Hashemite Kingdom of Jordan
Aqaba Special Economic Zone Authority (ASEZA)
Aqaba Development Corporation (ADC)

Hashemite Kingdom of Jordan

The Project for Updating ASEZ Master Plan

Final Report

September 2024

Japan International Cooperation Agency

Pacific Consultants Co. Ltd.
INGEROSEC Corporation

IM
JR
24-104

Table of Contents

Chapter 1 Introduction 1-1
1.1 Project Background 1-1
1.2 Outline of the Project 1-2
1.3 Target Area of Project 1-3
1.4 Implementation Structure 1-3
1.5 Activities to Date 1-4

Chapter 2 Related Plans and Studies 2-1
2.1 Relevant Plans at the National Level 2-1
2.2 Relevant Legislation for ASEZ's Development 2-9
2.2.1 List of Relevant Legal Systems 2-9
2.2.2 Overview of Relevant Legal Systems 2-12
2.3 Existing Plans in ASEZ 2-47
2.3.1 ASEZA Strategic Plan 2-47
2.3.2 Urban development 2-48
2.4 Related Studies Made by Donors Agencies 2-59
2.5 Planned Projects in ASEZ 2-61
2.5.1 Planned projects by ASEZA 2-61
2.5.2 Planned Projects by ADC 2-64
2.5.3 Project Information about the Scattered Area Provided by ASEZA 2-71
2.5.4 Marsa Zayed Master Plan 2-72
2.6 Development trends of surrounding countries and regions 2-74
2.6.1 Development trends of surrounding countries and regions 2-74
2.6.2 Comparison between Other Cities by City Index 2-79
2.6.3 Adaptation to global issues such as decarbonization, digital transformation (DX), climate change, and inclusiveness 2-90

Chapter 3 Current Status and Challenges by Sector 3-1
3.1 Natural Environment 3-1
3.1.1 Climate 3-1
3.1.2 Topography, Geology 3-2
3.1.3 Soil 3-4
3.1.4 Protected Area 3-5
3.1.5 Pollution Measures 3-8
3.1.6 Ecosystem 3-12
3.1.7 Natural Environmental Issues in the ASEZ 3-19
3.2 Socio-economic Trends 3-20
3.2.1 General Demographics 3-20
3.2.2 Society 3-39
3.2.3 Economy 3-46
3.2.4 Socioeconomic Issues in ASEZ 3-61
3.3 Land Use 3-63
3.3.1 Current Land Use Plan 3-63
3.3.2 General Land Use Condition 3-66
3.3.3 Land Use Planning and Operational Issues in ASEZ 3-75
3.3.4 Landscape and Urban Design Issues in ASEZ 3-75
3.4 Tourism Development 3-79
3.4.1 Current Situation of Tourism in Jordan 3-79
3.4.2 Current Situation of Tourism in ASEZ 3-82
3.4.3 Challenges on Tourism Development in ASEZ 3-92
3.5 Industrial Development 3-94
3.5.1 Current Situation of Industry in Jordan 3-94
3.5.2 Current Situation of Industry in ASEZ 3-96

3.5.3 Challenges on Industrial Development in ASEZ 3-101
3.6 Transport and Logistics 3-106
3.6.1 Overview of the Transport and Logistics Planning 3-106
3.6.2 Transport 3-111
3.6.3 Logistics 3-135
3.6.4 Traffic Management 3-153
3.7 Improvement of Infrastructure 3-154
3.7.1 Drinking Water Supply System 3-154
3.7.2 Wastewater System 3-168
3.7.3 Wastewater Reclamation 3-176
3.7.4 Irrigation 3-180
3.7.5 Rainwater Drainage 3-181
3.7.6 Electricity 3-184
3.7.7 Telecommunication 3-188
3.7.8 Waste Management 3-189
3.7.9 Gas 3-192
3.8 Disaster Risk Management 3-193
3.8.1 Overview of Disaster Risk in ASEZ 3-193
3.8.2 Climate Change and Flood Risk Management 3-198
3.8.3 Seismic Risk Management 3-267
3.9 Smart City (Utilization of ICT in ASEZ) 3-276
3.9.1 Smart City Approach in General 3-276
3.9.2 Smart City Related activities in Jordan 3-285
3.9.3 Smart City Related Activates in ASEZ 3-286
3.9.4 Smart City Approach in ASEZ 3-295
3.10 Questionnaire Survey Results 3-298
3.10.1 Survey Method 3-298
3.10.2 Contents of Questionnaire 3-300
3.10.3 Questionnaire Results 3-301

Chapter 4 Development Vision and Urban Structure 4-2
4.1 Socio-economic Framework 4-2
4.1.1 Population Framework 4-2
4.1.2 Economic Framework 4-12
4.2 Urban Planning Directions for MP Review and Revisions 4-16
4.2.1 Summary of Sectoral Issues 4-16
4.2.2 Urban Development Directions 4-18
4.2.3 Urban Management Directions 4-19
4.3 Development Vision and Strategy 4-21
4.3.1 Development Vision 4-21
4.3.2 Basic Strategy 4-22
4.4 Urban Structure 4-32

Chapter 5 Land Use Plan 5-1
5.1 Land Use Plan Update 5-1
5.1.1 Land Use Strategies for ASEZ 5-1
5.1.2 Land Use Plan Review Policy 5-2
5.1.3 Land Use Plan 5-14

Chapter 6 Urban Design 6-4
6.1 Sources of Identity in Landscape and Urban Design of ASEZ 6-4
6.1.1 Quality of Life 6-5
6.1.2 Opportunity of Business 6-7
6.1.3 Value of Environment 6-10
6.2 Urban Design Strategy 6-15

6.2.1 【Quality of Life】Strategy and References for “Full of Smile”.....6-15
6.2.2 【Opportunity of Business】 Strategy and References for “Full of Investment Opportunities”.....6-25
6.2.3 【Value of Environment】 Strategy and References for “Full of Green”.....6-26
6.2.4 Guiding urban design with individuality by zone/area.....6-31
6.2.5 Urban Design Considerations and References in Priority Districts.....6-31
6.2.6 Urban Design Strategy Map.....6-52
6.3 Work Items Needed for Updating Design Guidelines/Manual.....6-55
6.3.1 Review of existing D/G.....6-55
6.3.2 Points to note regarding updating and operating urban design guidelines.....6-61

Chapter 7 Development Strategies by Sector.....7-1
7.1 Industrial development.....7-3
7.1.1 Growth Scenarios.....7-3
7.1.2 Development Strategy for Industrial Development.....7-5
7.2 Transport and Logistics.....7-16
7.2.1 Transport and Logistics Contributing to “Quality of Life”.....7-17
7.2.2 Transport and Logistics Contributing to “Opportunity of Business”.....7-46
7.2.3 Transport and Logistics Contributing to “Value of Environment”.....7-60
7.3 Urban Utilities.....7-67
7.3.1 Drinking Water Supply System.....7-67
7.3.2 Sewage System.....7-68
7.3.3 Reclaimed Water.....7-69
7.3.4 Irrigation.....7-70
7.3.5 Rainwater Drainage.....7-70
7.3.6 Electricity.....7-71
7.3.7 Telecommunication.....7-71
7.3.8 Waste Management.....7-71
7.3.9 Gas.....7-71
7.4 Environment Preservation and Management.....7-72
7.4.1 Challenges on Environment Preservation and Management.....7-73
7.4.2 Environment Preservation and Management Strategy.....7-73
7.5 Disaster Risk Management.....7-75
7.5.1 Natural Disaster Risk Management Strategy.....7-77
7.5.2 Proposed Flood Management Strategies in the Very High-Risk Areas.....7-82
7.6 Smart City.....7-96
7.6.1 Challenges and directions to implement “smart city” in ASEZ.....7-96
7.6.2 Proposal of ASEZ smart city vision and strategies.....7-97
7.6.3 Road Map for realizing ASEZ Smart City.....7-123

Chapter 8 Zone Development Policy.....8-2
8.1 Zone Setting.....8-2
8.2 Development Policy by Zone.....8-3

Chapter 9 Implementation of Strategic Environmental Assessment.....9-1
9.1 Outline of Strategic Environmental Assessment (SEA).....9-1
9.1.1 Objectives of SEA.....9-1
9.1.2 Procedures of SEA.....9-2
9.1.3 Policies, Plans, Laws and Regulations related to Environmental and Social Considerations 9-3
9.1.4 Comparison of alternatives.....9-10
9.1.5 Project Components.....9-13
9.1.6 Scoping.....9-13
9.1.7 Baseline Environmental and Social Situation.....9-16

9.1.8 Legal System, etc. for Environmental Impact Assessment 9-16
9.1.9 Overview of Relevant Organizations 9-24
9.1.10 Impact Projections 9-25
9.1.11 Consideration of Mitigation Measures 9-27
9.1.12 Monitoring Plan 9-29
9.2 Stakeholder Meetings 9-31
9.2.1 First Stakeholder Meeting 9-31
9.2.2 Second Stakeholder Meeting 9-39

Chapter 10 Priority Project 10-1
10.1 Priority Projects (long list) 10-1
10.2 High Priority Projects 10-15

Chapter 11 Conclusion and Recommendations 11-1
11.1 Conclusion 11-1
11.2 Recommendation 11-3
11.2.1 Monitoring 11-3
11.2.2 Implementation 11-6

List of Figures

Figure 1-1 Schedule of Project 1-2
Figure 1-2 Project Area 1-3
Figure 1-3 Implementation Structure 1-4
Figure 1-4 Situation of Preparatory JCC Meeting and 2nd JCC 1-5
Figure 1-5 Situation of the 1st Stakeholder Meeting 1-5
Figure 1-6 Situation of TWG and Meeting with Stakeholders 1-7
Figure 2-1 Key Performance Indicators by the Aqaba governorate 2-2
Figure 2-2 Growth Drivers to implement the economic modernisation vision 2-4
Figure 2-3 High level areas of activities for each strategic objective 2-5
Figure 2-4 National Digital Transformation Committee Roles and Responsibilities 2-6
Figure 2-5 ASEZ Law 2-12
Figure 2-6 ASEZA Organization Chart (As of August 2024) 2-18
Figure 2-7 Color swatches (Left: Colors available for building facades, right: colors that can be used for up to 15% of the facade area) 2-22
Figure 2-8 ASEZA Design Guidelines (excerpt) 2-24
Figure 2-9 Examples of buildings in the Ayla Resort that use colors on their facades that are not allowed in the Design Guidelines 2-25
Figure 2-11 Land Use Plan Map by District in Design Standards (excerpt) 2-29
Figure 2-10 Wadi Rum Area (yellow line is Wadi Rum Protection Area, green line is the buffer zone that is being applied to be added to ASEZ, red is the land already added to ASEZ) 2-37
Figure 2-12 Inside the Aqaba Marine Reserve area 2-41
Figure 2-13 Strategic goals of the seven pillars 2-47
Figure 2-14 Proposed Land Use Plan 2-50
Figure 2-15 Project Location of Project List Provided By ASEZA 2-61
Figure 2-16 Project Plan for Detailed Organizational Plan for The South Beach Services Expansion Area . 2-63
Figure 2-17 Plan for Bird Observatory Project 2-63
Figure 2-18 Project Plan for Northern Expansion of Wadi Araba Master Plan 2-64
Figure 2-19 Project Plan for Al -Muthalathiya land project 2-64
Figure 2-20 Projects Locations of Project List Provided by ADC 2-65
Figure 2-21 Project Plan for KHIA(left) and airport Road Network (South Entrance) (right) 2-68
Figure 2-22 Project Plan for The Heritage Aircraft Museum 2-69
Figure 2-23 Project Plan for TARTAN – International Racetrack 2-69
Figure 2-24 Project Plan for Aqaba Agri-Food & Innovation Corridor 2-69
Figure 2-25 Project Plan for SUSTAINABLE URBAN DEVELOPMENT Aqaba Affordable Housing Project 2-70
Figure 2-26 Project Plan for Aqaba Town Park 2-70
Figure 2-27 Project Plan for Al-Quwaira Industrial International Estate 2-70
Figure 2-28 Location of scattered area plans 2-71
Figure 2-29 Marsa Zayed Land Use Plan 2-72
Figure 2-30 Marsa Zayed Land Use Area 2-73
Figure 2-31 Touristic Places along the Red Sea 2-74
Figure 2-32 Positioning of Red Sea Coastal Tourist Cities and Aqaba 2-78
Figure 2-33 Methodology for collecting city index data and its application 2-79
Figure 2-34 Data of the cities from City Prosperity Index 2-82
Figure 2-35 Status of Aqaba (red) compared to other cities (productivity index) 2-84
Figure 2-36 Status of Aqaba (red) compared to other cities (quality of life index) 2-85
Figure 2-37 Status of Aqaba (red) compared to other cities (equity and social inclusion indices) 2-86
Figure 2-38 Status of Aqaba (red) compared to other cities 2-87
Figure 3-1 Monthly temperatures in Aqaba 3-1
Figure 3-2 Monthly precipitation in Aqaba 3-1
Figure 3-3 Wind direction and speed in Aqaba 3-2
Figure 3-4 Topographic map of Jordan 3-3
Figure 3-5 Geological map of Jordan 3-4
Figure 3-6 Jordan soil map 3-5
Figure 3-7 Location of protected areas in Aqaba 3-7
Figure 3-8 Location of Air monitoring Stations 3-8

Figure 3-9 Water quality (seawater) monitoring points 3-9
Figure 3-10 Noise and vibration survey locations 3-11
Figure 3-11 Vegetation distribution map of Jordan 3-13
Figure 3-12 Hotspots of hard coral diversity 3-17
Figure 3-13 Location map of major seagrass beds along the Jordanian coast 3-18
Figure 3-14 Non-Jordanian Population in Aqaba Governorate by Country of Origin (Top 12 Countries) 3-22
Figure 3-15 Population Composition by Age Group in Aqaba Governorate (2015) 3-23
Figure 3-16 District Divisions within Aqaba Governorate 3-24
Figure 3-17 Population by Neighborhood in Central ASEZ (Central Area) (persons) 3-26
Figure 3-18 Population by Neighborhood in Central ASEZ (Greater Area) (persons) 3-27
Figure 3-19 Population by Gender by Neighborhood in Central ASEZ (Central Area) (persons) 3-28
Figure 3-20 Population by Gender by Neighborhood in ASEZ center (broad area) (persons) 3-29
Figure 3-21 Population Density by Neighborhood in Central ASEZ (persons/km2) 3-30
Figure 3-22 Population Density by Neighborhood (persons/km2) 3-31
Figure 3-23 Population Change by Neighborhood in Central ASEZ (%) 3-33
Figure 3-24 Population Change by Neighborhood in ASEZ (%) 3-34
Figure 3-25 Fields of education by population completing a university degree or higher in Aqaba Governorate (2015, persons) 3-41
Figure 3-26 Interregional FTAs (light blue) and bilateral FTAs (dark blue) 3-49
Figure 3-27 FTA Overview 3-50
Figure 3-28 Relationship Chart between Jordan's Major Export Products and Major Export Destinations (FY 2018, in value terms) 3-52
Figure 3-29 Relationship Chart between Jordan's Major Imported Products and Major Import Destinations (FY 2018, by value) 3-55
Figure 3-30 Percentage of Cargo volume by customs (FY 2022) 3-56
Figure 3-31 Percentage of Cargo value by customs (FY 2022) 3-57
Figure 3-32 Foreign Direct Investment in Jordan 3-59
Figure 3-33 Land use share (excluding the new expansion area) 3-63
Figure 3-34 Current Land use plan (Whole city) 3-64
Figure 3-35 Current Land use plan (City center) 3-65
Figure 3-36 General Land Use Condition (City center) 3-67
Figure 3-37 Land use share (excluding the new expansion area) 3-68
Figure 3-38 Issues related to land use 3-69
Figure 3-39 Issues in Downtown and CBD 3-70
Figure 3-40 Issues in Al Hafayer 3-71
Figure 3-41 Issues in Old town 3-72
Figure 3-42 Issues in Residential areas 3-73
Figure 3-43 Explanatory diagram of the setback provisions in the Design Guidelines (draft) 3-76
Figure 3-44Illustrative image of landscape town planning using the Landscape Law in Japan 3-77
Figure 3-45 Eight Priority Areas of the Economic Modernization Vision 3-79
Figure 3-46 Number of visitors to Jordan 3-81
Figure 3-47 Top 30 Countries by Visitor to Jordan (2019) 3-82
Figure 3-48 Seasonal fluctuations in the number of visitors in Jordan 3-82
Figure 3-49 Temperature and precipitation in Aqaba by month 3-83
Figure 3-50 Tourism resources in the Golden Triangle 3-83
Figure 3-51 Number of Hotel Arrivals in Aqaba (2019) 3-84
Figure 3-52 Top 30 countries by Number of Hotel Arrivals in Aqaba (2019) 3-85
Figure 3-53 Seasonal variations in Number of Hotel Arrivals in Aqaba 3-85
Figure 3-54 Seasonal variation of the number of Hotel Arrivals in Aqaba by source market 3-86
Figure 3-55 Tourism MEGA Projects in ASEZA 3-87
Figure 3-56 Seasonal variations in hotel occupancy rate in Aqaba 3-89
Figure 3-57 Major facilities in ASEZ 3-90
Figure 3-58 Tourism resources in the Golden Triangle 3-90
Figure 3-59 Tourism resources in the Golden Triangle 3-91
Figure 3-60 Motivation for the visit of visitors who visited Aqaba 3-92
Figure 3-61 Urban issues related to Tourism 3-93
Figure 3-62 Topographical conditions of M/P target areas and surrounding areas 3-97
Figure 3-63 Aqaba's Number of Employed Persons (Foreign Nationality) by Industry (2022) 3-99
Figure 3-64 Industrial Areas in ASEZ 3-100

Figure 3-65 ASEZA's zoning plan for the south area 3-103
Figure 3-66 ASEZ Competitive Diamond Analysis 3-104
Figure 3-67 Tourism resources in the Golden Triangle 3-105
Figure 3-68 Vision and Themes of Helsinki Strategy (2017-2021) 3-108
Figure 3-69 Four Pillars of the Goals for Helsinki's Transport Program 3-109
Figure 3-70 CO_2 Emission by Sectors in Jordan 3-110
Figure 3-71 Proposed structure and components of the transport and logistics plan 3-111
Figure 3-72 Simplified Structure of the Current Road Network 3-112
Figure 3-73 Road Classification Map Set in the ASEZA Design Guideline 2001 3-114
Figure 3-74 Overview of the Traffic Volume at Major Intersections (Morning Peak) 3-115
Figure 3-75 Locations of Traffic Survey in July 2023 3-118
Figure 3-76 Results of Traffic Survey in July 2023 (1) 3-119
Figure 3-77 Results of Traffic Survey in July 2023 (2) 3-120
Figure 3-78 V_{12}/C_{12} of Major Arterial Roads in Daytime (7:00-19:00) 3-121
Figure 3-79 Registered Public Bus Network in Aqaba 3-122
Figure 3-80 Responses to Questions Regarding Taxi 3-128
Figure 3-81 Responses to Questions Regarding Public Transport 3-128
Figure 3-82 Bus monitoring system in Aqaba Transport Company 3-130
Figure 3-83 Bicycle Lane along Al-Farouk Street 3-131
Figure 3-84 Major Transport Facilities in Aqaba 3-131
Figure 3-85 Passenger and Tourists by Sea 3-132
Figure 3-86 Direct Flights from King Hussein International Airport 3-133
Figure 3-87 Annual passengers at King Hussein Airport 3-134
Figure 3-88 Overview of the Logistics Routes 3-135
Figure 3-89 Container throughput and number of ports call 3-136
Figure 3-90 Container Volume by Country (Import and Export in 2021) 3-136
Figure 3-91 General and Bulk Cargo Throughput 3-137
Figure 3-92 Transit Cargo Volume by Destination 3-137
Figure 3-93 Locations of Existing Port Facilities 3-138
Figure 3-94 Development Options for Container Terminal 3-142
Figure 3-95 Status of Development of the Container Terminal (As-is) 3-143
Figure 3-96 Vision for Future Development of the Container Terminal (To-be) 3-143
Figure 3-97 Development Options for Cruise Terminal 3-144
Figure 3-98 Jordan National Railway Network 3-146
Figure 3-99 Railway Development Plan 3-148
Figure 3-100 Railway network with Jordan and Neighboring Countries (conceptual image) 3-149
Figure 3-101 Railway Network in Saudi Arabia (conceptual image) 3-150
Figure 3-102 Locations of Other Logistics Facilities 3-153
Figure 3-103 Current Situation of the Water Supply System 3-155
Figure 3-104 Annual Water Intake 3-156
Figure 3-105 Map of Wells and Subsurface Basins in Disi Wellfield 3-157
Figure 3-106 Target Water Distribution Zones 3-158
Figure 3-107 Locations of Distribution Reservoir and Relay Pumping Stations 3-161
Figure 3-108 Existing Network of Transmission and Distribution Pipes 3-164
Figure 3-109 Aqaba-Amman Desalination and Water Conveyance Project Overview 3-166
Figure 3-110 The Sewer System 3-168
Figure 3-111 Overview of the Existing Sewer System 3-169
Figure 3-112 Overview of the Sewage System in the Northern Area 3-170
Figure 3-113 Wastewater Treatment Zones 3-171
Figure 3-114 Alignment of Gravity Pipes 3-172
Figure 3-115 Existing Layout of Wastewater Treatment Plant 3-173
Figure 3-116 Schematic Diagram of the Wastewater Reclamation System 3-176
Figure 3-117 Overview of the Existing Wastewater Reclamation System 3-177
Figure 3-118 Location map of irrigation pipelines 3-180
Figure 3-119 Location map of wadi and rainwater channels 3-183
Figure 3-120 Location Map of Electricity Lines and Substation (Entire ASEZ) 3-186
Figure 3-121 Location Map of Electricity Lines and Substation (Central Area) 3-187
Figure 3-122 Composition of waste in Aqaba 3-190
Figure 3-123 Location of Landfill site 3-191

Figure 3-124 Location Map of Gas Network 3-192
Figure 3-125 Classifications of significant hazards and risks in Aqaba Governorate 3-193
Figure 3-126 DRR practice, ASEZA's organization structure 3-195
Figure 3-127 DRR practice, the proposed physical processes for the Aqaba city land use plan 3-196
Figure 3-128 The ten essentials of Aqaba city: ASEZA tools to monitor progress in DRR at the local level.... 3-197
Figure 3-129 Spider chart for the assessment of ASEZA for the ten essential components 3-197
Figure 3-130 Framework and scope of climate change and flood management in Aqaba 3-200
Figure 3-131 Wadi alluvial fans brought the flash flood in urban and non-urbanized areas. 3-201
Figure 3-132 Alluvial fan conveyance system alternative 3-202
Figure 3-133 Location map of the two representative rainfall stations 3-205
Figure 3-134 Schematic Diagram of the FEWS data flow 3-206
Figure 3-135 Flood prone areas in Aqaba 3-208
Figure 3-136 Location map of the received monitoring rainfall station, dams, and target study area of ASEZ and new development areas 3-209
Figure 3-137 Conceptual diagrams for the Wadi Yutum basin and mitigation along the alluvial fan 3-210
Figure 3-138 Site visit for two constructed dams and drainage channels in the urbanized area 3-211
Figure 3-139 Site inspection for four of the six newly developing target areas 3-211
Figure 3-140 Site inspections for the crossing Wadi structures as culvert and the drainage channels 3-212
Figure 3-141 Monthly and seasonal rainfall trend analysis for collecting data over the last 20 years from rain gauges 3-213
Figure 3-142 Rainfall photographs for telemetry stations of Aqaba airport, Al-Rashedia, Humeima, and Ras En-Naqab stations 3-213
Figure 3-143 Comparison between gauging stations and satellite data for the average monthly rainfall for the period (2001-2021) 3-214
Figure 3-144 Developed maps for flood-prone areas based on Google Earth Engine (GEE) to identify the flood extent in Aqaba 3-215
Figure 3-145 Collected observed and remote sensing data for historical climate analysis 3-217
Figure 3-146 Time series (1982 – 2019) of GPCC data of the mean daily rainfall over Aqaba 3-217
Figure 3-147 RCP scenarios presented in the d4PDF database (Source: https://www.miroc-gcm.jp/d4PDF/design_en.html) 3-218
Figure 3-148 Intra-annual variability of rainfall and maximum temperature over Aqaba during 1951-2011 3-219
Figure 3-149 Future precipitation (2023 –2089) of CMIP6 data for medium and high-emissions over Aqaba. 3-220
Figure 3-150 The change ratio for the extreme precipitation of a 100-year return period between historical and SSP5 (H_SSP5: 2060-2100) over Jordan. 3-221
Figure 3-151 The boundary of the study area is in the red boundary line, which is a part of the. Wadi Yutum catchment 3-222
Figure 3-152 Schematic diagram of required data, concept, and expected outputs of the RRI model (Sayama et al., 2012). 3-223
Figure 3-153 Schematic diagram of flood modeling procedure for RRI software. 3-224
Figure 3-154 Spatial rainfall variation during the storm on 13-14 March 2020. 3-225
Figure 3-155 The cumulative rainfall for the 13-14 March 2020 event and hourly rainfall distribution for the 13-14 March 2020 event 3-225
Figure 3-156 The spatial map represents the spatial distribution of rainfall over the simulated area. 3-226
Figure 3-157 Results of RRI model calibration and sensitivity analysis of mesh sizes during March 2020 3-227
Figure 3-158 Spatial distribution of rainfall of the 29th of May flood event over the simulated area 3-228
Figure 3-159 Hourly simulated hydrograph for 29th May 2023 3-229
Figure 3-160 Validation results of the RRI model and sensitivity analysis of mesh sizes during 13-15 March 2023 and 24-25 March 2023 3-229
Figure 3-161 Validation results of the RRI model on the 29th of May 2023 3-230
Figure 3-162 Simulation procedure of PCSWMM model 3-231
Figure 3-163 PCSWMM model setup of nodes, conduits, and outfalls preprocessing 3-231
Figure 3-164 Calibration and validation results of flood inundation maps using the PCSWMM model 3-232
Figure 3-165 Flood map for different return periods (a) 2 Y (b) 5Y (c) 10 Y (d) 25Y (e) 50 Y (f) 100Y 3-233
Figure 3-166 Flood hydrograph of the simulated discharge for the 100-year return period. 3-234
Figure 3-167 Flood hazard maps at the catchment scale using the RRI for different return periods 3-235
Figure 3-168 Percentage of the flood hazard area in the simulated catchment at different return periods... 3-236

Figure 3-169 The flood hazard area in the target area (ASEZ, Wadi Araba, six scattered areas)..... 3-236
Figure 3-170 The flood hazard area in the ASEZ and Wadi Araba for the 100 Y return period..... 3-237
Figure 3-171 Flood hazard maps at the catchment scale using PCSWMM for different return periods..... 3-238
Figure 3-172 Flood hazard maps at the city-scale using PCSWMM for 100Y 3-239
Figure 3-173 Flood hazard maps at the city-scale using PCSWMM for 100Y 3-240
Figure 3-174 Flood hazard maps at the city-scale using PCSWMM for 100Y 3-241
Figure 3-175 Flood hazard maps at the city scale using PCSWMM for 100Y 3-242
Figure 3-176 Flood hazard maps at the city scale using PCSWMM for 100Y 3-243
Figure 3-177 The flood hazard map under climate change scenario #1 (20%)..... 3-245
Figure 3-178 The flood hazard map for Scenario #1; zoom in on the affected areas in coastal Wadi, the area nearest the K-Hussein International Airport, and Aqaba City..... 3-246
Figure 3-179 The flood hazard map for Scenario #1, the northern region of Aqaba near Wadi Araba and the southern coastal Wadis in Aqaba of the simulated area. 3-247
Figure 3-180 The flood hazard map for the first scenario climate change scenarios with Zoom-in at the Al-Quwaira and Manshir regions..... 3-248
Figure 3-181 The catchment flood hazard map for the fifth climate change scenario 3-249
Figure 3-182 The catchment flood hazard map for the fifth climate change scenario 3-250
Figure 3-183 The flood hazard map for the high flood-prone areas under the fifth climate scenario..... 3-251
Figure 3-184 The flood hazard map for the fifth scenario zoomed in on the Al-Quwaira and Manshir regions 3-252
Figure 3-185 The catchment flood hazard map for the six-climate change scenario 3-253
Figure 3-186 The flood hazard map for the fifth scenario zoomed in the coastal wadi's region..... 3-254
Figure 3-187 The flood hazard map for the fifth scenario zooming in the northern region 3-255
Figure 3-188 The flood hazard map for the sixth scenario zoom-in on the Al-Quwaira and Manshir regions .. 3-256
Figure 3-189 Hydrograph of the simulated discharge for the different climate scenarios..... 3-257
Figure 3-190 Percentage of the flood hazard area in the simulated area for different climate scenarios 3-257
Figure 3-191 Flood hazard maps at the catchment-scale using PCSWMM for four climate scenarios 3-258
Figure 3-192 The flood hazard map developed by PCSWMM for the six scenarios zoomed in on the newly developed target areas..... 3-259
Figure 3-193 City-scale hazard map under the coupled impacts of urbanization and climate change scenario #6 using PCSWMM..... 3-260
Figure 3-194 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6..... 3-261
Figure 3-195 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6..... 3-262
Figure 3-196 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6..... 3-263
Figure 3-197 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6..... 3-264
Figure 3-198 Enhancing flood resilience management in Aqaba by considering an integrated approach from the mountains to the sea. 3-266
Figure 3-199 Seismic Hazard Map in Jordan 3-268
Figure 3-200 Peak Ground Acceleration 3-268
Figure 3-201 Spectral Acceleration Map..... 3-269
Figure 3-202 Seismic Risk Factor Map of Aqaba 3-270
Figure 3-203 Image of Smart City System..... 3-277
Figure 3-204 Basic Values of Smart Cities..... 3-278
Figure 3-205 Basic Principles of Smart Cities 3-279
Figure 3-206 Smart City Functions 3-280
Figure 3-207 Smart City Means 3-280
Figure 3-208 Smart City Domains and its activities (Example)..... 3-281
Figure 3-209 From sector-wise optimization to Cross-disciplinary optimization (Image)..... 3-281
Figure 3-210 Success Factors for Realization of Smart City 3-282
Figure 3-211 ASEZA application (Top page, Investment Services, Licensing Services, Transport Services, Complaints) 3-286
Figure 3-212 GIS System of AWC (Left picture) and SCADA System (Right picture) 3-288
Figure 3-213 Smart Meter (Left picture) and Monitoring System (Right picture)..... 3-288
Figure 3-214 Observation data from the Water Environment Observatory..... 3-289

Figure 3-215 Environmental information board (left) and location (right) 3-290
Figure 3-216 EWS Operation Room in ADC 3-291
Figure 3-217 Information flow of flood risk 3-291
Figure 3-218 Bus Monitoring System in Aqaba Transport Company 3-292
Figure 3-219 The Jordan Pass Website 3-293
Figure 3-220 Current situation and future directions of Smart City initiatives in ASEZ (proposed) 3-295
Figure 3-221 Example of Agile Development: Expansion of Smart City Activities In the case of targeting a specific area (left figure) and in the case of targeting a specific sector (right figure) 3-297
Figure 3-222 Questionnaire Flyers (left: for residents / right: for visitors) 3-298
Figure 3-223 Posters in the city 3-299
Figure 3-224 Zoning of residential area for the questionnaire survey 3-319
Figure 4-1 Population Change 4-4
Figure 4-2 Population Pyramid in 2040 4-5
Figure 4-3 ASEZ Central Locations by Area (Top) and Size of Habitable Area (Bottom) 4-7
Figure 4-4 Percentage of Built-up Areas and Population Density by Neighborhood in Area A 4-8
Figure 4-5 Confirmation of Approximate Living Capacity 4-9
Figure 4-6 Percentage of Built-up Areas by Neighborhood in Central ASEZ (enlarged) 4-10
Figure 4-7 Percentage of Built-up Areas by Neighborhood in Central ASEZ (wider area) 4-11
Figure 4-8 Projected Number of Hotel Arrivals in Aqaba 4-14
Figure 4-9 Urban Development Directions 4-19
Figure 4-10 Image of Development Vision and Strategy 4-21
Figure 4-11 Examples of Area Based Approaches to Realize Strategy (1/3) 4-24
Figure 4-12 Examples of Area Based Approaches to Realize Strategy (2/3) 4-26
Figure 4-13 Examples of Area Based Approaches to Realize Strategy (3/3) 4-28
Figure 4-14 Process for identifying the development vision and strategy 4-31
Figure 4-15 Image of Compact and Networked City 4-32
Figure 4-16 Development Scenarios and image of the development 4-33
Figure 4-17 Development Scenarios and image of the density of development 4-35
Figure 4-18 Proposed Urban Structure of Aqaba 4-37
Figure 4-19 Urban structure (city-wide) 4-39
Figure 4-20 Urban structure (Aqaba Town) 4-41
Figure 4-21 Urban structure (South Area) 4-42
Figure 5-1 Types and Development Image of Zoning in Japan 5-5
Figure 5-2 Recommendation for the Land Use Plan update by area 5-11
Figure 5-3 Updated New Land Use Plan (Whole ASEZ) and Area 5-14
Figure 5-4 Updated New Land Use Plan (exc. Wadi Rum area) 5-15
Figure 5-5 Updated New Land Use Plan (Central area) 5-16
Figure 6-1 Aqaba downtown area and its major roads 6-4
Figure 6-2 Historical site of Islamic Ayla 6-5
Figure 6-3 Ancient retaining wall left on unused land 6-5
Figure 6-4 Sharif Hussein bin Ali Mosque 6-6
Figure 6-5 Revolt Plaza commercial building using stone facade 6-7
Figure 6-6 Colors that may be used on building facades in ASEZ 6-7
Figure 6-7 Stores by the public beach 6-8
Figure 6-8 Small stores at the downtown area 6-8
Figure 6-9 Excerpts from the Master Plan for Marsa Zayed Project 6-9
Figure 6-10 New hotel under construction in Saraya 6-9
Figure 6-11 Private beach in Saraya 6-10
Figure 6-12 Buildings and pedestrian path in Ayla Resort 6-10
Figure 6-13 Distant view of public beach, Downtown and mountains from the Gulf of Aqaba 6-11
Figure 6-14 The view of Red Sea from Revolt Plaza 6-11
Figure 6-15 The current situation of South Beach 6-11
Figure 6-16 The view of Gulf of Aqaba from the slope at Old Town area 6-12
Figure 6-17 View of the mountain range 6-12
Figure 6-18 View of the downtown area and with the mountains in the background from Gulf of Aqaba 6-13
Figure 6-19 Greenery along the Al Hussein Bin-Ali Street 6-13
Figure 6-20 Princess Salma Park 6-14
Figure 6-21 Dessert at the Wadi Rum Protection Area 6-14
Figure 6-22 Wadi that was creating as a flash flood protection in the urban fringe area 6-15

