Istanbul New Airport ESIA

Proposed Project and Project Description

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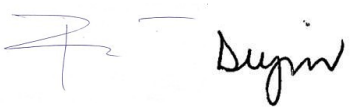
Project Manager/Director (signature):	Valéry Votrin/ Denise Wright 
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3 Project Description

3.1 Introduction

This chapter provides a description of the physical characteristics and operational elements of the INA Project, including earthworks, construction and operational arrangements. This chapter considers the following principal elements of the INA Project:

- On-site and off-site infrastructure;
- Design and technical specifications;
- Earthworks and construction management;
- Site layout and built form; and
- Operational considerations.

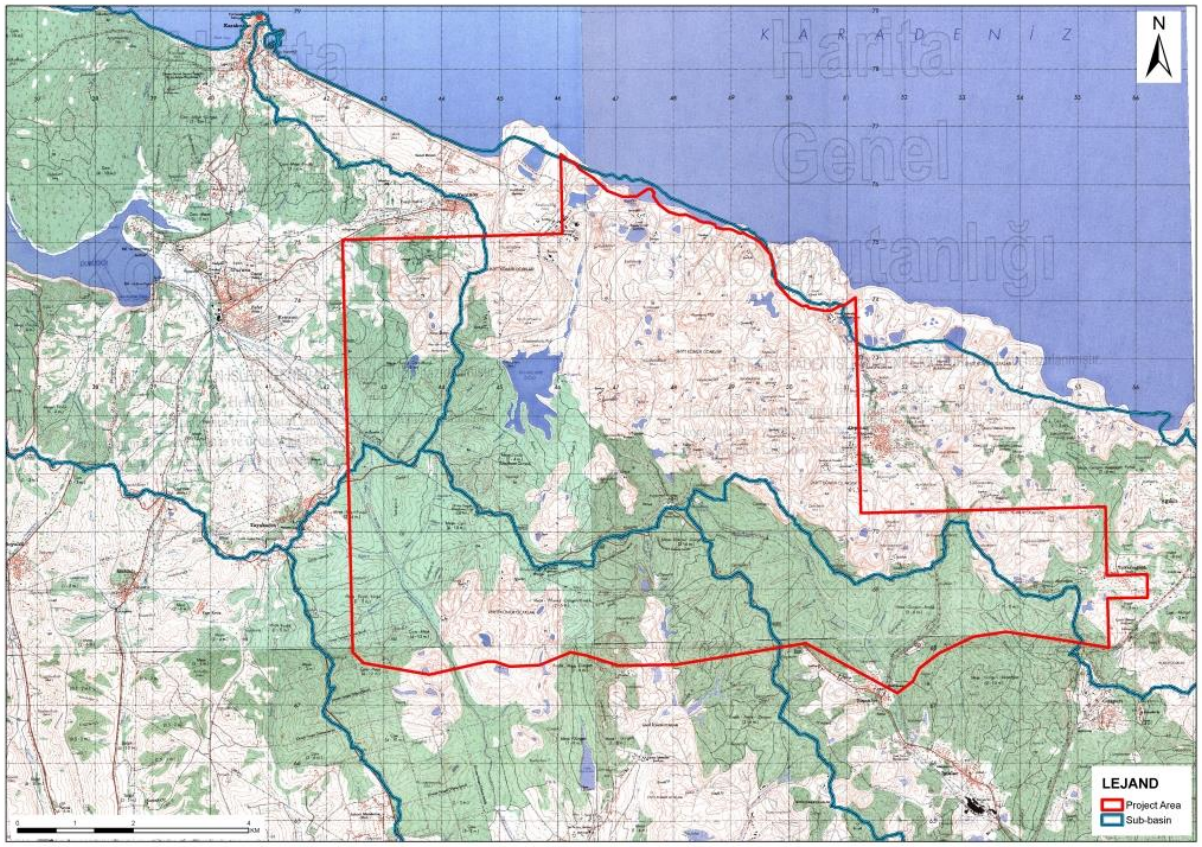
The content of this chapter is based primarily on information contained in the Project Master Plan (2013), the amended Project Master Plan with new runway layouts (2015) and the Project Conceptual Design (Ref. 3.1, Ref. 3.2, and Ref. 3.3).

3.1.1 Project Setting and Geography

The Project Area (Figure 3.1) is located on the Black Sea coast. The proposed airport Site is located 35 km north-west of the existing Ataturk International Airport and 40 km north-west from the centre of the City of Istanbul. The Turkish government has taken the decision to expand the airport capacity of the region by commissioning the construction of a new airport that will replace the existing Ataturk International Airport.

The topography of the area is uneven with a terrain elevation difference of approximately 120 m from one portion of the Site to another (typically between north and south). The Site covers an area of approximately 7,650 ha that borders the Black Sea coastline and falls within the municipalities of Eyup and Arnavutkoy. The Site is accessed by the Ihsaniye to Tayakadin Highway running along the southern portion of the Site. The highway links to the Northern Marmara Motorway construction project. The Project Area is located 2.5 km to the east of Terkos Lake which is one of the major drinking water sources supplying the City of Istanbul and is proposed as a potential drinking water source for INA. Portions of land within the Project Area are being mined for sand, gravel and lignite. Sixteen companies are listed as licensed mines, of which six are currently operational in an area of 1,180 ha. An area of 298 ha is listed as being used for agricultural and stockbreeding purposes (236 ha of pasture land, 60 ha of dry farming and 2 ha of scrub). An area of 5,230 ha has been identified as forestry and an area of 610 ha is comprised of different sized water bodies (70 in total ranging in size from 0.17 to 100 ha) resulting from previous quarry excavation (open pit mining) areas, which were then filled by precipitation. The remaining area of 332 ha is comprised of interconnecting roads and three landfill sites within the boundary of the Project Area (of which two are operational and licensed by the government to receive construction waste materials). To the east of the Project Area, land is characterised by quarry and mining activity, forestry and agricultural land; to the south land use is characterised by forestry and areas of agricultural land; to the west by forestry and agricultural land; and to the north by a recreational seaside area approximately 5-8 km along the coast.

Figure 3.1 Project Area



3.1.2 Social Setting

The nearest settlements to the Project Area are Tayakadin (350 m west), Akpinar (250 m east), Ihsaniye (150 m south), Yenikoy neighbourhood[1] (200 m north-west) and Yukari Agacli neighbourhood which is located within the Project Area. It should be noted that in recent design changes, the east-west runway length has been shortened to avoid the Yukari Agacli neighbourhood. However, the status of the neighbourhood has yet to be confirmed by the Turkish government. More detailed information on the social setting is provided in **Chapter 7.13 Social and Cultural Assessment**.

Infrastructure

Socio-economic characteristics show that a middle income level population resides within the region of the Project Area. In this regard, the area is transforming from being an agricultural/rural area to being an industrial/urban area. The social and economic infrastructure is developing in this regard in terms of economy, education, health and transportation. Istanbul is attracting migration and the population in the INA area has a potential to increase as well.

According to the Address Based Population Registration System (ABPRS) 2013 results (Ref. 3.4), the total population in the vicinity of the Project is 5,760 (Table 3.1).

[1] In Turkey, a new administrative law (published in Official Gazette on December 6, 2012) makes a change in the administrative boundaries. The most important effect of this new law is the abolishment of the legal entities of the villages in the provinces; they are now to be included in and governed by metropolitan municipalities as neighbourhoods.

Table 3.1 Population in the Nearest Settlements to the Project Area

District	Neighbourhood	Total
Arnavutkoy	Tayakadin	2,533
	Yeniköy	1,398
Eyup	Agacli	556
	Akpinar	1,108
	Ihsaniye	165
Total		5,760

Source: TurkStat, ABPRS-2013

The population of Arnavutkoy District is 215,531. The 15-64 age group comprises 65.7% of the population. The population of Eyup District is 361,531 and the 15-64 age group comprises 72.2% of the population. The age group indicates that the economically active population in the district has a significant share within the total population.

The literacy rate in Arnavutkoy District is 96.3%. There are 59 educational facilities around the district and 43,782 students are enrolled at these schools. There are 1,187 classrooms in these facilities and the number of students per classroom is 38 for primary schools and 30 for high schools. Additionally, 1,383 teachers are employed in these schools.

3.1.3 Area of Influence

The minimum study area for conducting an ESIA for a project is defined as the Area of Influence of the project. The Area of Influence is generally larger than the Project Area in order to address potential impacts. In this context, the Area of Influence is the geographic area that may experience impacts to the biological, physical or socio-economic environments from expropriation, earthworks, construction and operation of the Project components.

The Project Area of Influence includes the land permanently and temporarily affected by the Project features. The Turkish EIA (Ref. 3.5) defined the Area of Influence very broadly, mainly taking the Alibey Dam, located at about 12 km south-east of the Project Area and the planned Pirincci Dam (located about 9 km south-east of the Project Area) as two milestones. It was stated that this assessment was based on the anticipated potential impacts of the Project on the riverbeds passing through the Project Area and their possible impacts to these water bodies. In this regard, in the Turkish EIA the Area of Influence was considered to be a circle with a 12 km radius taking the centre of the Project Area (expropriation area) as the central point of the circle.

In this ESIA, the Area of Influence has been defined based on relevant requirements in the IFC Performance Standard 1 (PS1) Assessment and Management of Environmental and Social Risks and Impacts, considering "*the area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent*".

IGA has responsibility for the design, build and operation of INA. On this basis, all elements of design, build and operation carried out within the defined Project Area boundary are within the Project Area of Influence.

Table 3.2 summarises the Project Area of Influence for different environmental and social topics. For all these topics, different spatial extents (study areas/Areas of Influence) have been defined and studied in terms of baseline data collection and impact assessment.

