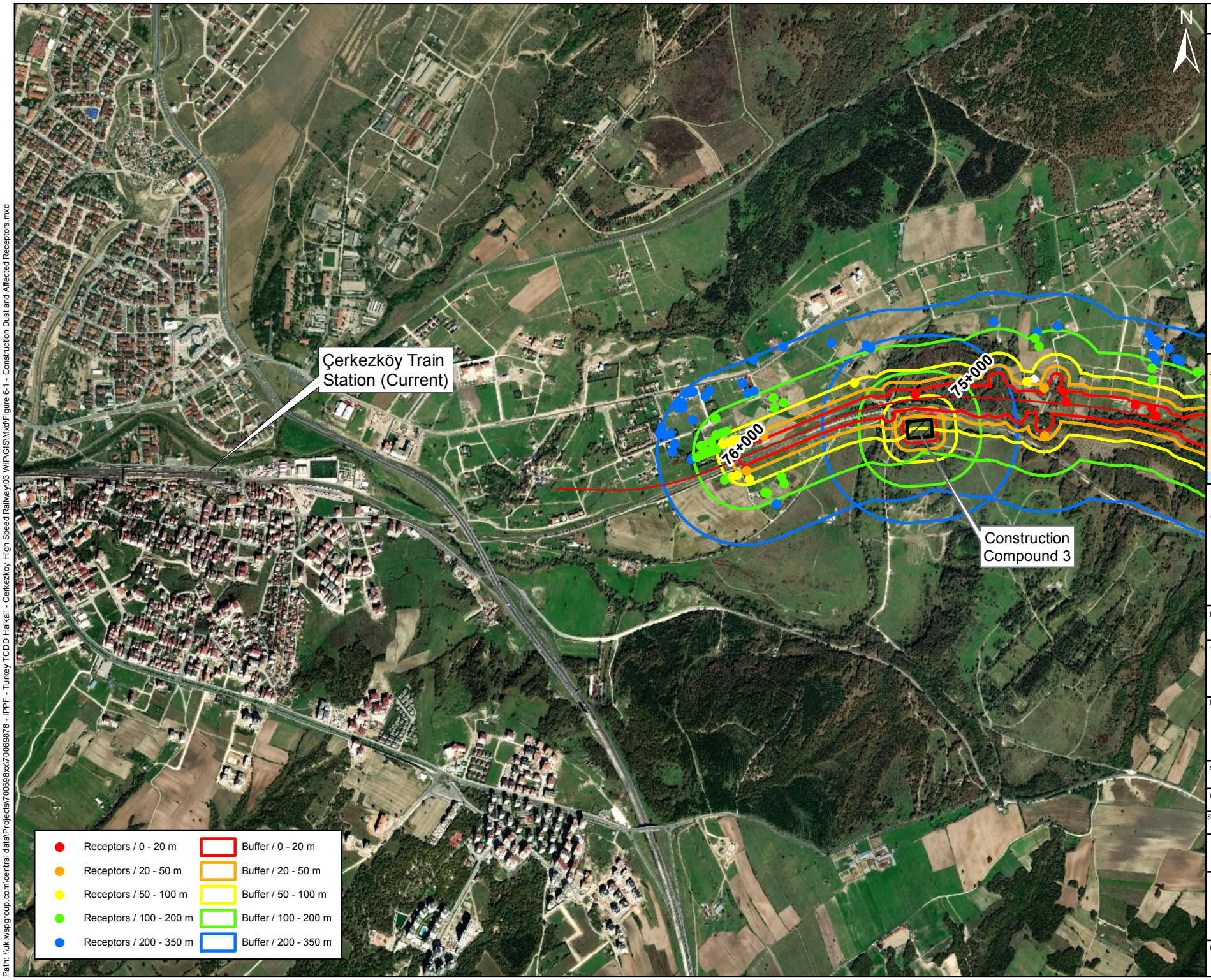
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Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 6-1 - Construction Dust and Affected Receptors.mxd

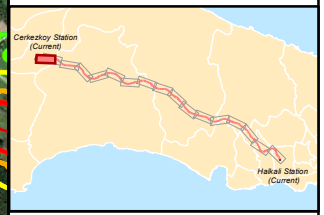


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Legend

- Proposed Railway Route
- Possible Construction Compounds



Note:

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Drawing Status

FINAL

Job Title:

HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title

Figure 6-1 - Construction Dust and Affected Receptors

Scale at A4

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AD	JW	DG	19/03/2021

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Drawing Number

Figure 6-1 (17 / 17)

Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 6-1 - Construction Dust and Affected Receptors.mxd

6.5.18. Under low wind speed conditions, it is likely that the majority of dust would be deposited in the area immediately surrounding the source. WSP has calculated that there are 4,509 high sensitivity receptors within the 350m study area surrounding the expropriation corridor and construction compounds. There are a further 481 medium sensitivity receptors within this study area. High sensitivity receptors are defined as dwellings, hospitals, schools or places where an individual will spend more than eight hours, when human health is considered. Whereas medium sensitivity receptors are places of work, or commercial buildings where individuals spend up to eight hours.