Figure 6-23 Reference case: Yokohama Motomachi Shopping Street, car-free zone designation 6-18
Figure 6-24 Reference case: Image of roadway reduction and sidewalk widening in the Sannomiya Station area National Highway No. 2 redevelopment project 6-18
Figure 6-25 Reference case: Woonerf in Yokohama Motomachi Shopping Street..... 6-19
Figure 6-26 Street furniture on Motomachi Shopping Street 6-19
Figure 6-27 Reference case: Greenery sidewalks on Nihon Odori (Yokohama, Japan)..... 6-20
Figure 6-28 Reference case: Greenery sidewalks on Jozenji Street (Sendai, Japan)..... 6-20
Figure 6-29 Reference case: American Village (Okinawa, Japan) 6-21
Figure 6-30 Reference case: Setbacks along the road in residential area (Kobe, Japan)..... 6-21
Figure 6-31 Reference case: Scraping crosswalks (Yokohama, Japan)..... 6-22
Figure 6-32 Crosswalks improvement for universal design 6-22
Figure 6-33 Reference case: Signs placed at intersections (Yokohama, Japan) 6-23
Figure 6-34 Reference case: Information map installed together with benches and plantings (Yokohama, Japan) 6-23
Figure 6-35 Current status of access to public beaches of Aqaba Town 6-24
Figure 6-36 Reference case: Universal design walkway of Azama Sansan beach (Okinawa, Japan)..... 6-24
Figure 6-37 Scene in the Ayla Circle before sunset..... 6-25
Figure 6-38 Reference case: Vista point of Harbor View Park (Yokohama, Japan)..... 6-27
Figure 6-39 Observatory of Harbor View Park 6-28
Figure 6-40 Scenic view from a vista point of Harbor View Park..... 6-28
Figure 6-41 Scenic view from Daijuji Temple gate to Okazaki Castle 6-29
Figure 6-42 Vista line from Daijuji Temple to Okazaki Castle 6-29
Figure 6-43 Store and residence with PV panels on the roof 6-30
Figure 6-44 Store and residence with PV panels on the roof 6-30
Figure 6-45 View toward the Red Sea from Pr. Muhamad St. 6-32
Figure 6-46 Al Hafayer..... 6-32
Figure 6-47 View of the Shallalah area from Old Town over Mecca Street..... 6-33
Figure 6-48 View of the Shallalah area from Old Town over Mecca Street..... 6-33
Figure 6-49 Priority Districts..... 6-34
Figure 6-50 Crosswalks scrubbed with sidewalks (left) and sidewalks with rest areas (right) 6-35
Figure 6-51 Zou no hana park 6-36
Figure 6-52 Bollards in ZOU-NO-HANA Park with elephant motif 6-36
Figure 6-53 Example of R (red) regulated colors for outdoor advertising in Kyoto City 6-37
Figure 6-54 Outdoor signage for a fast-food restaurant near Kyoto Station with low red saturation..... 6-37
Figure 6-55 Reference case: Yokohama Motomachi Shopping Street, car-free zone designation (reiterate). 6-38
Figure 6-56 Planting of public space with roses and benches with rose motif in Fukuyama City 6-38
Figure 6-57 Reference case: Image of roadway reduction and sidewalk widening in the Sannomiya Station area National Highway No. 2 redevelopment project (reiterate)..... 6-39
Figure 6-58 Sign board showing the history of urban design around Yokohama Port 6-40
Figure 6-59 Reference case: Universal design walkway of Azama Sansan beach (Okinawa, Japan) (reiterate) 6-40
Figure 6-60 View from East side of Princess Salma Park 6-41
Figure 6-61 Yokohama City Green Axis and Waterfront Axis 6-41
Figure 6-62 Pedestrian space on the green axis (left) and the intersection of the green and waterfront axes (right) 6-42
Figure 6-63 View of the Gulf of Aqaba from an alley in Old Town..... 6-43
Figure 6-64 Reference case: Vista point of Harbor View Park (Yokohama, Japan) (reiterate) 6-43
Figure 6-65 Observatory of Harbor View Park(reiterate)..... 6-44
Figure 6-66 Scenic view from a vista point of Harbor View Park(reiterate)..... 6-44
Figure 6-67 Reference case: Pedestrian path with bicycle path 6-45
Figure 6-68 Width regulations for integrating pedestrian and bicycle paths..... 6-45
Figure 6-69 Yokohama Osanbashi International Passenger Terminal 6-46
Figure 6-70 Rooftop Plaza of Yokohama Osanbashi International Passenger Terminal 6-46
Figure 6-71 Streetscape Formation of Motomachi Shopping Street 6-47
Figure 6-72 View from New Core intersection point 6-47
Figure 6-73 Reference case: Setbacks along the road in residential area (Kobe, Japan) (reiterate) 6-48
Figure 6-74 Sidewalk design for Motomachi Shopping Street..... 6-50
Figure 6-75 Barrie-free equipment(left), path with slopes on the beach(right)..... 6-50
Figure 6-76 Urban Design Strategy Map (Integrated)..... 6-52

Figure 6-77 Urban Design Strategy Map (Green) 6-53
Figure 6-78 Urban Design Strategy Map (Walkability) 6-54
Figure 6-79 Table of contents of existing ASEZ Design Guidelines 6-56
Figure 6-80 Relationship between urban development M/P and Urban Design Guidelines and proposed structure of Urban Design Guidelines 6-57
Figure 6-81 Example of presenting the area of urban space subject to landscape formation as a basic policy for urban design planning (Kobe City) 6-58
Figure 6-82 Three directions of landscape planning and images of their coordination (Kobe City) 6-58
Figure 6-83 Kobe City Basic Policy for Urban Landscape Formation Integrated Map (Environmental) 6-59
Figure 6-84 Example of a possible conservation building: remains of the oldest building in Aqaba 6-60
Figure 7-1 Strategy Planning System 7-2
Figure 7-2 Potential Agricultural Products in Aqaba 7-7
Figure 7-3 Examples of Knowledge-Based Industries in Agriculture and Fisheries through Digital Transformation 7-8
Figure 7-4 Three elements of tourism receipt 7-8
Figure 7-5 Habitas (Al-Ula, Saudi Arabia) Example 7-9
Figure 7-6 Photovoltaic industry cluster in Noor Complex, Ouarzazat, Morocco 7-12
Figure 7-7 Noor Complex's business model in Ouarzazat, Morocco 7-13
Figure 7-8 Examples of industries that utilize the potential of the region 7-13
Figure 7-9 Location of individual project ideas 7-13
Figure 7-10 Examples of smart mobility 7-14
Figure 7-11 Major Truck Routes in ASEZ 7-17
Figure 7-12 Traffic Volume at Intersection #3 Counted in July 2023 7-18
Figure 7-13 Traffic Safety Issue at and around Intersection #3 7-19
Figure 7-14 Proposal for Grade Separation of Intersection #3 7-19
Figure 7-15 Proposal for Enhancing Separation of Trucks from the City Center 7-20
Figure 7-16 Comparison of Bus, BRT, LRT, and MRT 7-21
Figure 7-17 Proposed Main Public Transport Corridor in Aqaba 7-22
Figure 7-18 Basic Concept of Modal Connection Initiatives in Japan 7-23
Figure 7-19 Existing Bus Terminal in Downtown of Aqaba 7-24
Figure 7-20 Candidates for the New Bus Terminal Location 7-25
Figure 7-21 Example of Traffic Movement to/from the New Bus Terminal (Location 1) 7-28
Figure 7-22 Proposed Key Public Bus Lines in Aqaba 7-29
Figure 7-23 Bus Stop with Seating and Shelter in Aqaba 7-30
Figure 7-24 Proposed Dimension of Bus Stop 7-31
Figure 7-25 Bus Bay Proposed for Bus Stops on Arterial Roads 7-31
Figure 7-26 Proposed Guidelines for Bus Stop Location 7-32
Figure 7-27 Existing Bus Depot and Maintenance Workshop 7-33
Figure 7-28 Mobile Phone Application “Amman Bus” 7-34
Figure 7-29 Examples of Digital Signage at Bus stops 7-35
Figure 7-30 Concept of On-Demand Bus 7-36
Figure 7-31 Concept of International Passenger Railway Route 7-36
Figure 7-32 Candidates for TOD Hub Locations 7-37
Figure 7-33 Proposal of Sea Taxi Route 7-38
Figure 7-34 Proposal of Flying Taxi Service 7-38
Figure 7-35 Accident-Prone Locations in ASEZ 7-39
Figure 7-36 Traffic Congestion in the Commercial Area in Aqaba 7-41
Figure 7-37 Traffic Capacity of At-Grade Intersections by Types 7-42
Figure 7-38 Signalized Intersections in ASEZ (9 Locations in Total) 7-43
Figure 7-39 Examples of Traffic Control Centers 7-44
Figure 7-40 Illegal Parking in the Downtown and on Arterial Roads 7-44
Figure 7-41 Transition of Main Traffic Corridor in Aqaba CBD 7-45
Figure 7-42 Proposal of New Inter-Regional Arterial Road Construction 7-46
Figure 7-43 Rough Measures of Elevation of the Back Road 7-47
Figure 7-44 Proposal of Mountain Highway 7-48
Figure 7-45 Proposal of Wadi Araba Bypass 7-48
Figure 7-46 Layout Plan in the KHIA Development Project 7-51
Figure 7-47 Modal Splits for the Landside Traffic Forecast 7-52
Figure 7-48 Proposal for North Port Area Zoning 7-54

Figure 7-49 Proposal for Middle Port Area Zoning 7-56
Figure 7-50 Proposal for New South Port Area Zoning 7-57
Figure 7-51 Freight Railway Routes under Study (as of June 2024) 7-58
Figure 7-52 Conceptual Railway Network 7-59
Figure 7-53 Examples of Bicycle Lane 7-61
Figure 7-54 Proposal for Bicycle Lane Network in Aqaba 7-63
Figure 7-55 On-Street Parking on Sharif Hussein bin Ali Boulevard in Aqaba 7-63
Figure 7-56 Example of Indoor Bicycle Parking in Tokyo, Japan 7-64
Figure 7-57 Examples of Shared-Bicycle Service 7-65
Figure 7-58 EV Quick Charging Devices in a Commercial Building (Japan) 7-66
Figure 7.59 Location maps of the proposed dams for protecting and harvesting the flash floods in the Al-Quwaira industrial zone 7-83
Figure 7.60 The layout of the dam sites with a zoom-in on the affected areas in Al-Quwaira overlaid on the flood hazard map for the following scenarios: a) 100-year return period without considering the impacts of climate change; b) 100-year return period under the impacts of climate change (Scenario #5); c) 100-year return period under the impacts of climate change (Scenario #6) 7-84
Figure 7.61 The tentative geometries and sections of the proposed dams 7-84
Figure 7.62 The characteristic and layout of the reservoir dam 1 7-85
Figure 7.63 The characteristic and layout of the reservoir dam 2 7-85
Figure 7.64 Proposed measures to improve permeable soils for runoff water using green infrastructures, water harvesting tanks, and low-impact development tools (LID) 7-86
Figure 7.65 Location maps of a potential dam site for flash flood protection in the logistics and trucking services area. 7-86
Figure 7.66 The layout of the dam site with a zoom-in on the affected areas in logistics and trucking services area overlaid on the flood hazard map for the following scenarios: a) 100-year return period without considering the impacts of climate change; b) 100-year return period under the impacts of climate change (Scenario #5); c) 100-year return period under the impacts of climate change (Scenario #6) 7-87
Figure 7.67 The tentative geometry and section of the proposed dam in logistics and trucking services area .. 7-87
Figure 7.68 The characteristic and layout of the reservoir dam in the logistics and trucking services area... 7-88
Figure 7.69 Proposed measures to improve permeable soils for runoff water using green infrastructures, water harvesting tanks, and low-impact development tools (LID) in the logistics and trucking services area. 7-88
Figure 7-70 Current status and future direction of smart city initiatives in ASEZ 7-96
Figure 7-71 Steps towards the realization of smart city 7-97
Figure 7-72 Three layers of smart city initiatives 7-99
Figure 7-73 Structure of a Data Platform (Image) 7-100
Figure 7-74 System Overview of the Takamatsu IoT Common Platform 7-101
Figure 7-75 Seven Smart City Service Domains (Proposed) 7-103
Figure 7-76 Phasing Development of Smart City Initiatives (Proposed) 7-120
Figure 7-77 Role of ASEZ Smart City Unit and Smart City Officer (Proposed) 7-121
Figure 7-78 Organizational Structure of ASEZ Smart City Unit (Proposed) 7-121
Figure 7-79 Establishment of a 'Smart City Unit', establishment of a 'City Management Centre' and appointment of a 'Smart City Officer' (Proposed) 7-122
Figure 7-80 Establishment of a ASEZ Smart City Promotion Team (left) and Muti Stakeholder Engagement (right) (Proposed) 7-123
Figure 8-1 Map of the Zones 8-2
Figure 8-2 Outline of the Zone development Policy 8-2
Figure 8-3 Development Concept Image 8-4
Figure 8-4 Development Concept Image 8-5
Figure 8-5 Development Concept Image 8-7
Figure 8-6 Development Concept Image 8-8
Figure 8-7 Development Concept Image 8-10
Figure 8-8 Development Concept Image 8-12
Figure 8-9 Development Concept Image 8-13
Figure 8-10 Development Concept Image 8-14
Figure 8-11 Development Concept Image 8-16
Figure 8-12 Development Concept Image 8-17

Figure 9-1 Strategies, Policies, Plans and Programs Covered by the SEA 9-1
Figure 9-2 Outline of SEA Procedures 9-2
Figure 9-3 Environmental and social impact flow in case of using the existing MP as it is (Without Project).. 9-11
Figure 9-4 Environmental and social impact flow in case of upgrading MP (With Project) 9-12
Figure 9-5 Project Components 9-13
Figure 9-6 Photos from the First Stakeholder Meeting 9-31
Figure 9-7 Photos from the Second Stakeholder Meeting 9-39
Figure 11.1 Relationship between master plan structure and monitoring 11-5
Figure 11.2 Organizational Structure for Monitoring and Implementation 11-6
Figure 11.3 Project Methodology Review Process for Each Initiative 11-9

List of Tables

Table 1-1 Outline of Field Study 1-4
Table 1-2 Outline of TWG Meetings 1-5
Table 2-1 List of relevant plans at national level 2-1
Table 2-2 JEGP Projects related to Aqaba 2-3
Table 2-3 Projects related to Aqaba 2-3
Table 2-4 List of implementation projects related to ASEZ 2-6
Table 2-5 List of related legal systems 2-9
Table 2-6 Table of Contents and main contents of ASEZA Design Guidelines 2-23
Table 2-7 [Annex 3 List of concession contracts concluded with ASEZA] 2-44
Table 2-8 Existing Plans in ASEZ 2-48
Table 2-9 Proposed Development Plan 2-51
Table 2-10 Proposed Development Plan for Infrastructure 2-53
Table 2-11 Key Development Issues of Existing Development Conditions in ASEZ 2-57
Table 2-12 Suggested Strategic Development Alternatives for ASEZA 2-58
Table 2-13 Recommended studies / steps 2-58
Table 2-14 List of studies related to Aqaba 2-59
Table 2-15 Project List Provided by ASEZA 2-61
Table 2-16 Project List Provided by ADC 2-65
Table 2-17 Details of the 6 Scattered Areas 2-71
Table 2-18 Evaluation of the available city indexes 2-81
Table 2-19 Data availability in Aqaba for city index 2-83
Table 2-20 City index indicators and CPT indices 2-87
Table 2-21 Benchmarks 2-88
Table 3.1 Summary of Protected Areas in Aqaba 3-6
Table 3.2 Air Quality Monitoring Results (2022) 3-8
Table 3.3 Water quality (seawater) monitoring results (2022) 3-10
Table 3.4 Summary of the noise and vibration field survey locations 3-11
Table 3.5 Result of the noise survey 3-12
Table 3.6 Endangered/threatened mammals inhabiting Aqaba 3-14
Table 3.7 Endangered/threatened bird species in Aqaba 3-14
Table 3.8 Endangered/threatened reptiles (terrestrial) in Aqaba 3-15
Table 3.9 Major endemic fish of the Gulf of Aqaba 3-19
Table 3.10 Population of Jordan and Aqaba Governorate 3-20
Table 3.11 Migration between Aqaba Governorate and other governorates (2015) 3-21
Table 3.12 Non-Jordanian Population by region of origin in Aqaba Governorate 3-22
Table 3.13 Reasons for Non-Jordanians to Reside in Aqaba Governorate, 2015 3-22
Table 3.14 Population by Age Group within Aqaba Governorate 3-23
Table 3.15 Population by District in Aqaba Governorate 3-24
Table 3.16 Urban and Rural Population Change (Average Annual Growth Rate from 2004 to 2015) 3-24
Table 3.17 Private Households by Number of Household Members 3-35
Table 3.18 Housing Unit Breakdown in Urban area (2015) 3-36
Table 3.19 Occupied Conventional Housing Units by Type of Tenure in Urban area (2004, 2015) 3-36
Table 3.20 Occupied Rented Conventional Housing Units by Monthly Rent Value (JOD) 3-36
Table 3.21 Conventional Buildings by Year of Laying Fundaments (2015) 3-36
Table 3.22 Buildings by Main Material of External Walls in Urban area (2015) 3-37
Table 3.23 Average of Annual Current Household Income by Source of Income (JOD) 3-37
Table 3.24 Average of Annual Household Expenditure (JOD) 3-38
Table 3.25 Absolute Poverty Rate (%) 3-38
Table 3.26 Human Development Indices for Jordan and Neighboring Countries (2021) 3-39
Table 3.27 Enrolment Rates by Age Group in Aqaba Governorate (2015) 3-40
Table 3.28 Education level of productive-age Jordanians not currently in school in Aqaba Governorate (2015) 3-41
Table 3.29 Working population and unemployment rate by governorate, Jordan (2015) 3-42
Table 3.30 Working population and unemployment rates by 5-Year age groups in Aqaba Governorate (2015) 3-43
Table 3.31 Changes in labor force and other populations in Aqaba Governorate 3-43

Table 3.32 Number of employees by length of employment in Aqaba Governorate, 2015 3-43
Table 3.33 Number of Jordanians by the type of employment (15 years old and over, 2021) 3-44
Table 3.34 Jordanian employment percentage by sector (15+, 2021) 3-45
Table 3.35 Percentage of Jordanians employed by occupation (15+, 2021) 3-45
Table 3.36 Percentage of Jordanians employed by industry (15+, 2021) 3-45
Table 3.37 Percentage of Jordanians' monthly income by governorate (15+, 2021) 3-46
Table 3.38 Average monthly wages of Jordanians by sector (15+, 2021) 3-46
Table 3.39 GDP and GDP per capita of Jordan 3-47
Table 3.40 Estimated GDP contribution by sector, in real price terms (2021, 2016=100) 3-48
Table 3.41 Estimated GDP growth by sector, in real prices (2021, 2016=100) 3-48
Table 3.42 Estimated GRDP of Aqaba Governorate 3-48
Table 3.43 Jordan's export trends in 2014~2018 (JOD) 3-51
Table 3.44 Characteristics of Jordan's export commodities 3-53
Table 3.45 Jordan's Export Trends in 2014~2018 (JOD) 3-54
Table 3.46 Jordan's Cargo volume by customs (thousand tons) 3-56
Table 3.47 Jordan's Cargo value by customs (million JD) 3-57
Table 3.48 Cargo volume in Al Aqaba Customs (thousand ton) 3-58
Table 3.49 Cargo value in Al Aqaba Customs (million JD) 3-58
Table 3.50 Ranking of MENA countries in WB Doing Business 2020 3-60
Table 3.51 KPIs of the tourism industry in the " Economic Modernization Vision " 3-80
Table 3.52 SWOT Analysis of Tourism Development in Aqaba 3-92
Table 3.53 KPIs for "High Value Industries" and "Future Services" 3-95
Table 3.54 Targets related to the development of ASEZ identified in BCG survey 3-101
Table 3.55 SWOT Analysis of Aqaba Industrial Development 3-102
Table 3.56 Situation of Labor market in ASEZ 3-105
Table 3.57 Projects in the ASEZA Master Plan 3-106
Table 3.58 Transport investment programme of Helsinki 3-109
Table 3.59 Road section design according to road classification 3-113
Table 3.60 Number of Vehicles Counted at Major Intersections (Morning Peak) 3-116
Table 3.61 Bus Route Information (1/4) 3-123
Table 3.62 Bus Route Information (2/4) 3-124
Table 3.63 Bus Route Information (3/4) 3-125
Table 3.64 Bus Route Information (4/4) 3-126
Table 3.65 Number of Passengers by Routes Operated by Aqaba Transport Company 3-126
Table 3.66 Suggestions by Respondents for Raising the Level of Transport System 3-129
Table 3.67 Information of Direct Flights Connecting Aqaba 3-133
Table 3.68 Overview of Existing Port Facilities (North Port Area) 3-138
Table 3.69 Overview of Existing Port Facilities (Middle Port Area) 3-139
Table 3.70 Overview of Existing Port Facilities (New South Port Area) 3-139
Table 3.71 Gap Analysis between Capacity and Forecast Demand 3-141
Table 3.72 Assessment of Development Options for Container Terminal 3-142
Table 3.73 Assessment of Development Options for Cruise Terminal 3-145
Table 3.74 List of Surveys on Railway Development in Jordan 3-147
Table 3.75 Other Existing Logistics Facilities 3-151
Table 3.76 List of Water Sources (Wells) 3-156
Table 3.77 Target Amount of Water Distribution by Distribution Zone 3-159
Table 3.78 Levels for the Target Water Distribution Amount 3-160
Table 3.79 Summary Description of Distribution Reservoirs 3-162
Table 3.80 Primary Pipe Network 3-163
Table 3.81 Outline of Facility Improvement by the Project 3-165
Table 3.82 Inflow to the Wastewater Treatment Plant 3-174
Table 3.83 Monthly Wastewater Amount (thousand m^3/month) 3-174
Table 3.84 Demand for Reclaimed Water 3-178
Table 3.85 Distribution Reservoirs for Reclaimed Water 3-179
Table 3.86 Pipes for URW 3-179
Table 3.87 List of Substation 3-184
Table 3.88 List of power line extensions 3-185
Table 3.89 Waste Collection in Jordan by Region (ton/year) 3-189
Table 3.90 Daily per capita waste generation in Jordan by region 3-189

Table 3.91 Waste Generated and Destination by Prefecture 3-189
Table 3.92 Waste Landfill Volume by Landfill Site 3-190
Table 3.93 Record of some flash flood events in Aqaba 3-207
Table 3.94 Information on the collected remote sensing datasets 3-209
Table 3.95 Summarized climate change impacts from the 4th NC report 3-216
Table 3.96 Precipitation intensities and cumulative rainfall for 100 Y-RP and climate scenarios 3-244
Table 3.97 Success Factors for Realization of Smart City (Reference) 3-282
Table 3.98 Overview of Water Quality Environmental Observatory 3-289
Table 3.99 Sector-wise activities and challenges in ASEZ 3-294
Table 3.100 Overview of Questionnaire Survey 3-298
Table 3.101 Items in the Questionnaire (for residents and visitors) 3-300
Table 3.102 Questionnaire Results 3-301
Table 3.103 Results of the cross analysis by gender and age 3-306
Table 3.104 Results of cross analysis based on the residential area 3-319
Table 3.105 Questionnaire Results 3-328
Table 4-1 Estimated Jordanian Population in Aqaba Governorate 4-2
Table 4-2 Estimated Non-Jordanian Population in Aqaba Governorate 4-3
Table 4-3 Estimated Scenarios for Non-Jordanian Population 4-3
Table 4-4 Population Estimates for Aqaba Governorate 4-4
Table 4-5 Proposed Population Scenario for Aqaba Governorate 4-6
Table 4-6 Number of Workers by Sector and Forecast Results Based on Sector-Specific CAGRs for Aqaba Governorate 4-12
Table 4-7 Proposed Population Scenarios for Aqaba Governorate 4-13
Table 4-8 Comparison of Current and Projected Number of Workers by Sector in Aqaba Governorate 4-15
Table 4-9 Sectoral Issues 4-16
Table 4-10 Development Scenarios and Concepts 4-33
Table 4-11 Pros and Cons of the three scenarios 4-34
Table 4-12 Components of the regional urban structure 4-40
Table 5-1 Land Use Policies to realize the development vision 5-1
Table 5-2 Overview of Land Use Types and Main Uses in Jordan 5-3
Table 5-3 Overview of building control in Jordan 5-4
Table 5-4 Use regulations in each zoning district 5-6
Table 5-5 Overview of Land Use Types and Main Uses 5-7
Table 5-6 Perspectives on Review of Uses 5-10
Table 5-7 Newly applied land use types and images 5-12
Table 5-8 Permittable use by land use types and images 5-13
Table 6-1 Urban Design Strategy 6-15
Table 7-1 Development Strategy for Industrial Development 7-3
Table 7-2 Transport & Logistics Policies to Realize the Development Vision 7-16
Table 7-3 Comparison of Candidates for the New Bus Terminal Location 7-27
Table 7-4 Recommended Spacing of Bus Stops 7-31
Table 7-5 Accident-Prone Locations and Major Causes of Accidents 7-39
Table 7-6 Phases of the KHIA Development Project 7-50
Table 7-7 Annual Air Traffic Forecast of KHIA 7-51
Table 7-8 Forecast of Peak Hour Landside Traffic 7-52
Table 7-9 Guideline for Bicycle Lane Types in Japan 7-62
Table 7-10 Proposal of Bicycle Lane Types for Aqaba and the Installation 7-62
Table 7-11 Utility Strategies to Realize Development Vision 7-67
Table 7-12 Environment Preservation and Management Strategies to Realize Basic Strategy 7-72
Table 7-13 Challenges related to Environment Preservation and Management in ASEZ 7-73
Table 7-14 Environmental Preservation and Management Strategy 7-74
Table 7-15 Disaster Risk Management Strategies to Realize the Development Vision 7-75
Table 7-16 Establishment of Sidewalk pervious pavement and typical bioretention cell in the area in front of Oryx Hotel 7-90
Table 7-17 Small Retention Park with Bio-Retention Techniques in Aqaba 7-92
Table 7-18 Small Retention Park with Bio-Retention Techniques in Aqaba North Park area 7-94
Table 7-19 ASEZ Smart City Vision 7-98
Table 9-1 Result of Scoping 9-13
Table 9-2 Implementation requirements for Environmental Impact Assessment (EIA) for development projects

in ASEZ 9-19
Table 9-3 Comparison of JICA Guidelines for Environmental and Social Considerations and the Jordanian and ASEZ Environmental Impact Assessment Law System 9-21
Table 9-4 Overview of the organizations involved in the environmental impact assessment 9-24
Table 9-5 Results of the Impact Projections 9-25
Table 9-6 Results of the Mitigation Measures 9-28
Table 9-7 Monitoring plan 9-29
Table 9-8 Overview of the First Stakeholder Meeting 9-31
Table 9-9 Main Comments from the First Stakeholder Meeting 9-32
Table 9-10 Main recommendations 9-34
Table 9-11 Main Results of the Questionnaire 9-35
Table 9-12 Overview of the Second Stakeholder Meeting 9-39
Table 9-13 Main Comments from the Second Stakeholder Meeting 9-40
Table 10-1 Timeline of the Projects -1 10-13
Table 10-2 Timeline of the Projects -2 10-14
Table 10-3 Evaluation Criteria 10-15
Table 10-4 Evaluation of the Projects -1 10-16
Table 10-5 Evaluation of the Projects -2 10-17
Table 10-6 High Priority Projects（Short list） 10-18

Abbreviation

ACED	Aqaba Community and Economic Development
ACES	Accelerated COVID-19 Economic Support
ACPOM	Aqaba Ports Management and Operation Company
ACT	Aqaba Container Terminal
ADC	Aqaba Development Corporation
AFD	Agence Française de Développement
AIIE	Aqaba International Industrial Estate
AMP	Aqaba Marine Park
AMR	Aqaba Marine Reserve
AMSU	Aqaba Medical Science University
APReWaM	Aqaba Proactive Waste Management
ARW	Agricultural Reclaimed Water
ARW	Agricultural Reuse System
ASBR	Al Safi Back Road
ASEZ	Aqaba Special Economic Zone
ASEZA	Aqaba Special Economic Zone Authority
AUT	Aqaba University of Technology
AWC	Aqaba Water Company
AZEM	Aqaba Zone Economic Mobilization project
BCG	Boston Consulting Group
C/P	Counterpart
CADRI	Capacity for Disaster Reduction Initiative
CAGR	Compound Annual Growth Rate
CBD	Central Business District
CCTV	Closed-circuit Television
CEGCO	Central Electricity Generating Company
CMO	Construction Management Office
CNG	Compressed Natural Gas
CPI	City Prosperity Index
D/G	Design Guideline
DMD	Development Management Office
DRO	Design Review Office
DRR	Disaster Risk Reduction
DX	Digital Transformation
EA	Environmental Audit
EBRD	European Bank for Reconstruction and Development
EDCO	Electricity Distribution Company
EFTA	European Free Trade Association
EIA	Environmental Impact Assessment
EIU	Economist Intelligence Unit
EPC	Economic Policy Council
EUR	Euros
EWS	Early Warning Systems
FCDO	Foreign, Commonwealth and Development Office
FDI	Foreign Direct Investment
FEWS	Flood Early Warning System
FPM/P	Flood Protection Master Plan
FTA	Free Trade Agreements
FY	Fiscal Year
GAM	Greater Amman Municipality
GDP	Gross Domestic Product
GEE	Google Earth Engine
GEF	Global Environment Facility

GG-NAP	The Green Growth National Action Plan
GPCI	Global Power City Index
GRDP	Gross Regional Domestic Product
GRPS	General Packet Radio Service
GSM	Global System for Mobile Communications
HDI	Human Development Index
HDPE	High-Density Polyethylene
ICT	Information and Communication Technology
IDF	Intensity Duration-Frequency
IoT	Internet of Things
ISIL	Islamic State
ITS	The Institute of Tourism Studies
JCC	Joint Coordination Committee
JD	Jordanian Dinar
JEGP	Jordan Economic Growth Plan
JICA	Japan International Cooperation Agency
JNPAs	Jordan Network of Protected Areas
JOD	Jordanian Dinar
JTB	Jordan Tourism Board
KPI	Key Performance indicator
LCC	Low-Cost Carrier
LCL	Less-Than-Container-Load
LNG	Liquefied Natural Gas
M/P	Master Plan
MEMR	Ministry of Energy and Mineral Resources
MENA	Middle East and North Africa
MICE	Meeting, Incentive, Convention, Exhibition
MITS	Ministry of Industry Trade and Supply
MLIT	Ministry of Land, Infrastructure and Tourism
MoAg	Ministry of Agriculture
MoDEE	Ministry of Digital Economy and Entrepreneurship
MoEnv	Ministry of Environment
MOTA	Ministry of Tourism and Antiquities
MPWH	Ministry of Public Works and Housing
MSMEs	Micro, Small and Medium Enterprises
MWI	Ministry of Water and Irrigation
NaTech	Natural and Technological
NDWI	Normalised Difference Water Index
NEPCO	National Electric Power Company
NG	Natural Gas
OEM	Original Equipment Manufacturing
OS	Operating System
PCKK	Pacific Consultants Co., LTD.
PMO	Property Management Office
PPP	Public-Private Partnership
R/D	Record of Discussion
RPA	Regulation for the Protection of the Environment in the Aqaba Special Economic Zone
RSS	Royal Scientific Society
SCI	Smart City Index
SDC	Swiss Agency for Development and Cooperation
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SECAP	Sustainable Energy and Climate Action Plan
SEZ	Special Economic Zone
SPC	Special Purpose Company

SUMP	Sustainable Urban Mobility Plan
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TIC	Tourist Information Center
TRC	Telecommunication Regulatory Commission
TWG	Technical Working Groups
UAE	The United Arab Emirates
UNDP	United Nation Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNESCO	The United Nations Educational, Scientific and Cultural Organization
URW	Urban Reclaimed Water
USA	United States of America
USAID	United States Agency for International Development
USPD	Urban Study and Planning Department
WAJ	Water Authority of Jordan
WAP	Wireless Application Protocol
WB	World Bank
WDPA	World Database on Protected Areas
WGA	Water Governance Activity
WMI	Water Management Initiative

Chapter 1 Introduction

1.1 Project Background

The State of Jordan has enjoyed high economic growth averaging over 7% per year since the 1990s but has been affected by the global financial crisis in 2008, the slowdown in economic growth due to the Syrian crisis since 2011, and the spread of the new coronavirus since 2020. This has resulted in a decline in tourism revenues, which account for a large share of the country's foreign exchange earnings, an increase in public debt, and a worsening economic and fiscal situation.

The Aqaba Special Economic Zone (ASEZ) plays a very important role in the stable growth of the country and the stability of the region as a hub of heavy industry, logistics and tourism that drives the national economy. To realize the further development of the country, it would be a key how the ASEZ is developed with a central focus of tourism, increasing capacities of foreign currency acquisition and employment creation.

ASEZ welcomes over 1 million tourists per year (based on hotel room nights in 2019, halving to 500,000 by 2020). However, with a resident population of approximately 200,000, it is also important to develop an urban environment that is attractive for highly skilled human resources. Strengthening its functions as a marine transport and logistics hub is also necessary, as the target is to increase the container handling volume at the Port of Aqaba by 2025 to about 2.5 times that of 2019. The key to developing the ASEZ lies in improving the urban environment and taking advantage of its unique characteristics as the only port city in Jordan.

Once ASEZA was established, the Urban Development Master Plan (here and after “M/P”) targeting 2020 was formulated and endorsed by ASEZA’s Board of Commissioners in 2002. The Aqaba Special Economic Zone Law, stipulated in 2000, stipulates the establishment of ASEZA and its responsibilities and roles. Even though the clear function of the M/P is not described in the law, it is stipulated that ASEZA must plan, design, and implement development projects and actions in ASEZ as its fundamental role (ASEZ Law, Article 9, 10). In addition, ASEZA’s Board of Commissioners has the responsibility to decide land use in ASEZ to promote development investment (ASEZ Law, Article 5).

The M/P endorsed in 2002 is the plan formulated to indicate land use and investment directions of ASEZ with comprehensive and long-term development perspective based on these ASEZA’s significant function and roles. The M/P covers sectoral development plans on tourism, commercial, industrial, logistics development and investment. Besides, the ASEZ Design Guideline 2001 was formulated based on the previous M/P and it sets down detailed land use, plan by urban functions, development procedure and standards. Considering the M/P as a fundamental policy, ASEZA has promoted the regional development in ASEZ, taking commitments of many investments for urban development and industrial development. Numerous development projects related to commercial and residential areas, tourism facilities, expansion of ports and the airport has been implemented, contributing to the activation of regional economic actions and urban attractiveness.

Based on the functions that the previous M/P worked, the new M/P will incorporate following concepts.

“The ASEZ M/P defines the long-term strategy of the ASEZA for organizing and managing the growth of development in ASEZ. The M/P serves as a guide that establishes the goals and

policies for governing the coordination of development throughout the area with respect to the use of land, intensity of development, means of access and circulation, provision of utilities, and protection of environmental, cultural, and historical resources. The M/P puts forth a framework that defines the location and relationships of current and future land uses and circulation systems. It also serves as the basis for establishing the density and capacity of land development, the location and capacity of utilities systems, and the projected direction and phasing of future growth. The M/P defines and directs proposed development policies and actions."

1.2 Outline of the Project

(1) Objective

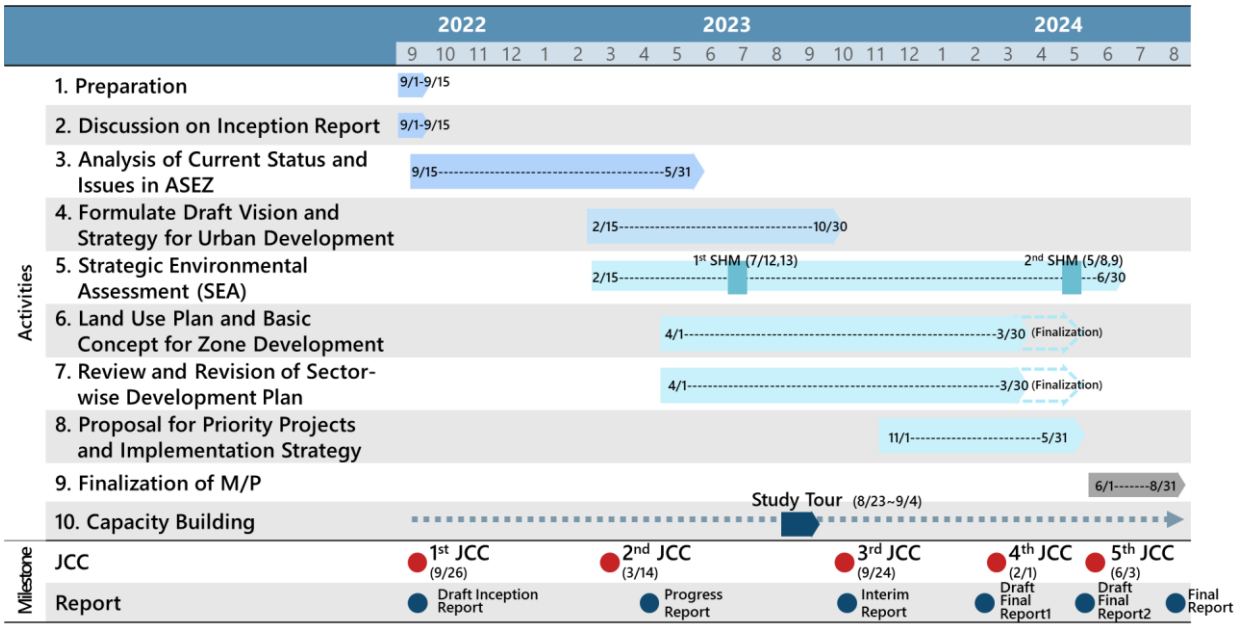
The objective of the project is to contribute to the economic and social development of Aqaba by updating and preparing an Urban Development Master Plan in the Aqaba Special Economic Zone (ASEZ).