Table 3.2 Project Area of Influence

Topic	Issue	AoI at Scoping Stage	Receptor	Actual AoI
Environmental and Social Impacts within the Project Area Boundary (Project Footprint)	Design, build and operate within airport boundary.	Airport boundary/Project Area (within the predefined expropriation boundaries).	Natural resources and human settlements and facilities.	Project Area
Resettlement	Receiving areas for displaced people.	If there are any designated relocation areas for settlements.	People/companies relocated as a result of expropriation and communities living in the relocation areas (if any).	No resettlement has been confirmed.
Air Quality	Air quality during construction and operation.	5 km along take-off and landing routes, and within an area of 3 km around the project site border.	Population within the vicinity of the airport.	The modelling studies covered an area of 25 km x 18 km centred on the Airport to assess the impacts on air quality.
Noise	Noise during construction and operation.	5 km along take-off and landing routes, and within an area of 3 km around the Project Area border.	Population within the vicinity of the airport.	The modelling studies covered a 10 km buffer around the Project Area, to assess the impacts of noise.
Forestry	Removal of forest from the Project Area.	Project Area and any new (compensation) plantation areas.	Location of compensation planting areas. Local population using existing forest area.	Project Area and any new (compensation) plantation areas.
Water Quality	Potential (uncontrolled) releases to Black Sea and surrounding water bodies.	1 km of airport border.	Surface water bodies and groundwater.	Project Area plus 1 km from airport border. Terkos Lake, located 2.5 km to the west of the Project Area, was included in the water quality assessment study as it is an important key biodiversity area. The main stream feeding into

Topic	Issue	AoI at Scoping Stage	Receptor	Actual AoI
				Terkos Lake was also included in order to capture the incoming water quality to the Lake.
Site drainage/stormwater discharge (construction and operation)	Potential (uncontrolled) releases to the Black Sea.	1 km of airport border.	Black Sea/local river beds	Project Area plus 1 km of airport border.
Fresh Water Discharge	Dewatering of existing lakes in the Project Area.	Black Sea/local river beds within 1 km of airport boundary.	Black Sea/local river beds and domestic water supply system.	The Project Area and the Black Sea/local river beds within 1 km of airport boundary.
Water Use (construction and operation)	Increased impact on municipal and ground water resources	Project Area for construction. For operation the boundary will be the water resources in the basin or water lines that supply water to municipality dams and from there to the airport.	Regional population.	Water supply during construction will be provided from lake dewatering activities, groundwater and municipal supplies. Water supply during operation will be provided from municipal sources.
Electricity Use (construction and operation)	Increased impact on energy resources.	Electricity transmission lines (ETL) to connect the airport to the national grid to supply electricity during both construction and operation.	Routes and vicinity of ETL connection to the site.	Electricity transmission lines (ETL) to connect the airport to the national grid to supply electricity during both construction and operation. During construction electricity requirements would be confined to four construction sites within the Project Area.
Fuel Use (operation)	Aviation fuel storage and transportation.	Project Area (where fuel would be stored) and the close vicinity (3km of airport boundary with	Storage area and settlements in the vicinity.	The source of fuel is still to be confirmed. Additional environmental impact assessment will be undertaken as necessary.

Topic	Issue	AoI at Scoping Stage	Receptor	Actual AoI
		regard to any associated risk) and the transportation means of the fuel to site.		
Fuel Use (Construction)	Fuel usage during construction.	Project Area for construction.	Storage area and settlements in the vicinity.	Project Area for construction.
Landfills (in the Project Area)	Tayakadın landfill has ceased operation at the Project's Ground Breaking Ceremony. There are currently two operational demolition waste landfill sites within the Project Area.	Project Area and location for alternative landfill options.	Environmental components in the new receiving landfill area.	Project Area. Plans for a new landfill, which would replace these landfills are not known as yet.
Transport/Roads	Increased road traffic.	5 km of airport boundary.	Local community, road users (highway and secondary roads).	5 km of airport boundary.
Construction Materials Sourcing	Requirement for quantities of construction aggregate.	Locations of the material borrow areas.	Quarries, regional economy, transport mechanism.	Materials will be reused on-site where possible (e.g. for cut and fill) and other materials will be sourced from licensed facilities off-site.
Ecology				
Ornithology	Loss of habitat, migrating bird route.	Project Area, Terkos Lake, 3-5 km from the site boundaries especially in southern direction.	Birds and their habitats.	The wintering bird surveys covered the Project Area, the adjacent sea area and Lake Terkos. The breeding bird surveys and migrating bird surveys were undertaken within the Project Area.

Topic	Issue	AoI at Scoping Stage	Receptor	Actual AoI
Aquatic and Marine Ecology	Possible negative impact of uncontrolled discharges, habitat loss and other environmental emissions (such as sedimentation, noise and dust) on aquatic and marine environment.	Project Area, 1 km of airport border, 1 km off shore.	Aquatic and marine species and habitats.	Marine field surveys were completed in the sea area adjacent to the Project Area. The marine sampling locations were identified based on the previous knowledge regarding the area, expert opinion and information gathered during the secondary data review. Surveys on freshwater fish were completed within a range of inland aquatic ecosystems including lakes, ponds, ephemeral pools and streams within the Project Area.
Terrestrial Flora and Fauna	Loss of habitat and species of conservation concern.	Project Area and 1 km of airport border.	Flora and fauna species and habitats.	Project Area and areas surrounding the airport border. Two reference flora and fauna samples were taken outside the Project Area in areas suspected as being particularly important for habitats and flora. Translocation and seed collection activities were done for flora species. As for fauna, mitigation measures will be organised in coordination with the Ministry.
Waste	Creation and management of wastes.	Project Area for on-site waste handling and storage and waste management facilities in the region to receive the wastes generated due to project activities.	Increased volumes of waste requiring handling and transport.	Project Area for on-site waste handling and storage, and licensed waste management facilities in the region to receive the wastes generated due to project activities. General waste management will be organised with Arnavutkoy Municipality

Topic	Issue	AoI at Scoping Stage	Receptor	Actual AoI
				with the exception of the Ihsaniye camp site which will remain within Eyup Municipality. For that site, domestic waste management will be organised in cooperation with Eyup Municipality. Recyclable and hazardous waste will be managed by licensed waste management companies. Relevant contracts/ protocols will be signed.
The D-010 İhsaniye to Tayakadın Highway Relocation	New highway being constructed to accommodate the Northern Marmara Motorway.	No specific area except the route, which is already under construction. This project would be mentioned and considered in the scope of the ESIA studies.	Local community, environment air/land/water/ waste/visual impact.	Relocation of the highway passing through the Project Area has not been confirmed at this time. Once relocation is confirmed, the study area should be at least 1 km either side of the new route. This is not IGA's responsibility but relocation of the existing highway is required to allow the Project to commence. The existing studies and potential impacts are considered in Chapter 7.13 Cumulative Impacts.

3.1.4 Affected Communities

The nearest settlements to the Project Area boundary are: Tayakadin (350 m west); Akpinar (250 m east); Ihsaniye (150 m south); Yenikoy villages (200 m north-west) and Yukari Agacli village, which is located directly within the Project Area. It should be noted that in recent design changes, the east-west runway length has been shortened to avoid the Yukari Agacli neighbourhood. However, the status of the neighbourhood has yet to be confirmed by the Turkish government. Other neighbouring settlements, which may appear to be within the Project Area of Influence, require special attention. This is because the villagers' agricultural land, sources of income and dwellings may be impacted as a result of land acquisition and resettlement processes and the INA project.

3.1.5 Project Workforce

It is estimated that the earthworks and construction workforce will be approximately 15,000 personnel at the peak of earthworks and construction operations. It is expected that the construction project workforce will primarily consist of locally-based Turkish nationals, although it is possible that non-Turkish nationals will be employed if the necessary technical skills are not available in the local/national market. It is expected that a total of 5,400 personnel will be accommodated within the construction camps.

It is estimated that the operational airport workforce will be approximately 90,000 – 120,000 personnel. It is expected that the operational airport will employ qualified personnel from the Ataturk Airport which is expected to close down by the construction on INA. In addition, preference will be given to suitably qualified personnel from the Istanbul region to deliver long term local community benefits through promoting local employment (including job training) to the extent possible.

3.1.6 Project Procurement

The INA Project is the subject of a Build, Operate and Transfer (BOT) contract arrangement between IGA and the Turkish General Directorate of State Airports Authority (DHMI). IGA has appointed an Engineering, Procurement and Construction (EPC) contractor (CMLKK) to undertake the earthworks and construction phases of the Project. The BOT contract is for construction works, starting on 1 July 2014 with an airport opening date of 1 January 2018, with a capacity of 90 million passengers per annum (mppa). The opening will be followed by a further three construction phases that are intended to expand the airport to meet a capacity target of 150 mppa. The airport will operate under a concession agreement for a minimum of 25 years at which point it is expected that another concession will be let.

3.1.7 Site Expropriation

IGA has had no involvement in the selection of the Site. The land within the Project Area boundary is primarily government owned with only approximately 20% being in private ownership. A portion of the Site is operated by six mining companies (16 companies have licences to mine of which it is understood that 10 licences are inactive). A large proportion of the remainder of the land is operated by the Ministry of Forestry and Water Affairs. A single settlement, Yukari Agacli, is located within the current Project Area, though the decision regarding whether Yukari Agacli will be within the Project Area has not been confirmed by the government.