6.5.19. As previously mentioned, most of the land between Istanbul and Çerkezköy has a low population density, particularly towards the mountains near Sinekli. Çatalca is the largest town along this section of the alignment, however, it is located no closer than 1km from the Project. Contrastingly, the section of the Project near Istanbul, passes by locations with a high density of medium sensitivity and high sensitivity receptors within 350m of the track. **Table 6-6** summarises the numbers of receptors at increasing distances from the expropriation corridor.

Table 6-6 - Receptors with Distance from the Expropriation Corridor and Indicative Construction Compounds

Distance from Expropriation Corridor and Indicative Construction Compounds (m)	Highly Sensitive Receptors	Medium Sensitive Receptors	Total
0 - 20	386	26	412
20 - 50	355	54	409
50 - 100	559	68	627
100 - 200	1,128	120	1,248
200 - 350	2,081	213	2,294
Total	4,509	481	4,990

Trackout

6.5.20. In order to quantitatively assess dust emissions arising from trackout, the IAQM construction dust methodology requires number of receptors to be identified within 20m and 50m from the roadside of construction compound access roads, and up to 500m from each construction compound.

6.5.21. At the time of this assessment, the specific construction access locations were unknown, so it was not possible to identify the precise number of receptors that would be sensitive to trackout. Nevertheless, using professional judgment, it is possible to obtain a realistic approximation of the Projects impact on receptors from trackout. This was undertaken based on the scale of the Project in relation to the IAQM construction dust criteria for the calculation risk of exposure.

6.5.22. It is probable that the routes to the construction compounds are likely to be located within 20m of approximately 15 highly sensitive receptors, these are predominately focused around the indicative location for construction compound 1. Accounting for the Project as a whole, it is entirely likely that greater than 10 highly sensitive receptors will be within 20m of all construction site the trackout routes. This number of highly sensitive receptors is high enough to trigger the IAQM criteria for a significant risk from dust soiling as a direct result of trackout emissions. This risk of dust soiling shall be addressed within the construction phase mitigation measures.

Human Health

6.5.23. Due to the lack of detailed information on construction activities for the Project, a worst-case scenario has been assumed, which is that receptors along the length of the project (not only limited to areas surrounding the construction compound) are sensitive to trackout emissions.

6.5.24. Where the Project passes close to areas of multiple residences, such as Esenyurt and Bahçeşehir, a large number of the buildings are multiple occupancy flats. A conservative estimate is that greater than 100 sensitive receptors are likely to be either located within 20m of the routes to the construction compounds, or within 500m from the construction compound themselves. This magnitude of receptors triggers the IAQM construction dust risk criterion for medium risk to human health from trackout emissions.

Ecological

6.5.25. The Project is located within the Northern Marmara biogeographic region. The dominating environmental characteristics and land use is characterised by approximately three distinct zones; the urbanised/ suburban landscape of Istanbul; the semi-rural agriculture zone covering the central section of the Project; and the more rural western extent of the Project, which is characterised by a more rural environment consisting of small settlements, woodland and scrub.

6.5.26. IBA mainly-wetland Important Bird Areas (IBA) are directly crossed by the Project, these are of international designation and encompass smaller national designations. IBA's form a subset of the Key Biodiversity Areas (KBA's) that have been embedded in various international agreements and safeguard mechanisms and serve as indicators for the biodiversity policy framework of the Convention on Biological Diversity (CBD) and the Sustainable Development Goals (SDGs). The IBA designation triggers the IAQM criteria for a highly sensitive ecological receptor. Ecological receptors and their assigned IAQM sensitivity are summarised in **Table 6-7**.