(2) Period of Project

September 2022 - September 2024 (24 months)

(3) Outline and Schedule

The outline and schedule are as shown in the following figures.



Source: JICA Study Team

Figure 1-1 Schedule of Project

1.3 Target Area of Project

The target area of the project is all area of ASEZ (651.5km^2) as shown in the following figure.

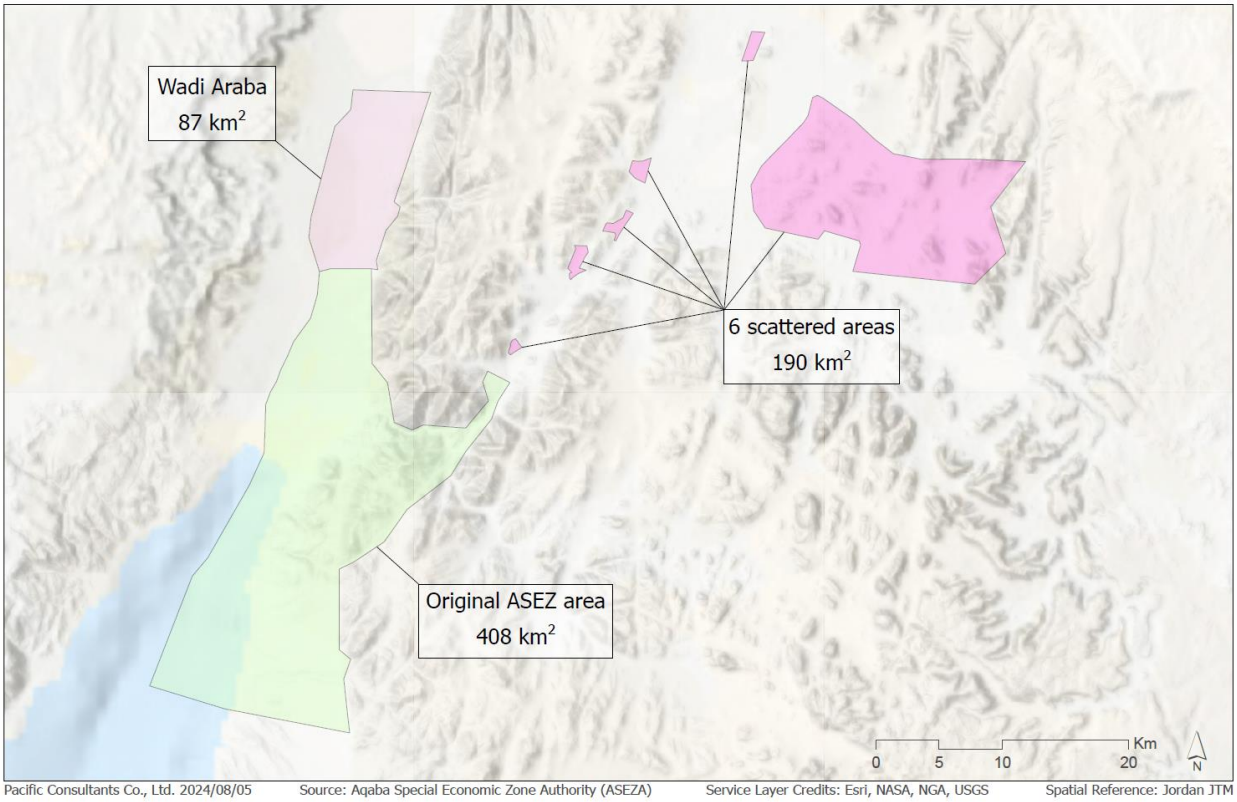
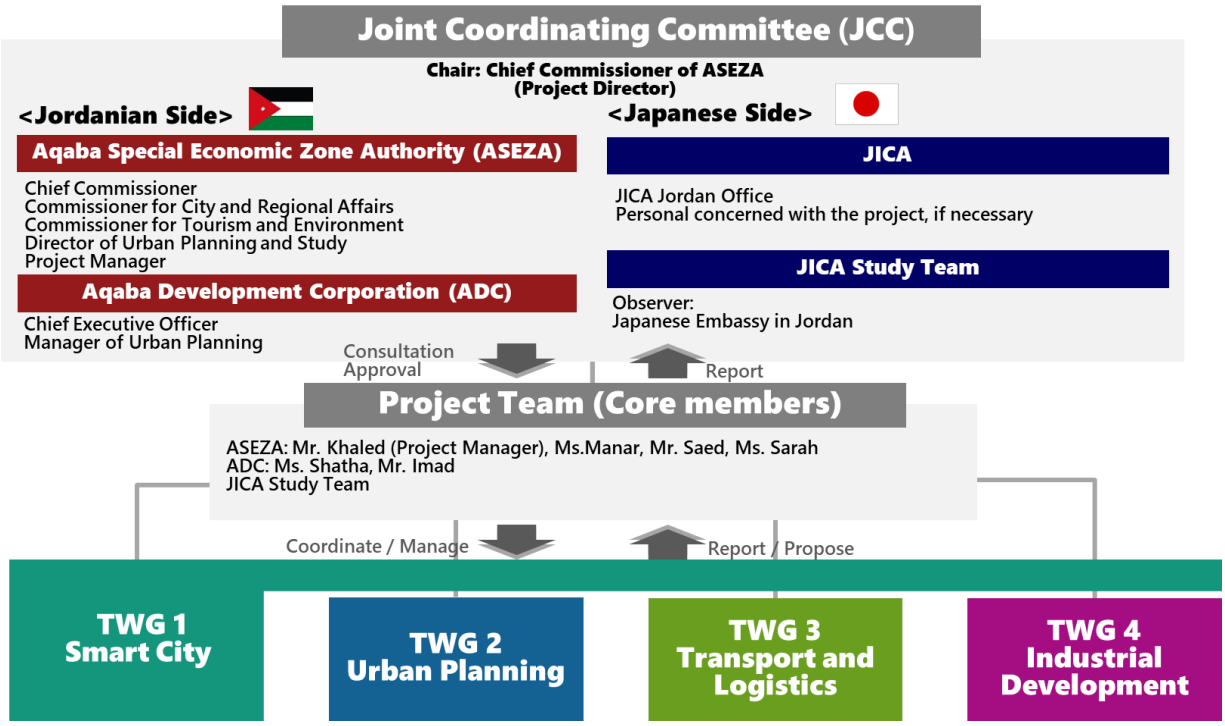


Figure 1-2 Project Area

1.4 Implementation Structure

The main counterparts (C/P) of the project are ASEZA and ADC. The following figure indicates the implementation structure of the project. In addition to the Joint Coordination Committee (JCC), in which important subjects are consulted and approved, the project team and the Technical Working Groups (TWGs) for four sectoral groups: Smart City, Urban Planning, Transport and Logistics, and Industrial Development are established. The project is promoted through discussions based on this structure.



Source: JICA Study Team

Figure 1-3 Implementation Structure

1.5 Activities to Date

Seven field study has been conducted throughout the study. During the field studies, JCC meetings, TWGs and meetings with different stakeholders in Aqaba and Amman were carried out. The outline of the past field studies is as shown in the following table.

Table 1-1 Outline of Field Study

	Study Period	Outline of Activities
1st Field Study	9th Sep. - 6th Oct. 2022	✓ Kick-off meeting, 1st JCC meeting ✓ Field survey, Meetings with stakeholders, Data collection
2nd Field Study	13th Nov. - 9th Dec. 2022	✓ TWG Meetings ✓ Implementation and coordination of questionnaire survey ✓ Field survey, Meetings with stakeholders, Data collection
3rd Field Study	12th Feb. – 18th Mar. 2023	✓ 2nd JCC meeting ✓ TWG Meetings ✓ Implementation and analysis of questionnaire survey ✓ Field survey, Meetings with stakeholders, Data collection
4th Field Study	2nd July – 24th July 2023	✓ The 1st Stakeholder Meeting ✓ TWG Meetings ✓ Field survey, Meetings with stakeholders, Data collection
5th Field Study	23rd Sept – 3rd Nov 2023	✓ 3rd JCC meeting ✓ TWG Meetings ✓ Field survey, Meetings with stakeholders, Data collection
6th Field Study	1st Feb – 6th Mar 2024	✓ 4th JCC meeting ✓ TWG Meetings ✓ Field survey, Meetings with stakeholders, Data collection
7th Field Study	19th May – 8th June 2024	✓ 5th JCC meeting ✓ Meeting with stakeholders

Source: JICA Study Team

During the period other than listed above, regular meetings with C/P and TWGs were held, and information collection and analysis have been executed. The table below describes the outline of TWG meetings that have been organized.



Source: JICA Study Team

Figure 1-4 Situation of Preparatory JCC Meeting and 2nd JCC



Source: JICA study team

Figure 1-5 Situation of the 1st Stakeholder Meeting

Table 1-2 Outline of TWG Meetings

Sector	Date		Main Agenda
TWG1: Smart City	1st	22nd Nov. 2022	✓ What is "Smart City"? ✓ Smart City Case in Amman ✓ Smart-City-Related Activities in ASEZA ✓ Discussion on "Smart City Approach"
	2nd	21st Feb. 2023	✓ Outline of the project ✓ What is "Smart City"? (Quick review of the previous TWG) ✓ Smart-City-Related Activities in ASEZA and its challenges ✓ Discussion on "Smart City Approach"
	3rd	18th July. 2023	✓ Review of the previous TWG ✓ Smart-City-Related Activities in ASEZA and its challenges ✓ Discussion on "Smart City Approach"
TWG2: Urban Planning	1st	28th Nov. 2022	✓ Master Plan Positioning ✓ Situation Analysis and Challenges
	2nd	5th Dec. 2022	✓ Master Plan Positioning ✓ Land used based on the estimated socioeconomic framework-Infrastructure planning process ✓ Situation Analysis and Challenge
	3rd	12th Dec.	✓ Literature Review for Disaster Risk Management in Aqaba

		2022	✓ Efforts by ADC for Flood Management
	4th	26th Dec. 2022	✓ Current Situation, Findings, and Data Collection ✓ Challenge (hypothesis), Methodology and Situation Analysis
	5th	23rd Feb. 2023	✓ Planning Framework ✓ Urban Issues ✓ Draft Vision for Future of City／Urban Development Strategies ✓ Urban Framework
	6th	8th May. 2023	✓ Analysis of collected data and water analysis ✓ Results of climate change analysis ✓ Flood model application and selection ✓ Methodology of modeling scenarios ✓ Regarding the future
	7th	31st Oct 2023	✓ Flood Hazard analysis ✓ Green network and Urban design
TWG3: Transport and Logistics	1st	30th Nov. 2022	✓ Outline of Transport & Logistics Planning Framework (Draft) ✓ Findings and Points to be Confirmed
	2nd	7th Dec. 2022	✓ Recapture of the Last Transport & Logistics TWG ✓ Public Transport Network and Review of Past Questionnaire ✓ Bus Center Relocation Plan ✓ Multimodal Public Transport (Transport on Sea/ Green Buses)
	3rd	13th Feb. 2023	✓ Brief Summary of the Previous TWGs ✓ Logistics Cargo Statistics ✓ Review or Port Development Master Plan and Discussion ✓ Railway and Other Logistics Infrastructure Plan and Discussion
	4th	14th June 2023	✓ Review of the previous TWG ✓ Promotion of bicycle use ✓ Improvements on public bus service ✓ New transit system
	5th	11th July 2023	✓ Review of the previous TWG ✓ Congestion in the city caused by freight vehicles ✓ Port freight transport by rail ✓ Development status and plans for logistics-related facilities
	6th	21st Aug 2023	✓ Urban mobility ✓ Inter-city passenger traffic ✓ Road planning and traffic management ✓ Logistics
	7th	30th Oct 2023	✓ Traffic control types of intersection (especially about roundabout and signalized intersection) ✓ Traffic situation in the urban area of Aqaba ✓ Recommendations for intersections in Aqaba
TWG4: Industrial Development	1st	28th Nov. 2022	✓ Main Points to be Discussed in TWG4 ✓ Fact Findings during the 1st Mission in September 2022
	2nd	5th Dec. 2022	✓ Workshop for tourism
	3rd	12th Dec. 2022	✓ Tourism Development ✓ SEA
	4th	12th Mar. 2023	✓ Current Status and History of Tourism in Aqaba ✓ Investment Volume
	5th	25th Sept. 2023	✓ Regarding the baseline 2022 ✓ Regarding the 2040 projection ✓ Industry and tourism development vision 2040 ✓ Industry and tourism development strategy 2040 ✓ Priority projects

Source: JICA Study Team



Source: JICA Study Team

Figure 1-6 Situation of TWG and Meeting with Stakeholders

Chapter 2 Related Plans and Studies

2.1 Relevant Plans at the National Level

A study of relevant plans at the national level in Jordan was conducted to understand the current standing and trends of the national development. This is to not only understand the vision of the nation but also to be able to compare the current visions and plans of ASEZ, to further understand the position and direction of ASEZ towards the future in updating the master plan.

Table 2-1 List of relevant plans at national level

Sector	Year	Name	Publisher	Description
National vision / strategy	2015	Jordan 2025 A National Vision and Strategy	Jordan Government	Detailed plan charting the integrated economic and social framework development for the country.
	2022	Jordan Economic Growth Plan 2018 – 2022 (JEGP)	Jordan Government	Economic growth plan to recapture the growth momentum and realize Jordan's development potential in 4 sectors, citizen, society, business, and government.
Economy	2021	Government's Economic Priorities Program 2021-2023	Jordan Government	Priority programs to enable the private sector to create jobs for Jordanians, stimulate local and foreign investments and increase national exports of goods and services.
	2022	Economic Modernisation Vision	Jordan Government	Vision to achieve leaps in economic growth and create job opportunities and realize a significant improvement in the quality of life for Jordanians.
Tourism	2021	Jordan Tourism Strategy 2021 - 2025	Ministry of Tourism & Antiquities	Addresses the challenges and gaps Jordan faces and aligns them with the strengths and opportunities the country can build on to bolster national economic growth and job creation.
Digital	2021	National Digital Transformation Strategy & Implementation Plan 2021 2025	Ministry of Digital Economy and Entrepreneurship	Provides a strategic framework for the digital transformation of Jordan for the next five years.
Green environment	2020	The Green Growth National Action Plan 2021-2025 (GG-NAP)	Ministry of Environment	Action plan to expand on Jordan's climate and sustainable development ambitions by mainstreaming green growth, climate change and sustainable development objectives into sectoral strategic frameworks.

Source: JICA study team

(1) Jordan 2025 A National Vision and Strategy

The Jordan 2025 A National Vision and Strategy is a detailed plan charting the integrated economic and social framework development objectives for the country, to provide opportunities for all. The government, the civil society, and the private sector is to undertake many training activities, develop new IT systems and fund community groups and volunteer activities as a part of performance management framework for implementation. This

document contains 4 outlines which are citizen, society, business, and government with its own desired outcomes each.

For the citizen sector, it aims to create an active citizen with a sense of belonging with high health level, equipped with the skills to succeed, local activities engaged in the economy and the decent and rewarding jobs for all Jordanians. For the society sector, it aims to create a safe and stable society, with confidence in and compliance with the law, an effective society based on active citizenship. Strong families and communities across the kingdom, protection, and empowerment of those in need and providing decent life and a safe society. For the business sector, it aims to create a dynamic and globally competitive private sector with a competitive regional hub, an efficient and stable business environment, supporting environment to establish business and regionally competitive clusters encouraging export and jobs for Jordanians. For the government sector, it aims to create an efficient and effective government with a financial service that maintain investors and market's confidence, efficient, ethical, and citizen-centered government services, excellent policy making & implementation in government, transparent government institution accountable to the Parliament and citizens, sustainable long-term management of food energy and water requirements and world-class infrastructure that support development.

Aqaba

Indicator	Baseline 2014	2017	2021	2025
GINI index that measures the equality of distribution	0.312	0.312	0.312	0.312
Poverty rate	19.2%	18.8%	17.8%	14.8%
Unemployment	16.6%	13.7%	10.7%	8.6%
Number of economic establishments operating in the governorate	4382	4500	4800	5000
Percentage of workers in the productive sectors	23.9%	24.9%	25.9%	27%
Percentage of workers in the public sector	22.2%	21.2%	20.2%	19%
Percentage of apprenticeship	0.3%	0.4%	0.45%	0.5%
Number of jobs created for Jordanians aged 15 years and over	1073	1400	1700	2000

Source: Jordan 2025 A National Vision and Strategy

Figure 2-1 Key Performance Indicators by the Aqaba governorate

(2) Jordan Economic Growth Plan 2018 – 2022 (JEGP)

The JEGP is a report developed in full cooperation between the Government of Jordan and the Economic Policy Council (EPC), comprised of economic, fiscal, and sectoral strategies that outline the vision and policies pertaining to each sector. It further identifies the required policy interventions, public projects and private investments that must be undertaken to realize these sectoral visions. A successful implementation of the JEGP by the Government of Jordan is expected to double the economic growth of the country over the coming 5 years. The JEGP addresses 19 areas and enabling environment by identifying 95 policy actions, 85 government projects that will costs USD 9.7 billion, and 27 private sector investments with a total value of USD 13.3 billion.

Under this document, Jordan is to prioritize identifying the necessary investments needed to maximize its share of such growth of Aqaba port as a logistic hub in the event of the opening of the border with Iraq. Projects related to Aqaba are stated in the table below.

Table 2-2 JEGP Projects related to Aqaba

Sector	Interventions	Type	Cost(JOD)
Water	Develop Aqaba desalination plant	Investment opportunities	5M
Energy	Build ground storage capacities for crude oil in Aqaba to be appropriate for oil products storage to replace the oil tanker in Jerash with a minimum capacity of 100k tons (under construction)	GoJ project	44M
	Develop Aqaba – Ma'an Oil Pipeline.	Investment opportunities	350M
Transport	Ma'an Dry Port: Establish a dry port in Ma'an that will serve the Industrial Park in Ma'an governorate, close to the proposed route of the national railway project, and connected to several national and international roads with Saudi Arabia, Jordan, Iraq, and Aqaba Port	Investment opportunities	50M
Tourism	Aqaba's High Lake Resort: Establish a mega resort to be built on 650,000 m2 of land north of Aqaba's coast and adjacent to Marsa Zayed project. ASEZA through ADC is willing to partner with future investors on this project or full ownership is available.	Investment opportunities	481M
	Sports City Camps- Aqaba: Develop a multi-venue sports complex investment opportunity in Aqaba. The Sport City can provide a mix of activities for up to 3000 users.	Investment opportunities	200M
Healthcare	Establish a state-of-the-art private hospital accommodating 100 beds and expandable to 200 beds located in Aqaba.	Investment opportunities	71M

Source: JICA study team

(3) Government's Economic Priorities Program 2021-2023

This document has been designed in accordance with the directives of His Majesty King Abdullah II to compile focused priority policies, reforms, and projects, in coordination with the private sector, to help place the economy on a trajectory for recovery and growth. The main objectives are, enabling the private sector to create jobs for Jordanians, stimulating local and foreign investments, increasing national exports of goods and services. To achieve these objectives, 53 priorities were selected across three pillars, improving the business and investment environment, enhancing competition, and increasing employment, supporting priority sectors (Tourism, IT, Agriculture, and Industry). Every priority has its own delivery target, as well as an implementation timeline and allocated funds for implementation.

Projects that are related to Aqaba in this document are:

Table 2-3 Projects related to Aqaba

Name	Stakeholders	Targets
Floating Gas Storage Unit	Aqaba Development Company	Fourth Quarter 2023
National Water Conveyance	Ministry of Water and Irrigation	Tendering project by the fourth quarter of 2022 at an expected cost of JOD 2 billion in partnership with the private sector to desalinate 300 million cubic meters of water from the Gulf of Aqaba to respond to the water deficit in the south and Amman
Prepare for the Launch for the First Phase of the National Railroad Project	Ministry of Transport Aqaba Development Corporation Public-Private Partnership Unit of the Prime Ministry	Establish a railroad that links seaports in Aqaba to land port in 'Madona' in partnership with the private sector

Source: JICA study team

(4) Economic Modernisation Vision

Centered on the slogan of "A better future", the Jordan's Economic Modernisation Vision is based on the following two strategic pillars, accelerated growth through unleashing Jordan's full economic potential and improved quality of life for all citizens, while sustainability is a cornerstone of this future vision. The implementation timeline is divided in to 3 phases. In Implementation Phase I (2022-2025) 93% of 344 initiatives will be implemented within this phase and at the end of this phase in 2025, a thorough review of the roadmap will be done to take into consideration the changing environment and its implications so that the long-term targets, priorities, and implementation agenda can be refined to best meet Jordan's long-term ambitions. In Implementation Phase II (2026-2029), the focus will be on fully leveraging and further extending the achievements of phase one, taking into consideration the most recent developments that will have created new opportunities. In Implementation Phase III (2030-2033), the focus will be on preparing to meet the needs of the subsequent decade by setting new long-term directions, creating new foundations, and catalyzing the necessary changes ahead of time. There was no information regarding any specification for Aqaba or Smart City, as Smart Jordan was written about education without any connection to smart city implementation.



Source: Economic Modernization Vision

Figure 2-2 Growth Drivers to implement the economic modernisation vision

(5) Jordan Tourism Strategy 2021 – 2025

The vision of the Jordan Tourism Strategy 2021 – 2025 is to create inclusive economic growth through authentic and sustainable tourism products & eliminate the impact of COVID-19. The vision is set to be realized through, highlighting the uniqueness of Jordan's history and heritage, development of products and experiences which exceed the expectations of international, regional and domestic tourists, solid partnership between the private sector and an empowered Ministry of Tourism and Antiquities, inclusiveness of local communities, preservation and protection of Jordan's heritage and cultural sites, initiating meaningful reforms to accelerate investment and improve competitiveness.

This strategy revolves around five major strategic objectives, which are products, human resources, marketing, heritage protection, and reforms.



Source: Jordan Tourism Strategy 2021 – 2025

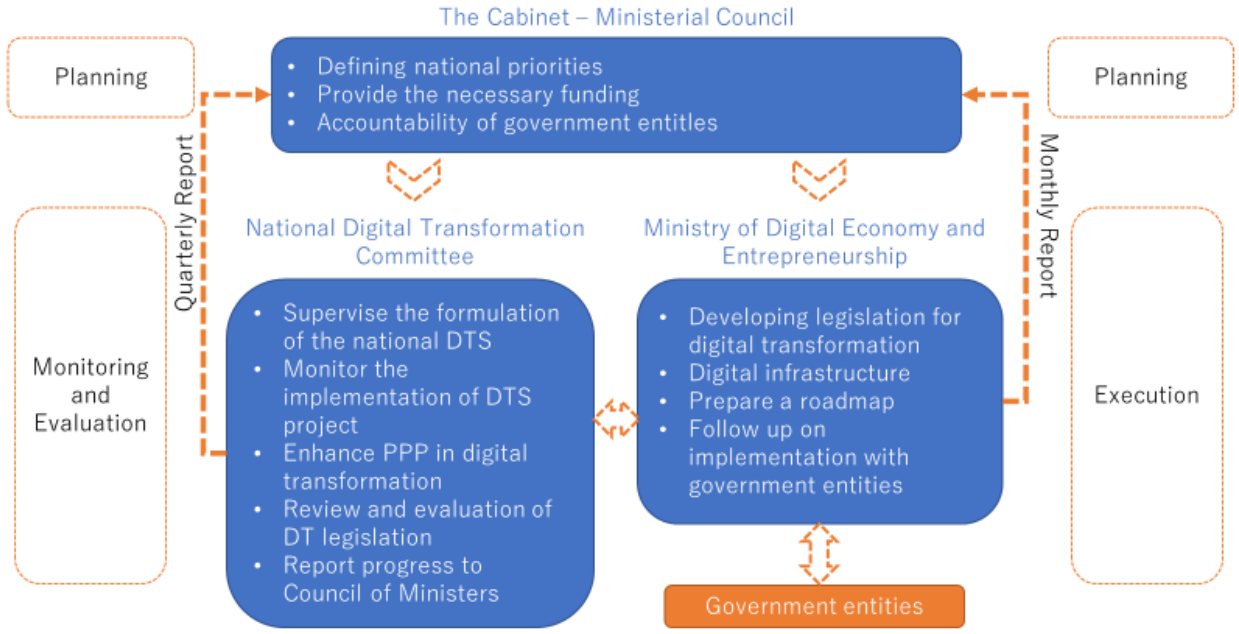
Figure 2-3 High level areas of activities for each strategic objective

Significant financial investments are projected for Heritage Protection, and site included in Aqaba are Al Aqaba Castle, Islamic Ayla, and Byzantine Church. There is also an action plan to form a new agreement with new LCCs under the marketing SO, for new routes to Amman & Aqaba to increase the number of passengers.

(6) National Digital Transformation Strategy & Implementation Plan 2021-2025

This strategy was prepared by the Ministry of Digital Economy and Entrepreneurship based on Jordan 2025 A National Vision and Strategy. The strategy includes the government's vision within five years to stimulate further digital transformation and the development of the digital economy in the Kingdom by relying on a set of basic procedures and capabilities to achieve the government vision, to build an advanced digital infrastructure based on emerging technologies, including 5G technology, and upgrading the level of government services through a central interactive services platform and reliance on data in planning, decision-making and policymaking. This strategy also includes an implementation roadmap with specific goals and clear timetables for implementing all the requirements and initiatives of the strategy.

The digital transformation included 8 strategic enablers, which are digital infrastructure, digital government services, data, youth, technology and jobs, innovation & partnership with private sector, E-participation, change management & human resources and management of government resources. A governance model was created with stating the role and responsibility as the figure below.



Source: National Digital Transformation Strategy & Implementation Plan 2021-2025

Figure 2-4 National Digital Transformation Committee Roles and Responsibilities

(7) The Green Growth National Action Plan 2021-2025 (GG-NAP)

This plan is made up of 6 different sector, Agriculture, Energy Tourism, Transport, Waste and Water and each GG-NAP provides implementable actions to achieve the five national green growth objectives and embody the principles of green growth implementation. Detailed descriptions of priority policy and investment actions are included in the sector actions plans, which will serve as the core of Jordan's green growth, climate change, and sustainable development agendas in the 2021 to 2025 period. Implementation projects related to ASEZ in each sector are summarized in the table below.

Table 2-4 List of implementation projects related to ASEZ

Sector	Name	Implementing Stakeholders	Other key partners	Budget
Agriculture	Conduct national prefeasibility and market assessment to measure and leverage agriculture sector biowaste to resource potential	Lead: MoAg Support: Private sector (farmers, associations, unions, etc.), MOLA, Municipal authorities (Greater Amman Municipality (GAM), ASEZA, PDTRA), MoEnv	UNDP	1.5MIL USD
Energy	Develop Industrial Renewable Energy Roadmap and Investment Plan	Lead: Ministry of Energy and Mineral Resources (MEMR) Support: JCI, NEPCO, NERC	Ministry of Industry and Trade, GAM, Aqaba Special Economic Zone Authority (ASEZA), concerned development and donor agencies	1MIL USD
Tourism	Develop and implement a green growth capacity building program for tourism sector stakeholders	Lead: MoTA Support: Tourism sector stakeholders: government, private sector, NGOs, Public media, all governance bodies: JTB, RSCN, JIC, PDTRA, ASEZA, Jordan Trail, Tourism Associations, and other private sector actors	-	1.5MIL USD
	Develop a world-class global marketing and branding campaign for Jordan's tourism sector	Lead: MoTA / JTB Support: ASEZA, PDTRA, JIC, RSCN, Jordan Trail, Tourism Associations, Royal Jordanian, Private Sector, and other related tourism organizations	Donor and development agencies with existing funded projects for tourism development, including USAID, United Nations Development Programme (UNDP), JICA, etc.	Up to 10MIL USD
	Develop tourism	Lead: MoTA	Development agencies, donors,	5MIL

Sector	Name	Implementing Stakeholders	Other key partners	Budget
	development master plan, investment map and packages for improved knowledge sharing, decision-making and marketing	Support: JIC, The National Center for Security and Crisis Management, ASEZA, PDTRA, DoA, JTB, RSCN, Jordan Free and Development Zones Group, and all other tourism authorities, private sector, and NGOs	and professional institutions	USD
	Develop a roadmap for crisis, disasters, and climate change management in the tourism sector	Lead: MoTA, MoEnv, RSCN Support: The National Center for Security and Crisis Management, ASEZA, PDTRA, Jordan Trail, JTB, Tourism associations	Private sector and NGOs, particularly in areas heavily affected by climate change	0.5MIL USD
	Develop a roadmap for increasing resource efficiency in the tourism sector	Lead: MoTA, Jordan Chamber of Commerce, Hotels and Restaurants Associations, Royal Scientific Society (RSS) Support: ASEZA, PDTRA, Investment Commission, Ministry of Energy and Natural Resources, JREEEF, Ministry of Water and Irrigation, Ministry of Local Administration, Ministry of Transport, Greater Amman Municipality (GAM)	Decentralization Committees, municipalities, development agencies and donors, tourism associations	1.2MIL USD
	Establish a tourism sector center of excellence to promote innovation and market development	Lead: MoTA Support: RSCN, RSS, JEDCO, Chambers of Commerce, Ministry of Labor, PDTRA, ASEZA, JTB, tourism associations, local universities/ NGOs/research institutions, tourism police	Development and donor organizations, JIC	2MIL USD
	Scale-up and expand the Jordan Trail	Lead: Jordan Trail Association Support: MoTA, PDTRA, ASEZA, JTB, tourism associations, RSCN, tourism police	Development and donor organizations, tour operators	3MIL USD
	Scale up eco-tourism experiences in protected areas and stimulate linkages with other tourism products	Lead: RSCN Support: MoTA, ASEZA, PDTRA and JTB	MoEnv, Ministry of Agriculture, Jordan Trail, Donors, and development agencies	7MIL USD
	Improve the quality and quantity of Jordan cultural heritage tourism products following participatory approach	Lead: DoA, ACOR and Tarmeem Centre Support: MoTA, PDTRA, ASEZA	Friends of Archaeology, universities, and research centers, international organizations concerned with archaeology and cultural heritage, donor, and development agencies	7MIL USD
	Formulate sector reform roadmap to update the legal, policy and institutional frameworks governing the tourism sector	Lead: MoTA Support: JTB, DoA, ASEZA, PDTRA, JIC, Tourism private sector stakeholders, NGOs	Donors to support technical assistance	1.5MIL USD
Transport	Implement transport sector governance enhancement program and reform agenda to increase the effectiveness and efficiency of the transport sector policymaking process	Lead: MoT Support: Ministry of Local Administration, GAM, Municipal Governments, Ministry of Public Works and Housing, Ministry of Industry, Trade and Supply, MEMR, Ministry of Labor, MoEnv, MOPIC, Private sector transport providers, Aqaba Special Economic Zone Authority, Petra Development and Tourism Region Authority	-	1MIL USD
	Develop a public-private dialogue and roadmap for improving road transport services linked to the tourism sector	Lead: Ministry of Tourism and Antiquities, MoT Support: Ministry of Finance, Private sector tourism transport service providers Jordan Investment Commission	Petra Development and Tourism Region Authority, Aqaba Special Economic Zone Authority, GAM, MOPIC, Jordan Tourism Board, Royal Society for the Conservation of Nature	1MIL USD
	Develop a joint public-private strategy and roadmap to improve the environmental sustainability of the logistics sector	Lead: MoT Support: Ministry of Industry, Trade and Supply, MEMR, Ministry of Finance, Freight Forwarders Association, Jordanian Logistics Association, Chamber of Commerce, others	Private sector service providers in the freight and logistics sector (Aramex, DHL, food delivery companies, Uber-Careem, etc.)	1MIL USD
	Develop a national electric mobility strategy and action plan	Lead: MoT Support: MoEnv, MEMR, Ministry of Industry, Trade and Supply, Ministry of Public Works and Housing, Ministry of Digital Economy and Entrepreneurship,	-	1MIL USD

Sector	Name	Implementing Stakeholders	Other key partners	Budget
		Ministry of Finance, Royal Hashemite Court, GAM, Aqaba Special Economic Zone Authority, EV Owners Association, etc.		
Waste	Introduce a policy dialogue platform for implementing extended producer responsibility in the waste sector	Lead: MoEnv, Ministry of Industry, Trade and Supply (joint leadership) Support: Private sector companies, Research institutions, MOLA, GAM and ASEZA	Business networks, associations	1MIL USD
	Design and implement a national behavior change campaign about circular economy and waste management	Lead: MoEnv, MoLA, GAM, ASEZA, PDTRA Support: Ministry of Health, environmental NGOs	Ministry of Education, Ministry of Industry and Trade & Supply	10MIL USD
	Implement program for waste tire disposal and reuse	Lead: Ministry of Industry and Trade & Supply Support: MoEnv, Private sector investor, ASEZA, and GAM	JIC, United Nations Development Programme (UNDP), GIZ, private sector companies using tire waste as inputs	450K USD
Water	Implement capacity building program for evidence-informed investment decision making in the water sector	Lead: MWI, JVA, WAJ Support: MoEnv, Ministry of Agriculture (MoAg)	Ministry of Tourism and Antiquities (MOTA), MOPIC, Ministry of Industry and Trade and Supply (MITS), ASEZA, Utilities	760K USD
	Implement Key Wastewater Treatment Projects to improve Water Supply Augmentation	Lead: MoEnv, MWI, WAJ Support: ASEZA, Aqaba Development Corporation (ADC), Arabetch Jardaneh	-	1.5MIL USD
	Technical Assistance to support water efficiency in businesses, industries, and commercial activities	Lead: RSS Support: Amman Chamber of Industry, ZCI, MWI, MoEnv	ASEZA, Chamber of Industry	1.64MIL USD
	Undertake Desalination of Seawater at the Gulf of Aqaba through Renewable Energy Sources	Lead: MoEnv, CVDB Support: MWI, Ministry of Public Works and Housing (MPWH), MOPIC, MoF, ASEZA, ADC, Ministry of Energy and Mineral Resources (MEMR)	-	1MIL USD

Source：JICA Study Team

2.2 Relevant Legislation for ASEZ's Development

2.2.1 List of Relevant Legal Systems

The following is a summary of the laws and regulations published on ASEZA's official website (https://aseza.jo/Pages/viewpage.aspx?pageID=12) and those received during the survey that are relevant to M/P.