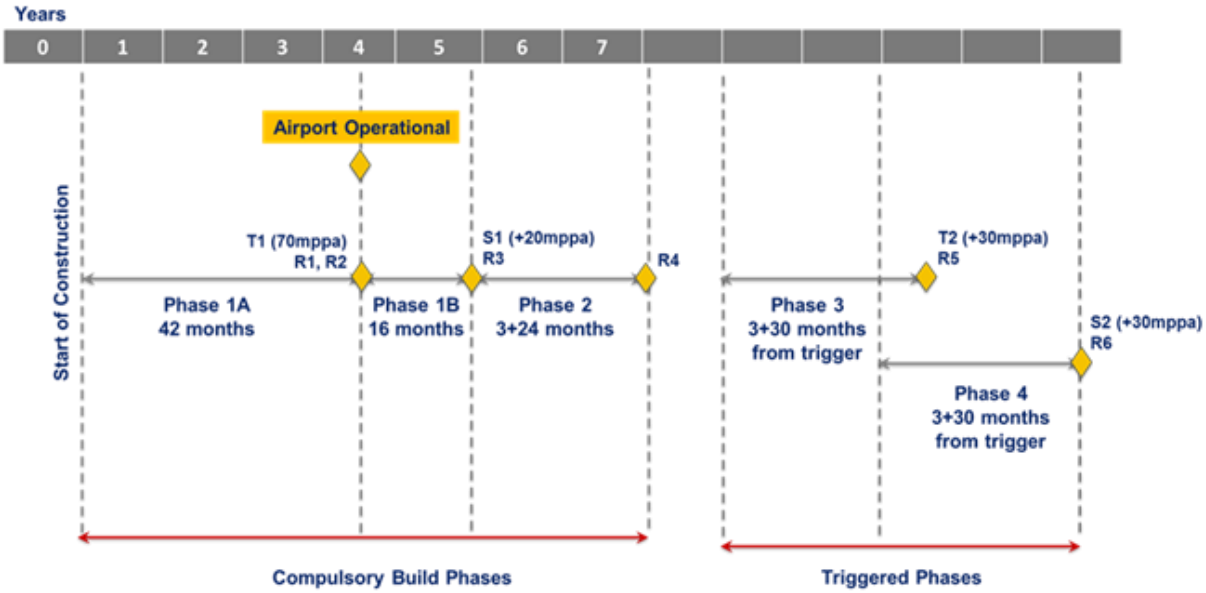
The Turkish government has been responsible for the land expropriation and the negotiations over the mineral rights licences. The land expropriation process has been conducted by the Housing Development Administration of Turkey (TOKI). The expropriation process has been undertaken in accordance with Turkish legal requirements, during which the Turkish rapid land expropriation process was invoked. This allowed TOKI to expedite the expropriation and appeals process. IGA has not had any involvement with the land expropriation process and no Resettlement Action Plan (RAP) has been prepared to date. Once land handover takes place, IGA will implement its Stakeholder Engagement Plan (SEP) which forms part of **Chapter 5 Stakeholder Engagement**.

3.2 Early Works and Construction Phase

3.2.1 Construction Programme

The development programme for the Phase 1 works (including construction) runs between December 2013 and December 2017. The programme assumes a land handover before 1 July 2014.

Figure 3.2 Project Implementation Calendar



Source: IGA, 2014

3.2.2 Project Phasing

Phase 1

Phase 1 is scheduled to span a total of 58 months from the date of construction site delivery (for Phase 1a and 1b combined). Phase 1 will provide an airport capacity of 90 mppa (Ref. 3.2). The Phase 1 development will include:

- A single terminal facility (Terminal 1) with a processing capacity of 90 mppa;
- Three independent north-south runways (18R/36L, 18C/36C and 18L/36R);
- Supporting taxiway system;
- Air traffic control tower(s);

- Cargo terminal;
- VIP and General Aviation terminals; and
- Other airport support facilities, including a wastewater treatment plant; fuel farm; waste collection facilities; de-icing facilities; combined heat and power (CHP) plant; heating and cooling centre; automated people movers (APMs); and access road construction.

The process to secure project financing has been initiated for Phase 1 works. The scope for financing from International Financial Institutions is all Project phases, with the exception of cargo, maintenance, repair and overhaul (MRO) and the catering facilities as it is planned that these facilities will be financed by the concessionaires.

Phase 2

Phase 2 will be delivered within 27 months of the completion of the Phase 1 programme. The Phase 2 development will include:

- An east-west runway (09/27) located in the eastern portion of the Project Area;
- A supporting taxiway;
- Helicopter hangar building and parking;
- Rescue and firefighting service area;
- Medical centre; and
- Additional air traffic control tower.

Phase 3

Phase 3 will be delivered within 33 months following a capacity trigger of 80 mppa and will increase airport capacity by a further 30 mppa. The Phase 3 development will include:

- A second terminal to the east of Terminal 1;
- An additional north-south runway (17R/35L);
- Supporting taxiway system;
- Expansion of existing cargo and support facilities; and
- Additional maintenance and support facilities area in the eastern portion of the Project Area.

Phase 4

Phase 4 will be delivered within 33 months of a capacity trigger of 110 mppa and will increase airport capacity by a further 30 mppa. The Phase 4 development will include:

- A satellite concourse located to the north of Terminal 1;
- An additional north-south runway (17L/35R);
- Supporting taxiway system; and
- Expansion of existing cargo and support facilities.

3.2.3 Major Construction Activities

All construction activities will be undertaken by the EPC contractor. IGA will agree commitments and environmental management approaches with the EPC contractor to ensure that EPC contractor's activities are consistent with the commitments made by IGA in this ESIA.

The EPC contractor will be responsible for developing detailed Construction and Operational Environmental and Social Management Plans (ESMPs) in accordance with the commitments made by IGA and the ESMP framework presented in **Chapter 8 Environmental and Social Management Plan**.

The draft construction programme has been developed for the Phase 1 activities and incorporates:

- Soil investigation and earthworks design;
- Mobilisation for the runway and main site works;
- Pre-construction:
    a. Water body drainage works;
    b. Relocation of the ISKI[2] pipeline;
    c. Relocation of power transmission line; and
    d. Removal of forestry wastes (tree cutting will be done by General Directorate of Forestry).
- Construction:
    a. Substructure works:
        i. Earthworks – first runway zone;
        ii. Earthworks – second runway zone;
        iii. Earthworks – third runway zone.
    b. Superstructure works including:
        iv. Passenger facilities:
        v. Terminal building;
        vi. Airport systems; and
        vii. Other passenger facilities;
- Air-side facilities:
    a. Apron;
    b. First runway and taxiways;
    c. Second runway and taxiways;
    d. Third runway and taxiways;
    e. Airport service roads; and
    f. Other air-side facilities.
- Auxiliary facilities.
- Landscaping works.
- Testing, commissioning and handover from the EPC contractor to IGA.

[2] The 16 largest cities in Turkey have each have legally separate and financially autonomous municipal water and sanitation companies called Su ve Kanalizasyon Idaresi (SKIs). These utilities were created during the 1980s and 1990s, beginning with the establishment of ISKI in Istanbul in 1981.

More detail on elements of the Project is set out in the following sections.

3.2.4 Soil Investigations

Geotechnical investigative drilling at specific locations across the Project Area is being undertaken to prepare a full geotechnical report for the area and inform engineering decisions regarding the quality of on-site material and its suitability for use as fill material.

3.2.5 Earthworks Design

The Project Area is currently characterised by open cast mining and quarrying activities and forestry land. The area will be redeveloped to provide a platform for the airport up to an average of 92 m above sea level. This will require water bodies to be dewatered, filled and land to be levelled. The volumes of cut and fill presented in Table 3.3 are estimated to be required throughout the Project to establish the required platform levels.

Table 3.3 Estimated Earthworks Volumes

	Cut (10^6 m^3)	Fill (10^6 m^3)	Net (10^6 m^3)	Total
Phase 1	650	320	330	970
Phase 2	28	34	-6	62
Phase 3	53	18	35	71
Phase 4 (final)	15	24	-9	39
Total	746	396	350	1,142

Source: IGA, 2015

It is planned that fill material will be sourced from the areas of the Site where cutting is required to remove obstacles and achieve the average 92 m platform level. It is expected that the earthworks for the Phase 1 development will last for an estimated 20 month period in order to meet Project delivery timescales.