Table 6-7 - Sensitive Ecological Receptors

Site Name	Designation (and IUCN category)	IAQM Sensitivity Criteria
Büyükçekmece Lake	Important Bird Area (IBA) (IUCN cat. IV)	High
Küçükçekmece Basin	IBA (IUCN cat. IV)	High
Terkos Basin	Key Biodiversity Area (KBA)	High

Site Name	Designation (and IUCN category)	IAQM Sensitivity Criteria
	The KBA also encompasses four nationally designated areas: Kasatura Körfezi (Bay) – Natural Protection Area (IUCN cat. Ia) Istanbul-Catalca-Cilingoz – Wildlife Development Area (IUCN cat. IV) Cilingoz – Nature Park (IUCN cat. V) Camlikoy – Nature Park (IUCN cat. V)	

6.5.27. The Project will intersect all the above sensitive habitats therefore triggering the IAQM criterion for a high-risk area; namely that a highly sensitive ecological receptor is within 20m of the Project. The IAQM methodology is based upon assessing the impacts at the most sensitive receptors, therefore only impacts at highly sensitive ecological receptors are considered within this stage of the assessment.

Sensitivity of the Study Area

6.5.28. Taking the above into account and following the IAQM construction dust risk assessment methodology, the sensitivity of the area to changes in dust and PM_{10} has been determined for each of the construction activities considered. The results are shown in **Table 6-8**.

6.5.29. Since there are many high and medium sensitivity receptors within 350m of the Project, the impacts at these receptors are already enough to trigger the IAQM criteria for high risk exposure. This level of risk cannot be obtained through low risk receptors, which is why high and medium risk receptors are the focus for this assessment.

Table 6-8 - Sensitivity of the Study Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Medium	Medium	Medium	Medium
Ecological	High	High	High	High

Risk of Impacts

6.5.30. The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. **Table 6-9** provides a summary of the risk of dust impacts for the proposed Project. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 6-9 - Summary Dust Risk Table to Define Site Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High Risk	High Risk	High Risk	High Risk
Human Health	High Risk	Medium Risk	Medium Risk	Medium Risk
Ecological	High Risk	High Risk	High Risk	High risk

6.5.31. The Project is likely to present a high risk to nearby receptors for all aspects of construction works. Across demolition, earthworks and construction receptors sensitive to dust soiling and negative ecological effects will be in the high-risk category. Human health is also considered to be at high risk from the Project, however only for demolition activities. For earthworks and construction, the risk is lessened to 'medium'.

Construction Vehicles and Plant

6.5.32. The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the site access.

6.5.33. Focusing on construction compound 1 (see **Figure 6-3**), it is anticipated that construction traffic will access the site via Beypinarlar Cd where there are 14 households within 20m of site access roads, with three more within 50m. Construction compound 2 is situated in an industrial region on the outskirts of Istanbul, and will likely be accessed first via the E80, then via O-3 Kuzey Yanyolu, and then via an unnamed local road. An alternative route to access this compound would be towards the south via Amasyalilar Cd and then on to the local unnamed road. There are no receptors within 50m of potential access roads for this site. Lastly concerning construction compound 3, it is situated just to the east of Çerkezköy and likely to be accessed via local unnamed roads, with only a single household within 20m of potential access routes up to 500m away.

6.5.34. Due to the size of the Site, it is considered likely that the construction traffic will be low in comparison to the existing traffic flows on these roads. Although the location of the construction compounds is indicative, the **ESMP** requires the Contractor to select locations away from sensitive receptors, so this assessment is considered appropriate.

OPERATION PHASE

Project Emissions

6.5.35. The results of the Project-wide emissions calculations are presented in **Table 6-10**.

Table 6-10 - Emissions Summary Between 2026 - 2055 For NO_x and PM_{10} With and Without the Project (all emissions are presented in tonnes/yr)

Year	NOx Emissions				PM_{10} Emissions			
	With Project	Without Project	Difference	%	With Project	Without Project	Difference	%
2026	31.7	37.2	-5.5	-15%	1.21	1.80	-0.59	-33%
2027	33.2	39.0	-5.8	-15%	1.26	1.88	-0.62	-33%
2028	34.9	41.0	-6.1	-15%	1.33	1.97	-0.65	-33%
2029	36.7	43.1	-6.4	-15%	1.40	2.07	-0.67	-33%
2030	55.7	89.7	-34.1	-38%	2.12	5.37	-3.25	-61%
2031	57.9	94.0	-36.1	-38%	2.20	5.66	-3.45	-61%
2032	60.2	98.6	-38.4	-39%	2.29	5.96	-3.67	-62%
2033	62.7	103.4	-40.8	-39%	2.38	6.28	-3.89	-62%
2034	65.3	108.6	-43.3	-40%	2.48	6.62	-4.14	-63%
2035	68.0	114.0	-46.1	-40%	2.59	6.98	-4.40	-63%
2036	70.9	119.8	-49.0	-41%	2.69	7.37	-4.68	-63%
2037	73.9	126.0	-52.1	-41%	2.81	7.78	-4.97	-64%
2038	77.1	132.5	-55.4	-42%	2.93	8.22	-5.29	-64%
2039	80.5	139.5	-59.0	-42%	3.06	8.69	-5.63	-65%
2040	84.0	146.8	-62.8	-43%	3.20	9.19	-5.99	-65%