Table 2-5 List of related legal systems

Name of Law/Institution	Year	Purpose and Outline
The Aqaba Special Economic Zone Law no (32) for the Year 2000 and its amendments (Hereinafter referred to as the ASEZ law)	2000	It is the law that defines the establishment of ASEZ and ASEZA and is the basis and root of the following related legislation.
Regulation No. (89) of 2000 Regulation on the Administrative Organization of Aqaba Special Economic Zone	2000	This regulation defines the organizational structure of ASEZA, the roles and composition of the Board and Committee, and the responsibilities of the Chief Commissioner. The relevant articles in the ASEZ Law are Articles 12 through 18.
Regulation No. (11) of 2001 on Regulation on Organization and Development of the Investment Climate of Aqaba Special Economic Zone	2001	The purpose of this regulation is to promote competition in conducting various economic activities and to create an investment environment based on economic liberalization by simplifying procedures and enhancing transparency in business activities. The regulations stipulate the procedures for applying for a license to conduct business activities in ASEZs, as well as the requirements for such licenses.
The Design Guidelines	2001	It is a guideline that provides principles for design and construction in ASEZs in accordance with the ASEZA Master Plan and is still in operation as of 2023 as the base document for building permit discussions between ASEZA and the developer/designer. The purpose of these design guidelines is to provide the ASEZA with building regulations that will coordinate and control the planning and design of all new or modified residential, commercial, tourism and industrial development within the ASEZ, to enhance the identity, character, quality, and attraction of Aqaba, and improve economic and social benefits to owners, users, residents, and visitors alike.
Regulation No. (32) of 2004 Regulation on Zoning and Construction Licensing in Aqaba Special Economic Zone	2004	ASEZ Law No. 43A and 56, Law No. (79) of 1966 on City, Village and Building Zoning, Article 67A, Section 14, which is equivalent to the Building Code in ASEZ. It is a supplementary regulation to the Design Guidelines, and provides more specific calculation methods, standards, etc.
Design Standards	2022 (The year of enactment of district-specific regulations varies from district to district.)	Regulations that specify detailed building restrictions (building use, setbacks, maximum height, number of stories, etc.) for each plot in the district within the ASEZ. Individual enactment dates vary by district. A list of land use maps and building restrictions for each plot in the district is compiled.
Regulation for the Sale and Lease of Lands in the Aqaba Special Economic Zone No. (7) for the Year 2001	2001	Provisions for the sale or lease of land owned by ASEZA under Articles 44 and 56 of the ASEZ Law.
Regulation No. (1) for the year	2022	The Jordanian regulations corresponding to the Building

Name of Law/Institution	Year	Purpose and Outline
2022 Building Regulations and Organizing Cities and Villages		Code Enforcement Regulations, based on Law No. (79) for the year 1966 on organizing cities, villages, and temporary buildings. According to Article 6 of the ASEZ Law, the provisions of the ASEZ Law and ASEZ regulations take precedence over national laws in principle in ASEZs, but for large-scale developments, known as mega-projects, the relevant provisions are referred to during individual development discussions.
Regulation No. (21) for the Year 2001 Regulation for the Protection of the Environment in the Aqaba Special Economic Zone	2001	Regulations on environmental protection under Articles 52 and 56 of the ASEZ Law. It also stipulates implementation requirements and procedures for Environmental Impact Assessment (EIA) and Environmental Assessment (EA) when implementing development projects in ASEZs. There is no statement regarding SEA. With regard to SEA, the Ministry of Environment in Jordan is studying institutionalization of SEA with support from the Netherlands, and a system is scheduled to be established in 2024.
Regulation No. (24) for the Year 2001 Regulation for the Development of Wadi Rum Area	2001	Regulations for the development of the Wadi Rum Area (outside the ASEZ), based on Articles 11 and 56 of the ASEZ Law. The duties and authority of the Wadi Rum Area Committee and the Director of Wadi Rum Area, chaired by The Environmental Affairs Commissioner, to be established within ASEZA, and prohibitions on development in the Wadi Rum Area are stipulated. The regulations also stipulate the prohibited development of the Wadi Rum Area.
The Aqaba Marine Reserve System	2022	Regulations concerning the Aqaba Marine Protected Area, based on Articles 10 and 56 of the ASEZ Law. It stipulates the designation of the protected area and prohibitions within the area.
Regulation No. (90) for the Year 2000 Regulation for Entry Visa, Labor and Residency in the Aqaba Special Economic Zone	2000	Regulations concerning visas and permits that may be issued to non-Jordanians entering the ASEZ, based on Article 48 of the ASEZ Law. It defines the procedures for applying for and obtaining various types of visas and permits (Visit visa, Transit visa, Work visa, Work permit, Residency permit) in ASEZ and the duties and powers of the ASEZA Board in relation to them.
Regulation No. (82) for the Year 2000 Financial Regulation for the Aqaba Special Economic Zone	2000	This is ASEZA's financial and accounting regulations based on Article 56 of the ASEZ Law. The regulations include the method of accounting and reporting, the duties and powers of the Chief Commissioner, Financial Directorate, Financial Director, and Audit, as well as the budgeting system and the internal audit system.
Regulation No. (9) of 2001 Regulation on Customs in Aqaba Special Economic Zone	2001	Regulations on customs in ASEZs, which are special economic zones, in accordance with Article 22B and Article 56 of the ASEZ Law.
Regulation No. (6) of 2001 Regulation on the Development and Management of Aqaba Special Economic Zone	2001	Article 17A and Article 56 of the ASEZ Law provides that the ASEZA may enter into an agreement with a developer to entrust such developer with the development and management of the zone in part or in its entirety. (Possible ADC's prescriptive law)
Regulation No. (4) of 2001 on Supplies and Works of Aqaba Special Economic Zone Authority	2001	The regulations, in accordance with Article 56 of the ASEZ Law, provide for the procurement of maintenance, insurance, and other services related to movable property belonging to ASEZA, as well as technical services for the construction, maintenance, and operation of infrastructure,

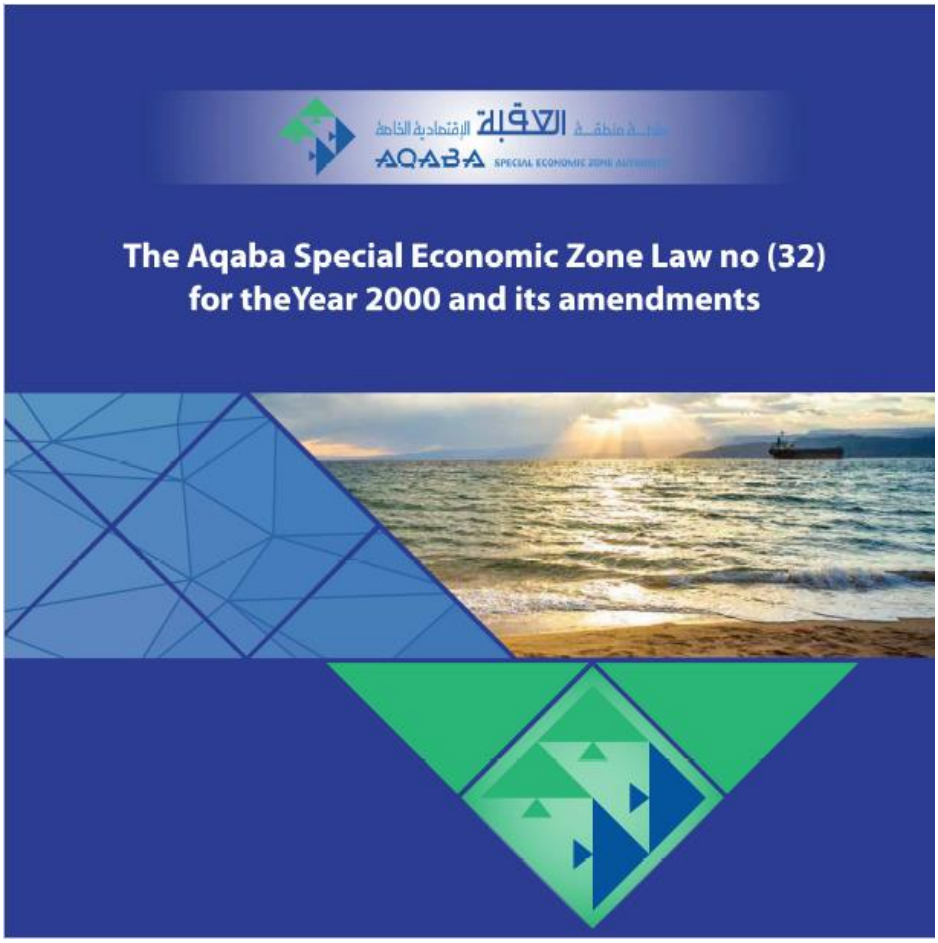
Name of Law/Institution	Year	Purpose and Outline
		buildings, and civil engineering structures. It defines the roles of the Financial Directorate/Director and the Chief Commissioner in relation to these services, as well as the bidding method and other related matters.
Regulation No. (31) of 2001 Regulation on Registration of Enterprises in Aqaba Special Economic Zone	2001	Regulations regarding the registration of enterprises engaging in economic activities in the ASEZ, based on Article 22B and Article 56 of the ASEZ Law. In ASEZ, economic activities are possible even for enterprises that are not registered if certain conditions are met, but they are not entitled to benefits such as tax exemptions. The registration procedure, types of economic activities that are restricted to registration, etc. are defined.
Regulation (23) of 2001 Organizing of Accounts and Financial Statements of Registered Entities in the Aqaba Special Economic Zone	2001	Regulations regarding the accounting and financial affairs of businesses registered in ASEZs, in accordance with Article 40A of the ASEZ Law. It stipulates the procedures for importing and exporting goods between ASEZs, which are special economic zones, and outside the zones.
Regulation No. 157 of 2003 on the Temporary Vehicle Entry to Aqaba Special Economic Zone	2003	Regulations regarding the permission for companies registered in the ASEZ to temporarily enter vehicles in the ASEZ, in accordance with Article 30D of the ASEZ Law. It defines the conditions under which entry is permitted and the license granted to vehicles entering the ASEZ on a temporary basis.
Income Tax Regulation for the Aqaba Special Economic Zone, as amended No. (53) for the Year 2005	2005	Regulations regarding income tax in the ASEZ, based on Articles 32 and 56 of the ASEZ Law. It stipulates, among other things, that income generated in the ASEZ, and income generated outside of the ASEZ should be split and claimed separately.
Regulation no. 54 of 2005 for the Goods and Services Sales Tax in Aqaba Special Economic Zone (ASEZA) as amended	2005	Regulations on sales tax in ASEZs under Articles 36 and 56 of the ASEZ Law. ASEZs, which are special economic zones, do not impose consumption tax on goods and services in the zone in accordance with Article 30 of the ASEZ Law. However, the law stipulates goods and services that are taxed exceptionally, the procedures for taxation of these goods and services, and special taxes that are additional to the taxation.
Regulation No. (51) for the Year 2006 Regulation of the Court Formation of the Aqaba Special Economic Zone	2006	The regulation that provides for the establishment of district courts in ASEZs under Article 3 of the Municipalities Courts Formation Law.

Source: JICA Study Team

2.2.2 Overview of Relevant Legal Systems

This section provides an overview and review of the relevant laws and regulations listed in the table above that are highly relevant to the urban development M/P.

(1) ASEZ Law (2000)



Source: https://aseza.jo/EchoBusV3.0/SystemAssets/AR/Laws_and_Regu/law%20english.pdf

Figure 2-5 ASEZ Law

1) Purpose of establishing ASEZ (Article 3)

The aim of the establishment of the Zone is to enhance economic capability in the Kingdom by attracting different economic activities and investments thereto. (Article 3)

2) Boundary of ASEZ (Article 4, 7)

The Authority shall be associated with the Prime Minister. (Article 7, C)

The boundaries of the Zone shall be determined by a decision of the Council of Ministers upon the recommendation of the Board. The Council of Ministers may amend these boundaries according to the business of the Authority and the exigencies of public interest. The decision and any amendment thereto shall be published in the Official Gazette. (Article 4)

A total of six new areas scattered along the Desert Highway and north of Wadi Rum will be added to the ASEZ under the Prime Minister's declaration, and in the updated master plan,

the scope of the ASEZ will be expanded from the existing master plan.

3) Installation of ASEZA (Article 7 A, 7 C, 9, 10 A)

An Authority to be known as the "Aqaba Special Economic Zone Authority" shall be established in the Kingdom and shall have a juridical personality with financial and administrative autonomy. As such, the Authority may acquire movable and immovable property and perform all legal acts necessary to achieve its objectives, including concluding contracts, accepting aids, grants and donations, and litigating. The Civil Attorney General or any attorney appointed by the Authority for this purpose shall represent the Authority in any legal proceedings. (Article 7 A)

The Authority shall be associated with the Prime Minister. (Article 7 C)

The following are defined as functions of ASEZA (Article 9)

A. Develop and qualify the Zone to attract investments and create an advanced investment environment to stimulate industry, trade, tourism, and services in the Zone.

B. Increase job opportunities for Jordanians and coordinates and cooperate with investing entities in the Zone to train, qualify and enhance the capacity of Jordanian manpower and priorities their employment.

C. Enhance the role of the private sector in participating in the development of the Zone, including providing infrastructure services and any public services.

D. Encourage competition and prevent monopoly in the various economic activities within the Zone.

E. Plan, design and execute projects for the development of the Zone in various fields, directly or through other parties.

F. Protect the environment in the Zone.

G. Encourage Registered Enterprises to conduct and support research and development.

ASEZA's defined responsibilities include the following (Article 10 A)

1. Administer the Zone and oversee its affairs according to its authorities entrusted therewith pursuant to this Law and the Regulations issued pursuant thereto.

2. Prepare the necessary plans and programs for developing the Zone.

3. Establish the applicable basis for investment in the Zone.

4. Register enterprises wishing to enjoy the benefits and exemptions stipulated pursuant to this Law.

5. Promote the Zone in coordination and cooperation with the relevant bodies.

4) Application of the law (Article 6, 10 B)

All legislation in force in the Kingdom is applicable in the Zone and the provisions of this Law shall supersede in case of contradiction with the provisions of such legislation. (Article 6)

Notwithstanding the contents of any other legislation, the Authority shall assume within the Zone boundaries and in accordance with this law, the responsibilities, and authorities in relation to the following: (Article 10 B)

1. Regulate and control the economic activities to assure the abidance with this Law and the regulations issued pursuant to it and the by-laws issued by virtue of any of it, including the public health and safety affairs in relation to these activities.
2. Issuing permits and certificates and any other authorizations which pertain to conducting economic activities in the Zone according to the provisions of this Law and the Regulations issued pursuant thereto.
3. Zoning of cities, villages, and buildings.
4. Municipal affairs.
5. Protecting the environment, water resources, natural resources, and biological diversity.
6. control the imported or exported food and drugs, to or from the Zone and control and inspect all places for slaughter, food preparation and manufacturing and its derivatives, selling and serving. For this purpose, the Chief Commissioner shall have the Minister's authorities and the Commissioner concerned shall have the Director 's authorities given to each of them in the Food and Drugs Administration Law in force and the regulations issued pursuant to it.
7. Customs procedures and matters.
8. Collecting the taxes, fees, fines, and service charges stipulated in this Law and the Regulations and issued pursuant thereto.
9. Work and Employees affairs.
10. Any authorities entrusted to other official bodies accorded to the Authority by the Council of Ministers.

According to these regulations, building permits in the ASEZ are not based on the Jordanian Building Code, but on the provisions of Regulation No. (32) of 2004 Regulation on Zoning and Construction Licensing in Aqaba and Design Guidelines published when the ASEZA Master Plan 2001-2020 was formulated.

5) Establishment of Board of Commissioners (Article 12, 15, 18)

ASEZA's Board of Commissioners (hereinafter referred to as the "Board") is a four-year term body consisting of six full-time members, including the Chief Commissioner and Deputy Commissioner, who are appointed upon the recommendation of the Prime Minister. (Article 12)

The Board is the approver of the Master Plan to be updated by this project and the role of the Board is defined as follows (Article 15):

The Board shall assume the following functions and authorities:

A. Prepare the general policy to develop the Zone with the approval of the Council of Ministers and approve the necessary plans and programs for the implementation thereof.

B. Allocate investment areas in the Zone and determine land use therein on the basis of the different sectors.

C. C-Approve the organizational structure of the executive body of the Authority, the Classifier Table and the job descriptions therein.

D. Supervise the executive body of the Authority and the operation of the Authority in a manner that ensures good performance.

E. The functions of the Municipal Council according to the provisions of the Municipalities Law in force and the regulations issued pursuant thereto. For this purpose, the chief commissioner shall assume the powers of the minister as stimulated in the relevant applicable legislations.

F. The authorities of the Higher Zoning Council and the Province and Local Zoning Committees in accordance with the Cities, Villages and Buildings Zoning Law in force and the regulations issued pursuant thereto.

G. Expropriate lands and property necessary for the operations of the Authority's activities or development of the Zone according to the provisions of the Eminent Domain Law in force.

H. Approve contracts and agreements to which the Authority is a party thereto.

I. Prepare the necessary draft legislation for the activities of the Authority and submit such to the Council of Ministers.

J. Recommend to the Council of Ministers to appoint the certified auditor of the Authority.

K. Approve the annual estimated budget of the Authority and submit such to the Council of Ministers for endorsement.

L. Approve the annual report of the activities, balance sheet and year-end accounts for the previous fiscal year of the Authority and submit such to the Council of Ministers.

M. Issue instructions relevant to the activities and procedures of the Authority, particularly the following:

1. *Regulating and monitoring the activities of Registered Enterprises.*
2. *Regulating the activities of investors in the Zone.*
3. *Collecting the prescribed taxes, fees, fines, and service charges in the Zone.*
4. *Issuing certificates of origin for goods produced in the Zone and determining the entities entitled to issue such.*
5. *Determining the fees, which the Authority collects in return for services rendered to any pertinent body to the Authority's activities.*
6. *Ratifying the status of economic activities violating the provisions of vocational license legislation prior to the date of commencing operations of the Zone.*

The Chief Commissioner is also the chief executive of ASEZA and has the authority of the Governor of Aqaba if the Minister of Interior of the State of Jordan does not appoint a governor of Aqaba (Article 18).

6) Tax System (Article 30)

In principle, ASEZs are exempt from customs duties, import taxes, and general sales tax (consumption tax) on the sale of goods and services, but some goods and services are subject to taxation as stipulated in Regulation no. 54 of 2005 for the Goods and Services Sales Tax in Aqaba Special Economic Zone (ASEZA) as amended. In addition, companies registered in ASEZA based on Regulation No. (31) of 2001 Regulation on Registration of

Enterprises in Aqaba Special Economic Zone (ASEZA) are subject to income tax on income derived from activities outside ASEZ and Jordan. In addition to income tax, social services tax, and company stock dividend tax on income derived from activities outside the ASEZ and Jordan, companies registered in ASEZ are exempt from tax on buildings and land owned in the ASEZ.

Goods and Services Subject to the Tax on Goods and Services Sales.

1. Men's suits and women's clothing sets as defined in Chapter (61 and 62) of the Customs Tariff.
2. Perfume and cosmetics preparations as defined in Chapter 33 of the Customs Tariff
3. The following electrical devices: a) Hair dryers. b) Shaving machines c) Irons d) Phones e) Automated call devices f) Recording and audio-visual devices. g) Radio and television sets and fixed and mobile cameras as defined in Chapter 85 of the Customs Tariff.
4. Cameras as defined in Chapter 90 of the Customs Tariff
5. Watches as defined in Chapter 91 of the Customs Tariff
6. Sunglasses as defined in Chapter 90 of the Customs Tariff.
7. Auto spare parts as defined in chapters (39), (40), (70), (83), (84) (85), (87) and (91) of the Customs Tariff.
8. Tires as defined in Chapter 40 of the Customs Tariff.
9. Cement as defined in Chapter 25 of the Customs Tariff
10. Reinforcement steel as defined in Chapter (72) of the Customs Tariff.
11. Hotel services as defined in the International Standard Classification Table (ISIC 3)
12. Catering Services as defined in the International Standard Classification Table (ISIC 3)
13. Services of car rental
14. Mobile phones including smart phones
15. Magnetic processing devices of weighing no more than 10 kg.

(2) Regulation on the Administrative Organization of Aqaba Special Economic Zone

The Regulation lists the organization of ASEZA as follows. (Article 4)

a. Board

b. Chairman

c. Vice Chairman

d. Commissioners

e. The following directorates:

1. Directorate of Investment

2. Directorate of Investment Services

3. *Directorate of Tourism*
4. *Directorate of Transportation*
5. *Directorate of Labor*
6. *Directorate of Environment*
7. *Directorate of Laboratories*
8. *Directorate of Licenses*
9. *Directorate of Rum Region*
10. *Directorate of City Services*
11. *Directorate of Financial Affairs*
12. *Directorate of Administrative Affairs*
13. *Directorate of Human Resources*
14. *Directorate of IT*
15. *Directorate of Local Community Development*
16. *Directorate of Public Works*
17. *Directorate of District Affairs*
18. *Directorate of Studies and Planning*
19. *Directorate of Public Control and Enforcement*
20. *Directorate of Lands and Real Estates*
21. *Directorate of Engineering Tenders*
22. *Directorate of Collection and Revenues*
23. *Directorate of Warehouses*

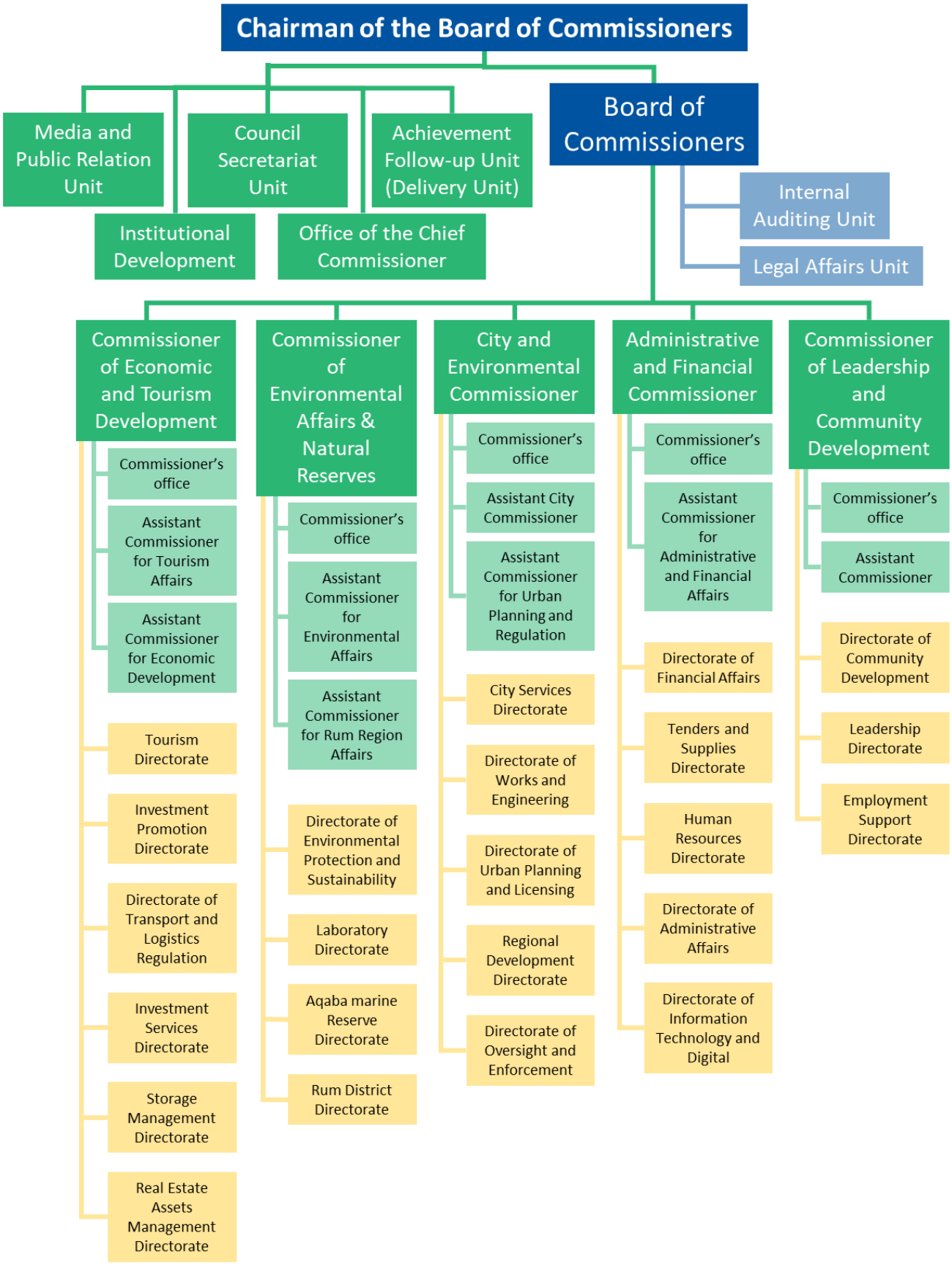
f. And the following units

1. *Internal Control Unit*
2. *Legal Affairs Unit*
3. *Media and Communications Unit*
4. *Institutional Development Unit*

g. Board Secretary

h. Chairman Office

On the other hand, since this regulation was formulated more than 20 years ago, we have once again studied the organizational structure of ASEZA and have identified the structure shown in the figure below, and this project shall be based on the figure below.



Source: JICA Study Team

Figure 2-6 ASEZA Organization Chart (As of August 2024)

(3) Regulation on Organization and Development of the Investment Climate of Aqaba Special Economic Zone (2001)

In order to encourage competition in economic activities within the ASEZ and to stimulate investment activities, the regulations stipulate requirements for permits and other permissions for business activities conducted by enterprises.

1) Activities that require permission from ASEZA to operate (Article 4, Annex 1, Annex 2, Article 6-15)

The activities that each company is required to obtain a commencement permit from ASEZA to carry out, regardless of whether or not the company is registered with ASEZA under the Regulation on Registration of Enterprises in the Aqaba Special Economic Zone, are as follows

- *Distribution of drugs and medical, veterinary and pharmaceutical products.*
- *Distribution of fertilizers, growth stimulators and pesticides.*
- *Distribution of hazardous chemicals.*
- *Medical and therapeutic services and institutions, including:*
  - *hospitals and medical centers.*
  - *Nursing and rehabilitation centers.*
  - *Elderly and handicapped and physiotherapy centers.*
  - *Mineral spas*
  - *Medical and physiotherapy centers*
  - *Physician and dentist clinics*
  - *Optics stores*
  - *Medical laboratories and dental laboratories*
- *Production and distribution of fireworks.*
- *Hotels and motels.*
- *All kinds of amusement parks.*
- *Diving and water sport clubs.*
- *Marine and land zoos.*
- *Tourism and travel offices.*
- *Kindergartens and child special care centers.*
- *Driving learning schools.*
- *Tourist transport in the Zone.*
- *Taxi and transportation offices.*
- *Fuel, car wash and lubrication stations. - Animal production (livestock) and poultry facilities.*
- *Water plantation and fish farms.*

- *Stables and pet farms.*
- *Quarries*
- *Water extraction from wells.*
- *Industrial activities.*
- *Activities of public utilities, the exercise of which is assigned by the Authority to the private sector.*
- *Potable water purification, treatment and sterilization.*
- *Luxurious auto offices (limousine)*
- *Floating cafeteria and bar*
- *Floating restaurant.*
- *Brick and pavement plants, and stone and granite cutters.*
- *Building maintenance and finishing.*
- *Fishing sport.*
- *Scooter lease.*
- *Bicycle and motorcycle lease.*
- *Natural massage centers.*
- *Permit to commence work for practicing the activity of recruitment of non- Jordanian domestic worker, cooks, gardeners and the like within the Zone.*
- *Rent a car office.*
- *Chemical storage.*
- *Firework shows (except for storage).*
- *Furnished apartment lease.*
- *Hotel suits.*
- *Public and private pharmacies and drugstores.*
- *Logistic storage centers.*
- *Special utility vehicle lease for driving on un-paved roads.*

In addition to the above, the following activities require obtaining a permit from ASEZA after consultation with the relevant authorities other than ASEZA.

- *Sea transport services*
- *Air transport services*
- *Communication services*
- *Basic, secondary and higher education*
- *Aero recreational sports and aviation teaching.*
- *Mining and other exploration industries, except for quarries.*
- *Issuance of newspapers and periodical printed matter.*

- *Radio and TVC programming and broadcasting services*
- *Activities of public utilities, the exercise of which is assigned by the Authority to the private sector*
- *Small marine boats.*

In order to conduct these business activities, the company conducting the business must submit to ASEZA drawings of the facilities to be used for the business, documents based on the technical standards established by ASEZA for the business activity, and the results of an Environmental Impact Assessment (EIA) based on the Regulation for the Protection of the Environment in the Aqaba Special Economic Zone (RPA), if one is required and the results of the EIA must be submitted to ASEZA for review, including an inspection of the building in question.

It is necessary to confirm whether the priority industries to be considered in the master plan revision and the industries to be promoted to attract investment fall under any of the above categories.

2) Issuance of Investor Guide (Article 30)

ASEZA has separately issued an Investor Guide related to these regulations, which investors should refer to when starting a new business. The Investor Guide provides information on the fees, required documents, and specific procedures for various applications that may be necessary in the course of implementing the business.

(4) ASEZA Design Guidelines (2001)

Within the ASEZ, no new buildings, structures, paving, landscaping, exterior lighting, mechanical equipment or signs, nor any changes or additions to any existing buildings, structures, paving, landscaping, exterior lighting, mechanical equipment or signs, may be built or installed by either private or public entities, without first obtaining written approval from the Aqaba Special Economic Zone Authority.

The organization and structure for the operation of the guidelines and the review process are shown below.

1) Organization and structure for the implementation of the Guidelines

The following is a list of the organizations involved in administering the guidelines as described in the Guidelines.

- *ASEZA CONSTRUCTION MANAGEMENT OFFICE (ASEZA/CMO)*

  The office within the ASEZA responsible for managing the construction of all public development in the ASEZ and approving the construction of all private sector development to ensure that it is consistent with the standards set forth in this document.

- *ASEZA DESIGN REVIEW OFFICE (ASEZA/DRO)*

  The office within the ASEZA responsible for reviewing and approving submittals for design and construction of all development in the ASEZ to ensure that it is consistent with the standards set forth in this document.

- *ASEZA DEVELOPMENT MANAGEMENT DIVISION (ASEZA/DMD)*

The division within the ASEZA responsible for managing all public and private development in the ASEZ to ensure that it is consistent with the objectives of the ASEZA Master Plan.

- ASEZA PROPERTY MANAGEMENT OFFICE (ASEZA/PMO)

  The office within the ASEZA responsible for managing and maintaining common facilities, infrastructure, and landscaping in public areas of the ASEZ.

Interviews with the Urban Study and Planning Department (hereinafter referred to as USPD) confirmed that as of 2022, the roles described in the guidelines as being handled by the CMO, DRO, and DMD, respectively, is being handled by the USPD. In subsequent reviews of the guideline, references to CMOs, DROs, and DMDs will be unified to USPD.

1) Design Review Process

a) Design Orientation

Preliminary discussions with USPD must be conducted.

b) Concept Design Review

A set of conceptual designs must be submitted.

c) Construction Documents Review

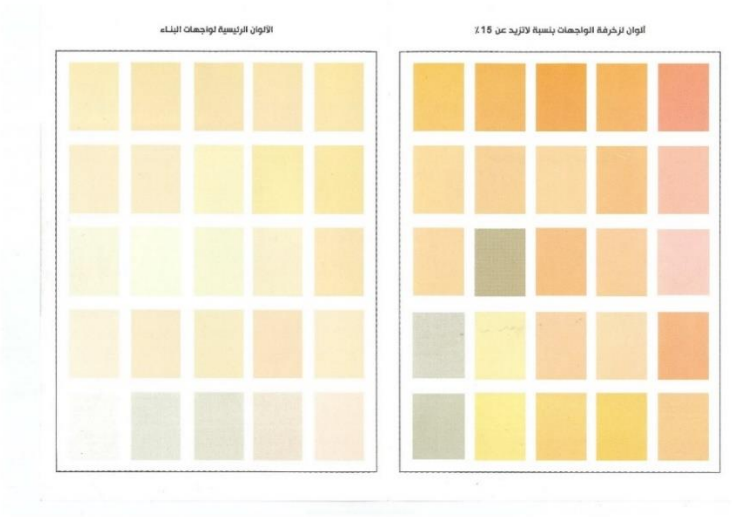
A complete set of construction document drawings and specifications must be submitted.

Official approval letters and building permits for Steps 2 and 3 from the USPD must be obtained before beginning construction. In addition to the drawings, samples of materials and color samples as shown below are used for review.

d) Construction Verification

Inspection is needed to check that construction has been completed in accordance with approved plans. Written approval for Step 4 and a Certificate of Occupancy is obtained from the USPD prior to making final utility connections.

Once construction has begun, on-site design supervision is also performed.



Source:：Provided by ASEZA Mega Project Department

Figure 2-7 Color swatches (Left: Colors available for building facades, right: colors that can be used for up to 15% of the facade area)

In addition, these reviews are for new buildings and structures planned after the establishment of the Design Guidelines, and buildings and structures constructed before the establishment of the Guidelines are not subject to correction, even if they do not confirm to the existing standard.

2) Subject of the guideline

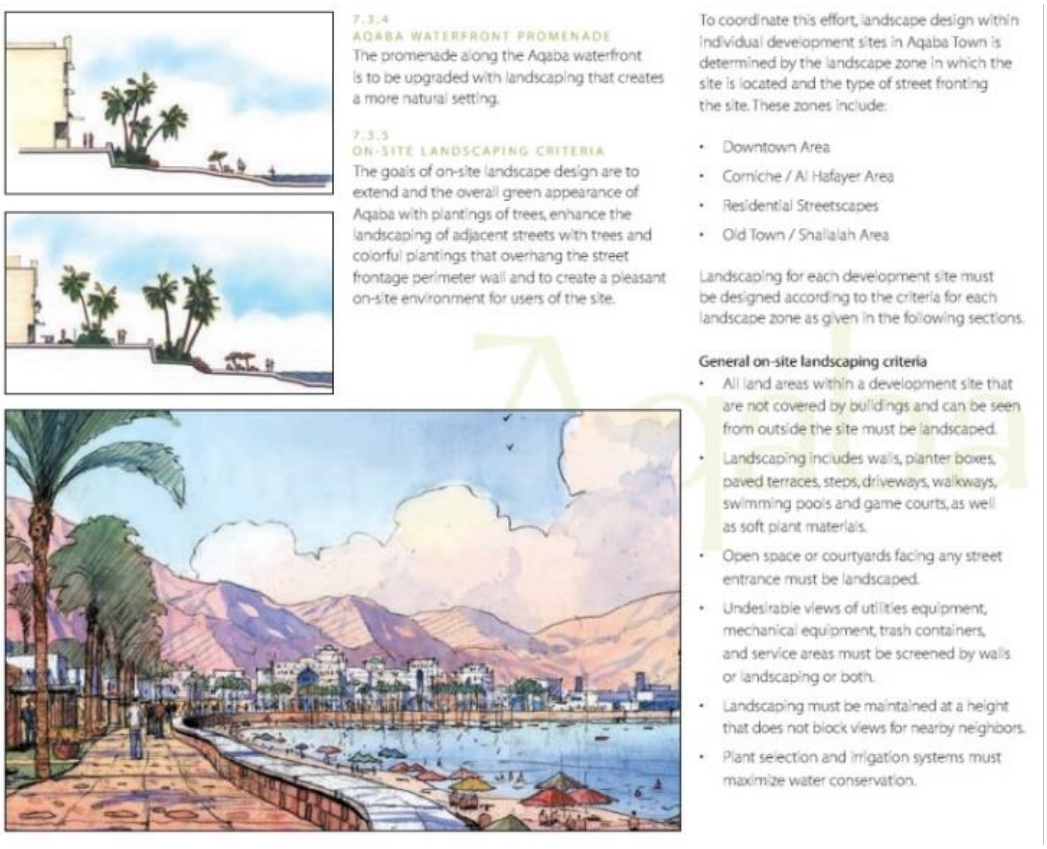
The subjects addressed in these Design Guidelines are not limited to items related to landscape, such as color and building materials for buildings and structures in the ASEZ, but also include a wide range of architectural collective provisions such as floor area ratio, as well as road types, designation of environmental and historic preservation areas, outdoor lighting regulations, outdoor advertising regulations, and construction-related procedures. In practice, they are not just "landscape guidelines," but are used as decision criteria in all phases of design and construction.