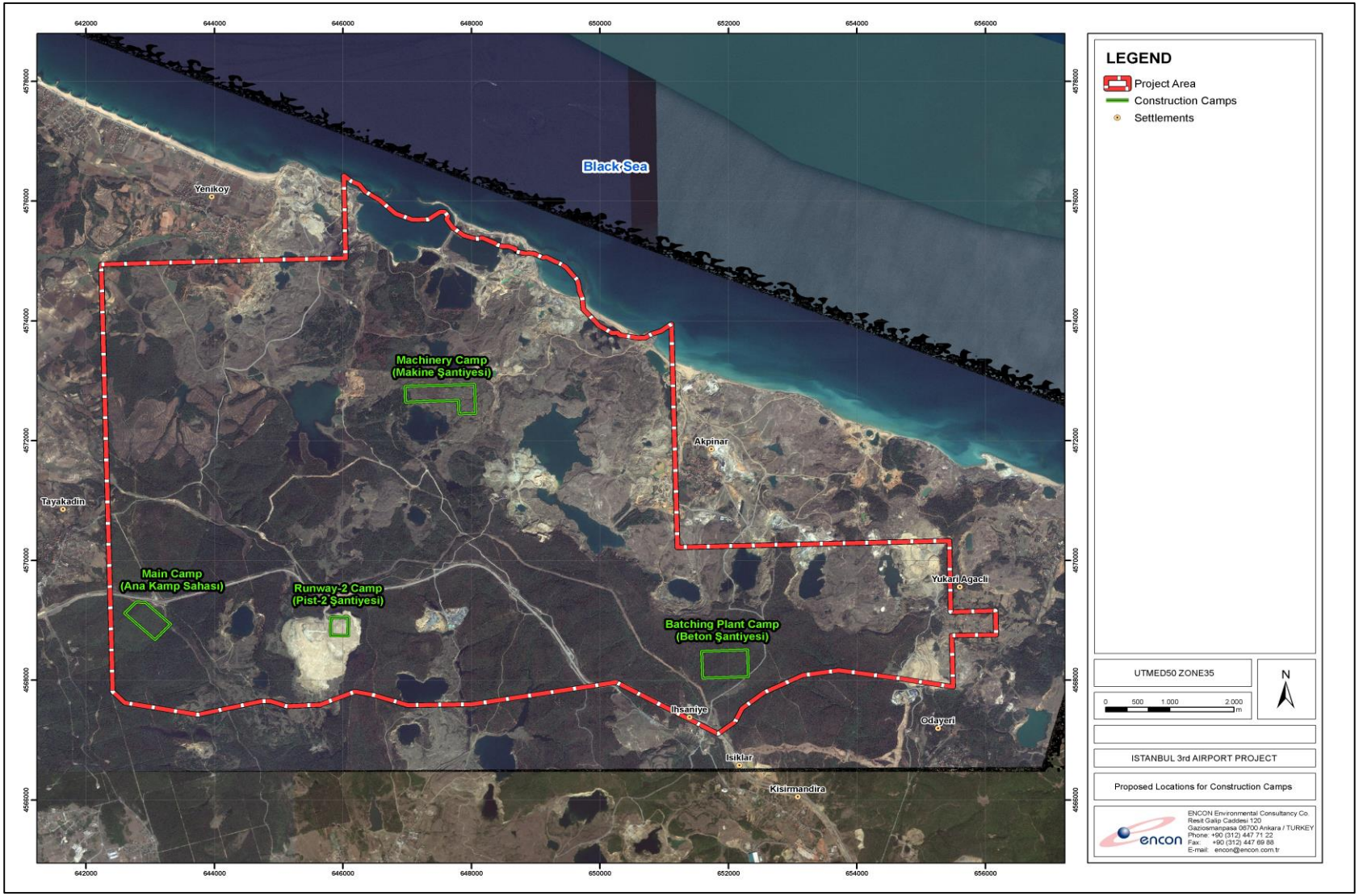
3.2.6 Mobilisation

Mobilisation will commence as land is made available through the handover process. In order to meet contractual obligations, earthworks and construction are expected to take place in shifts covering 24 hours per day, seven days per week.

Worker Camp Completion

The mobilisation stage of the programme will require site construction camps to be introduced at defined locations within the Project Area boundary. The main construction camp will be located within the vicinity of the first runway. The second sub-construction camp will be located at the second runway location and will also house vehicle/plant and equipment warehousing and maintenance and fuel store/dispensing facilities. An additional two-sub construction camps will be located strategically across the Project Area (Figure 3.3).

Figure 3.3 Proposed Locations for Construction Camps



The main construction camp will include: a central kitchen and canteens; worker, foreman and VIP dormitories; laundry; mosque; heliport; medical facility; offices; and a waste collection area. The other sub camps will be a smaller version of the main camp. Camps will be provided with LNG and generators for heating and power provision, and with potable water from water body dewatering and municipal supplies, as appropriate. It is estimated that in total the camps will have a capacity to accommodate 5,400 personnel (Year 2015).

Batching Plants

An aggregate crusher, asphalt plant and sub-base (Plentmix) plants will be installed to support construction activities. The capacities of the plant are summarised in Table 3.4.

Table 3.4 Plant Capacities

Plant	Number	Capacity
Asphalt plant	1	320 tonnes per hour
Sub-base plant (Plentmix)	1	750 tonnes per hour
Sub-base plant (Plentmix)	1	1,500 tonnes per hour
Sub-base plant (Plentmix)	1	1,000 tonnes per hour
Aggregate crusher	1	10 million tonnes per year

Source: IGA, 2014

Aggregate will be obtained from nearby quarries and transported to the Site. Detailed material requirements are given in **Chapter 7.10 Resource Efficiency**.

Earthmoving Equipment

An equipment and truck park will be established at one of the construction camps, including a 1,000 tonne diesel fuel storage facility to support vehicle refuelling. Earthmoving and immovable equipment will be refuelled in-situ by mobile tankers. The equipment listed in Table 3.5 will be required for the earthmoving and construction phases.

Table 3.5 Construction Equipment List

No.	Construction Equipment List	Total
1	D8 T Dozer	42
2	D9 T Dozer	2
3	390 D/F Excavator (90ton)	74
4	329 D Excavator (30ton)	2
5	966 H Wheeled Loader	12
6	14M Grader	27
7	140M Grader	8
8	BW 216 D-4 Cyclinder (16ton)	10
9	BW 226 DH-4 cylinder (26ton)	85
10	BW 226 DI-4 BVC Cylinder (26ton)	15

No.	Construction Equipment List	Total
11	Dump Truck – New FMX 500 BG 10x4 (for excavation works)	300
12	Dump Truck – Classic FMX 380 BG 8x4 dump truck (for maintenance and water tank purposes)	8
13	Dump Truck – Classic FMX 380 BG 6x4 dump truck (as fuel tank)	52
14	Truck – A40 (for use on lake floors)	15
15	Puller Truck – Classic FMX 500 BG 6x4	3
To be purchased		655
16	Truck – 20m^3 (for excavation works) (to be rented)	700

Source: IGA, 2014

There are no plans to introduce conveyors to the Project Area, because free movement of vehicles across and around the Project Area is critical to meeting the Project programme.

3.2.7 Pre-Construction

Currently, there are two ISKI steel water distribution pipelines with a total length of 38 km, including an operational water pipeline with diameter of 2200 mm and an inactive water pipeline with diameter of 1000 mm, along with a power transmission line. The Ihsaniye to Tayakadin D-010 Highway also runs from east to west within the southern portion of the Project Area. These installations require relocation in advance of earthworks commencing.

Water Body Drainage Works

The Project Area includes 70 water bodies which will be dewatered and then filled to accommodate the construction of runway platforms, airport terminals and support buildings and operations. These water bodies will require dewatering prior to earthworks and water will be used for dust suppression and vehicle washing during the construction phase. Water body drainage will be done by diverting water from one to another via open channels and pumping, where required. One of the water bodies will act as a sediment trap for a sufficient time before water is discharged into the Black Sea.

Relocation of the ISKI Pipeline

The new location for the ISKI operational water pipeline will be confirmed and excavation will take place to install the pipework and the excavation will be backfilled. The work will be undertaken in conjunction with the ISKI organisation to ensure that a minimum of disruption to the Istanbul drinking water supply from Lake Terkos. The new pipeline will be tested and commissioned and, once approved, the existing ISKI pipelines (active and inactive) will be dismantled.

Relocation of the Power Transmission Line

The actions for the relocation of the power transmission line that crosses the Project Area have not been defined at the time of preparing this ESIA. The EPC contractor will undertake environmental and social impact assessments in advance of work being undertaken.

Forest Areas

Tree felling will be undertaken by the Ministry of Forestry and Water Affairs to allow Phase 1 work to commence. Removal and commercial sale of the wood will be the responsibility of the ministry and the removal of the root systems will be integrated into the earthworks programme. The programme for tree removal has not been confirmed but options for handling of forestry wastes are being studied by IGA and will be set out in an Afforestation Plan.

Road Access

The Project Area is currently only served by the D-010 İhsaniye to Tayakadın Highway (which is currently a two-lane dual carriageway highway) and a number of other local roads servicing the existing developments and facilities in the surrounding area. D-010 highway which crosses the airport Site will be relocated to the south; the new highway will constructed in parallel to the airport boundary as a dual carriageway three-lane highway. The highway relocation will be undertaken by the General Directorate of Highways (KGM) and plans for this activity have not been confirmed.

3.2.8 Construction

Substructure Works

The earthworks for the runway zones will include topsoil stripping, base preparation, improvements to the ground and water body floors, and excavation and backfilling of excavated materials.

Superstructure Works – Passenger Facilities

The terminal building and airport systems will involve the construction of the terminal building structure, including structural works, exterior façade and roof, partitioning and finishing works.

Other passenger facilities will incorporate a tunnel for automatic people movers (APM) and baggage handling, a metro station area and tunnel, construction of the VIP terminal and apron, and construction of Government House and apron.

Passenger facilities will incorporate the building of a 4-storey terminal building (Terminal 1 with an associated two level traffic forecourt; the installation of airport systems (including escalators, apron systems, baggage handling and IT systems) and other passenger facilities (including tunnels to incorporate the APM and baggage handling systems. This will also include construction of a tunnel and station to accommodate a metro link and construction of a VIP terminal, Government House and associated aprons. Following Phase 1, further development is planned and will include Terminal 2 as a satellite passenger area for Terminal 1, which will be based on the same principles as for Terminal 1 on a smaller scale.

Superstructure Works – Air-Side Facilities

The construction of airside facilities will require granular backfilling, construction of a base and the introduction of concrete and/or asphalt.

Auxiliary Facilities

Auxiliary facilities will include the construction of facilities for cargo, airport and airline support functions, airport service buildings, an airport city complex (including a mosque, hotel and hospital) and airport transportation facilities. Other airport support facilities will also be constructed including: a wastewater treatment plant; fuel tank farm; waste collection facilities;

de-icing facilities; combined heat and power (CHP) plant; APMs; access roads; and metro access facilities.

Surface Water Runoff

All surface runoff during the construction phase will be diverted through settlement lagoon areas to reduce the level of suspended solids discharged into the Black Sea. Specifically, all runoff from the northern portion of the Project Area will be taken through a silt attenuation system prior to discharge to the sea.

The development of drainage structures will be based on the permanent drainage configuration, to implement a regime of environmental management and protection throughout the construction phase.

The temporary drainage features for the construction phase are being designed for a 2-yr event, with the exception of diversion ditches along the top of the platform which are sized to be easily installed by a motor grader and can be reconstructed immediately as the platform is raised on a daily basis. It is expected that these diversion ditches will be earthen during the dry season and rock-lined during the wet season. All temporary drainage features on the main earthworks platforms will discharge to collector drains that will be sized and aligned for the Health and Safety Arrangements

Health and safety arrangements on Site during earthworks and construction will be the responsibility of the EPC contractor. The EPC contractor will be required to undertake health and safety risk assessments and introduce control measures in accordance with national and international legislation and GIIP for construction sites.