Year	NOx Emissions				PM_{10} Emissions			
	With Project	Without Project	Difference	%	With Project	Without Project	Difference	%
2041	85.9	150.2	-64.4	-43%	3.27	9.41	-6.14	-65%
2042	87.8	153.7	-66.0	-43%	3.34	9.63	-6.29	-65%
2043	89.7	157.3	-67.6	-43%	3.41	9.86	-6.45	-65%
2044	91.7	161.0	-69.3	-43%	3.49	10.10	-6.61	-65%
2045	93.7	164.7	-71.0	-43%	3.56	10.34	-6.78	-66%
2046	95.8	168.6	-72.8	-43%	3.64	10.59	-6.94	-66%
2047	97.9	172.5	-74.6	-43%	3.72	10.84	-7.12	-66%
2048	100.1	176.6	-76.5	-43%	3.81	11.10	-7.29	-66%
2049	102.3	180.7	-78.4	-43%	3.89	11.37	-7.48	-66%
2050	104.6	184.9	-80.4	-43%	3.98	11.64	-7.66	-66%
2051	106.9	189.3	-82.4	-44%	4.07	11.92	-7.85	-66%
2052	109.3	193.7	-84.4	-44%	4.16	12.21	-8.05	-66%
2053	111.7	198.2	-86.5	-44%	4.25	12.50	-8.25	-66%
2054	114.2	202.9	-88.7	-44%	4.34	12.80	-8.46	-66%
2055	116.8	207.7	-90.9	-44%	4.44	13.11	-8.67	-66%

6.5.36. The Project will result in a reduction in localised emissions along the road network between Çerkezköy and Halkali. As a consequence, the reduction in localised emissions will improve air quality in the urbanised areas along the road network between Halkali and Çerkezköy. This in turn will have a positive impact on residential areas, including some high-density residential areas, which are within close proximity to major roads, between Istanbul and Çerkezköy, through reducing their exposure to air pollutants.

6.5.37. This is offset in part by an increased load to the national grid (it is not possible to determine where these emissions are likely to occur and so for the purpose of this assessment these emissions have been considered at a Project-wide level). As can be seen in **Table 6-10**, in every year from 2026 to 2055, overall emissions of NO_x and PM_{10} decrease with the Project. The magnitude of the reduction increases over time as more road-based journeys are converted to rail-based journeys.

Receptor Count

6.5.38. The results of the receptor count for both the existing railway alignment and the Project are shown in **Table 6-11**.

Table 6-11 - Operational Receptor Count for the Existing Railway and the Project

Distance (m)	Sensitivity	Existing Railway Alignment Receptor Count	Project Receptor Count	Difference
0 – 50	High	219	480	241
50 - 100	Low	411	618	207
100 - 200	Low	1,044	1,122	78
Total		1,674	2,200	526

6.5.39. Operational impacts arising from the Project are limited to changes to human PM_{10} exposure as a result of emissions from increased brake and rail wear. This effect is likely to be of secondary importance compared to reduction in emissions associated with the Project.

6.5.40. **Table 6-12** shows an increase in likely human exposure to operational impacts arising from the Project, with increases to the number of receptors located within each band considered. The cause of this increase is the alignment of the Project through densely populated regions surrounding Istanbul. However, this increase will be offset by a large section of this rail section being contained within a tunnel 6.35 km in length, and by a reduction in human exposure through Inceğiz. As the number of rail movements will increase upon Project completion, receptors surrounding the Project are likely to experience a minor increase in PM_{10} exposure to emissions arising from the Project.

6.5.41. As can be seen in the local monitoring undertaken for the Project, shown in **Figure 6-2**, PM_{10} concentrations in rural areas such as Inceğiz are well below the annual mean air quality standard for PM_{10}. As such the Project is unlikely to result in any significant operational air quality effect.

6.5.42. Towards Istanbul, background concentrations are high or exceed the air quality standards, as shown in **Figure 6-2**. However, the elevated concentrations in this region are likely due to non-rail-based

sources. This indicates that, whilst the area is of higher risk of exceedance of air quality standards, it is unlikely that the Project or other rail activity in the area are significant contributors to poor air quality.