Table 2-6 Table of Contents and main contents of ASEZA Design Guidelines

	Table of Contents	Content
1	INTORDUCTION	ASEZ and Guidelines Overview and Definitions of Terms
2	DESIGN REVIEW SUMITTAL PROCEDURES	Explanation of the design review process and procedures
3	COMMUNITY DESIGN	Organization of the direction to be taken by the ASEZA Master Plan 2001-2020 and Design Guidelines Explanation of zoning (development zone, land use) in ASEZ
4	ROAD AND STREET STANDARDS	Status of ASEZ and surrounding road network Definition of road types Standard cross section of road type
5	ENVIRONMENTAL STANDARDS	Designation and definition of environmental/historic and cultural preservation areas and a description of the regulations in each protected area Description of the socio-economic resources that need to be preserved in Aqaba, including scenic features, accessibility to beaches, preservation of old town areas, etc.
6	GENERAL DESIGN GUIDELINES	A description of existing architectural features and unacceptable architectural designs in Aqaba The following provisions for planning and design throughout the ASEZ Site-specific provisions for building design (collective provisions, vehicular access, attached parking, paving, utilities, fencing, etc.) ASEZ-wide regulations for each part of the building (facade, doors, windows, roofing, exterior materials, etc.) Designation of colors Design provisions for streets and roadside spaces Design provisions for open spaces (parks, beaches, pedestrian paths, etc.) Landscaping regulations (designation of tree species that may be planted, design of open spaces)
7	SPECIFIC AQABA TOWN GUIDELINES	Description of the features and status of the Town of Aqaba Detailed design specifications applicable to the Town of Aqaba
8	SPECIFIC COASTAL ZONE GUIDELINES	Description of Specific Coastal Zone features and status Detailed design provisions applicable to Specific Coastal Zones

	Table of Contents	Content
9	SPECIFIC PORT AND INDUSTRIAL ZONE GUIDELINES	Description of Specific Port and Industrial Zone features and status Detailed design provisions applicable to the Specific Port and Industrial Zone
10	SIGN DESIGN GUIDELINES	Regulations on signs (boundary signs in ASEZ, zone signs in ASEZ, housing lot signs, directional signs, road signs, advertisements, construction signs)
11	CONSTRUCTION PROCEDURES	Procedures and regulations for construction

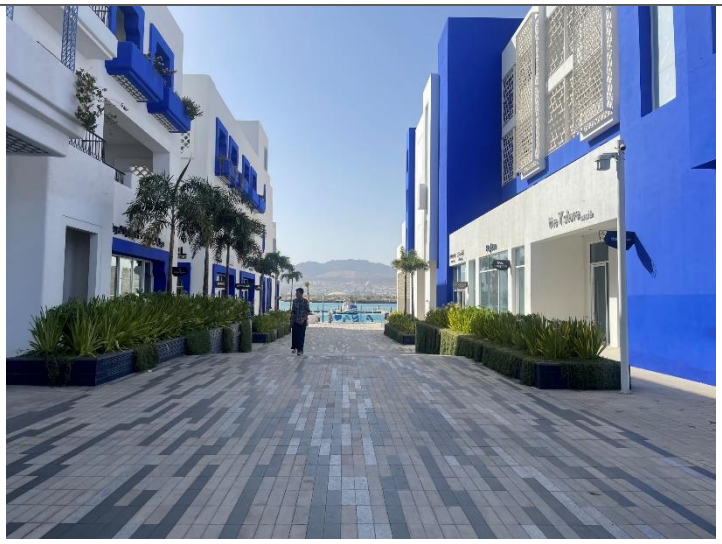
Source: JICA Study Team



Source: ASEZA Design Guidelines

Figure 2-8 ASEZA Design Guidelines (excerpt)

According to the Present Mega Project Study Department, approval of mega project plans is currently determined on a case-by-case basis, and no uniform requirements or regulations have been established. In order to make decisions based on certain criteria, development of planning criteria for mega-projects is to be considered in the future.



Source: JICA Study Team

Figure 2-9 Examples of buildings in the Ayla Resort that use colors on their facades that are not allowed in the Design Guidelines

(5) Regulation on Zoning and Construction Licensing in Aqaba Special Economic Zone (2004)

These regulations were established to supplement and clarify the regulations set forth in the Design Guidelines. It is still used by ASEZA as a basis for making decisions during the review process of design and construction in ASEZ, together with the Design Guidelines.

1) Application of provisions (Article 3)

The general provisions set forth in this Regulation relating to the management, monitoring and control of construction and the licensing of the projects thereof shall apply, unless the approved zoning plans included detailed construction provisions approved in accordance with the provisions of the Zoning Law and this Regulation.

2) Preparation and review of land use plans (Article 4)

a. *The regulatory body shall prepare the zoning plans for the zoning area at all levels thereof and submit the same to the Board for endorsement. It shall further review such plans on a periodical basis or whenever needed based on the population growth requirements in the Zoning Area with a view to achieve the developmental, investment and social objectives and progression and advancement of the local community in the Zone.*

b. *At preparing the regulating plans for the zoning area, the local architectural feature and color consistency and synergy within the surrounding environment, as well as having in place a hierarchal setting of the road network in the Zone shall be taken into consideration to achieve a balanced distribution of the traffic in the city and avoid passing through highways within the residential neighborhoods to the extent possible.*

Since the zoning plan review clearly states that the zoning plan should be based on population growth, the update of the land use plan should consider the target population scenario.

It also specifies that various regulations shall be established including a landscape and traffic perspective. These requirements are part of the contents listed in some chapters of the

Design Guidelines based on the ASEZA Master Plan 2001-2020, but it is considered necessary to include them as part of the introductory section of the guidelines, as mentioned above. This should be done along with the urban image and desired cityscape and landscape policies that ASEZA aims to achieve, as well as the basic approach for setting various regulations, to summarize them.

3) **Items for which criteria are set (Article 5)**

a. The following key criteria shall be observed for controlling and monitoring the construction process within the Zoning Area :

1. The permitted limits for building heights.

2. Construction density.

3. Setbacks.

4. Exterior appearance of the buildings and the architectural pattern.

b. The Board shall issue instructions necessary for defining the detailed construction provisions in each planning division area or detailed zoning area in accordance with the criteria referred to in Clause (a) of this article.

4) Deregulation of maximum height of building (Article 7 a)

a. Notwithstanding the provisions of Clause (c) of Article (6) of this Regulation, the Board may, upon a submission made by the regulatory body for justified reasons, designate certain sites within which buildings exceeding the higher permitted height within the Zoning Area can be erected.

5) Floor-area ratio (Article 8 a, b)

a. Construction density in each of the planning division areas or detailed zoning areas shall be organized by determining the permitted floor ratio, provided that such a ratio is to be specified at preparing the regulating plans and detailed provisions on construction of each of them.

b. Calculation of the floor ratio of the building for each construction project shall be within the permitted setbacks and heights of the project and in accordance with the detailed provisions on construction of the planning division area or the detailed zoning area in which it is situated.

The building density for each district and land use area will be organized based on their respective allowable floor area ratio, which will be specified during the formulation of regulations for each district or area.

The "Design Standards" described below set detailed building regulations for each neighborhood and are considered to fall under the bylaws described above.

6) Building materials and finishes (Article 11)

a. For erection of buildings for all uses, the same shall be made using natural materials such as stone, timber, clay, steel, concrete materials or prefab concrete units, where the Board shall issue instructions under which the colors of buildings façades and the conditions for finishing thereof shall be determined.

b. Non - concrete prefab buildings may not be erected but for the purposes of public utility

buildings or in industrial zones and warehouses, subject to the approval of the licensing body.

c. *No light reflecting materials may be used in the exterior façades of the building but with the approval of the licensing body, where the area rates of reflective materials in building façades shall be determined under instructions to be issued by the Board, provided that the area rate thereof shall in no case exceed (40%) of the area of each façade.*

Regarding the color scheme for building finishes, it was confirmed that color samples were used in the design review based on the Design Guidelines mentioned above; however, the color samples received from ASEZA do not have quantitative expressions such as Munsell values or color codes, which makes it difficult to conduct a highly accurate review. It would be desirable to quantify these criteria and make the guidelines easier to understand in conjunction with the Design Guidelines update planned by ASEZA in the future.

7) Parking (Article 14-18)

It shows how to calculate the number of spaces required for each class (star) of hotel (Article 15), as well as for building uses for which there is no specific mention of parking in the Design Guidelines (movie theaters, religious facilities, administrative facilities, educational facilities, complex facilities, etc.).

If a public parking lot is planned in the district, ASEZA's licensing authority may, at its discretion, reduce the number of parking spaces attached to buildings that can use that public parking lot, and the public parking lot may collect parking fees from users (Article 16). On the other hand, in interviews with the Directorate of Control and Execution of ASEZA, it was found that people in Aqaba value immediate access to stores and other facilities after getting out of their cars, and they prefer to park near the entrances to the facilities they use, so public parking lots are being developed. The study also showed that multiple on-street parking occurs in front of stores in the city center.

8) Pavement (Article 23 a, b)

As per the following, ASEZA may require the owner of a site in ASEZ to carry out pavement construction on the road facing the site. Therefore, when constructing a building on one's own site in ASEZ, the owner is not only responsible for the construction within the site, but also for pavement works on the public road. Additionally, if the development timing of each site within the same block differs, there may be gaps in pavement continuity within the same block, and the need for repairs may arise at different times due to different pavement construction timelines. This poses challenges in terms of efficient maintenance and management of public spaces, ensuring safety, and maintaining consistent aesthetic appearance of the streetscape.

a. *The landlord shall, in the zoning area and before procuring an occupancy permit, build and pave the pavement adjacent to or bordering the property thereof for the first time at his own expense on the basis of the length of the façade of the property thereof. For this purpose, by resolution of the Board, the width, dimensions, measurements and shapes of the pavement shall be defined, as well as the materials that can be used in paving and the period within which the work shall be done.*

b. *The Board may engage the landlord whose property is adjacent to or boarding the road,*

under an announcement to be published in two daily local newspapers, to build the pavement in front of the property thereof at his own expense within thirty days as of the date of publishing the announcement.

9) Protection of Existing Trees and Greening (Article 24)

The following standards are established for the protection of existing trees and the greening of the site, with a general policy of preserving existing trees. Additionally, in the aforementioned Design Guidelines, a list of plant species that can be planted on each site within ASEZ is provided. The principle is to select plants from this list and green 10% of the site. The required greening rate is uniformly 10%, applying the same standard to both high-density residential and commercial areas, as well as large-scale public facilities. It is anticipated that this requirement might be challenging to meet for the former. Furthermore, in Aqaba, which has low annual rainfall, the installation of irrigation systems for plant maintenance is considered one of the challenges in developing each site.

a. At drawing up the licensing plans, the engineer shall :

1. Preserve the trees existing on the project land.

2. Indicate the big trees existing on the project land on the licensing plans.

3. Indicate the trees to be kept on the project land or those that can be soundly transported.

b. The Board may, upon the recommendation of the licensing body, mitigate or amend the provisions on construction of certain buildings if the same would help in persevering trees of particular significance.

c.

1. No tree may be removed from the project land if the perimeter thereof was (300) mm or more without procuring a permission to do so from the licensing body.

2. If a tree was removed from the project land, a tree of similar features in terms of species and type shall be planted in lieu thereof.

d. At least (10%) of the area of the project land on which buildings are licensed and erected shall be planted.

e. The Board shall issue instructions under which the type of trees and specification for planting thereof on pavement on every street shall be defined.

(6) Design Standards

In this standard, a planning map has been developed for each district in ASEZ that defines the uses by site, and based on the plan, building regulations (collective regulations) are established for sites in the district by category or individual site unit, classified by use, size, and other factors. The main items subject to regulation are as follows. Depending on the category or site, not all items may be covered.

- Setback (front, side, rear)
- Floor Area Ratio
- Maximum height

- Building-to-land ratio
- Floors

The Criteria does not describe the future vision of each district or its position in the ASEZ, only the regulations to be followed at each site.

According to interviews with the Local Community Development Directorate, although each site has a defined use, if a landowner proposes to ASEZA to build a building for a different use by paying the prescribed fee and be approved, the landowner can build a building for a use different from that planned on the site. In such case, the building regulations will be in accordance with the use for which the building is actually constructed. Therefore, in some cases, plans that have a negative impact on the surrounding environment, such as the construction of a tall building in a residential area where only low-rise buildings were permitted, may be permitted.



Source: Provided by ASEZA

Figure 2-10 Land Use Plan Map by District in Design Standards (excerpt)

(7) Regulation for the Sale and Lease of Lands in the Aqaba Special Economic Zone (2001)

This provision is for the sale or lease of land owned by ASEZA.

1) Construction period when land is purchased from ASEZA (Article 8)

If the land is purchased from ASEZA for a development project site, the project must be completed to operational readiness by the following period.

A. Whoever purchases Land from the Authority to establish any project thereon shall undertake to complete such project within the period specified by the Authority, provided that such period does not exceed three years from the date of purchase, unless the Board approves the extension thereof for the period deemed necessary, provided that the extension shall not exceed two years, for one time, and is on a case-by-case basis.

B. The Board may decide to grant the purchaser a period not exceeding nine years to complete the project if the nature of such project requires execution through phases, provided that the Board specifies in its decision the period necessary for executing each phase considering it as a separate project.

C. Notwithstanding Paragraphs (A) and (B) of this Article, the Board may under the approval of the Council of Minister extends the period of implementing the project or any stage thereof for more than once for the period they deem appropriate.

D. If the periods stipulated in Paragraphs (A), (B) and (C) of this Article are exceeded, the Authority shall be entitled to reclaim the Land according to the provisions of Article (14) of this Regulation.

E. For the purposes of this Article, "establishment of the project" shall be taken to mean "completion of the execution of the project and the preparation for its operation".

As described above, development projects using land purchased from ASEZA have a construction period of three years in principle, but ASEZA can flexibly phase in or extend the deadline at its discretion, depending on the scale and content of the project.

2) How ASEZA sells or leases land (Article 12)

Sale and lease of the Lands of the Authority shall be through auctioning unless the Board decides otherwise for justifiable reasons, provided that the auctioning procedures are undertaken according to the instructions issued by the Board for this purpose.

In addition, an interview with the Land Directorate of ASEZA regarding the sale of land owned by ASEZA confirmed the following operations.

In case of an individual buys the land owned by ASEZA:

- All individuals involved in the purchase process must be Jordanian citizens. However, if an authorized representative is appointed through power of attorney, they must have the legal authority to sign on behalf of the buyer.
- The representative should submit a purchase request to the Land Directorate, detailing the agreed-upon price and payment terms.

In case of a company buys the land owned by ASEZA:

- To have a branch in Jordan.
- Submit an investment license application.
- Determine the investment objective for purchasing the land and whether it will be time-bound or open-ended.
- Then ASEZA studies the offer and if it is approved on financial, organizational, and technical matters, then the purchase process is completed.

In addition, based on the interview with the ADC's Contract Department, ADC has its own procedures for selling or leasing their land.

Investors should submit an investment application to ADC and after submitting it, the purpose of the sale process is carefully studied, determining the type of sales procedures based on the nature of the investment.

In the next step, the decision is elevated to the Higher Technical Committee specializes in land sales to investors, where it is ratified by the council after several studies on the nature of the investment and the characteristics of the land. In some cases, the decision might need to be elevated to the Cabinet, especially if the land area to be purchased exceeds 100 dunums for specific matters.

Based on the interview with the Land Directorate of ASEZA, the following documents are to be used for the procedures regarding land sales between private parties.

- Land Title Deed: The official land title deed is a crucial document that establishes ownership. It is obtained from the Land Directorate.
- Land Survey Plan: The survey plan is another essential document obtained from the Land Directorate, outlining the boundaries and specifications of the land.
- Zoning Plan: The zoning plan provides information about the designated use of the land and is acquired from ASEZA.
- Clearance Certificate from Aqaba Special Economic Zone Authority: This certificate ensures that the land complies with the regulations of the Aqaba Special Economic Zone Authority from ASEZA.

(8) Regulation for the Protection of the Environment in the Aqaba Special Economic Zone (2001)

1) EIA (Environmental Impact Assessment) (Article 8-14)

Environmental Impact Assessment (EIA) shall mean any process which objective is to identify, examine and define the impacts of a Project on the Environment, its effects on, and how it is affected by the economic and the social aspects. Such process shall include the specification of means to limit the adverse impacts on the Environment so as to achieve sustainable development. The EIA process shall be undertaken during the planning, designing, executing and operating of a Project. (Article 8)

The items that need to be described in the application form for the conduct of an EIA in ASEZ are as follows; (Article 11 A, Annex 1)

1. *Description of the Project, including the following:*
    - *The characteristics of the Project as a whole including land-used requirements during the site preparation, and construction, operational phases, and decommissioning of the Project and restoration of its site.*
    - *The main characteristics of production processes (e.g., nature and quantity of used materials).*
    - *An estimate, by type and quantity, of expected residues and emissions (e.g., water,*

air and soil pollution; noise; vibration; light; heat; radiation) resulting from the operation of the Project.

- *An estimate of the expected number of people, vehicles, equipment, and their movement during the various stages of the Project.*

2. *An outline of the main alternatives to the proposed Project (including setting, design, and technology), and an indication of the main reasons for selecting the proposed Project over the alternatives, taking into account environmental effects. In cases where a less environmentally damaging site, design, or technology alternative has not been selected, the reasons for rejecting this alternative should be explained.*
3. *Description of the aspects of the Environment likely to be affected by the proposed Project, e.g., public health, infrastructure, fauna, flora, soil, water, air, climatic factors, landscape, and material assets (including architectural and archaeological heritage), and the inter-relationship between these aspects.*
4. *Description of the likely significant effects of the proposed Project on the environment resulting from:*
   - *The erection of the Project.*
   - *The use of natural resources.*
   - *The emission of pollutants, the creation of nuisances, and the disposal of waste.*
5. *Description by the Project Owner of the forecasting methods used to describe the environmental effects.*
6. *Description of the measures envisaged to prevent, reduce and, where possible, offset any significant adverse effects on the Environment.*
7. *A non-technical summary of the information provided under the above headings.*
8. *An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the Project Owner in compiling the required information, and recommendation of remediation.*

Projects that may be subject to an EIA are categorized as follows. (Article 11B, Annexes 2 and 3)

Category (1): Projects which Require Comprehensive EIA

1. *Crude-oil refineries.*
2. *Thermal power stations.*
3. *Reclamation of land from the sea for building industrial or recreational facilities or other.*
4. *Construction of harbors and marine ports and accessories thereof.*
5. *Construction of highways, railways, and airports.*
6. *Construction of marinas, jetties and offshore facilities for industrial or recreational purposes.*
7. *Construction of major hotels and entertainment complexes.*
8. *Waste-disposal installations for the incineration, chemical treatment or landfill of*

toxic wastes.

9. *Integrated chemical installations, such as petrochemical manufacturing complexes, pesticide and fertilizer factories, etc.*
10. *Industrial estate development Projects.*
11. *Installations for the extraction of asbestos and for the processing and transformation of asbestos and products containing asbestos.*
12. *Integrated works for cast-iron and steel manufacturing.*
13. *Cement manufacturing installations.*
14. *Construction facilities for the storage, repair or maintenance of trucks, buses, and cars.*
15. *Fish-breeding farms in the sea.*

Category (2): Projects which are required preliminary assessment, on the basis of which it shall be determined whether or not comprehensive EIA is needed.

1. *Agricultural Projects*
2. *Extractive Industries:*
3. *Energy Generation Industries*
4. *Processing of Metals*
5. *Glass Industry*
6. *Chemical Industries*
7. *Food Industries*
8. *Textile, leather; wood and paper Industries*
9. *Rubber Industry and Treatment of Rubber-Based Products*
10. *Infrastructure Projects:*
    - *Urban development Projects.*
    - *Construction of roads, harbors, including fishing harbors, (Projects not listed in Category I).*
11. *Other Projects*
    - *Hotel complexes and recreational facilities (not listed in Category I).*
    - *Permanent motor vehicle racing and test tracks; horse racing tracks.*
    - *Dumpsters of domestic waste (unless included in Category I).*
    - *Wastewater treatment plants.*
    - *Sludge disposal sites.*
    - *Storage of scrap iron.*
    - *Sports complexes.*
12. *Modifications and Expansions to Projects According to the Provisions of this*

Regulation.

13. *Projects in Category I undertaken exclusively or mainly for the Development and Testing of New Methods of Production.*

Category (3): It shall include Projects that do not require neither comprehensive nor preliminary EIA.

The Project Owner shall insure that the EIA study shall in particular include the following (Article 14):

A. *A detailed description of the surrounding Environment and natural, cultural, economic and social aspects thereof as stated in Annex (1) to this Regulation.*

B. *Potential environmental impacts, including chances of environmental enhancement.*

C. *Significant impacts which shall be subject to evaluation and examination in appropriate accuracy and precision in order to adopt the appropriate decision thereon.*

D. *A systematic environmental comparison of investment and technical alternatives of the proposed Project.*

E. *Environmental mitigation and management plan and following up and monitoring plan and decommissioning and restoration plan.*

The EIS (Environmental Impact Statement) shall include especially the following (Article 15).

1. *A description of the main features of the proposed Project which may cause significant adverse environmental impacts, including a report on the residues and wastes it may create.*
2. *A description of the surrounding environment likely to be significantly affected by the proposed Project.*
3. *An assessment of the potentially significant impacts of the proposed Project, including the extent of its compatibility with environmental policies, legislation and criteria relating thereto and land use according to the zoning plan set forth by the Board for the Zone.*
4. *A description of any mitigation measures which are proposed, or which have already been incorporated into the Project design, to reduce the Project's potentially harmful effects on the Environment.*
5. *A determination of the main investment and technical alternatives of the proposed Project which have been investigated by the Project Owner in addition to the grounds for the preferred choice, taking into account their respective likely environmental effects.*
6. *A study and analysis of the anticipated cumulative any irreversible impact of the proposed Project.*
7. *Environmental mitigation and management plan, which shall include financial estimates, maintenance programs, time schedules and required cadres and*

training thereof.

8. *A plan for overseeing the execution of the Project and monitoring its impacts.*

The Project Owner shall provide a summary of the EIS. Such summary shall be in writing, signed by the Project Owner and binding thereto. It shall be written in a language that allows third parties to comprehend the information and technical analysis contained therein. Such summary shall also illustrate the main results achieved in the statement.

Where the Project is classified in category (2), the Directorate shall request from the Project Owner to conduct a preliminary EIA to the Project as specified in Annex (4) to this Regulation. Such preliminary assessment shall take into account the following (Article 18 A):

1. *The size or nature of the Project which may result in significant impacts on the environment.*
2. *The location of the Project where it may be near to or within a particularly sensitive ecological system.*

2) EA (Environmental Audit) (Article 25-35)

Environmental Audit (EA) shall mean any tool adopted by the environmental management, which comprise an organized, documented, periodical and objective evaluation for a Project, or the executive body and equipment thereof, in order to protect the environment through (Article 25):

A. *The management's monitoring and control of environmental practices.*
B. *The Project's compliance with the Operator's plan adopted for conforming with regulatory and environmental requirements.*

The Operator shall conduct an Environmental Audit upon the Commissioner's request in any of the following cases (Article 26 A):

1. *Upon receiving complaints from area residents or workers in the Facility about any harm or pollution resulting from the operations conducted therein.*
2. *In case an accident related to the Facility's operations takes place within or outside the Facility, and such accident resulted or might result environmental harm.*
3. *If monitoring results show that the project's activities are resulting in the release of pollutants into air, soil or water in excess of permitted levels according to adopted standards, or in amounts that cause direct harm to the Environment.*
4. *Where periodical inspection shows the necessity of conducting Environmental Audit.*
5. *Where an Audit is required to monitor the Facility's compliance with any mitigation or management plans that have been established by the Operator in accordance with a previous Environmental Impact Assessment.*

The scope of an environmental audit shall take into account the nature and size of the operation involved, according to the Terms of Reference which shall, in particular, cover the following areas (Article 27 C):

1. *The Operator's environmental strategy applied in the audited Facility.*
2. *The Operator's procedures pertaining to monitoring the Facility's compliance with relevant laws, regulations and instructions, and the Operator's standards within the Facility, and procedures for training the Facility's managers and employees on environmental protection and the disposal of pollutants and limiting use thereof, and storage and handling of hazardous substances, and the Facility's internal inspection and auditing, housekeeping and record-keeping procedures and submitting the information relating thereto.*
3. *The Operator's emergency plans in the event of the occurrence of environmental accidents, provided that they include mechanisms for communicating with competent authorities and potentially affected members of the public.*
4. *The suitability of environmental monitoring and control equipment at the Facility and the necessity for additional environmental monitoring or control equipment.*
5. *Past or present incidents or activities pertaining to the Facility that have an adverse impact on the environment.*
6. *The procedures of the Authority or relevant bodies, or the complaints of local community pertaining to the Facility's environmental performance and the Operator's response thereon.*

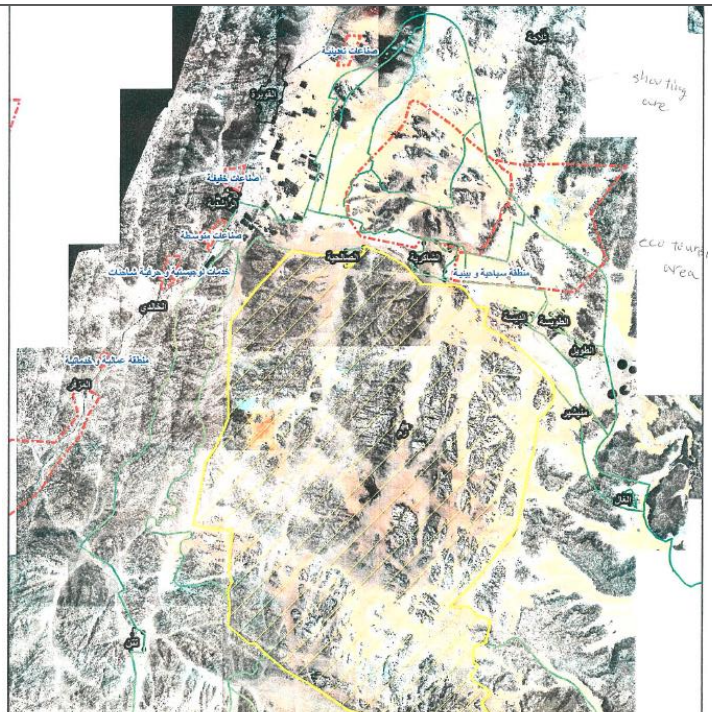
3) Incorporation into special accounts (Article 65)

All sums incurred from implementing the provisions of this Regulation shall be allocated in a special Account in the Authority's Budget. Such sums shall be expended for purposes of protecting the Environment.

(9) Regulation for the Development of Wadi Rum Area (2001)

The Wadi Rum area was established in 1996, prior to the establishment of ASEZ, in accordance with Resolution (18) by the Aqaba Regional Authority. As shown in the figure below, the Wadi Rum Protection Area is located east of the boundary of ASEZ and is outside the scope of ASEZ. The Wadi Rum Protection Area was declared a World Heritage Site (composite heritage) in 2011.

The area north of the Wadi Rum Protection Area, which partly had been and are planning to be added as part of ASEZ, is planned as an ecotourism area and a filming area, and the land use is envisioned to utilize existing resources such as tourism, nature, and landscape. In the future, it is necessary to consider within ASEZA whether the additional area should be included in the scope of this regulation or whether separate regulations should be established.



Source: Provided by ASEZA Directorate of Wadi Rum Protection Area

Figure 2-11 Wadi Rum Area (yellow line is Wadi Rum Protection Area, green line is the buffer zone that is being applied to be added to ASEZ, red is the land already added to ASEZ)

1) Authority held by ASEZs in the Wadi Rum area (Article 3)

The Authority shall, in coordination with the relevant bodies, assume the following powers in the Wadi Rum Area:

A. Developing Wadi Rum Area and premises thereof, improving its efficiency to achieve growth in all aspects therein, promoting tourism, developing basic services therein and creating work opportunities in fields of tourists, handicrafts, mountain climbing and desert guiding to improve life conditions of the Area's inhabitants.

B. Preserving the historical heritage, geological compositions and unique natural landscapes of Wadi Rum Area.

C. Preserving wild creatures whether plants, animals and birds in the Area.

D. Relocating endangered wild creatures such as Badan and Arabian gazelle by means of creating appropriate environment for such in the area, and maintaining the original environment conditions which is appropriate thereto and any other means.

E. Preserving historical places, facilitating access thereto and providing necessary information thereabout through different means to introduce such.

F. Preserving Wadi Rum Area's environment, preventing pollution sources and preserving public safety.

G. Increasing level of environmental education and awareness to identify importance and vulnerability of environment and methods of preserving and sustain such.

H. Exchanging expertise and information with relevant local and international bodies.

2) Regime for the Wadi Rum area in ASEZA (Article 4)

A special committee named the (Wadi Rum Area Committee) shall be formed in the Authority to administer the Area, under the Chairmanship of the Commissioner, and the membership of the following:

- *Wadi Rum Area's Director Vice-Chairman*
- *One representative of the Ministry of Tourism and Antiquities nominated by the Minister of Tourism and Antiquities.*
- *Three members nominated by the Chief Commissioner upon the Commissioner's recommendation provided they include representatives of the local community.*

The roles of the Committee are as follows

1. *Establishing the policy necessary for Wadi Rum Area's administration, development and improvement in accordance with the accredited Environmental Management Plan, and submitting such to the Chief Commissioner to be presented to the Board to issue a decision thereon.*
2. *Preparing an annual administration plan for Wadi Rum Area subject to the Board's approval, and overseeing its implementation.*
3. *Defining necessary allocations for the Wadi Rum Area's expenditures to be approved by the Board and listed within the Area's annual budget.*
4. *Drafting administrative, financial and technical instructions and submitting them to the Chief Commissioner to be presented to the Board to issue a decision thereon.*
5. *Seeking the advice of people of expertise and competence in preparing necessary studies to develop and promote Wadi Rum Area.*
6. *Any other tasks required for Wadi Rum Area's good performance and assigned thereto by the Chief Commissioner.*

3) Prohibitions in the Wadi Rum area (Article 9)

Subject to legal liability, it shall be prohibited to undertake any actions, activities or procedures that may result in the destruction, damage, or deterioration of the natural environment, or damaging the wild and plant life, or affect the esthetic of Wadi Rum Area. In particular, it shall be prohibited to undertake the following:

1. *Constructing within the Wadi Rum Area's perimeters, excluding the village site existing in Rum and the visitor's center, provided that provisions of zoning and the instructions issued in accordance with this Regulation are taken into account when constructing therein.*
2. *Entering and exiting Wadi Rum Area from other than the specified areas.*
3. *Entering to no-entry places without official authorization.*
4. *Mining, stone-crashing and engraving and quarries.*
5. *Hunting, transferring or harming wild animals, birds and reptiles, or undertaking any action that may lead to harming such.*
6. *Destroying or damaging geological compositions or places that are considered habitation, reproduction or migration places of species of animals, birds and plants.*

7. *Writing, painting or engraving any compositions of Wadi Rum Area.*
8. *Timbering or destroying plant cover (Flura)*
9. *Polluting soil, water or air resources.*
10. *Entering exotic (alien) animal or plant species to Wadi Rum Area.*
11. *Undertaking any procedures which affect Wadi Rum Area's environment such as lighting fire or littering within the Area.*
12. *Driving vehicles outside the designated roads.*
13. *Pasturing in other than the allowed areas and seasons.*

(10) The Aqaba Marine Reserve system (2022)

1) The extent of the Aqaba Marine Reserve (Article 3)

The extent of the protected area is defined as follows, but accurate location information will need to be obtained through GIS or other means.

A. The Boundaries of the Reserve

1. *The boundaries of the reserve extend from the southern border in the passenger port in the north, up to the southern border of the diving club in the south, for a distance of (50) on the eastern land side, (350) meters on the seaside on the west, and to the seabed vertically on the sea side.*
2. *The boundaries of the reserve shall be amended by a decision of the Council of Ministers upon the recommendation of the Council.*

B. The Buffer Zone of the Reserve

1. *The buffer zone of the reserve extends for a distance of (50) meters to the east of the eastern land borders of the reserve, in a way that does not conflict with private property, and to a distance of (100) meters to the west of the western, marine borders of the reserve.*
2. *Amendment of the borders of the buffer zone according to the amendment of the boundaries of the reserve is according to what is stated in the administrative plan.*

2) Establishment of The Aqaba Marine Reserve Management Committee (Article 4)

Within ASEZA, there shall be a body consisting of the Commissioner and the following members

- *Director of the Aqaba Marine Reserve*
- *Three persons appointed by the President upon the recommendation of the Commissioner.*

The roles of the committee are as follows

1. *Preparing the administrative plan for the management of the reserve, presenting it to the council and following up its implementation.*
2. *Participate in reviewing and developing the administrative plan in cooperation with the reserve administration.*

3. *Reviewing the provisions of the buffer zone once every five years.*
4. *Providing the necessary funding for the reserve and promoting it.*
5. *Five Determining the necessary allocations for protected expenses for approval by the Council and including them in the budget of the secondary authority.*
6. *Preparing administrative, financial and technical instructions and submitting them to the Chairman for presentation to the Council.*
7. *Any other work or tasks assigned to them by the chairman or the council.*

3) Protected Area Management Plan (Article 6 E)

The administrative plan of the reserve must include the following basic elements:

1. *Description of the reserve and its vital, physical, social and economic characteristics.*
2. *Evaluation of the components of the reserve*
3. *The executive plan, indicators, and timetable for at least five years, including general goals, practical goals, outputs, and activities.*
4. *A comprehensive plan for the reserve, including illustrative maps, details, and permitted and prohibited activities in each area.*
5. *The proposed budget for the reserve.*
6. *Monitoring and evaluation program.*
7. *The expected axes for regional and international cooperation.*
8. *Determine the requirements and conditions for licensing and monitoring scientific research activities.*
9. *Develop awareness and education programs about the value of coral borders, their fragility and other natural resources in the Gulf of Aqaba and how to deal with them.*
10. *Any other matters that the Ministry of Environment decides to add to the error.*

The latest management plan should be referenced in this work and reflected in the SEA implementation and master plan.

4) Restrictions in protected areas (Article 9)

The following activities are prohibited or restricted in protected areas.

- Road incision, implementation of agricultural projects, fish farming, industrial or residential projects, or the establishment of buildings or facilities.
- Hunting, transporting, or harming any organisms, articles, or organic materials such as corals, rocks, or soil in any way for any purpose, except with a statement issued by the Chief Commissioner.
- Harming of facilities, equipment, machines, wild or maritime facilities, or destroying multiplying or migrating geological formations or areas that are considered a habitat for animal factions or plants.
- And- destroying or collecting fossils without obtaining the approval of the authority. Fossils must be kept in the museums or qualified sites to preserve them.

- Conducting scientific research and collecting endangered, rare or communicable species and their parts except with prior permits issued by the Chief Commissioner.
- Inserting animals such as dogs, horses, livestock, etc. Entering the types of animals or plants, or any strange types that cause environmental damage that threaten the survival of the original species or negatively affect the facilities and local societies to pollute the soil, water or air in any way.
- To dispose the garbage and waste of all kinds.
- The entry of vehicles and their leaders except with a statement from the reserve administration.
- Camping outside of designated areas is subject to the permission of the reserve administration.
- Photography and production of films for commercial or advertising purposes, for the benefit of television stations or others, except with a prior statement from the reserve administration.
- Any other activity that contradicts the goals of the reserve.



Source: JICA Study Team

Figure 2-12 Inside the Aqaba Marine Reserve area

(11) Regulation for Entry Visa, Labor and Residency in the Aqaba Special Economic Zone (2000)

1) Types of visas and permits (Article 3 A)

The Authority shall issue the following for non-Jordanians pursuant to instructions issued by the Board:

1. *Visit visa*
2. *Transit visa*
3. *Work visa*
4. *Work permit*
5. *Residency permit*

2) The percentage of Jordanian nationals in the workplace within ASEZ (article 15)

In order to protect the employment opportunities of Jordanians in the ASEZ, it is stipulated that the number or percentage of Jordanians in each workplace shall not be less than

A. All work fields in the Zone shall be open for non-Jordanian workers according to instructions issued by the Board, provided that Jordanian workers are given priority in work opportunities.