3.3 Operational Phase

3.3.1 Terminal Structure

The Terminal 1 building is planned over four primary levels – Basement, Arrivals, Mezzanine and Departures. Floor to ceiling heights between levels will nominally be 7 m and the height between departures and the roof will be in excess of 25 m.

The roof will be supported on a system of structural trees supporting a repetitive modular system of 18 m x 18 m roofing panels. The modules may be prefabricated to maximise construction efficiency and reduce build time. A similar system of repetitive modules will be used on the piers but within a smaller grid system (Ref. 3.1).

3.3.2 Building Services

There is a total site requirement of 188,000 m^2 (18.8 ha) for general aviation, which includes a building footprint of 53,000 m^2, landside area of 65,000 m^2 and apron area of 70,000 m^2. Facilities will include private jet business centres, a heliport, VIP facilities and Government House amongst others (Ref. 3.1).

3.3.3 Passenger Peak Hours

Table 3.6 shows the predicted peak arrival and departure passenger figures and number of air traffic movements for each of the phases.

Table 3.6 Peak Arrival and Departure Figures for Passengers and Air Traffic Movements

Annual Demand	**90 mppa**			**180 mppa**
Approximate Year	2019			2042
Arrivals peak hour				
Pax	12,738			23,351
ATM	80			132
Departures peak hour				
Pax	14,204			25,130
ATM	84			133
pax – passenger; mppa – million passengers per annum; ATM – air traffic movements				

Source: Updated Master Plan (Ref. 3.2)

3.3.4 Passenger Aircraft Stands

The number of passenger aircraft stands provided at the airport is set out in Table 3.7 for the 90 mppa and 180 mppa horizons. The number of active and inactive stands required in the single and split terminal scenarios has been determined and been broken down by size of aircraft (Code C, E and F) and contact versus remote stands.

Table 3.7 Airport-Wide Stand Provision Summary

Stand Type	**90 mppa**	**180 mppa**
Contact Stands	**77**	**175**
Code F MARS	15	37
Code E MARS	22	55
Code E	25	34
Code C	15	49
Active Remote Stands	**79**	**91**
Code F MARS	14	14
Code E MARS	14	14
Code E	0	12
Code C	51	51
Inactive Remote Stands	**156**	**266**
Code F MARS	29	51
Code E MARS	36	69
Code E	25	46
Code C	66	100

Source: Updated Master Plan (Ref. 3.2)

3.3.5 Surface Access

As discussed previously, the INA Site is currently only served by the D-010 İhsaniye to Tayakadın Highway (which is currently a dual carriageway two-lane highway) and a number of other local roads servicing the existing developments and facilities in the surrounding area. The D-010 highway which crosses the airport Site will be shifted to the south to parallel the airport boundary as a dual 3-lane highway. Another main access will be via the Northern Marmara Motorway, which is a major infrastructure investment as a follow up to the construction of the 3rd Bosphorus Bridge (located approximately 25 km to the west of the Project Area). The General Directorate of Highways (KGM) is planning to construct a multi-level interchange on the Northern Marmara Motorway to provide access to the airport. This will also allow the use of the D-010 highway to access the airport. The new interchange will not connect these two highways but provide access to an exit from Terminal 1 at the airport. These two main highways will connect to each other at two points: to the south of the Odayeri Interchange to the east; and at Tayakadın Interchange to the west.

Another interchange/junction on D-010 highway is likely to be planned to provide access to the future Terminal 2. There is also a need for access to the airport's eastern support facilities. Access to western facilities can be provided from the existing junction on D-010 to the west.

The highway connection projects, interchanges and junctions require collaboration and coordination with the relevant authorities (DHMI and KGM) in terms of plans that also have an effect on surrounding development zones (Ref. 3.1).

3.3.6 Rail

There are two metro lines and a high speed rail line planned to support the connectivity and the operation of INA. These two lines will be the responsibility of the Istanbul Metropolitan Municipality and the General Directorate of Infrastructure Investments (AYGEM, formerly DLH).

The municipality is working on a metro line 'New City – Airport - Halkalı' which is anticipated to have a capacity of 70,000 passengers per hour. This line will connect Halkalı to the airport. There will also be interchanges to this line from the lines listed below:

- Başakşehir – Olimpiyat Metro;
- Kirazlı – Halkalı Light Rail (pre 2019);
- Başakşehir – Bahçeşehir Metro (after 2019);
- Habipler – Arnavutköy Metro (after 2019); and
- Kayabaşı Tram (after 2019).

In addition to the metro development plans set out above, the Gayrettepe – INA – Halkalı rapid transit system, which is under the responsibility of AYGEM, is planned as a conventional metro line with few station stops so that it allows a faster journey directly to the airport. This line will connect the city centre to the airport and Gayrettepe station will act as a major interchange point. According to AYGEM, this investment is likely to materialise after 2019.

Although the municipality plans high-speed rail connections to the airport, it is understood that other relevant authorities have proposed alternatives, which are currently under discussion. As such, there currently is no definitive data regarding the high-speed rail that will pass the 3rd Bosphorus Bridge.

With a degree of uncertainty about the nature, alignment and timing of rail links to the airport site, the following strategy has been adopted for the Master Plan:

- Provision is made for a rail/metro station served by one line (two tracks) as part of the initial ground transport interchange. It is assumed that this will be the high speed metro link to Gayrettepe providing the fastest connection to the centre of the city; and
- An Allowance is made for an additional rail station, served by a second metro line, running to the south of the car park development, providing a link to the airport and landside zones.

No provision has been made for a separate high speed rail connection in anticipation that the primary route will run to the south of the airport and into the city centre (Ref. 3.1).

3.3.7 Runway Operations – Airfield System

The development of the runway and taxiway system layout has been driven by consideration of:

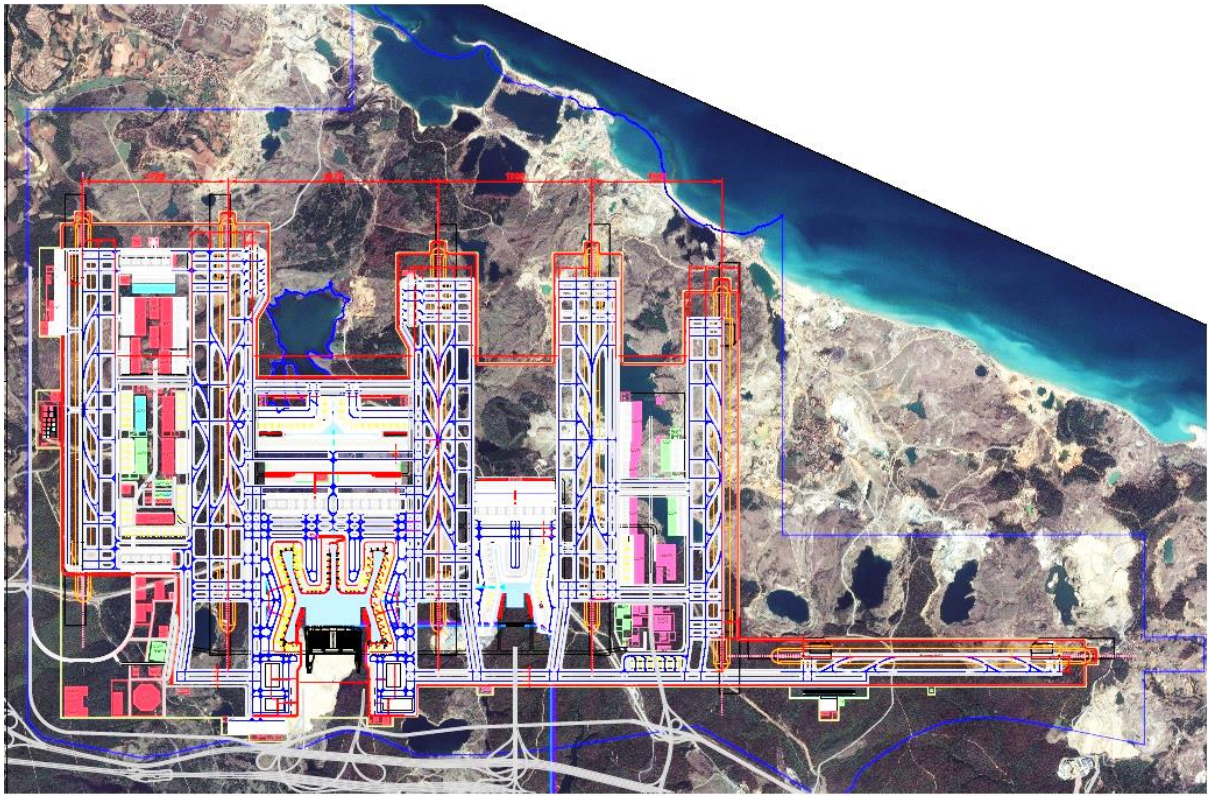
- Runway and airspace capacity;
- Airfield efficiency;
- Relationship to terminal areas;
- Land use; and
- Buildability.

Runway alignment has been determined based on the consideration of prevailing wind conditions, regional airspace, local obstacles and site geometry.

Runway operational modes and assignments have been assessed based on airspace and runway capacity requirements and route mix. This informs the overall operational concept, passenger terminal location and airline assignment assumptions. Taxiway layouts have been developed to support proposed runway operational modes and optimise airfield efficiency, minimising taxi times and delays. The resulting airfield layout provides a total of five north-south runways (18R/36L, 18C/36C, 18L/36R, 17R/35L, 17L/35R,), and one east-west runway (09/27), with four of the five north-south runways being independent.

The ultimate runway layout (achieved in the construction of Phase 4) consists of six runways; five north-south (orientation 0-180 degrees) and one east-west (orientation 90–270 degrees).