6.5.43. Data taken from Air Pollutant Emissions Data Viewer[30] for the whole of Turkey suggests that the rail contribution to PM_{10} emissions is minimal. Road traffic makes up 77% of transport-based emissions, whereas emissions from rail are substantially lower, contributing 2% of total transport emissions.

SUMMARY

6.5.44. During construction, the Project will result in an increase of emissions of PM_{10}, arising from construction activity. Any increase in emissions resulting from the construction of the Project are temporary (for example, lasting for the duration of the construction period), with ambient concentrations returning to existing levels shortly after completion of works. Providing the construction is completed using good practice, and with the application of controls tailored to the construction processes utilised for the Project, it is unlikely that the Project would give rise to any significant air quality effects. The Contractor will be required to apply the proposed guidance and control measures during construction, to avoid the risk of a significant air quality effect.

6.5.45. During operation, the Project results in a reduction in local emissions and a reduction in overall NO_x and PM_{10} emissions across the Project. There is an increase in human exposure to PM_{10} emissions arising from brake and rail wear during the operational phase of the Project. However, PM_{10} emissions arising from the operation of the Project represent a very small portion of overall emissions. Overall it is unlikely that the Project would give rise to any significant operational air quality effects.

6.6 MITIGATION AND ENHANCEMENT MEASURES

CONSTRUCTION PHASE

6.6.1. Based on the air quality assessment results, mitigation will be required. The mitigation measures have been set out in the **ESMP** for the Project, and the mitigation measures are also given below. The Contractor will be required to develop the **ESMP** into the **CESMP** prior to the start of the construction phase.

General Dust Management

- A **Dust Management Plan** (**DMP**), including measures to control other emissions, in addition to the dust and PM_{10} mitigation measures given in this report, will be developed and implemented, and approved by the Istanbul and Tekirdağ Metropolitan Municipalities. The DMP will include a requirement for monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.

Site Location and Management

- Construction compounds are required to be located away from sensitive receptors to minimise any adverse impact of dust nuisance and exposure as a result of construction activities.
- All dust and air quality complaints will be recorded by the Contractor and causes identified. Appropriate remedial action will be taken in a timely manner with a record kept of actions taken including of any additional measures put in-place to avoid reoccurrence.
- The complaints log will be made available to the Istanbul and Tekirdağ Metropolitan Municipalities on request.

- Any exceptional incidents that cause dust and/or air emissions, either on or offsite will be recorded, and action taken to resolve the situation recorded in the logbook.
- Regular liaison meetings with other high-risk construction sites within 500m of the Project boundary should be held, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.

Monitoring

- Daily on-site and off-site inspections will be undertaken, where receptors (including roads) are nearby to monitor dust. The inspection results will be recorded and made available to the Istanbul and Tekirdağ Metropolitan Municipalities when requested. This will include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100m of site boundary, with cleaning to be provided if necessary.
- Regular site inspections to monitor compliance with the **DMP** will be carried out, inspection results recorded, and an inspection log made available to the Istanbul and Tekirdağ Metropolitan Municipalities when requested.
- The frequency of site inspections will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations will be agreed with the Istanbul and Tekirdağ Metropolitan Municipalities. Where possible baseline monitoring should start at least three months before work commences on a construction phase commences.
- Dust and particulate monitoring will be focused around areas with multiple sensitive receptors within close proximity to the works (e.g. Esenyurt, Bahçeşehir and Catalca). Dust and particulate monitoring will also provide information which would be used to reduce dust exposure of the health of construction workers in the event of an exceedance of the short-term EU Air Quality Standard.

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- Where practicable, erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Where practicable, fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover appropriately.
- Where practicable, cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicle operators switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
- A maximum-speed-limit of 25 kph on surfaced and 15 kph on unsurfaced haul roads and work areas should be imposed. If long haul routes are required these speeds may be increased with

suitable additional control measures provided, subject to the approval of the Contractor (nominated undertaker) and with the agreement of the local authority, where appropriate.