B. The number of Jordanian workers in any Registered Enterprise or project within the Zone, whose number of workers exceed (5) workers, shall not in any case be less than the following:

1. (3) workers if the number of workers does not exceed (18) workers.

2. (30)% of the total of workers if the number of workers exceeds (18) workers.

C. If there is insufficient or unqualified Jordanian manpower to work at a Registered Enterprise or the relevant project, the Board may decrease the percentage of Jordanian workers or exempt the employer from such according to the bases determined in instructions issued by the Board for this purpose and stated in Paragraph (A) of this Article.

However, if there is a shortage or ineligibility of Jordanian workers working in an enterprise or related project registered in ASEZA under the Regulation on Registration of Enterprises in the Aqaba Special Economic Zone, discussed below, The Board may, at its direction, reduce the percentage of Jordanian workers in such enterprises/projects or exclude the employer from such enterprises/projects.

3) Issuance of residence permits to investors (Article 19)

The Chief Commissioner or whom he delegates may grant the foreign investor and his dependents a residency permit according to the conditions determined in accordance with instructions issued by the Chief Commissioner for this purpose.

(12) Regulation on Registration of Enterprises in Aqaba Special Economic Zone (2001)

Companies conducting business activities in ASEZA can avail themselves of tax exemptions under Article 30 of the ASEZ Law by registering with ASEZA based on these regulations. However, even registered companies must obtain separate operational commencement permits from ASEZA in accordance with Article 4 of the Regulation on Organization and Development of the Investment Climate of Aqaba Special Economic Zone, when implementing business activities as stipulated in the said regulation.

1) The Prohibited and Restricted Activities (Article 5, Annex 1, 2, 3)

a. An entity may not register with ASESZA to engage in any of the following "Prohibited Activities"

[Annex 1 Prohibited Activities]

1. Manufacturing, storage and trading in firearms, ammunitions and explosives.

2. Manufacturing, storage and trading in radioactive or nuclear materials or environmentally hazardous materials.

3. *Manufacturing, storage and trading in hazardous, toxic or poisonous materials, expect for the requirement of permitted industry under the relevant legislations in effect within the Customs Territory.*
4. *Printing banknotes, stamps and coins.*
5. *Production of and trading in active biological and genetic materials.*
6. *Any other activities as resolved by the Council of Ministers.*

b. You may not register with ASEZA to engage in the following "restricted activities", but you may register if certain conditions are met. Details of "restricted activities" are described below (Article 11).

[Annex 2 Restricted Activities]

Schedule 1. Activities the exercise of which is governed to a restriction relating to the legal form of the Enterprise:

- *Legal services*
- *Auditing*
- *Maritime navigation agents*
- *Financial services*
- *Insurance and reinsurance*
- *Tourism and travel agents*
- *Engineering services*
- *Mining services, except for quarries*
- *(land/ sea) cargo agent services*
- *Construction contracting activities*

Schedule 2. Activities the exercise of which is governed to a restriction relating to the limitation on the number of Enterprises exercising the same:

- *Public transport of passengers*
- *Taxi services*
- *All kinds of commercial fishing*
- *Extraction of underground water*
- *Lottery*
- *Communication services except for (internet service providers)*
- *Electricity generation*
- *Mining and other exploration industries expect for quarries*
- *Newspapers and periodical printed matter*
- *Radio and TVC programming and broadcasting services*
- *Cement industry*

- *Tanning*
- *Air transport*
- *Massage*
- *Importation and distribution of natural gas, and establishing storage tanks within the Kingdom, and natural gas pipeline and storage services.*

【Requirements for companies with restricted activities to register with ASEZA】

1. *That the Enterprise is of the Enterprises listed in Annex (2), Schedule (2) with regards to the activities stated therein.*
2. *Issuance of resolution by the Board on conducting the activities specified in Annex (2), provided that to comply with the conditions set out in the resolution and to pay the returns prescribed by the Board.*
3. *Termination of the concession contracts relating to the activities listed in Schedule No. (3), whereby the provisions of Annex (2) shall apply then thereto apply.*

Table 2-7 [Annex 3 List of concession contracts concluded with ASEZA]

Eligible Business Activities	Entities that are permitted to conduct such activities under a concession contract	Year in which the concession contract ends
Oil refining, distribution and storage	Jordan Petroleum Refinery Co.	2008
Goods, passenger and mail transport between Aqaba and Nweibe'a	Arab Bridge Maritime Co.	2035
Extraction, manufacturing and distribution of Potash	Arab Potash Co.	2058

Source: Regulation on Registration of Enterprises in Aqaba Special Economic Zone

Noted that the concession contract with Jordan Petroleum Refinery Co. has already been terminated.

c. *No Enterprise shall be registered in the Zone if it exercises any of the public utilities activities, the performance of which is assigned to the private sector by the Authority or any other governmental body, but upon issuing a resolution by the Board allowing the same in accordance with the provisions of the legislation relating to such an activity within the Customs Territory and upon coordination with the relevant bodies.*

d. *The Council of Ministers may, upon a justified recommendation of the Board, permit the registration of any Enterprise for exercising an Economic Activity of a special tourist nature, provided that the resolution issued in this respect is to contain the principles and conditions with which the Enterprise shall comply and determine the amount of returns resulting from the same.*

Tourism is included in "activities subject to restrictions regarding the legal form of the enterprise," but may be permitted to register on a special exception basis upon recommendation of the Board.

2) Restricted activities (Article 11, 12)

The activities listed in Annex No. 2 above are considered restricted activities and are not allowed to be carried out in ASEZ unless they comply with the provisions of this Regulation.

The restrictions on such activities are as follows (Article 11)：

a. Limiting the legal form of the Enterprise.

b. Limiting the number of enterprises conducting a certain Economic Activity.

c. Limiting the nationality of Enterprise or the nationality of founders or partners thereof, or stipulating certain qualifications to be available therein.

d. Restrictions related to the activities of public utilities, the exercise of which is assigned to the private sector by the Authority or any other governmental body.

The industries subject to restrictions on the number of enterprises in Article 11 (b) range from highly public businesses, such as public transportation services and infrastructure, to massage, but these restrictions shall not be made for the purpose of restricting competition (Article 12), except for requirements of public order and public interest, such as protection of the environment and natural resources and attracting investment to public utilities.

(13) Regulation no. 54 of 2005 for the Goods and Services Sales Tax in Aqaba Special Economic Zone (ASEZA) as amended (2005)

1) Taxable Subject (Article 3, Table 1)

Upon sale for consumption purposes in the Zone, the goods and services listed in the table no. (1) attached to this Regulation shall be subject to the Goods and Services Sales Tax.

[Table 1]

1. Men's suits and women's clothing sets
2. Perfume and cosmetics preparations
3. The following electrical devices:
   a) Hair dryers.
   b) Shaving machines
   c) Irons
   d) Phones
   e) Automated call devices
   f) Recording and audio-visual devices.
   g) Radio and television sets and fixed and mobile cameras
4. Cameras
5. Watches
6. Sunglasses
7. Auto spare parts
8. Tires
9. Cement

10. Reinforcement steel
11. Hotel services as defined in the International Standard Classification Table (ISIC 3)
12. Catering Services as defined in the International Standard Classification Table (ISIC 3)
13. Services of car rental
14. Mobile phones including smart phones
15. Magnetic processing devices of weighing no more than 10 kg.

2) Imposition of special taxes (Article 7)

The special tax imposed on tobacco and its products, alcohol, liquor and beer shall be collected for one time upon the occurrence of the first sale of such items after being imported or produced.

2.3 Existing Plans in ASEZ

2.3.1 ASEZA Strategic Plan

ASEZA launched its 2024-2028 strategy in May 2024 to transform ASEZA into a pioneering institution for a sustainable and smart zone, and a global destination for investment, tourism, and commerce. The mission is to stimulate and enhance economic activity and the business environment within the Aqaba Special Economic Zone and the surrounding region, aligning with the Sustainable Development Goals and international best practices, in order to bolster the national economy and improve the quality of life.

The strategy has seven pillars:

1) Tourism

2) Investment

3) Sustainable Growth

4) Smart Cities

5) Skills Development and Local Community Development

6) Entrepreneurship and Innovation

7) Institutional Development



Source: ASEZA Strategic Plan 2024-2028

Figure 2-13 Strategic goals of the seven pillars

It aims to make Aqaba a unique destination for sustainable tourism in the Red Sea, a desirable global investment hub, and a resilient, adaptable region. It seeks to turn Aqaba into a smart city to improve quality of life and governance, make it a regional hub for skills development, entrepreneurship, and innovation, and ensure ASEZA works as an efficient, effective institution with advanced services, systems, and technical capabilities.

Each pillar has its strategic goal, and strategic goal KPIs. Under the seven pillars fall 26 strategic objectives, strategic objectives KPIs and 197 projects for the next five years.

Among the seven pillars of the strategic plan, especially four pillars of tourism, investment, sustainable growth, and smart cities, has significant interconnection with the urban development master plan. Given their significant interconnection, both plans have been coordinated to ensure consistency. The urban development master plan outlines long-term policies and projects up to 2040, while the strategic plan selects and details goals achievable by 2028. Additionally, the strategic plan includes numerous soft measures outside the scope of the urban development master plan.

The urban development master plan outlines the long-term growth and development of the city over several decades. In contrast, organizational strategy sets short-term achievable goals and specifies concrete projects and actions. By aligning these two approaches and harmonizing long-term and short-term objectives, sustainable growth can be fostered.

The urban development master plan typically undergoes periodic reviews every few years to actively consider progress and external environmental changes, capturing new challenges and opportunities through updates. Similarly, organizational strategy adjusts promptly based on execution progress and market trends to maximize the feasibility and impact of the plan. Through mutual information sharing and responsive adjustments to changing circumstances during plan updates, a coherent development strategy is ensured.

2.3.2 Urban development

Currently there are 3 existing plans in ASEZ related to the urban development master plan as listed on the following table. These plans were studied to understand the current vision and strategy of ASEZ's development.

Table 2-8 Existing Plans in ASEZ

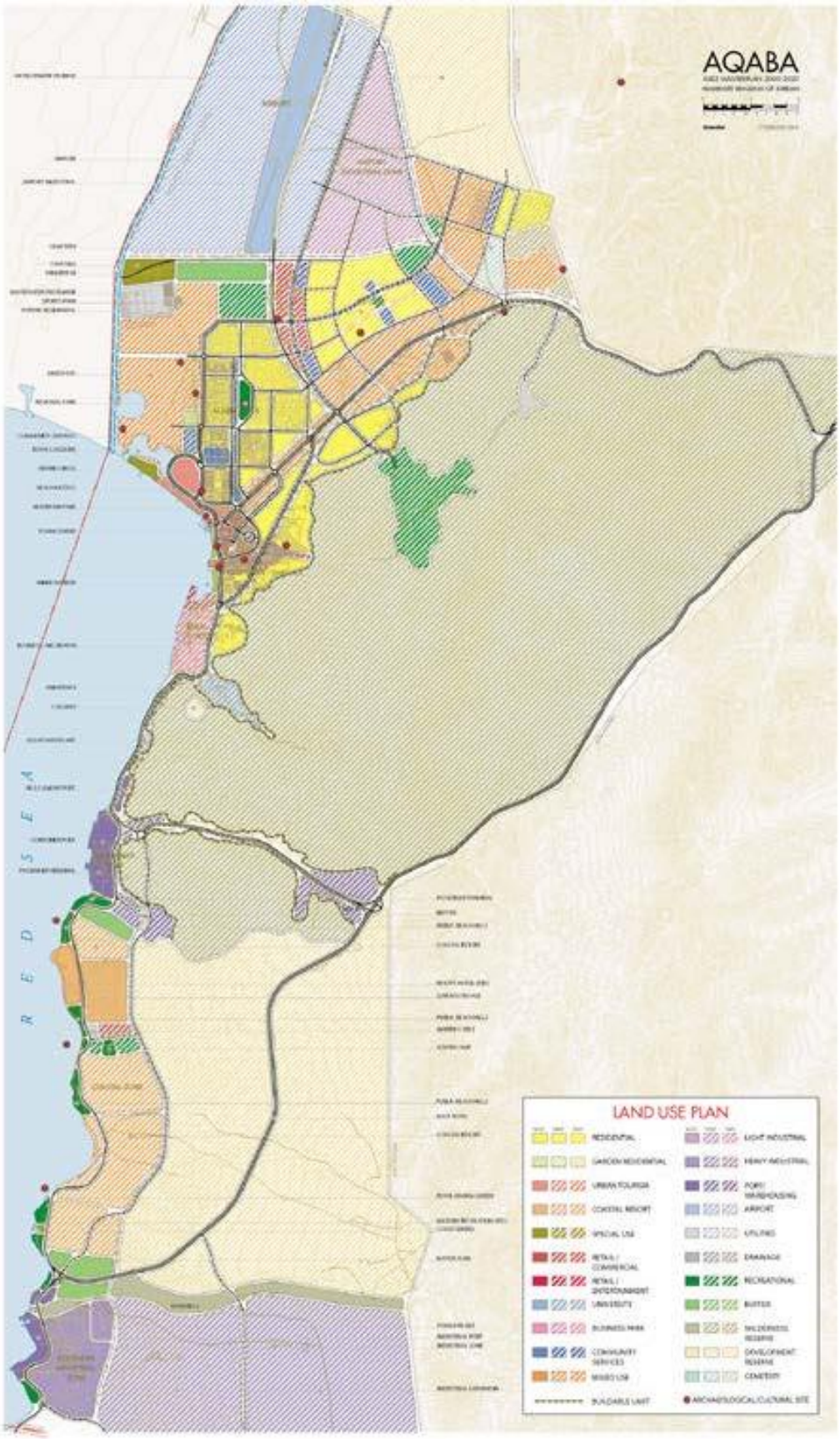
Year	Name	Description
2000	ASEZA Master Plan 2001-2020	Also known as the Gensler Master Plan, this is the latest master plan that is in use currently.
2010	Draft ASEZ Master Plan 2010-2030	A master plan draft for ASEZ 2010-2030 which was created by the Amman Institute reviewing the master plan made by Gensler in 2000 but was not approved.
2020	Aqaba MP Technical Commentary	Constitutes a concise set of comments pertinent to the current Aqaba masterplan which was studied by Buro Happold.

Source: JICA study team

(1) ASEZA Mater Plan 2001-2020

The ASEZA Master Plan 2001-2020 was created by Gensler and approved by the Jordan Government in the year 2000, with the goals to improve economic and social well-being, improve the effectiveness of the Port of Aqaba, encourage new business, encourage environmental, historical, and recreational tourism, protect unique environmental, historical and cultural resources, upgrade opportunities for Old Town and Shallalah, provide opportunities for resort and residential areas along the South Coast, upgrade the image of Aqaba as an attractive place to visit, work and live. The master plan was created based on an understanding of existing conditions such as land use relationship, roads and utilities, natural features, views and landmarks and topography. A proposed land use plan was made as shown in Figure 2-14 Proposed Land Use Plan, and proposed development for each sector was created based on the land use plan as shown in Table 2-9. Proposed development

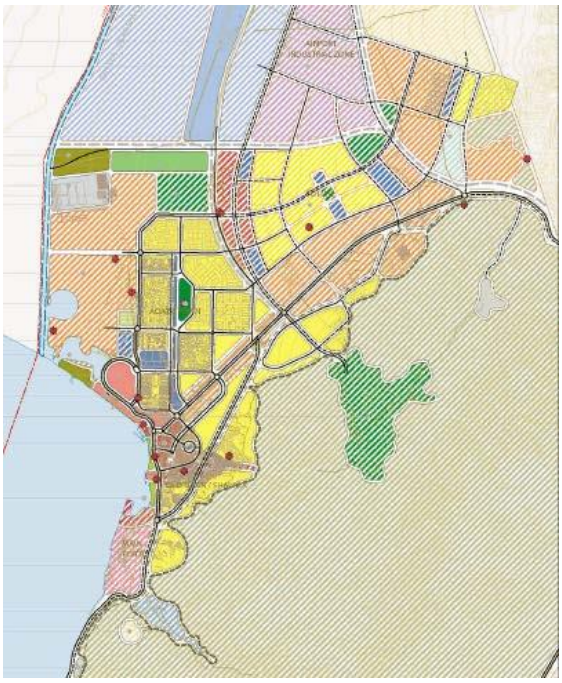
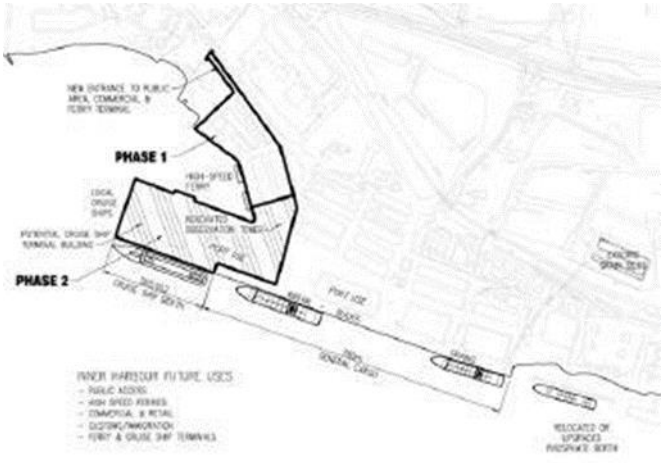
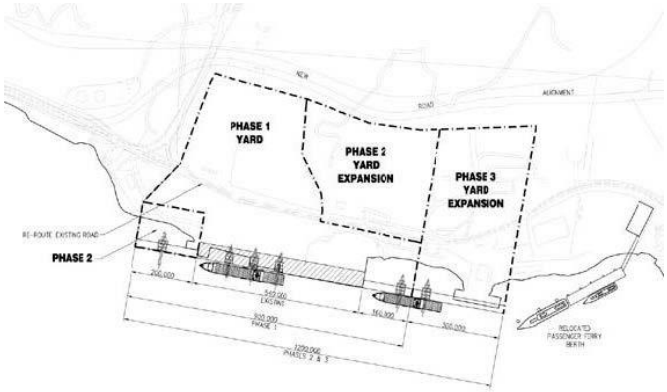
for infrastructure such as roads and utilities were made as shown in Table 2-10 Proposed Development Plan for Infrastructure. Aqaba Corniche, a design concept along the coast of Aqaba was created with intends to make an immediate impact on the image of Aqaba and environmental protection policies were created to enhance the protection of the coral reef reserves, and to create natural area reserves in mountain areas, ridgelines, upper wadi areas and desert areas. The master plan proposed development was divided into the following 3 phases: Immediate Actions, Phase I (2001-2005), Phase II (2006-2010) and Phase III (2011-2020).

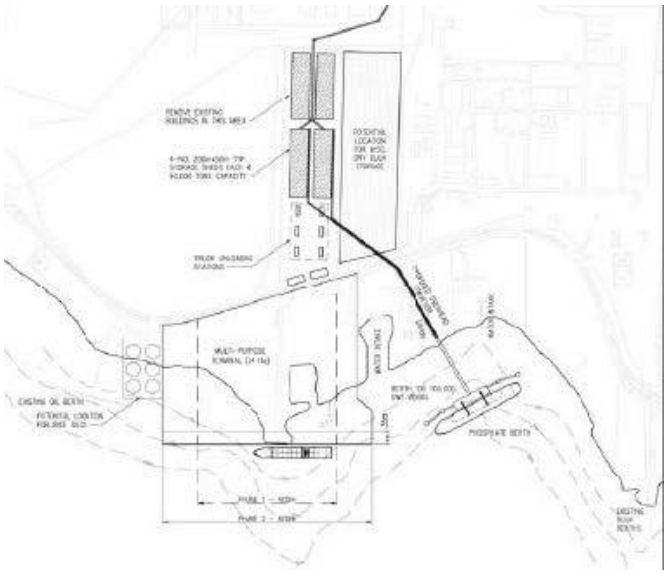
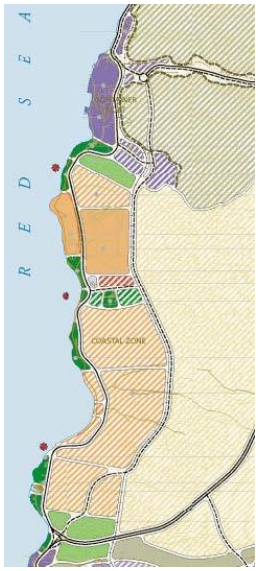
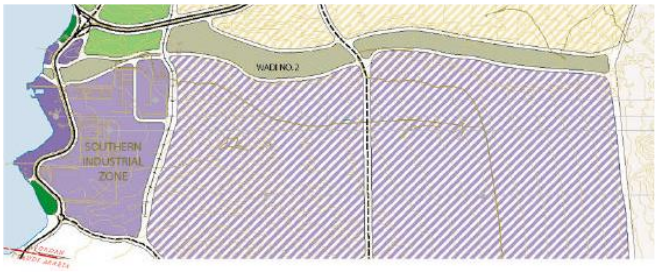


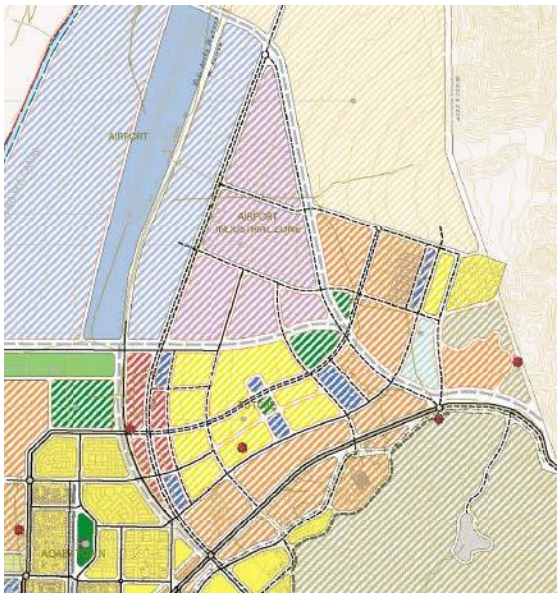
Source: ASEZA Mater Plan 2001-2020

Figure 2-14 Proposed Land Use Plan

Table 2-9 Proposed Development Plan

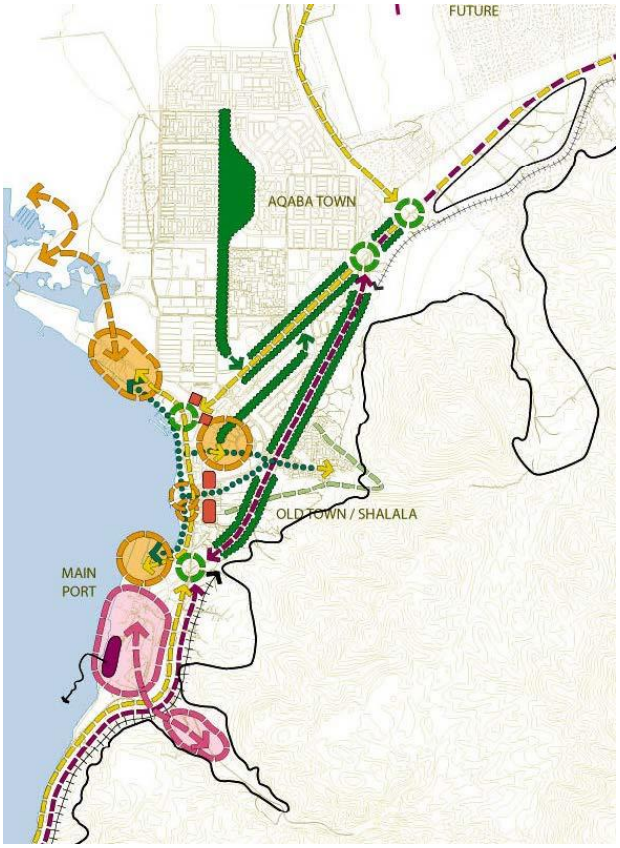
Location	Development Plan	Details
Aqaba Town		New Land Use Areas 1. Retail / Entertainment around the Inner Harbor in the Main Port. 2. Business Park in the remaining area of the Main Port. 3. Garden Residential in Al-Hafayer. 4. University in Wadi Jeisheia. 5. Retail Commercial along two pedestrian streets in Old Town and Shallalah. 6. Resort Residential and Garden Residential in the western area. 7. Light Industrial in the Al Rabia area.
Main Port Redevelopment		・ Relocate general cargo to multi-purpose terminal in Industrial Port. ・ Convert inner harbor to cruise ship and fast ferry terminal and mixed-use hotel, retail, entertainment and residential. ・ Convert phosphate and grain terminals into business incubator complex.
Container Port Expansion		・ Relocate Coast Road to improve yard operations ・ Relocate passenger jetty farther south. ・ Expand container berths north and south. ・ Expand yard area to south. ・ Expand across Coast Road into wadi.

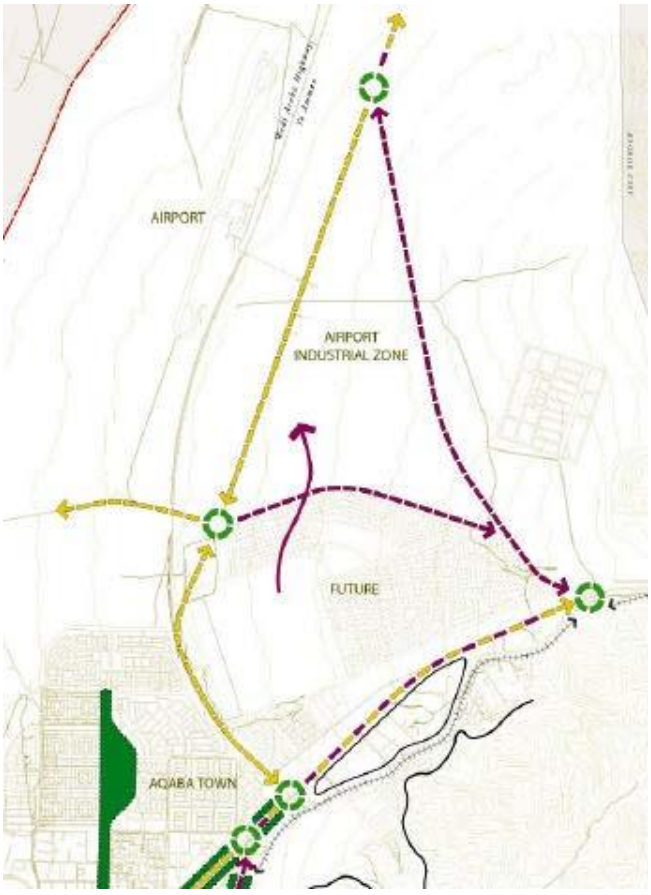
Location	Development Plan	Details
Industrial Port Expansion		・ Improve efficiency of bulk jetty. ・ Install multi-purpose berth at old timber berth. ・ Relocate phosphate operations ・ from Main Port to new jetty south of multi-purpose jetty. ・ Relocate cement terminal to bulk jetty. ・ Relocate rice terminal to new jetty at Wadi 2.
New Coastal Zone Development		・ Provide pedestrian and bike trail along beach from Marine Sciences Center to Royal Diving Club. ・ Build National Marine Park visitor facilities. ・ Locate resort residential sites above the Coast Highway. ・ Build retail and commercial services center near Qaboos Village.
Southern Industrial Zone		・ Convert the old timber terminal to a multi-purpose terminal. ・ Improve parcellation and circulation. ・ Expand site capacity to the east ・ Reduce power plant air pollution ・ Eliminate the gypsum waste

Location	Development Plan	Details
Airport Industrial Zone		・ Expand the airport ・ Relocate the airport road ・ Consolidate free zone sites ・ Provide direct runway access to cargo and warehousing operations ・ Connect the Dead Sea and Desert Highways with airport bypass road

Source: JICA study team

Table 2-10 Proposed Development Plan for Infrastructure

Sector	Plan	Details
Roadway Development Plan		<u>Aqaba Town</u> ・ Widen the truck bypass through town and provide sight and sound buffers. ・ Install grade-separated intersection at the truck bypass and Sharif bin Hussein intersection. <u>Port Areas</u> ・ Relocate the Coast Road around the Container Port to consolidate the Container Port yard areas. ・ Add truck route parallel to the Coast Road from the Main Port to the Container Port. ・ Simplify interchanges and eliminate crossovers between truck road and Coast Road.

Sector	Plan	Details
		<u>Coastal Zone</u> ・Build an Upper Coast Road as a through road to the Southern Industrial Zone and Saudi Arabia. ・Build a connector road between the Coast Road and Upper Coast Road at commercial center site. <u>Southern Industrial Zone</u> ・Upgrade the Back Road to the Southern Industrial Zone. ・Provide an access road into the Southern Industrial Zone expansion area. ・Simplify the Back Road, Coast Road and Upper Coast Road interchange.
		<u>Airport Industrial Zone</u> ・Relocate the Airport Road to provide expansion room for the airport. ・Add airport bypass road between the Dead Sea Highway and Desert Highway ・Install roundabout at intersection of Desert Highway and Dead Sea Highway bypass road. ・Extend road from Israel border crossing road across Airport Road to airport bypass road.

Sector	Plan	Details
Electrical Power		・Provide underground 11kv distribution lines into the Airport Industrial Zone. ・Install 11kv underground distribution line in the Upper Coast Road to create a looped power system. ・Encourage solar power in new resort, industrial and residential developments.
Telecommunications		・Install RLU unit in the Airport Industrial Zone ・Install direct satellite downlink in business park and university at the Main Port.

Sector	Plan	Details
Water Supply		・Resolve water reservoir and distribution system pressure problems in Aqaba Town. ・Provide water mains into Airport Industrial Zone. ・Install water main in the Upper Coast Road to create a looped water system for the Coastal Zone. ・Require desalinization water supply for new hotel, resort, and industrial development.
Wastewater Treatment		・Expand Aqaba wastewater treatment plant capacity to 24,000 m3 per day capacity, then 48,000 m3 per day. ・Install treated effluent reservoir on high site In the Airport Industrial Zone ・Install treated effluent landscape irrigation systems in all major streets ・Require individual wastewater treatment plants on major sites in Coast Zone.

Source：JICA study team

(2) Draft ASEZ Master Plan 2010-2030

This document was created by the Amman Institute for ASEZ as an update for the ASEZ Master Plan 2001-2020 in 2011, but it was not approved by the authorities. This master plan overviews the ASEZ Master Plan 2001-2020, providing information on general spatial development conditions, coastal development condition, development trends and projections, issues, alternatives, and scenarios, and finally a development vision, principles, and preferred scenario. As a comment towards the ASEZ Mater Plan 2001-2020, it is stated that the current master plan does not make any reference to the potential for infill development to absorb a portion for project growth and the new master plan should place more emphasis on infill in existing residential areas and consider the urban expansion to the Northeast of Aqaba town based on the actual population growth and densities. On the other hand, it is also stated that the changes to the status and use designation of the land in the southern area reflects a development 'Bubble' condition and are far more than any plausible need or market demand within the 20-year planning period. Key development issues of the existing development conditions in ASEZA stated in the document are listed in Table 2-11, and suggested strategic development alternatives are listed in Table 2-12.

Table 2-11 Key Development Issues of Existing Development Conditions in ASEZ

Development Issue	Description
Current Fragmented Growth Plan	Development in ASEZA is in a wide area and is random, scattered and disconnected.
Land Use Planning and Growth Projection	Land use and spatial planning are not based on realistic growth projections for the population and economy
Resort & Seasonal Development vs. Community Life & Identity	Development proposal in the southern area is dominated to be resort, hotel, and seasonal 2nd residences, with a little provision for establishing a continuous resident population to provide continuous life, activity, and identity.
Status of Development Projects	The status, feasibility and schedules of outstanding major private development projects have changed due to diminished economic circumstances
Coastal Development & Access	Public beach access has been lost to private development
Integration of the Aqaba Town Centre	The town center needs to be better integrated with adjacent neighborhood and resort development, linked primarily by pedestrian and public open space
Building Heights & Densification	Increases in development rights in specific areas will be need for increased development densities, as the current regulated regime is primarily low-rise
Urban Services Capacity	The capacity of existing urban service network is uncertain and development proposals and designated areas for urban expansion or densification needs to be considered.
Financing Urban Services	The current policy essentially subsidizes private development which is not financially sustainable and needs to be reclarified.
Transit Development	Development and extension of bus transit within the town center is required as part of any strategy for reducing traffic congestion within the town center.
Parking Policy, Capacity and Practices	The town center currently has insufficient parking capacity, minimal enforcement, and no parking fees, which needs to be addressed.

Source: JICA study team

Table 2-12 Suggested Strategic Development Alternatives for ASEZA

Development Issue	Description
Spatial Growth & Development Pattern	A dysfunctional and expensive pattern of urban development is emerging in ASEZ that can be maintained or altered based on the planning decisions contained in the new Master Plan.
Urban Deification & Intensification	As part of the new Master Plan, ASEZA can maintain the current patterns of development density or encourage infill development and provide for planned increases in density in certain locations
Town Centre Revitalization	ASEZA should reassess the balance of infrastructure investment between the town center and the outlying area.
Coastal Zone Development & Access	Intentions and policies need to be clarified with respect to coastal development including development in Al Hafayer.
Financing Urban Development	The current practices in ASEZ for financing infrastructure and urban services for development project are not sustainable
Transportation, Transit & Parking	ASEZA's policy with roadways, transit provision and parking need to be clarified in the master plan.

Source: JICA study team

(3) Aqaba MP Technical Commentary

This is a review of the ASEZA Master Plan 2001-2020 provided by Buro Happold (UK) in 2020. Buro Happold's commentary in this document sits alongside and in support of a wider strategy refresh that has been undertaken in parallel by the Boston Consulting Group. The headline objectives underpinning the expedited technical review were to inform BCG's strategy work by appraising the current master plan from 2 perspectives: Looking Backward and Looking Forward, undertaken through 4 distinct discipline lenses: Planning, Mobility / Transport, Infrastructure and Environment. It is commented in the document that the previous master plan has been able to provide serviced land for all key built projects, however it is also stated that land use has been conflicted, creating inappropriate contrasts and conflicts in connectivity between logistics / heavy industrials and visitor activity and development have been created as a standalone / gated development. Therefore, the ASEZA Master Plan needs to be reassessed under a wider strategic developments and new priorities, done under the following 3 scales: wider regional, whole zone and detail. Studies and steps recommended in this document for the 4 distinct discipline lenses are listed in Table 2-13.

Table 2-13 Recommended studies / steps

Discipline Lenses	Recommended studies / steps
Planning	・ Reassess SEZ wide Spatial Plan/ Masterplan ・ Establish District level masterplans
Transport and Mobility	・ Establish a SUMP ・ (Sustainably Urban Mobility Plan)
Infrastructure	・ Updated Renewable Energy and Grid Resiliency Study ・ Review potential for additional subterranean data cable take-offs ・ Flood Management Plan to be updated for extended water capture and reuse ・ Water Resource Management Plan to be established (including options for water desalination and STW)
Environment	・ Establish and operate an environmental management system certified to ISO14001 as medium-term priority.

Source: JICA study team

2.4 Related Studies Made by Donors Agencies

Information on the status of studies or activities done in Aqaba/ASEZ by international donor agencies were collected to consider the alignment and coordination with the master plan. The list of studies that are related to Aqaba/ASEZ are summarized in the table below.