Figure 3.4 Proposed Runway Layout



Source: Updated Master Plan (Ref. 3.2)

3.3.8 Runway Dimensions and Declared Distances

Runways will be provided with the following dimensions (Ref. 3.2):

- Runways 18R/36L, 18L/36R, 17R/35L and 17L/35R, are 3,750 m in length;
- Runway 18C/36C is 4,100 m in length;
- Runway 09/27 is 3,000 m in length;
- The width of each runway is 60 m (suitable for ICAO code F); and
- For each runway, the full length of runway is available for take-off and landing.

Analysis of runway capacity has identified that:

- Three independent runways are required to meet the projected demand at airport opening and to accommodate the full Phase 1 requirement (90 mppa).
- Four independent runways with a fifth dependent[3] runway provide capacity exceeding the required for Phase 4 (150 mppa) and accommodating demand up to at least 180 mppa. The reduction in runway separation that was made possible by arranging 18R/36L and 18L/36R as a dependent pair results in significant savings in taxi distances, airline operating costs and environmental impact.

[3] A dependent runway is one where the distance only allows a runway to be used as departure only with the other dependent runway being used for arrivals alone. An independent runway can be used in arrival, departure or in mixed mode.

3.3.9 Runway Operating Modes

Potential runway operating modes have been identified based on the consideration of airfield geometry and airspace.

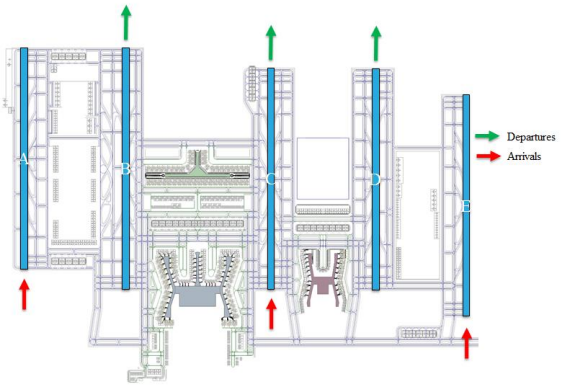
Runways 18R/36L and 18C/36C are separated by 1,700 m and therefore can only be operated dependently, with one runway serving departures and the other arrivals. All other runways may be operated independently of each other and of the dependent pair. The independent runways could be operated in arrival, departure or mixed mode. In general, the preferred mode of operation is for the outside runways to operate as arrival only. This is due to the fact that taxi distances between the outside runways and the terminals are generally longer than between the inner runways and terminals. From a fuel burn point of view, it is better that heavier aircraft (departures with high fuel mass) have shorter taxi distances than lighter aircraft (arrivals with a lower fuel mass).

The middle runway is nominally operated in mixed mode, to enable both terminals to have access to an arrival and a departure runway. In peak arrival/departure times, the middle runway can be operated in either an arrivals or departures only mode to increase arrivals/ departures capacity.

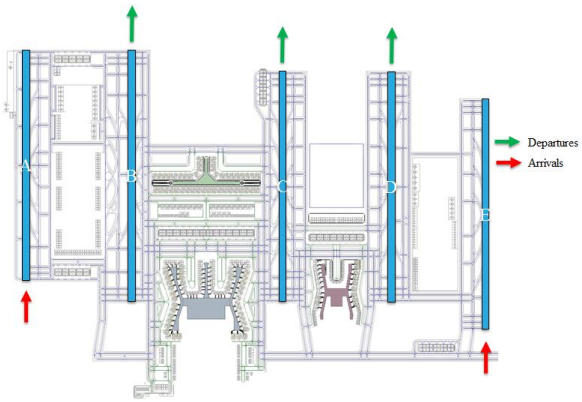
Figure 3.5 describes the optimal runway operating modes during balanced flows, peak departure hours and peak arrival hours for the ultimate runway configuration (Phase 4). Green arrows represent departures and red arrows represent arrivals.

Figure 3.5 Optimal Runway Operating Modes

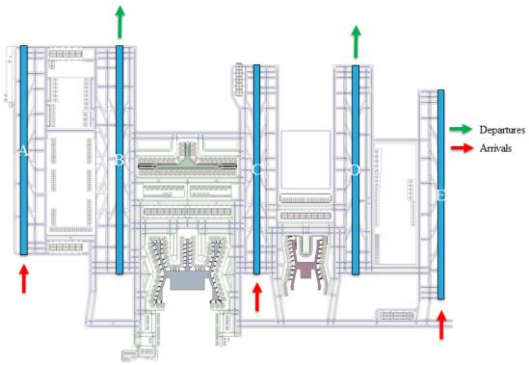
Balanced Arrivals and Departures



Peak Departure Hours



Peak Arrival Hours



Source: Updated Master Plan (Ref. 3.2)

Heliport

A heliport and Final Approach and Take Off (FATO) area have been provided to the south of the proposed location of the crosswind runway (09/27) (Ref. 3.1).

3.3.10 Airport Support Facility Requirements

Support areas are required to accommodate a wide range of facilities, many of which are likely to be planned and delivered by third parties (such as cargo, aircraft maintenance and catering facilities). The Master Plan for the support areas is intended to provide a framework for the structured development of these areas, coordinated with the wider airport development plan. This will, however, need to be refined over the concession period to suit the demands from

third party operators. For the purpose of the Master Plan, the phasing of support area development is aligned with that of runways and terminal areas.

The support areas are located to the south of runway 17R/35L. They are planned to accommodate the phased demand for facilities over the concession period. The location and layout of support areas has been closely co-ordinated with that of the passenger terminal, reflecting the needs of cargo, catering and other ground handling operations. The planning approach taken is to locate landside access roads to the two support areas on their outside perimeters, and airside roads on the inside perimeters closest to Terminal 1 and Terminal 2. The landside roads penetrate into the support areas to ensure that all facilities are provided with both landside and airside access. Tunnel connections under the runways provide airside access for support vehicles to the terminal aprons.

Table 3.8 Summary of Provisions for the Airport

	Phase 1	Phase 2	Phase 3	Phase 4	Ultimate
Runway	18L/36R 18C/36C 18L/36R	09/27	17R/35L	17L/35R	18L/36R 18C/36C 18L/36R 09/27 17R/35L 17L/35R
Air Traffic Control Tower	2	3	3	3	3
Passenger Terminal Buildings	Terminal 1	Terminal 1	Terminal 1 Terminal 2	Terminal 1 Terminal 2 Satellite 1	Terminal 1 Terminal 2 Satellite 1
Fixed Bridge Passenger Aircraft Stands	109	109	146	181	197
Total Passenger Aircraft Parking Area	158	158	230	271	301
Light Rail System/Automated People Mover	-	-	1	2	2
Cargo Terminal Building Area	166,000 m^2	166,000 m^2	218,000 m^2	267,000 m^2	321,000 m^2
Cargo Aircraft Stands	9	9	10	11	14
Airport Support Facility Zones	1	1	2	2	2
General Aviation Area	163,000 m^2	163,000 m^2	163,000 m^2	188,000 m^2	188,000 m^2

Source: Master Plan December 2013 (Ref. 3.1)

3.3.11 Maintenance Repair and Overhaul

The aircraft maintenance facilities were sized using estimates of the number of aircraft that will be based at the airport in conjunction with estimates of the maintenance time requirements for each aircraft. These were then used to estimate the total required capacity of the maintenance facility. The layout and configuration of the facilities are then designed using benchmarking and also IATA and ICAO recommendations and best practice examples.

The maintenance facility requirements include areas for hangars for light and heavy aircraft maintenance, and associated landside vehicle parking areas for goods delivery and access.

There is also a requirement for a compass base and an engine run-up area to be provided close to the other maintenance facilities. The compass base allows aircraft compass swings to be conducted to calibrate on-board equipment following maintenance. The engine run-up area allows aircraft engines to be safely tested following maintenance and overhaul.

Phase 1 and 2 support facilities are located to the west of the Site and have a total land area of 67.5 ha with the following provisions:

- The landside area accommodates delivery docks, internal roads and parking;
- The cargo apron has a depth of 100 m (minimum) and 30 aircraft parking positions, including 28 Code E and two Code F; and
- The engine run-up area of 1 ha, equipped with taxi lane access for Code F aircraft and perimeter blast fences is located to the north of the western support zone.

The total land area required for aircraft maintenance for the Phase 4 demand is 483,104 m^2 (48.3 ha), which includes building footprints for hangars and workshops totalling 182,152 m^2, and related landside and apron areas. This includes an engine run-up area for aircraft. All aircraft maintenance facilities are located in the east support area (Ref. 3.1).

3.3.12 De-Icing Infrastructure

The de-icing operations will be centralised as far as possible in order to reduce operational costs and equipment storage space. Due to the size of the airfield, six separate airfield areas have been safeguarded for de-icing operations.

Table 3.9 De-Icing Provisions

	Phase 4 provision	Number of Stands	De-icing Platform Area (m^2)	Area of Support Infrastructure* (m^2)
1	Central	14	130,000	11,900
2	Terminal 1 south	8	48,000	6,600
3	Terminal 1 north	5	48,000	7,800
4	Terminal 2 Central	8	72,000	6,600
5	Terminal 2 south	5	48,000	6,600
	Total	**40**	**346,000**	**39,500**
*includes parking and buildings				

Source: Updated Master Plan (Ref. 3.2)

The de-icing platforms will be provided with consideration for the likely fleet mix of departing aircraft. It has been assumed that four aircraft can be de-iced per stand per hour. The peak departure hour for Phase 4 will occur from at 07:35–08:34, when a total of 133 movements are scheduled of which 34 are wide body. However, the most demanding departure hour for de-icing will occur from 00:15–01:14, when a total of 123 departures are scheduled, with 45 wide body aircraft. The number of wide body stands required therefore has a dominant impact on the sizing of the de-icing platform. The central platform has been sized for a fleet mix in the wide body-dominated hour, on the basis that the runways most likely to be assigned to these flights are Runways 18L/36R and 18C/36C. This is justified, as almost all the wide body flights will have destinations in Asia and the Middle East, for which these runways are preferred.