- A **Construction Traffic Management Plan** will be produced to manage the sustainable delivery of goods and materials.
- A **Construction Travel Plan** that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) will be prepared, to minimise disruption and emissions brought about locally by avoidable construction related car journeys.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for enabling effective dust or particulate matter suppression or mitigation on-site and on surrounding construction corridors, using non-potable water, this is likely to be sourced from groundwater.
- Ensure an adequate supply of non-potable water trucks which can carry out dust suppression in the areas around construction activities and construction access routes.
- Use enclosed chutes conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste management

- Avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure effective water suppression is used during demolition operations. Handheld sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Where practicable, only remove the earthworks cover in small areas during work and not all at once, noting that this is likely to only be possible on the construction compounds.
- Stockpile surface areas should be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up.

- Where practicable, windbreak netting/screening should be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between Project and the surroundings.
- Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction.
- During dry or windy weather, material stockpiles and exposed surfaces should be dampened down using a water spray to minimise the potential for wind pick-up.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
- All construction plant and equipment should be maintained in good working order and not left running when not in use.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being in frequent use.
- Avoid dry sweeping of large areas
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site logbook.
- Where practicable, hard surfaced haul routes should be installed, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Access gates to be located at least 10m from receptors where possible.

6.6.2. The **Construction Traffic Management Plan** will set out mitigation measures to control construction traffic, including criteria to ensure the Contractor selects suitable access and haul routes for the site traffic, in order that works are planned to enable them to be delivered safely and, in a manner, which minimises congestion, road safety risks, disruption for all road users and local access. A summary of these measures includes:

- Works on the road network to be limited to avoid occupying more than one single lane, therefore always enabling one-way traffic, where practicable;
- Temporary roads to be provided around the construction areas, where necessary;

- Where temporary roads are necessary, roadblocks will be provided to prevent access to the areas where construction activities are taking place;
- Temporary vehicle bridges to be constructed with sufficient capacity for the existing vehicle usage; and
- The Contractor will ensure that road users are informed of any works which will affect access;

6.6.3. The above measures will ensure that construction traffic does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc.) where possible, and that vehicles are kept clean (through the use of wheel washers, etc.) and that loads are covered when on public highways. Timing of large-scale vehicle movements to avoid peak hours on the local road network will also be beneficial.

OPERATIONAL PHASE

6.6.4. The Project results in an overall decrease in pollutant emissions attributable to traffic emissions associated with the operation phase of the Project. It can be expected that these decreases in overall emissions will have a positive impact in local air quality where traffic emissions are reduced as a result of the Project. Whilst the load to the national grid increases, overall regional emissions of both NO_x and PM_{10} have been shown to decrease. As such, no mitigation measures are required.

6.7 RESIDUAL EFFECTS

6.7.1. With the application of the mitigation measures described above and further detail in the **ESMP** the generation of dust and PM_{10} during construction will not result in any significant air quality effect. Residual effects of are considered to be **Negligible (not significant)**.

6.7.2. The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **Negligible (not significant)**, following the enforcement of the mitigation techniques.

6.7.3. The Project is predicted to cause an overall reduction in operational NO_x, PM_{10} and $PM_{2.5}$ emissions. There are no residual effects anticipated.

6.8 SUMMARY

6.8.1. An assessment of the potential impacts on local air quality from construction activities has been carried out for this phase of the Project using the IAQM construction dust assessment methodology. This identified that there is a high risk of dust soiling impacts and a medium risk of increases in particulate matter concentrations due to construction activities. However, through good site practice and the implementation of suitable mitigation measures, as set out in the CESMP, the effect of dust and PM_{10} releases will be reduced. The residual effects of dust and PM_{10} generated by construction activities on air quality are therefore considered to be negligible. A summary of the effects is shown in **Table 6-12** overleaf.

6.8.2. A qualitative assessment of the potential impacts during the operational phase was undertaken using the EFT to predict the changes in NO_x, NO_2 and PM_{10} concentrations that would occur due to predicted traffic reductions as a result of the Project.

6.8.3. The results show that the Project would cause an overall reduction in pollutant emissions. The residual operational effects of the Project are considered to be negligible for both NO_2 and PM_{10}.

6.8.4. Furthermore, it is considered that the Project will comply with national and local policy for air quality.

Table 6-12 - Summary of Potential Impacts, Effects and Mitigation (Air Quality)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Construction Dust	Monitored PM_{10} concentrations low throughout the study area	Construction	Increased PM_{10} concentrations, dust soiling.	Risk of exposure to higher concentrations of PM_{10}	Best practice methods - Summarised in Section 6.6.	Negligible (not significant)
Operational Emissions	Monitored exceedances of air quality standards for PM_{10} and NO_2 in Istanbul and Çerkezköy (PM_{10} only)	Operation	Impacts to human and ecological health	Negligible (not significant)	N/A	Negligible (not significant)