Table 2-14 List of studies related to Aqaba

Doner	Sector	Year	Name	Description
EU	Tourism / Industry	2016	Sahara Forest Project	Partnership with ADC to establish saltwater pipeline from Red Sea.
	Energy	2015	Sustainable Energy and Climate Action Plan (SECAP) for ASEZA	Analyses the status of ASEZ and creates a target and SECAP action for different sectors.
Friedrich Ebert Stiftung	Urban Planning	2021	Aqaba A Resilient City Through Its Neighborhoods	Provide a framework for transformational change in Aqaba's neighborhoods to build towards a sustainable, resilient city with an improved environment, inclusive mobility, and increased social equity.
	Energy	2022	Green Hydrogen Opportunities in Jordan	Reviews the energy status in Jordan, examines the drivers for green hydrogen. And the barriers that Jordan might face. It also explores main policy recommendations and steps that can be taken to implement a green hydrogen chain across the country.
GIZ	Tourism	2019	Jordan's Tourism Sector Analysis and Strategy for Sectoral Improvement	Aims to provide a comprehensive understanding of the sectoral structure and current trends, as well as challenges and opportunities for improved competitiveness domestically and abroad.
UK Aid	Tourism / Industry	2020	BCG's Evaluation and Assessment Step 1 findings: Analysis of current state Aqaba's Strategic Direction	High-level analysis of the impact of the COVID-19 and the direction that ASEZs should take in comparison with surrounding SEZ developments. Also refers to the challenges of the implementation system.
	Urban Planning	2020	Aqaba MP Technical Commentary	Analyses current issues and suggests directions for review. Suggestions are made regarding the distinctiveness of each zone, separation of industrial logistics and human flows, renewable energy, flood and water supply, environmental management, etc.
UNDP	DRR	2011	Disaster Risk Assessment for Aqaba	Contains a Seismic Risk Assessment, evaluation of an earthquake on Aqaba & Jordan economy and public finances and gender & social vulnerability assessment.
	Tourism	2014	Aqaba Ecotourism Development Plan	Promotion of biodiversity conservation was investigated to promote more effective and integrated management of the coastal zone in the ASEZ.
	Environment	2015	State of The Coast Environment, Report for Aqaba	Reviews available information on the state of the marine environment of the most northern sector of the Gulf of Aqaba providing an assessment of its status, environmental issues and threats, and the needs for additional actions.
		2020	Aqaba Marine Reserve	Analyses the current characteristics of AMR and proposes how AMR needs to be revised and what capacity building programs needs to be implemented.
USAID	Economy	2004	Aqaba Zone Economic Mobilization project (AZEM)	Supported ASEZ to become a model for governance in Jordan through changes in management, capacity building, economic development, and small grant program.
		2014	Aqaba Community and Economic Development (Aced II) Program	Aims to improve ASEZA institutional service capacity, strengthening the private sector and enhance the community participation.
	Environment	2015	Water Reuse and Environmental Conservation Project	The objective was to document the information collected for the selection of new pilot project sites and present the process and outcome of the site

Doner	Sector	Year	Name	Description
				selection.
	Industry	2019	Industry Sector Profile	Analyses Jordan's industrial sector through its manufacturing sub-sectors and it's industrial characteristics.
	Tourism	2008	The Aqaba Model an Exercise in Destination Marketing	Analyses Aqaba's strategy through global trends and examples, with a suggestion of a choses model and next steps.
		2009	Aqaba Tourism Marketing Strategy 2010-2015	Reviews Aqaba tourism performance undertaken in April 2009.
		2009	Destination Aqaba	A concept to create a destination promotion organization for Aqaba.
		2014	The Aqaba Historic Complex Improvement Plan	To provide concepts for physical upgrading and improvements specific to the presentation of the Sharif Hussein bin Ali Building and the Aqaba Fort.
	Transportation and Logistics	2001	Port Master Plan and Integrated Transportation Study for Aqaba	A comprehensive port and transportation plan for the entire Aqaba area, providing a critical road map.
	Water	2019	WATER MANAGEMENT INITIATIVE (WMI) Aqaba Water, Wastewater, and TSE Investment Master Plan and Financial Model – Final	Create an investment plan for the wet infrastructure in the ASEZ area including the potable water system, the wastewater collection system, and the treated sewage effluent system throughout the planning horizon of 2040 and develop existing condition models.
		2019	Water Management Initiative (WMI)	Address Jordan's pressings needs, including developing critical capacity, improving sector performance, and developing broad-based support for immediate and long-term reform.
		2022	USAID Water Governance Activity (WGA)	Promote sustainable water sector management and governance by strengthening reform efforts, policy development and implementation, and capacity building for sector counterparts.
World Bank	Water	2019	Strategic Assessment: The 2019 Project Pipeline for Jordan	Presents a strategic assessment for the 2019 PP for water, wastewater, digital economy, education, transport, and energy sector.

Source: JICA study team

2.5 Planned Projects in ASEZ

2.5.1 Planned projects by ASEZA

Currently there are 17 large scale development planned by ASEZA as show in Figure 2-15, and noticeable projects are summarized in Table 2-15.



Source: Made by the JICA team based on the information from ASEZA

Figure 2-15 Project Location of Project List Provided By ASEZA

Table 2-15 Project List Provided by ASEZA

No.	Project Name	Approval	Status	Description
1.	Organizational plan for the South Beach Services Expansion Area	Done	Under Construction	The area is still under implementation and development, and it includes plots of land with areas ranging between (5 - 8 dunams) with tourist and multi-use uses. A road network has been designed, but it has not been fully implemented to date.
2.	Detailed plan for Bedouin village District	Not yet	Planning	The Bedouin villages area is adjacent to the expansion area of the South Beach services and is considered one of the oldest tourists' areas in the South Coast region. It consists of tourist camps and diving clubs. The plan was updated by organizing new plots of land with new and more comprehensive uses under the name of tourism, the road network for the area was designed and implemented.
3.	Bird observatory project	Done	Planning	The site is one of the important sites for resting migratory birds, it is an environment of water pools, produced from treated sewage water that attracts birds. It is in the north of Aqaba city, south of King Hussein International Airport. Components of the project: water pools, bird hide-towers, recreational area, visiting center,

No.	Project Name	Approval	Status	Description
				Research center 5. Multipurpose halls, library.
4.	Science Park Project	Done	Planning	ASEZA has purchased a piece of land in the Marsa Zayed area and plans to develop a marine research park and aquarium.
5.	Al Matal High Lake Project	Done	Planning	Tourism project to build an artificial lake, hotel and housing on a mountain adjacent to the Marsa Zayed area. Land development, road infrastructure and observatory construction are underway, but further investment is needed due to high investment costs.
6.	Master plan for the plot (306) in the south beach	Done	Planning	A proposed comprehensive plan on plot No. (306) of the lands of the Aqaba region, Basin No. (42/Al-Masnaa), plate No. (164), which is located in the southern coastal region to include the following uses: seasonal residential use / residential use / educational use / commercial use / Al-Awn Hospital for the treatment of addiction cases.
7.	Northern Expansion of Wadi Araba Master Plan	Not yet	Planning	The northern expansion of the city of Aqaba with an area of (87) km2.The vision for that area is to provide new Entertainment Environmental (Solar farms, Fishing farms, recreational /open spaces, etc.) and agricultural projects. It's divided into two parts: the western part is for environmental projects, while the eastern part is for the expansion of the city in the future.
8.	International logistic city in Aqaba North Expansion	Not yet	Planning	Establishing a media logistics city in the lands of Wadi Araba in the expansion area of the ASEZ and preparing a proposed plan for the location of the land with an area of 22 thousand acres.
9.	Back Road Master Plan	Done	Planning	Plots of land were organized within the south area of the customs center by chiefs' board decision No. (1128/2019) and a service road was provided on the main street. Multiple uses were made available, which are commercial, maintenance, and storage use.
10.	Aqaba Middle Port	Not yet	Planning	Plans to renovate the central port, which used to be used for rice and cement, for handling silica, salt and other products, but it is currently awaiting for new projects.
11.	The comprehensive plan for the investment zone east and west of the Amman-Aqaba Road	Not yet	Planning	The area still under study is located east and west of Amman-Aqaba Road at the entrance of the city located on Sharif Al-Hussein bin Ali Street (the investment zone).
12.	Water Park	Done	Under Construction	It is currently under construction at the south tourist area and has expansion plans to the east.
13.	Municipality Landfill Green Park	Not yet	Planning	Plans to expand the landfill at the southern area into a sanitary landfill. EBRD is to support this project.
14.	Town Park	Done	Under Construction	Plan for the development of a central park (public entertainment project) located in the city center. It covers an area of 275,000 m^2 and is planned to be completed in 2 years.
15.	Al -Muthalathiya land project	Done	Under Approval	An overall development plan to develop the Al-Muthalathiya Land Project that includes the following functions: 1. Adventure Park. 2. 3-star hotel. 3. 4-star hotel 4. Multi-themed Market. 5.Recreational area.

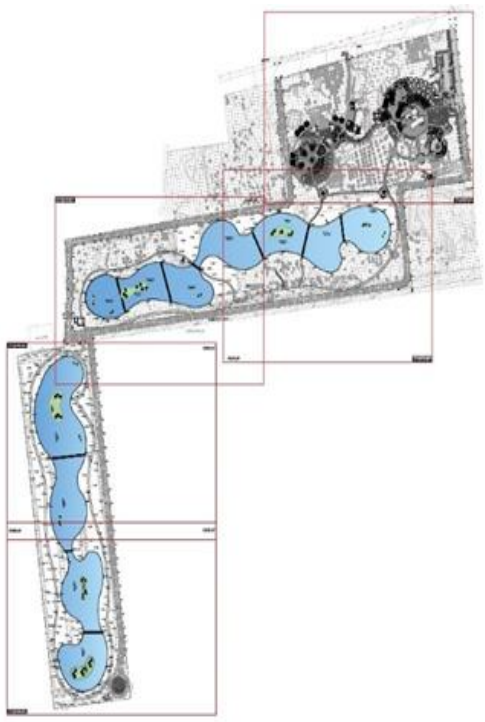
No.	Project Name	Approval	Status	Description
16.	Media City Project	Done	Under Construction	Detailed plans for the digital city project provided at land No. (306), plate (164), basin (42 / factories) of the new Shumaisi area in the southern area. The site contains two main buildings: Data Center /administration building and Business center.
17.	AL Matal Promenade	Done	Under Construction	A seafront commercial corridor under construction between the Marsa Zayed area and the Central Port as a tourism project.

Source: JICA study team



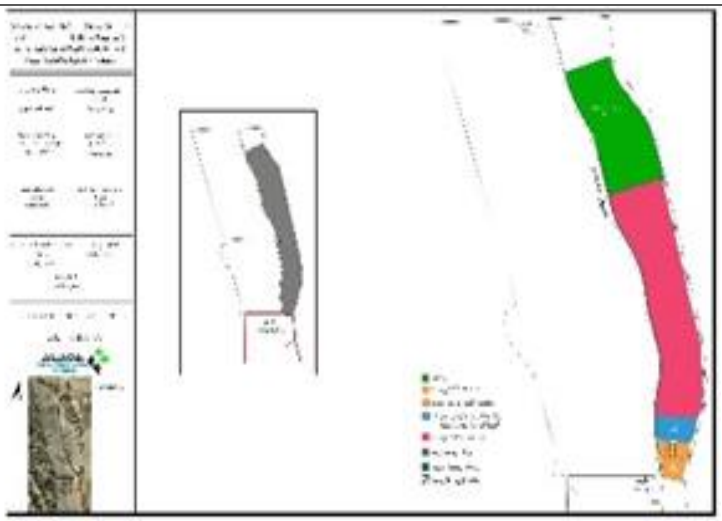
Source: Provided by ASEZA

Figure 2-16 Project Plan for Detailed Organizational Plan for The South Beach Services Expansion Area



Source: Provided by ASEZA

Figure 2-17 Plan for Bird Observatory Project



Source: Provided by ASEZA

Figure 2-18 Project Plan for Northern Expansion of Wadi Araba Master Plan



Source: Provided by ASEZA

Figure 2-19 Project Plan for Al -Muthalathiya land project

2.5.2 Planned Projects by ADC

In 2021 BCG conduced an analysis of the current assets and regional competitiveness of Aqaba, and a project pipeline for 2023-2025 for ADC was created based on 6 domains (tourism, lifestyle, manufacturing, logistics & transport, green growth / renewable energy, education & vocational and creative & digital). ADC's project pipeline spans across 4 main development zones which are, the northern zone, central zone, southern zone and Al Quwaira Industrial Zone. The location of the projects is listed in Figure 2-20.(No.24 is outside the map)



Source: Made by JICA study team based on the data provided by ADC

Figure 2-20 Projects Locations of Project List Provided by ADC

There is a total of 247project planned for 2023-2025 across Aqaba and some of the notable projects are summarized in Table 2-16.

Table 2-16 Project List Provided by ADC

No.	Project Name	Approval	Status	Description
1.	KHIA – Airport Masterplan & Development	Not yet	Planning	New airport expansion masterplan, to grow the airport capacity to 2 million passengers. The new masterplan includes an additional passenger terminal, baggage security inspection facilities, an aircraft protective storage hangar, an airport business park, as well as other facilities and dedicated parks.
2.	Airport Road Network – South Entrance	Not yet	Planning	New Roundabout and road works from the south entrance of the KHIA to the Heritage Museum and Conventions Centre. Fully Fenced on both sides (for security).
3.	The Heritage Aircraft Museum (Land Area: 90,000 m^2)	Done	Under Construction	The Heritage Aircraft Museum will be the first of its kind in Jordan, providing a unique opportunity for visitors to view the kingdom's portfolio of heritage military and non-military aviation assets.
4.	Aqaba International Conventions Center (Land Area: 170,000 m^2)	Done	Under Construction	The project encompasses the Aqaba International Convention & Exhibitions Center. In addition to accommodating SOFEX bi-annually, the facility will be developed to host an array of conventions, exhibitions, trade shows as well as large private events.
5.	TARTAN – International Racetrack (Land Area: ~ 1,000,000 m^2)	Done	Designing	The TARTAN project will add Jordan to the international Racetrack map and contribute to enriching the calendar of events and tourism attractions in Aqaba. The TARTAN will encompass the main racetrack, a karting track, a low friction center, and car vaults.
6.	Aqaba Bird Observatory (Land Area: 210,000 m^2)	Done	Planning	(described in ASEZA projects)
7.	Aqaba Agri-Food & Innovation Corridor (Land Area: ~ 7 million m^2)	Not yet	Planning	In line with the Jordan Green Growth Plan and to help address sustainable food security and sustainable water solutions for agricultural use in Jordan, ADC has engaged with a sample of industry-leading academia and practitioners to explore global niche opportunities to attract Agri-Food Tech investments and finetune the scope and components of the Aqaba Agri-Food &

No.	Project Name	Approval	Status	Description
				Innovation Corridor ecosystem.
8.	SUSTAINABLE URBAN DEVELOPMENT Aqaba Affordable Housing Project (Land area ~ 2,000,000 m^2)	Not yet	Planning	In July 2022, ADC in partnership with ASEZA and the Royal Hashemite Court developed the plan for a new master-planned residential community in Aqaba that will target middle / lower-income families. The project features a design that meets lower-income (affordable housing) budgets, uses local building materials and energy-saving solutions. It also provides urban spaces to accommodate residents' enhanced quality of life and efficient road networks with pedestrian and bike pathways.
9.	North Business District	Done	Planning	Well promoted and many agreements made (Hotel, 3 malls, Vocational training, etc.) Plan to create a business hub in the area.
10.	Aqaba Box Park	Not yet	Planning	A new waterfront destination within Aqaba that offers a tourist culinary experience that includes: Specialty Foods, Bars, Live Music, etc.
11.	Town Park	Done	Under Construction	(described in ASEZA projects)
12.	Aqaba Teaching Hospital	Done	Under Construction	As a part of the Aqaba Medical University Project, Al Sayegh Group is currently developing a University Teaching Hospital within the Aqaba Vibrant district (North Business District). The Aqaba University Teaching Hospital will use the existing building of "Al Raya Complex" which will be transformed into a state-of-the-art University Hospital affiliated with Aqaba Medical University. At the beginning of 2023, the Investor took over the building and start the construction phase.
13.	Aqaba Filming Studios & Institute of Cinematic Arts	Done	Planning	In collaboration with The Royal Film Commission, and as part of the global investments of the Eurasian Dialog, the project aims to establish and operate an international educational and tourist cluster based on a full-cycle film studio.
14.	Aqaba Cruise Terminal	Done	Designing	The new state-of-the-art cruise terminal, set to be AD Ports Group's first cruise terminal built outside the UAE, will serve as a gateway to Aqaba, and Jordan at large, receiving cruise ship passengers visiting the Red Sea and serving as a major attraction for the city. The urban, multi-use waterfront development encompasses a wide range of tourism, commercial, and entertainment services that aim to attract additional new cruise ship liners to Aqaba and play a vital role in increasing the number of arriving tourists into the golden triangle as well as potentially extending the tourist's average stay.
15.	Marsa Zayed Master Development	Done	Planning	Marsa Zayed is a $10 billion redevelopment project in Aqaba, consisting of high-rise mixed-use buildings, hotels, retail, residential, entertainment, and a financial district. The first phase consists of a residential town and a mosque, which are almost completed. The second phase is currently in the master planning stage
16.	Aqaba Container Terminal (ACT)	Done	Planning	ADC & APM Terminals are working to extend their partnership and invest in ACT to further position Aqaba as a regional logistics hub and a trade gateway. The extension of the concession comes with an ambitious goal of decarbonizing the port by 2040 as the first net zero emission port in the region, and a commitment from APM Terminals to invest USD $242 million into six key areas that aim to elevate the port's

No.	Project Name	Approval	Status	Description
				competitiveness and operational capacity.
17.	Vocational Training - Logistics & Maritime	Not yet	Planning	Svitzer Company and the Aqaba Maritime Education and Training Center are exploring an oversea cadets training after Graduating from Albalqa Applied University and hold a Bachelor of Maritime Technology and Marine Engineering Diploma. Additionally, the collaboration includes providing STCW78 as amended courses which are approved by Jordan Maritime Commission including all Competencies Certificates and establishing a research and Development facility in Albalqa Applied University.
18.	Eye of Aqaba - Entertainment Park	Not yet	Designing	Marhaba Holding group is currently working on developing an entertainment park in the south of Aqaba which will be home to the Eye of Aqaba Ferris wheel and an array of other facilities. The tourist attraction will also host cafés and restaurants.
19.	Aqaba Digital HUB	Done	Planning	The Project Positioned in Aqaba to serve the local, regional market, and international market, the Hub embraces everything from the data center, neutrally optimized internet exchange to cloud platforms and fiber-optic networks via its telecom and technology arms, NaiTel and 35D respectively. A landmark project that taps into the growing demand for modern digital transformation to businesses, carriers, and technology providers in Jordan, MENA, and the rest of the world. It embraces everything from a mega data center and internet exchange point to cloud platforms and fiber networks, among many more.
20.	Vocational Training - Hospitality & Tourism	Not yet	Planning	ADC is working closely with Aqaba University of Technology (AUT) to establish a Hospitality and Tourism Vocational Center/College in Aqaba within the AUT campus. ADC has reached out and facilitated cooperation with The Institute of Tourism Studies in Matla (ITS).
21.	Green Ammonia & Hydrogen Production	Not yet	Planning	On behalf of the Government of Jordan, ADC signed a Framework Agreement with FFI to construct a factory for Green Hydrogen and Green Ammonia in the southern industrial and ports zone area of Aqaba. The agreement also outlines establishing renewable energy projects (wind and solar energy) in other locations in the Kingdom.
22.	Aqaba LNG Gas Network for Industrial Zones	Not yet	Planning	Utilizing Aqaba's Liquefied Natural Gas Terminal – LNG (The Sheikh Al Sabah Terminal), ADC is looking into several options to supply industries and facilities in Aqaba with gas via a state-of-the-art network system that ensures the safe and timely delivery of LNG. This will allow Aqaba's industries (Sothern Industrial Zone, North Zone & Al-Quwaira industrial Zones) access to a cost-effective source of energy-boosting Aqaba's investment competitiveness. Aqaba LNG terminal is connected to The Arab Gas Pipeline and consists of several units' depressurization and transfer of natural gas to the Aqaba-gas line. The project is envisioned to be implemented in two phases: • Stage One: Mother & Daughter / CNG (Temporary System). • Stage Two: Pipeline & Network / NG (Permanent System).

No.	Project Name	Approval	Status	Description
23.	Hotel & Retail Complex	Not yet	Planning	Plans to build a mixed-use hotel and commercial complex on the site of an old dense residential area that has been demolished.
24.	Yamaniyeh Beach Development Plan	Not yet	Planning	A development plan for a beach adjacent to a marine reserve in the south. The aim is to create a more attractive and comfortable beach environment for tourists.
25.	Aqaba South-Beach Downtown	Not yet	Planning	Need huge investment (6 mill USD) so thinking of phasing development No investor is interested at this stage because no sewage, infrastructure and high cost The chief wants a new plan for the whole area
26.	Al-Quwaira Industrial International Estate	Done	Under Construction	A joint development agreement has been signed for the development of the International Industrial Estate Project (AIIE) between the ASEZA, ADC and PBI Aqaba Industrial Estate Co. located in Al-Quwaira area, on a 1.8 million m2 plot of land, providing industrial, logistics, energy and other supporting services

Source: JICA study team



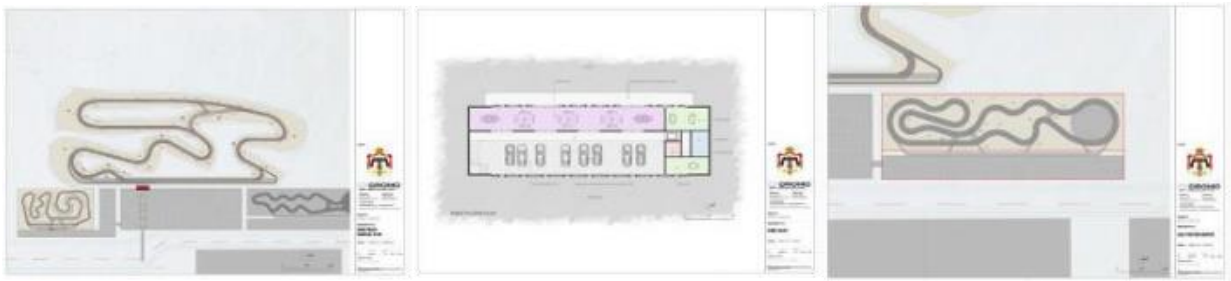
Source: Provided by ADC

Figure 2-21 Project Plan for KHIA(left) and airport Road Network (South Entrance) (right)



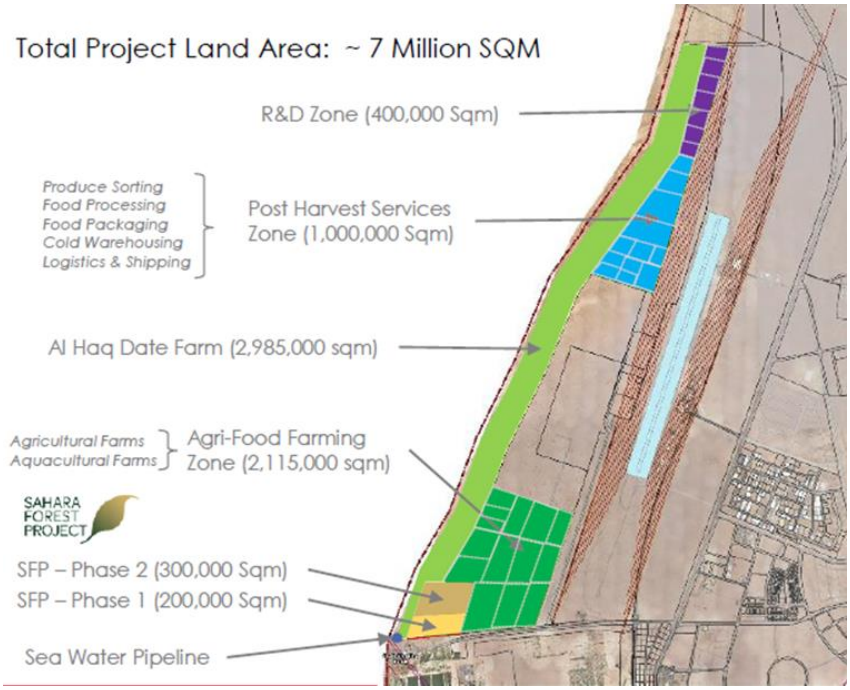
Source: Provided by ADC

Figure 2-22 Project Plan for The Heritage Aircraft Museum



Source: Provided by ADC

Figure 2-23 Project Plan for TARTAN – International Racetrack



Source: Provided by ADC

Figure 2-24 Project Plan for Aqaba Agri-Food & Innovation Corridor



Source: Provided by ADC

Figure 2-25 Project Plan for SUSTAINABLE URBAN DEVELOPMENT Aqaba Affordable Housing Project



Source: Provided by ADC

Figure 2-26 Project Plan for Aqaba Town Park



Source: Provided by ADC

Figure 2-27 Project Plan for Al-Quwaira Industrial International Estate

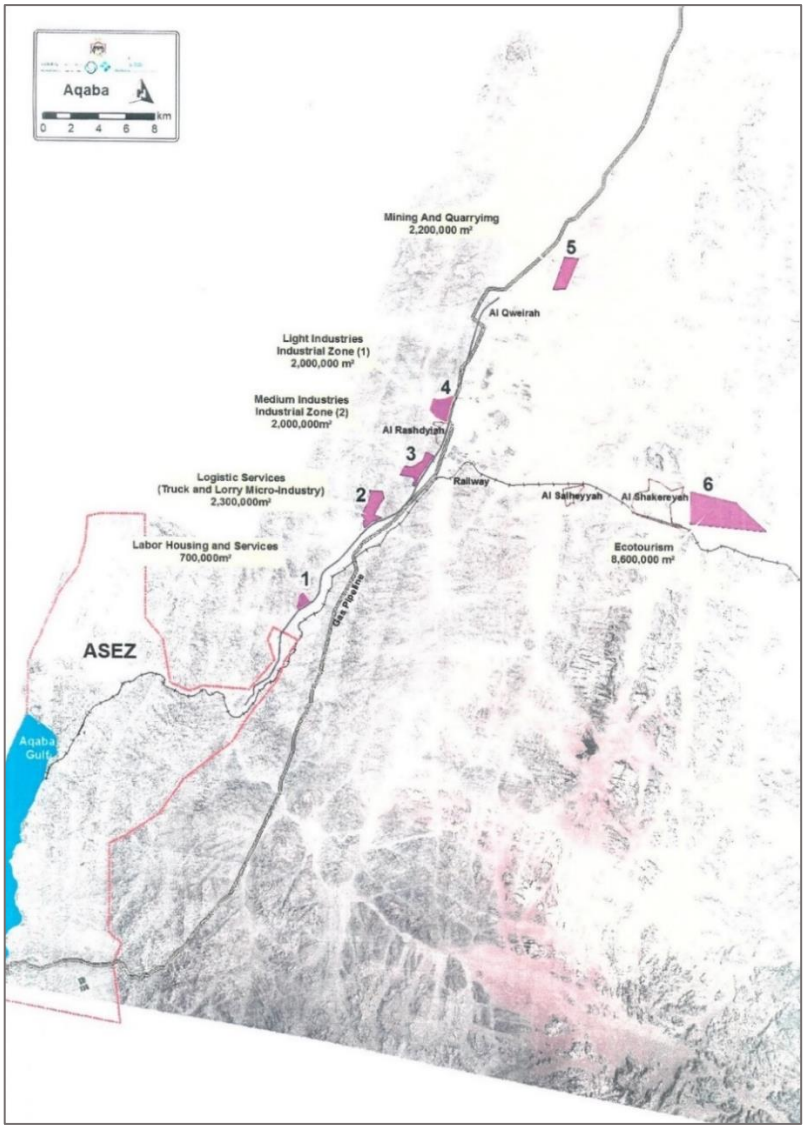
2.5.3 Project Information about the Scattered Area Provided by ASEZA

In 2019 under the Prime Minister's Declaration, 6 scattered area was added to the ASEZ region with a total land area of 17,800,000m^2. The details of each scattered area are shown in Table 2-17. Land No.1-5 are focused on industries and land No.6 focuses on ecotourism which includes movie shooting at the Wadi Rum area.

Table 2-17 Details of the 6 Scattered Areas

Land No	Description	Land area (m^2)
1.	Labor Housing and services	700,000
2.	Logistic Services (Truck and Lorry Micro-industry)	2,300,000
3.	Medium Industries Industrial Zone (2)	2,000,000
4.	Light Industries Industrial Zone (1)	2,000,000
5.	Mining and Quarrying	2,200,000
6.	Ecotourism	8,600,000

Source: JICA study team

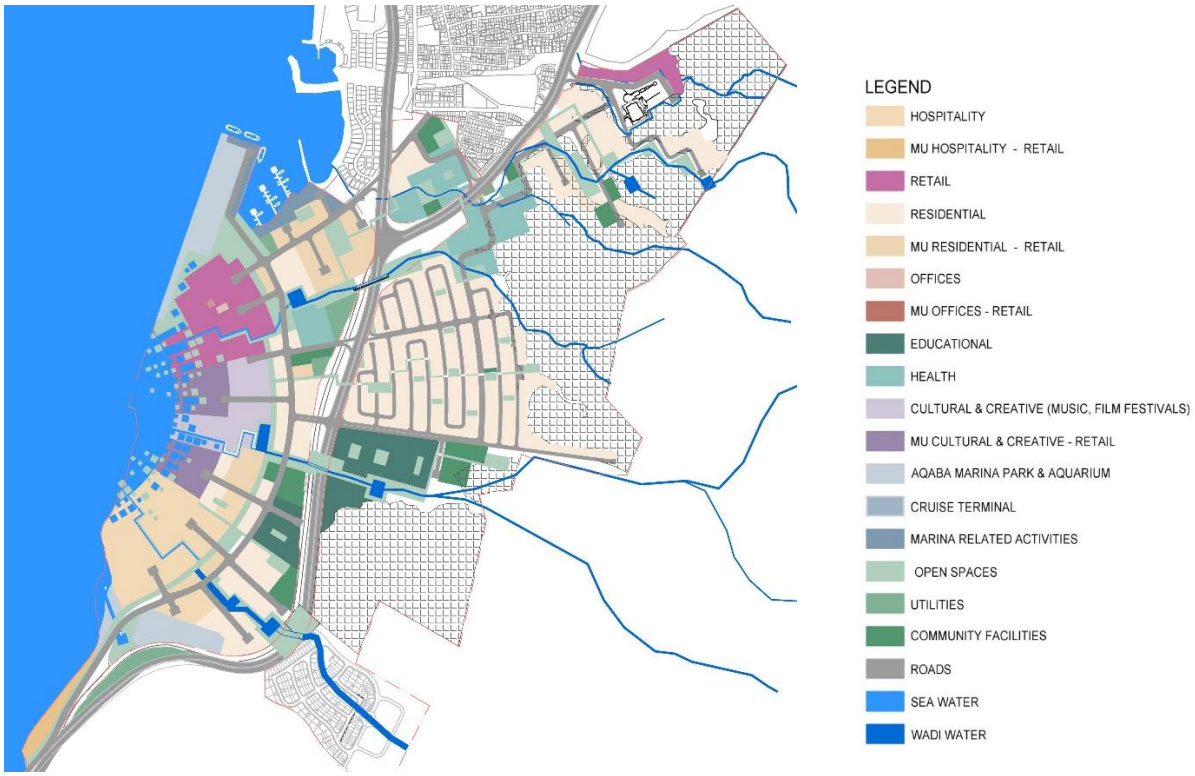


Source: Provided by ASEZA

Figure 2-28 Location of scattered area plans

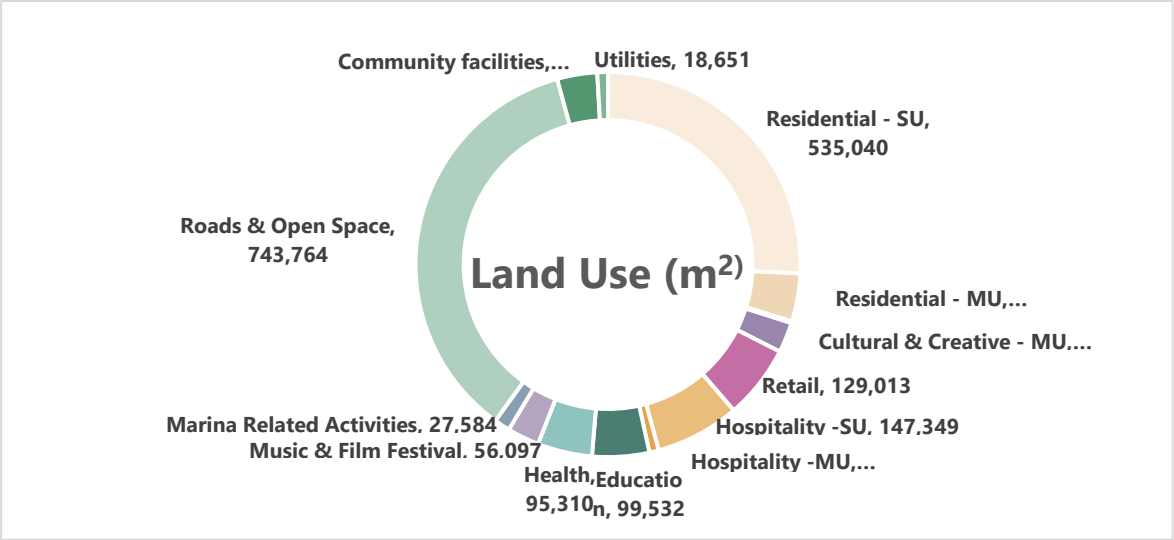
2.5.4 Marsa Zayed Master Plan

Marsa Zayed project is being led by Eagle Hills, an Abu Dhabi-based real estate development company, in partnership with the Jordanian government. The development plan for Marsa Zayed includes the construction of residential and commercial buildings, hotels, retail centers, and cultural facilities. The project is being designed to be a modern, sustainable, and vibrant waterfront community that will attract both residents and tourists. The project is divided into several phases, with the first phase already completed in 2021. This phase included the construction of a new cruise terminal, as well as a marina, a retail center, and several residential buildings. Future phases of the project will include the construction of additional hotels, residential buildings, and retail centers, as well as cultural facilities such as museums and art galleries. The development plan also includes extensive landscaping and public spaces, including parks, pedestrian areas, and waterfront promenades.



Source: Provided by ADC

Figure 2-29 Marsa Zayed Land Use Plan



Source: JICA study team

Figure 2-30 Marsa Zayed Land Use Area

2.6 Development trends of surrounding countries and regions

2.6.1 Development trends of surrounding countries and regions

To differentiate Aqaba and the other countries in the region, the development trends of NEOM, Eilat, Sharm El Sheikh was studied.



Source: Made by JICA study team from Open Street Map

Figure 2-31 Touristic Places along the Red Sea

(1) NEOM of Saudi Arabia

NEOM is a project announced by the Saudi Crown Prince in 2017, which is chaired by him and is a project under a closed joint-stock company, fully owned and funded by the Public Investment Fund (the sovereign wealth fund of Saudi Arabia)

The project area is in Tabuk, at the northwest region of Saudi Arabia, with a total area of 26,500 km^2, including 468km of coastline along the Aqaba Gulf and the Red Sea, as well as mountains up to 2,500m high. According to their website, NEOM is a vision of what a new future might look like, and an attempt to do something that has never been done before. The project is based the following 4 principles.

- Sustainability as a main driver

To introduce a new model for urban sustainability, powered by 100% renewable energy

- Built from the ground up

Reimagine urban living by establishing walkability as its cornerstone

- Economic Engine

To be a hub for innovation, where established global business and emerging players can research, incubate, and commercialize ground-breaking technologies to accelerate

human progress.

- Humanity-centered

NEOM will be built around people and designed for convenience and walkability. Adopting a pedestrian-first approach, with all amenities withing a five-minute walk.

As of 2023, currently there are 4 projects under NEOM, The LINE, TROJENA, OXAGON and Sindalah.

1) The LINE

The LINE is a project stated as the future of urban living, where it takes an approach to create a vertical city in a straight line. It is to be 200m wide, 170km long and 500m above sea level, with a footprint of only 34km^2. It would be built without roads, removing cars and emissions from the city, provided with 100% renewable energy (Solar, Wind and Hydrogen) and 95% of land preserved for nature, prioritizing people's health and wellbeing over transportation and infrastructure. It is set to accommodate about 9million people, with all facility within a 5-minute walk, with a high-speed rail with an end-to-end transit time of 20 minutes. It is also set to create about 380,000 jobs by the year 2030.