De-icing substances are not confirmed and will be the choice of third party operators. De-icing facilities will be designed to contain the de-icing fluid and surface water runoff and allow collection of the de-icing fluid for recycling, if appropriate, if nationally accessible recycling facilities can be identified.

3.3.13 Snow Removal

All airports which are likely to be subject to icing conditions or annual snowfall will have snow removal equipment provided on site. The Federal Aviation Authority (FAA) provides a definition that snow removal should be undertaken to maintain runways, high speed turnoffs, and taxiways in a ‘no worse than wet’ (i.e. no contaminant accumulation) condition.

Snow removal land and building area requirements have been calculated based on the equipment required to clear the designated top priority areas of the airfield within a given time period. The following sets out the provisions made within the Master Plan:

- The total land area requirements calculated for snow removal operations for Phase 4 is 101,002 m^2 (10.1 ha), which includes a building footprint requirement of 28,858 m^2 and a landside/airside requirement of 7.2 ha;
- The Phase 1 and 2 land area of 8.68 ha is located towards the south end of the west support area, which includes a single building footprint of 24,797 m^2 (2.24 ha) and
- A second facility of 1.4 ha, including a building footprint of 4,061 m^2, is provided in the east support area to meet Phase 3 and 4 requirements.

3.3.14 Rescue and Firefighting Services

This section is based on the December 2013 Master Plan as the relevant updated information was not available at the time of the preparation of the section.

Multiple Rescue and Firefighting Service (RFFS) stations will be provided to ensure that the ICAO recommended 2 minute response time to reach any point on the operational runways can be achieved. Fire and rescue equipment to support the RFFS and medical centre requirements are specified depending on the size of the largest operating aircraft and the geometry of the airfield. The medical centre will be associated with the RFFS requirement and can be located either in shared facilities or in different places on the airfield and is based on the total passenger throughput. Table 3.10 describes the location of the planned RFFS stations and the operational coverage of each station.

Runways 18R/36L, 18C/36C, 18L/36R and 09/27 will each be equipped with one RFFS station located approximately at the midpoint of the runway. Two are located in the Terminal 1 midfield, one is located in the support services area adjacent to Runway 18L/36R and one is located south of the crosswind runway (09/27).

Given the north-south extent of the airfield, an additional RFFS station has been located south of Terminal 2 in order to cover the End Around Taxiways[4] (EATs) and the thresholds of Runways 35L, 35R and 36L. To provide better coverage of thresholds 17L and 17R, the RFFS station to the west of the airfield has been provided slightly north of the runway midpoint.

A training facility has also been provided alongside the RFFS station to the west of Runway 17R/35L (RFFS 1). It is assumed that a medical facility will be co-located at each RFFS site.

Table 3.10 Rescue and Firefighting Service (RFFS) Stations

Phase 4 RFFS	Building Area (m^2)	Total site area (m^2)
RFFS 1 (adjacent to Runway 17R/35L)	14,550	2,250
RFFS 2 (adjacent to Satellite terminal)	12,000	2,250
RFFS 3 (adjacent to Runway 18C/36C)	15,000	2,250
RFFS 4 (Adjacent to Runway 18L/36R)	15,000	2,250
RFFS 5 (Adjacent to Runway 09/27)	14,250	2,250
RFFS 6 (adjacent to Runway 17L/35R)	7,000	1,700
Training facility	432	23,364

Source: Master Plan December 2013 (Ref. 3.1)

3.3.15 Cargo

This section is based on the December 2013 Master Plan as the relevant updated information was not available at the time of the preparation of the section.

Phase 1 and 2 cargo developments will be located in the east support area, to the south of the ATC tower and will comprise an area of 51.22 ha.

The total site area required for all cargo related facilities for the Phase 4 demand is 790,318 m^2 (79.03 ha) as per the programme requirement for a 150 mppa airport, which includes building footprints and related landside and apron areas for cargo terminals, as well as for cargo agents and shipping companies.

The Master Plan makes provision for cargo terminal buildings with a minimum depth of 140 m, up to a combined width of 750 m. It is anticipated that a minimum of two cargo facilities will be required in the initial phase, including both a Turkish Airlines cargo operation and a third party facility. The detailed planning of the initial phase cargo facilities, including the future expansion strategy of the Turkish Airlines facility, will be subject to detailed discussions with potential occupiers.

The apron will have a minimum depth of 130 m, which is suitable for freighters with nose-loader operations, and have the capacity for nine aircraft stands. The apron will be accessed from dual taxi lanes, which will be shared with the aircraft maintenance facilities to the north.

The landside area will include truck docks and related manoeuvring and access roads, and visitor and employee parking. Separate buildings will be provided in the landside area for cargo/shipping agents and customs agents.

[4] An End Around Taxiway is a path for an aircraft to taxi around an active runway.

Phase 3 and 4 cargo development will be located in the west support area, and have a site area of 27.81 ha. The cargo building will have a depth of 140 m and width of 550 m and be served by an apron with two freighter positions and landside facilities similar to Phase 1 and 2, but on a smaller scale. The apron is planned for expansion to the west and north, with provision for additional taxi lanes when required.

Total land area provided upon completion of the four development phases is approximately 79.03 ha, as per the programme requirement for a 150 mppa airport. The cargo building footprint provided is 267,300 m^2.

3.3.16 Flight Catering

A total land area of 204,848 m^2 (20.48 ha) is required for flight catering facilities for the Phase 4 demand, assuming an equal split between building footprint and landside/ airside areas. The following is a summary of the requirements:

- Phases 1, 2 and 4 sites are located in the east area, in support of Terminal 1, with Phase 3 in the west area in support of Terminal 2; the catering buildings will be oriented on the sites to provide a split between landside (for deliveries and public access), and airside (for secure routing of catering vehicles to and from aircraft);
- Based on recent flight kitchen developments at major airports (e.g. Dubai, Singapore), it is assumed that large facilities with a production capacity in the range of 65,000 to 75,000 meals/day will be constructed;
- This capacity would result in the construction of up to four kitchens for Phases 1 and 2 and an additional two kitchens for subsequent phases. Each of these kitchens will have a typical building footprint in multiples of approximately 15,000 m^2;
- The total building footprint indicated in Phase 4 will be approximately 100,000 m^2; and
- The demand for catering facilities may be increased if one or more flight catering operators also wishes to service operations in the terminal buildings (e.g. CIP/VIP lounges) from the same kitchen.

3.3.17 Fuel Systems

The basic concept of the proposed aircraft fuelling system is an on airport fuel receipt, storage and distribution facility in conjunction with a high capacity aircraft hydrant fuelling system. This concept will permit the airport to receive and store large amounts of jet fuel to sustain several days of operations and provide the direct into-plane fuelling of aircraft with safe and efficient fuel hydrant dispensers.

The engineering design and construction will be based on stringent and specific codes and standards developed by a number of international associations, e.g. IATA, Energy Institute. The system will be operated in accordance with the Joint Inspection Group (JIG) Guidelines for Aviation Fuel Quality Control & Operating Procedures, latest edition (references JIG1, JIG2 and JIG3), as applicable. The requirement for fuel to be held on-site is based on an assumption of five days' supply of fuel being required to be stocked on-site, based on the peak day requirement.

Some elements of the fuel system can be phased to match airport growth but other elements (e.g. the fuel hydrant feeder pipelines diameter) may have to be fixed from the outset consistent with the ultimate capacity forecast for the site. This design basis considers the use of JetA-1 fuel by current generation commercial aircraft and does not include general, corporate or military aviation requirements (which will be defined in due course).

3.3.18 Fuel Supply

The potential methods of fuel delivery to the airport include:

- Transport by sea and import by jetty pipeline;
- Emergency road tanker offloading;
- Receipt from an extended NATO pipeline;
- Receipt from future dedicated jet fuel pipeline(s); and/or
- Future rail tanker offloading.

Only a jetty pipeline and road route are likely to be available for the opening day. Given the large and continuous volume demand, approximately 350 road bridgers (tankers) would be required to deliver fuel each peak day in the opening year, increasing to over 700 per day ultimately. This is not considered to be a workable supply method but it could be used to mitigate a fuel shortage. The most obvious supply fuel route for such a large demand is by sea tanker. The pipeline supplement/alternative is a new pipeline from a source to be determined, e.g. a refinery. Even then, the selected refinery's entire jet fuel production may not be sufficient to meet the forecast fuel demand, necessitating jet fuel imports.

3.3.19 Fuel Depots

The fuel storage depot configuration will be:

- Jetty Import Depot (JID) located at the coast near the jetty containing import tanks, quality control facilities and fuel circulation/filtration options. The location provides landside access to facilitate public access to the facility and 'seaside' operator access to the jetty; and
- Airport Fuel Depot (AFD) containing dedicated pipeline receipt from JID, storage tanks, fuel hydrant pumps/filters, operations/control room, vehicle maintenance. The location (which has not been confirmed) should provide both landside and airside access to facilitate public access to the facility and operator access to the airside aprons.

Both depot sites must have:

- Accessibility to utilities such as electrical power, telephone, potable water, firewater, sanitary sewers and storm sewers; and
- Fuel containment bunds, vehicular access roads, vehicle parking and an operations/ maintenance building.

3.3.20 Fuel Hydrant and Into-Plane Operations

Based on the large amount of fuel required and scale of the site, a buried hydrant pipeline system will be constructed to serve the airport's into-plane fuelling operations (rather than the use of fuel tankers). The fuel hydrant concept will include two sets of twin distribution feeder lines connecting the AFD to the apron area fuel hydrant systems. The fuel hydrant piping will be constructed in a loop configuration around each Terminal/Concourse. This fuel hydrant dual distribution loop concept will provide the maximum inflow/pressure capabilities, operational flexibility and future expansion options. The system will be complete with isolation valve chambers, hydrant pits, leak detection, cathodic protection and emergency fuel shut-down systems.

3.3.21 General Aviation

There is a total site requirement of 188,000 m² (18.8 ha) for general aviation which includes a building footprint of 53,000 m², landside area of 65,000 m², and apron area of 70,000 m². The nature of these facilities is not standard and will be highly dependent on the local demand. Facilities, as described previously, will include private jet business centres, a heliport, VIP facilities and a Government House amongst others (Ref. 3.1).

3.3.22 Heliport

A heliport and Final Approach and Take Off (FATO) area will be provided to the south of the proposed location of the crosswind runway (09/27). The FATO will be an area over which the final phase of the approach manoeuvre to hover or land is completed and from which the take-off manoeuvre is commenced.

A 600 m x 18 m runway has been provided for a non-instrument curved take-off climb and approach to and from the south, designed for helicopters operated in performance Classes 2 and 3. In Phases 1, 2 and 3, the FATO will lie on the alignment of the east-west runway (09/27). Before the runway is constructed in Phase 4, the FATO will be moved to a location just south of the east-west runway (Ref. 3.1).

3.3.23 Operational Vehicles and Equipment

An initial list of vehicle and equipment requirements for the airport during the operational phase are summarised in Table 3.11. This list is expected to be refined as the Project approaches the opening date.

Table 3.11 Operational Vehicle and Equipment Requirements

Vehicle/Equipment	Quantity
Four wheel drive combine snow removal vehicle	20
Compact combine snow removal vehicle	6
Rotary (snow swinger)	6
De-icing fluid scatter vehicle	6
Snow removal vehicle for beneath bridges (multifunctional) (quantities are associated with quantities of bridges)	20
Measuring vehicle for runway breaking	4
Vacuum sweeper	32
Vehicle for erasing tyre marks	5
“Follow me” vehicle	35
Lifting platform	12
Tractor for hedge trimming	24
Pat area marking machine	3
Sewage (vacuum truck) and grooving vehicle	4
Pick-up vehicle (for administrative staff)	4
Minibus (capacity 18 passengers) (for administrative staff)	4

Vehicle/Equipment	Quantity
Minibus (capacity 14 passengers) (for administrative staff)	4
Passenger vehicle (for administrative staff)	5
Vehicle/Equipment	**Quantity**
Rescue and Fire Fighting equipment – Main Firefighting Station	
Firefighting vehicles – 32,000 L capacity	3
Reserve firefighting vehicle – 32,000 L capacity	1
ERV – Dry chemical powder (4 x 4)	1
Rescue vehicle	1
Water supply vehicle – 14,000 L capacity	1
Satellite Firefighting Station	
Firefighting vehicles – 32,000 L capacity	3
Reserve firefighting vehicle – 32,000 L capacity	1
ERV – Dry chemical powder (4 x 4)	1
Rescue vehicle	1
Other Items	
Ambulances – allowance for vehicles	1
Aircraft rescue kit – Allowance	1
Runway foam vehicle – Allowance	2
Note: catering, cleaning, maintenance, baggage handling, ground handling vehicles and passenger movement vehicles will be provided by third parties and numbers are unknown at this time.	

Source: IGA, 2014

3.3.24 Other Airport Support

Airport support facilities will include buildings for airport maintenance administration, facilities maintenance, airfield vehicle maintenance and central stores, as well as facilities for waste collection and recycling, and a garden centre. The total Site area requirement for Phase 4 is 109.5 ha), which is assumed to be split 80% airside area and 20% landside area.

- Phase 1 and 2 support facilities will be located in the western support zone, which will have a land area of 67.5 ha. The building footprint requirement of 195,400 m^2 is laid out on the site with each facility having its own landside and airside access;
- Expansion of the western support zone will accommodate some Phase 3 and 4 facilities, but the majority will be located in the eastern support zone, with groups of buildings laid out in a manner to provide landside and airside connections.

3.3.25 Utilities

Power Supply

Underground service tunnels will provide primary distribution routes for mechanical, electrical and public health (MEP) services across the airport. These service tunnels will run beneath each terminal and provide interconnectivity for MEP systems. Supply for these primary services is planned as follows:

- To meet the electrical demand, two separate and dedicated incoming utility feeders (A + B) at 154 kV, with diverse routing will be provided;
- Primary electrical substations coupled to generators will be located above the services tunnels at key locations around the site to provide resilient power supply to the terminals, airfield and ancillary buildings;
- Similarly, primary chilling stations will be located at key locations around the site to provide resilient cooling supply to the terminals and ancillary buildings;
- To save energy, sea water will be used for heat rejection from the condenser water from the primary chilling stations, removing the need for cooling towers; and
- A centralised, gas-fired combined heat and power (CHP) plant will provide electricity and hot water for both heating and domestic uses.

The total electrical maximum demand of the site will be approximately 222 MVA, this includes for 30% spare capacity. The utilities grid sub-station will be owned by the utility provider. Each generator farm will include up to five 2.25 MW diesel generators, which will operate on loss of both A+B power supplies (incoming feeders to the grid and primary sub-stations). Fuel to power the backup generators will be stored locally in aboveground tanks.

Water Supply

Water tanks will be supplied from the most appropriate water source (mains or well abstraction dependent on final survey work). Tanks will be located at higher elevations to utilise water head pressure within the network. Water treatment units will be installed to ensure that water meets appropriate drinking water Project Standards (**Chapter 2 Policy, Legislative and Regulatory Framework**).

Table 3.12 Daily Water Demand

		Phase 1 and 2	Phase 3	Phase 4	Ultimate
Water demand (m^3)	**Passengers**	2,700	3,600	4,500	5,400
	Employees	8,630	11,507	14,384	17,260
	TOTAL	11,300	15,100	18,900	22,700

Source: IGA, 2015

Indicative capacities of tanks to be installed are 33,000 m^3 for Phase 1 and 17,000 m^3 for Phase 4. Tanks will be constructed with two compartments:

- Raw water: provided in storage reservoirs for two day water demand for their service area, and
- Processed water: providing a storage reservoir that can meet a 12-hour demand.

Raw water will be processed and disinfected prior to being moved to the processed water tank. The processed water tank will feed the water softening unit for cooling and heating water purposes; the water treatment unit for drinking water supply and utility water for wet areas (such as wash rooms and toilets). Additionally, the raw water tanks will supply the firefighting water which will service as a minimum sprinklers and wet risers within each building and external hydrants.

3.3.26 Drainage

Surface Water

The development of the INA footprint will result in accelerated runoff from impermeable surfaces. The design strategy for the surface areas will utilise swale features in grassland areas adjacent to runways and taxiways. This will allow limited infiltration but will throttle runoff rates somewhat, by the incorporation of swale elements on the platform surface. All discharges will pass through an attenuation feature to allow interception of suspended material (including hydrocarbons) arising from potential spills. The drainage design will seek to avoid the use of ponds and permanent wetland areas to prevent bird habitats from becoming established close to the flight areas.

Dry swales and short term retention areas will be used to attenuate runoff from extreme events, but the presumption is that normal rain fall events will be carried to low level drainage infrastructure with limited retention and delay. The main receiving drainage structures at the base of runway embankments will be designed for a 100-yr event. The swales will not be impermeable, but infiltration into the embankment structure is expected to be minimal, based on the grading and compaction requirements of the embankment fill and the seasonal transpiration demand of the surface vegetation.

The design of the permanent catch basin/piping systems and permanent slope drains that comprise the permanent platform drainage will be sized for a 100-yr event with a check of the 200-yr event.

Drainage to the south will continue to follow the same flow path as at present, but with incorporation of settlement features to remove suspended sediment and to provide pollution control measures

Wastewater

The ideal location for the Biological Wastewater Treatment Plant (BWWTP) has been identified as the north-eastern and eastern edges of the Project Area. This location has been selected taking into consideration site levels i.e. at lower elevations the need for pumping can be avoided. The total footprint area for the BWWTP is estimated as 50,000 m^2 with a population equivalent that compares with a number of existing advanced biological treatment plants in Istanbul. The effluent from the BWWTP will be discharged into the Black Sea and/or pumped to terminal areas for irrigation of landscaped area.

Wastewater production figures have been based on 100% return rate from domestic water, including a peak water flow rate of 1.7. These are summarised in Table 3.13.

Table 3.13 Wastewater Production Levels

		Phases 1 and 2	Phase 3	Phase 4	Ultimate
Wastewater (m^3/s)	**Passengers**	0.0428	0.0571	0.0713	0.0856
	Employees	0.0999	0.1332	0.1665	0.1998
	Total	0.1427	0.1903	0.2378	0.2854

Source: Master Plan December 2013 (Ref. 3.1)

Table 3.14 Wastewater Treatment Plant Capacity

	Phase 1 and 2	Phase 3	Phase 4	Ultimate
Maximum Daily Flow (m^3/day)	21,000	28,000	35,000	42,000

Source: Master Plan December 2013 (Ref. 3.1)

Industrial wastewater generated from operational and maintenance works will first be sent to an Industrial Waste Water Treatment Plant IWWTP). Effluent from the IWWTP will then be directed to the BWWTP. All domestic wastewater collected in the sewerage system will be directed to the BWWTP. Surface water runoff from de-icing areas will first be directed to de-icing pads (areas where airplanes are directed for de-icing) and overflows from these pads will discharge to the BWWTP.

Grey water will be treated by local package treatment in the building where it is generated, to be reused in toilets.

References

Ref. 3.1	Istanbul New Airport Master Plan, Ove Arup and Partners, December 2013
Ref. 3.2	Arup and Partners International Limited, Istanbul New Airport Master Plan December 2013 as amended in March 2015 (new runway layouts and drawing)
Ref. 3.3	Istanbul New Airport Concept Design, Grimshaw Nordic, December 2013
Ref. 3.4	Address Based Population Registration System (ABPRS), 2013
Ref. 3.5	Istanbul Region 3. Airport Final Environmental Impact Assessment Report, May 2013