2) OXAGON

OXAGON is being built as the future of advanced and clean industries, a hub for innovation and an automated port integrated with a smart supply chain network. The project is located at the south area of NEOM by the red sea, targeting the 13% of global trade that passes through the Suez Canal. The project with a development area of 48km^2 has 2 ongoing developments, with one being onshore and the other one being offshore. All the onshore development is set to be completed in 2030, creating 70,000 jobs and having a population of 90,000 people by then. It is also set to be operated by 100% clean energy.

3) TROJENA

TROJENA is part of the tourism project together with Sindalah. TROJENA is called as The Mountains of NEOM as it is located 50km from the gulf of Aqaba coast with elevations ranging from 1,500m to 2,600m, covering an area of nearly 60km^2. TROJENA will offer year-round outdoor skiing and adventures sports which is set to be completed in 2026. The project is made up of 2 main parts, the first one is the Vault, where it will be the main gateway into TROJENA and the 'brain' of the region, accommodating about 450+ homes, 1000+ hotel rooms and 13,000m^2 of retail and dining space. The second part is the Ski Village, where in the daytime is a ski resort and transforms into a center for outdoor entertainment, events, elevated dining, and stargazing. TROJENA is set to create about 10,000 jobs by 2030 with an impact of 3billion+ SAR GDP impact by 2030, while also attracting 7,000 residents by the same year.

4) Sindalah

The Sindalah project is the second part of the tourism project by NEOM, an island located off shores at the southern part of NEOM, the first of the many other islands to come. Sindalah is scheduled to complete in the year 2024 creating about 3,500 jobs. The island will have a total area of 840,000m^2, 86 berth marina, 51 luxury retail outlets, 3, rooftop lounges, 9 fine dining restaurants, 9 premium casual restaurants, 38 unique culinary offerings, 433 ultra-premium rooms, 88 villas, 333 serviced apartments and 3 luxury hotels. Other facilities to be included are beach clubs, yacht club, sports club, gold course and also

spa and wellness facilities. It is also expected to have 2,400 visitors per day by 2028 with 11% of NEOM tourist visiting the island.

(2) Eilat

Eilat is Israel's southernmost city located beside Aqaba, with a busy port and a popular resort. It is a duty-free area with a population of about 53,000 people and a tourist number of over 200,000 in the year 2019. Some of the popular tourist destinations are underwater observatory park, Eilat fountain and the Timna National Park. Located just beside each other, Eilat has a lot of similarities to Aqaba such as average temperature, beach activities such as diving and water sports that the Gulf of Aqaba has to offer. Despite the similarities, the prices in Aqaba are often considered cheaper compared to Eilat. For a 5-star hotel, the prices range from around 200-400 USD per night for Eilat and around 100-200 USD per night for Aqaba. Meals ranges from 20-50 USD in Eilat whereas, it ranges from 15-30USD in Aqaba. Despite the higher price range, Eilat offers more entertainment options than Aqaba such as nightclubs, bars and theatres, while cafes are the only few entertainment options available in Aqaba.

In terms of development, Eilat currently has plans to create a high-speed rail link between Arava, Eilat and the airport, which will spur southward from the existing rail line at Beersheba. The project currently has some planning issues and implementing issues regarding the allocation of the budget by the government. There are also plans to build a deep-water port and a huge logistics warehouse to be used for overland shipping to Saudi Arabia, Jordan, Iraq, Egypt, and North Africa, connected by rail to central Israel. Currently, there are also projects to construct more hotels in Eilat, with about 1,800 hotel rooms in planning and another 8,737 hotel rooms in the planning pipeline.

Regarding smart city-related developments, Eilat has installed 300 cameras in its city in 2021, to detect, predict and analyze events of interest in real-time and alert authorities of crowding, violent/suspicious activity, traffic, crowd congestion and more. It also aims to implement electric transportation solutions along with some degree of gas-powered vehicles and analyze the highest carbon-polluted areas of the city to detect realistic emission reduction goals and keep in mind the long-term goal of a 100% emissions-free city. In 2020, Eilat and Nice, France launched a joint two-year initiative aimed at using smart technologies to solve common municipal problems in the fields of infrastructure, transportation, energy, community services and tourism.

(3) Sharm El Sheikh

Sharm El Sheikh is a city in Egypt located along the coastline of the Red Sea at the southern tip of the Sinai Peninsula, in the South Sinai Governorate. Its population is 53,670. While it was part of Israeli territory until 1979, in recent years it has gained popularity as a tourist destination due to its beautiful beaches, stunning coral reefs, and unique diving spots. Some famous tourist attractions in Sharm El Sheikh include Ras Mohammed National Park, Mount Sinai and St. Catherine's Monastery, and the Old Town. As for transportation in Sharm El Sheikh, there are taxis and buses available as public transportation, but they are not commonly used by tourists. Instead, tour buses and private cars offered by hotels and travel agencies are often used for transportation.

In recent years, there has been a development trend in Sharm El Sheikh towards promoting

environmental investments in the fields of clean energy utilization and ecosystem conservation, through cooperation between the United Nations Development Programme (UNDP) and the Ministry of Foreign Affairs. There are plans to establish several priority projects related to new energy, with the aim of transforming Sharm El Sheikh into an environmentally friendly tourist city by 2028. In addition, with the cooperation of the Global Environment Facility (GEF), efforts are being made to model Sharm El Sheikh as a comprehensive and ecologically sustainable tourist city that attracts attention from both domestic and international sources, through the introduction of low-carbon technologies, active waste prevention and management, and strengthening the protection of natural capital infrastructure.

(4) Hurghada

Hurghada is a city located at the southern coast of Egypt, facing the Red Sea. It is the largest city of the Red Sea Governorate of Egypt and was founded in 1905. Hurghada was a small fishing village before it became a major Red Sea resort as a result of Egyptian and foreign investments. The average temperature during the day throughout the year is about 35° C, but it can reach up to 45° C during July and August. Hurghada has an international airport that offers flights to Aqaba and Amman. Hurghada not only offers a variety of water sports such as windsurfing, kitesurfing, yachting, scuba diving and snorkeling but it also has the largest aquarium in Egypt and the second largest in Africa.

El Gouna, a privately owned hotel town is located about 25km north of Hurghada. It has a 10km long coastline including 20 islands surrounded by lagoons. El Gouna offers a variety of water sports, and an annual film festival called El Gouna Film Festival that was established in 2017.

(5) Aqaba moving forward

As mentioned above, distinctive cities are being developed along the Red Sea coast, and Aqaba needs to differentiate itself from neighboring cities in the competition among Red Sea coastal cities and enhance its competitiveness.

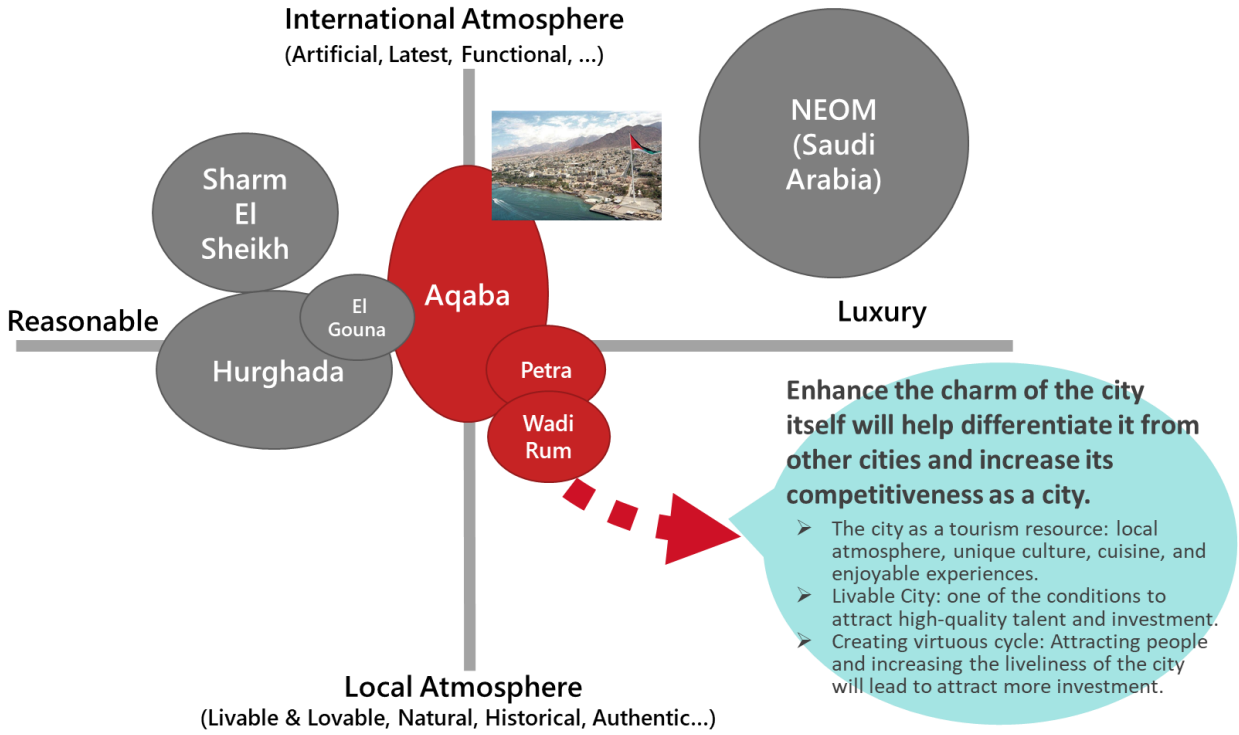
The characteristics of each city have been organized in a matrix as shown in the diagram below. The vertical axis represents the atmosphere of the city (whether it is international or local), and the horizontal axis represents the target tourist segment (whether it is luxury-oriented or budget-oriented).

NEOM is a city that is currently under development and is expected to have a modern and luxury-oriented atmosphere, likely to be plotted in the top right quadrant of the diagram. On the other hand, Sharm El Sheikh is a relatively budget-friendly international city with a strong international flavor, plotted in the top left quadrant of the diagram. Meanwhile, Hurghada is a budget-friendly tourist city with some local atmosphere, plotted in the bottom left quadrant of the diagram.

Among them, Aqaba is a city that combines the international resort atmosphere of the Golden Triangle, which includes Petra and Wadi Rum, with the enjoyment of the local culture and other unique features of the land.

To enhance the competitiveness of Aqaba in the future, it is important to enhance the charm of the “city itself" where visitors can enjoy the local culture and atmosphere. By increasing the uniqueness and attractiveness of the city it is possible to enhance its value as a tourist

resource. Creating a livable city that attracts high-quality talent and investments can also lead to a positive cycle where the city becomes more vibrant, attracting more investments.



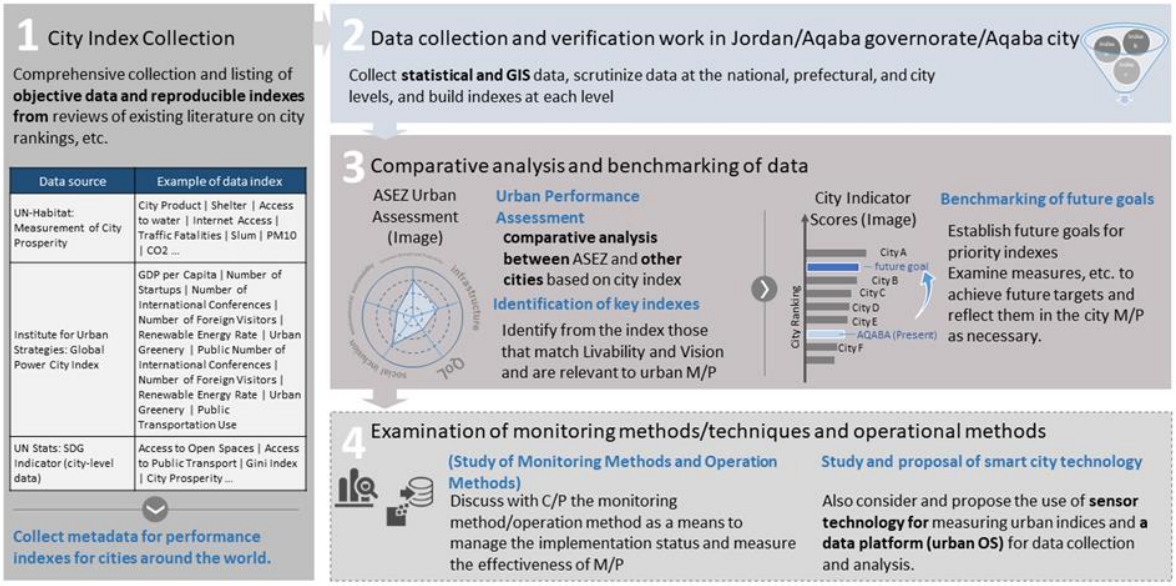
Source: JICA study team

Figure 2-32 Positioning of Red Sea Coastal Tourist Cities and Aqaba

2.6.2 Comparison between Other Cities by City Index

(1) Outline and methodology

An index for the city will be developed, which can be used to compare with other similar cities and benchmark Aqaba's current and future goals. The methodology for collecting data for this index is shown in the figure below. Firstly, data will be collected from available city indexes and databases. Secondly, data collection will be conducted in Jordan for country-level data and in Aqaba for city-level data. Then, the data will be used to assess the situation in Aqaba and to define future goals that can be incorporated into the urban master plan if applicable. Finally, monitoring methods will be studied and proposed, including the introduction of smart city technologies such as sensor technologies and data platforms (city OS).



Source: Compiled by the JICA study team

Figure 2-33 Methodology for collecting city index data and its application

(2) Review of city indexes

In arranging the city index which could be used for comparing with other cities, various city indexes and database were explored and then assessed based on applicability for Aqaba Masterplan, data availability, comprehensiveness of data coverage, and reproducibility of the data.

1) Review of city indexes

In exploring the city index and database, data and indexes that target city-level were closely examined. Listed below are the literatures and data sources that were examined:

- UN-Habitat: Measurement of City Prosperity

UN-Habitat's City Prosperity Index (CPI) is designed to enable city authorities, as well as local and national stakeholders, to identify opportunities and potential areas of intervention for their cities to become more prosperous. The composite index is made of six dimensions: productivity, infrastructure, quality of life, equity and social inclusion, environmental sustainability, and Governance and Legislation.

The component data of the index are largely quantitative data, which is available in spreadsheet and covers 333 cities and urban areas on 25 indicators. It includes quantitative data such as: city productivity, population with shelter, access to water, internet access, traffic fatalities, population in slum, and air quality.

- UN-Habitat: Measurement of City Prosperity Initiative – perception index

With the intention to complementing the City Prosperity Index (CPI) explained above, the CPI-Perception Index uses the same six dimensions of prosperity and sustainability, and offers data on the thoughts and feelings of the population which qualifies the prosperity, the sustainability of the city, beyond the raw data.

The methodology for the survey, including the question items to the population is established which enables replicating in other cities. However, the results of other cities are not disclosed.

- The Economist Intelligence Unit (EIU): livability index

The livability index of the Economist Intelligence Unit (EIU) assesses which cities around the world provide the best living conditions. It adopts qualitative and quantitative factors across five broad categories: stability; healthcare; culture and environment; education; and infrastructure. For qualitative indicators, a rating is awarded based on the judgment of in-house analysts and in-city contributors. For quantitative indicators, a rating is calculated based on the relative performance of a number of external data points.

The latest series of this survey covers 173 cities which includes some middle east cities such as Bahrain and Amman. The full report is available upon purchase, but the original dataset would not be disclosed.

- Institute for Urban Strategies (The Mori Memorial Foundation): Global Power City Index

The Global Power City Index (GPCI) evaluates and ranks the major cities of the world according to their "magnetism," or their comprehensive power to attract people, capital, and enterprises from around the world. It does so through measuring 6 functions – Economy, Research and Development, Cultural Interaction, Livability, Environment, and Accessibility – providing a multidimensional ranking.

It covers 44 cities, mainly from the developed countries. The original dataset is not disclosed.

- IMD-SUTD Smart City Index

The IMD-SUTD Smart City Index (SCI) assesses the perceptions of residents on issues related to structures and technology applications available to them in their city. There are two pillars for which perceptions from residents are solicited: The Structures pillar referring to the existing infrastructure of the cities, and the Technology pillar describing the technological provisions and services available to the inhabitants. Each pillar is evaluated over five key areas: health and safety, mobility, activities, opportunities, and governance.

The latest edition of the SCI assesses 118 cities worldwide. The full data is not disclosed. The detail of the survey method is not available, while this index deals with residents' perceptions, which makes it difficult to replicate in other cities by a third party.

2) Evaluation of available city indexes

The indexes and the database described above were evaluated based on several criteria

which is explained below:

- **Availability of the data**: whether the data is available for the use of this project.
- **Applicability for Aqaba and the purpose of updating the masterplan**: whether the data and indicators are suitable for the purpose of urban planning.
- **Comprehensiveness of the data coverage**: whether the data and indicators cover the cities comprehensively including the developing cities, especially the cities of similar size and economic level, and in the middle east region for reference and benchmarking.
- **Reproducibility of the index/ indicator**: whether the index/ indicator is reproducible, or the data could be collected in Aqaba. It is important to note that qualitative data, either residents' perception or expert evaluation, are difficult to replicate.

The evaluation is as shown in the table below.

Table 2-18 Evaluation of the available city indexes

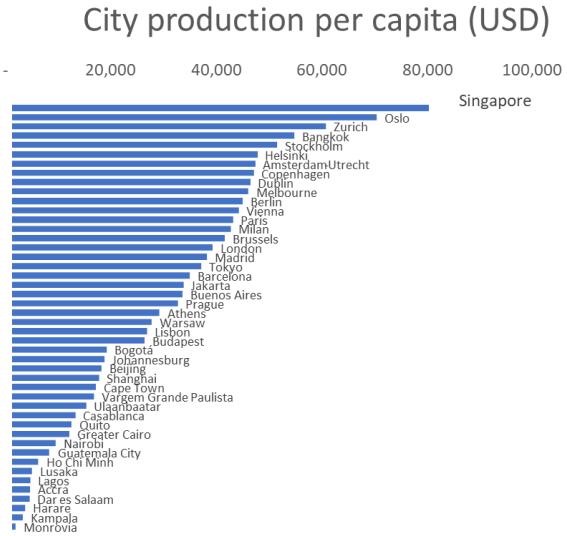
City indexes	Availability	Applicability	Comprehensiveness	Reproducibility
UN-Habitat: CPI	⊕	⊕	⊙	⊕
UN-Habitat: CPI-Perception	⊙	⊕	⊙	⊙
EIU: livability index	⊙	⊕	⊙	⊙
Global Power City Index	⊖	⊕	⊖	⊖
IMD-SUTD Smart City Index	⊖	⊙	⊖	⊖

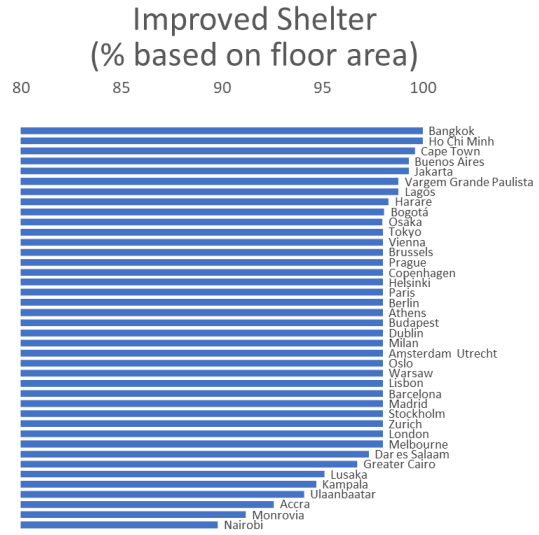
⊕: Positive / ⊙: Neutral / ⊖: Negative
Source: Compiled by the JICA study team

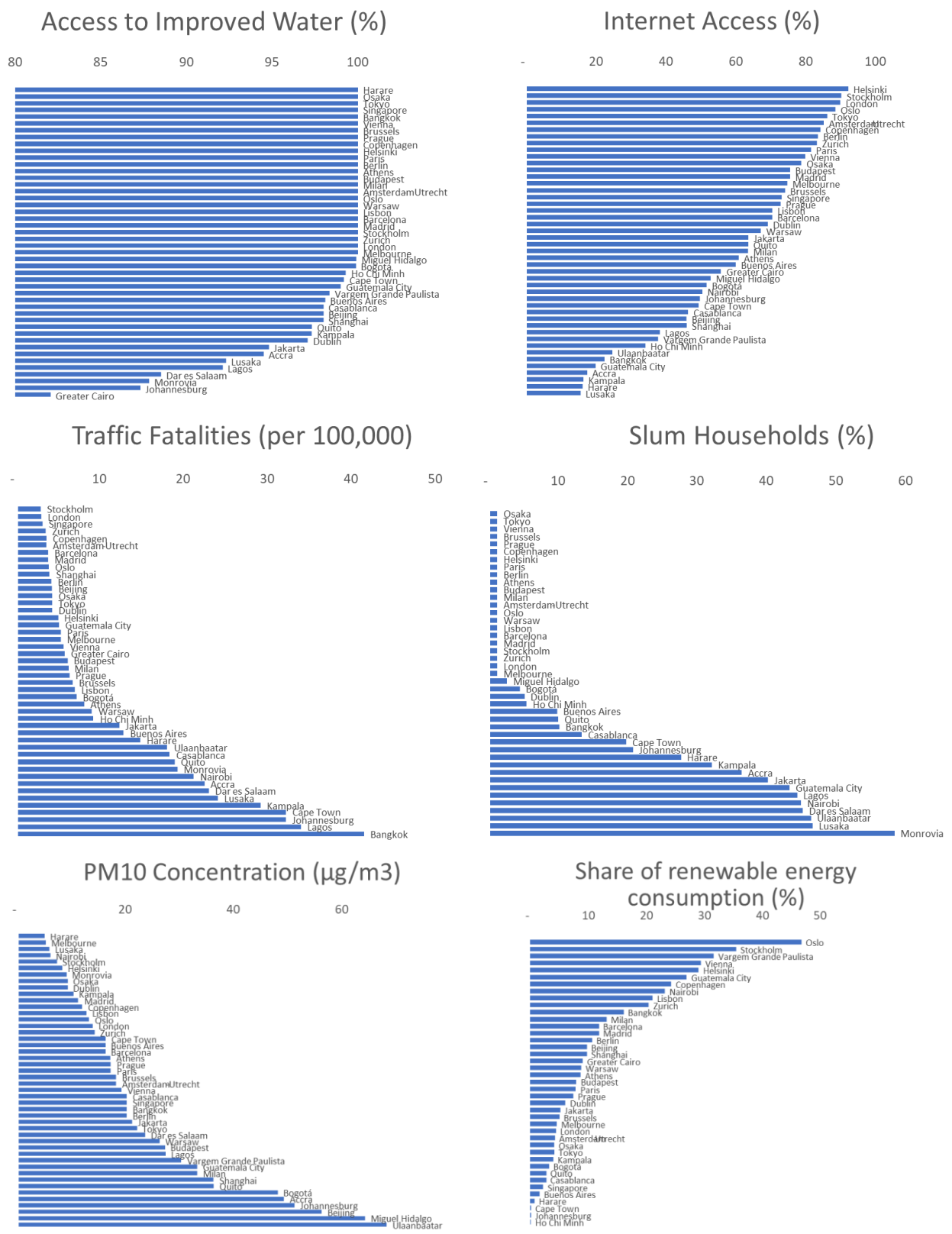
3) Data and Indexes for UN-Habitat: City Prosperity Index (CPI)

Following the assessment, the data and indicators from UN-Habitat CPI is collected and compiled as the first step. The data of the cities are shown below.

Other applicable data could be also incorporated.







Source: UN-Habitat: Measurement of City Prosperity Index data

Figure 2-34 Data of the cities from City Prosperity Index

(3) Evaluation

1) Data Collection

Shown in the table below is the availability of data in Aqaba for the evaluation of CPI.

As a result, available data in Aqaba did not meet the required list of indicators. Therefore, it is difficult to show the CPI or evaluate the position of Aqaba. Therefore, we used the latest published database UN-Habitat: City Prosperity Index. Global CPI. Base Data. 2016 as a benchmark and analyzed the position of Aqaba in available indicators.

Table 2-19 Data availability in Aqaba for city index

CITY PROSPERITY INITIATIVE INDEX INDICATORS	DIMENSION SUB-DIMENSION	INDICATOR	Existence of Data
PRODUCTIVITY (P)	1. Economic Strength (EG)	1.1 City Product per capita	×
	2. Economic Agglomeration	3.1 Unemployment Rate	○
INFRASTRUCTURE DEVELOPMENT (ID)	1. Housing Infrastructure (HI)	1.1 Improved Shelter	×
		1.2 Access to Improved Water	△
	2. Social Infrastructure (SI)	2.1 Physician Density	△
	3. Information and Communication Technology (ICT)	3.1 Internet Access	△
	4. Urban Mobility (UM)	4.1 Use of Public Transport	×
		4.2 Average Daily Travel Time	×
		4.4 Traffic Fatalities	×
QUALITY OF LIFE (QOL)	1. Health (H)	1.1 Life Expectancy at Birth	○
		1.2 Under-Five Mortality Rate	○
	2. Education (E)	2.1 Literacy Rate	○
		2.2 Mean years of Schooling	○
	3. Safety and Security (SS)	3.1 Homicide rate	△
EQUITY AND SOCIAL INCLUSION (ESI)	1. Economic Equity (EE)	1.1 Gini Coefficient	△
		1.2 Poverty Rate	△
	2. Social Inclusion (SI)	2.1 Slums Households	×
		2.2 Youth Unemployment	○
	3. Gender Inclusion (GI)	3.1 Equitable Secondary School Enrolment	○
URBAN GOVERNANCE AND LEGISLATION (UGL)	1. Participation (P)	1.1 Voter Turnout	○
ENVIRONMENTAL SUSTAINABILITY (ES)	1. Air Quality (AQ)	1.2 PM2.5 Concentration	×
		1.3 CO2 Emissions	△
	3. Suitable Energy (SE)	3.1 Share of Renewable Energy	×

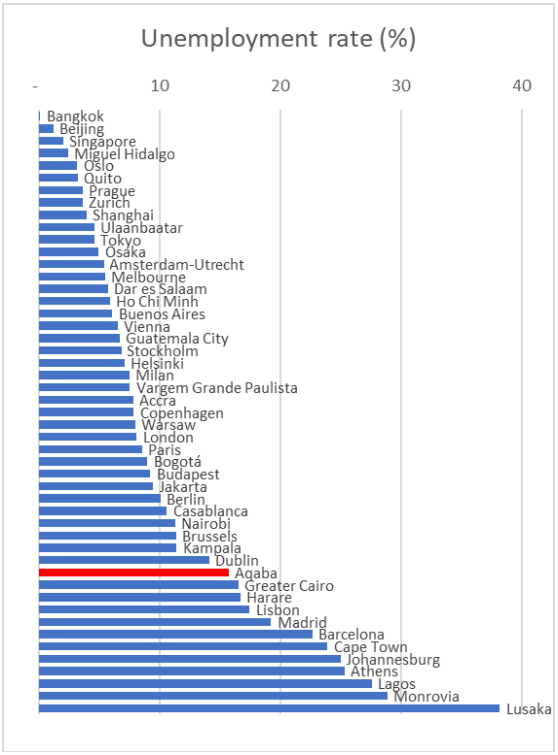
(× : No available data, △ : Only National Data available, ○ : Data available)

Source: Compiled by the JICA study team

2) Assessment

Productivity index

The unemployment rate, one of the indicators used to determine "economic agglomeration," is 15.7% in Aqaba, while most major cities have less than 10%. As Aqaba is in the relatively high unemployment category, this indicates that the city may not have a high level of economic agglomeration. Cities with similar unemployment rates include Dublin (Ireland), Greater Cairo (Egypt), Harare (Zimbabwe), and Lisbon (Portugal). However, some cities in developed countries with a higher economic agglomeration than Aqaba, such as Madrid and Barcelona (Spain), Athens (Greece), Cape Town and Johannesburg (South Africa), have unemployment rates above 20%.



Source: Prepared by the survey team based on the UN-Habitat: Measurement of City Prosperity Index and the data collected

Figure 2-35 Status of Aqaba (red) compared to other cities (productivity index)

Quality of life index

In terms of life expectancy at birth, an indicator used to assess "health," many cities in developed countries have a life expectancy of over 80 years, with Madrid (Spain) having the longest at 84 years. In contrast, life expectancy in Aqaba is 74.3 years, about 10 years shorter and belonging to a distribution with a relatively short life expectancy. Cities with similar figures include Beijing and Shanghai (China), Bangkok (Thailand), and Ho Chi Minh City (Vietnam). Cities with shorter life expectancies than Aqaba are mostly located in Africa.

A similar trend is observed for under-five mortality (per 1,000), with many cities in developed countries having 5 or fewer, while cities in developing countries, such as those in Africa, have 30 to 100 or more. Aqaba falls in the middle category with 10, and cities with similar numbers include Quito (Ecuador) and Vargem Grande Paulista (Brazil).

In terms of literacy, an indicator used to measure "education," Aqaba has a low literacy rate of 91.4%. This places it in a lower category than other developed countries, cities in Southeast Asia, and some African cities. Cities with similar figures include Guatemala (Guatemala), Kampala (Uganda), and Lagos (Nigeria).

As for average years of schooling, the average is 10.4 years, which places it in the medium category. No national or regional trends were found for this indicator.

Based on the above indicators of "health" and "education," the quality of life in Aqaba is not as high as in other major cities. It is in the lower middle of the range.



Source: Prepared by the survey team based on the UN-Habitat: Measurement of City Prosperity Index and the data collected

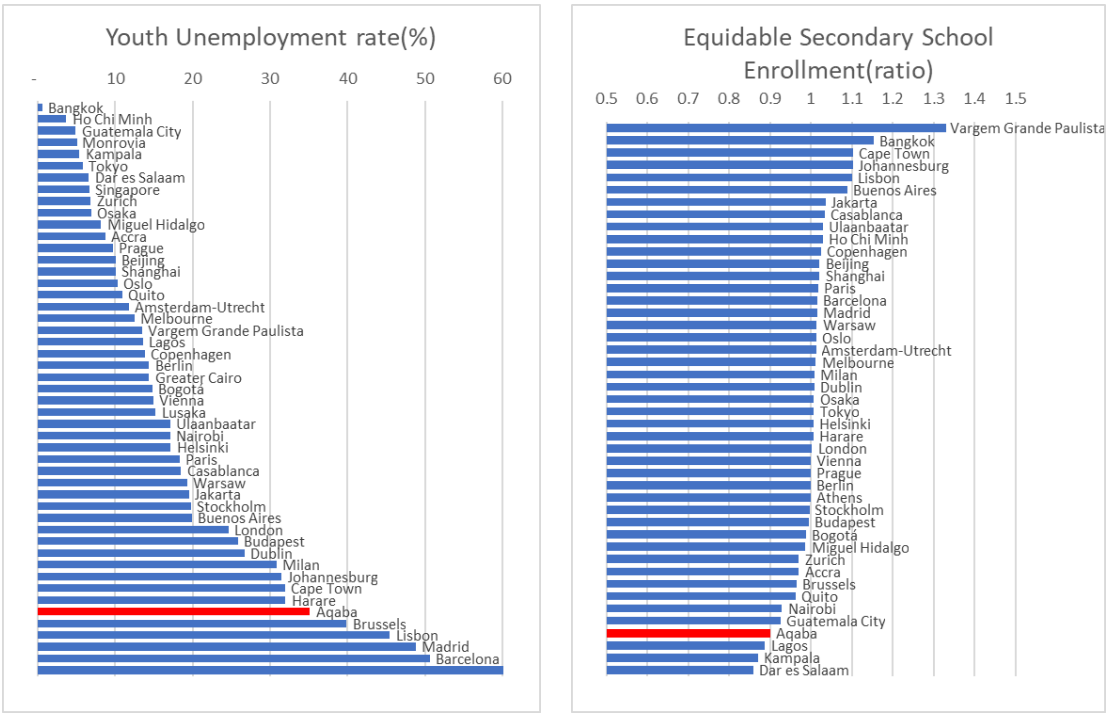
Figure 2-36 Status of Aqaba (red) compared to other cities (quality of life index)

Equity and social inclusion indices

As for the youth unemployment rate, an indicator used to assess "social inclusiveness", Aqaba has a high unemployment rate of 35.14%. It is in a lower category than the cities even after excluding Brussels (Belgium), Lisbon (Portugal), Madrid and Barcelona (Spain), and Athens (Greece).

Aqaba also ranks low in terms of the ratio of women to men enrolled in secondary education, an indicator used to determine gender inclusiveness. The percentage of women going on to secondary education is about 90% of men, placing Aqaba in a lower category compared to other major cities.

Based on the above indicators of "social" and "gender" inclusiveness, it can be assumed that Aqaba's social inclusion of youth and women is not well positioned.



Source: Prepared by the survey team based on the UN-Habitat: Measurement of City Prosperity Index and the data collected

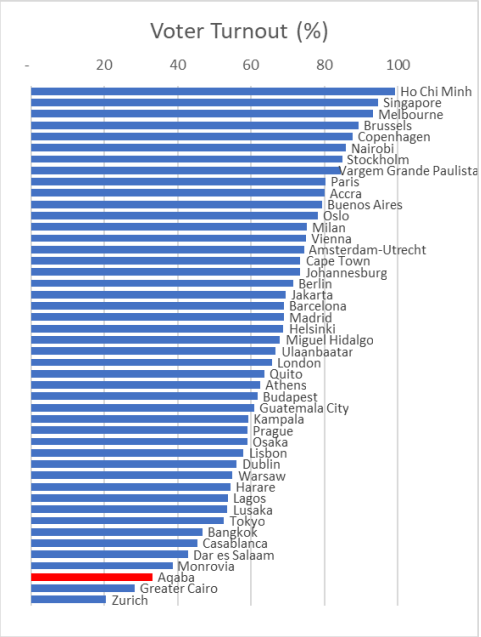
Figure 2-37 Status of Aqaba (red) compared to other cities (equity and social inclusion indices)

Participation in municipal administration and legal systems

In terms of voter turnout, an indicator used to assess "participation in municipal administration," Aqaba is low at 33.21%, placing it in a very low category compared to other cities.

In addition, access to public information, which is also an indicator for understanding administrative participation (although data from other cities have not been published), is also insufficient in Aqaba. This is evidenced by the inadequate sharing of public information (financial information, salaries of public employees, organizational charts, contract information, statistical information, tender information, etc.) on the government website.

Based on the above indicators, it appears that the participation of residents in municipal administration is not sufficiently promoted in Aqaba.



Source: Prepared by the survey team based on the UN-Habitat: Measurement of City Prosperity Index and the data collected

Figure 2-38 Status of Aqaba (red) compared to other cities

The numerical values for each indicator were standardized for conversion to a CPI index[1]. The values for each indicator were converted to a scale between 0 and 100 compared to benchmarks (maximum and minimum values) of other cities to determine Aqaba's rating compared to the values of other cities. The results are presented in the table below. Note that the Urban Performance Assessment could not be conducted due to a lack of data.

Table 2-20 City index indicators and CPT indices

Sub-Dimension	Indicator	Actual Data	Standardized (CPI Index)	Scale
PRODUCTIVITY (P)				
1. Economic Strength (EG)	3.1 Unemployment Rate	15.7%	23.8%	Under moderate
QUALITY OF LIFE (QOL)				
1. Health (H)	1.1 Life Expectancy at Birth	74.3 years old	73.4%	Strong
	1.2 Under-Five Mortality Rate	10 people	65.8%	Moderate Strong
2. Education (E)	2.1 Literacy Rate	91.4%	90.0%	Very Strong
	2.2 Mean years of Schooling	10.4 years	74.3%	Strong
EQUITY AND SOCIAL INCLUSION (ESI)				
2. Social Inclusion (SI)	2.2 Youth Unemployment	35.14%	25.0%	Under moderate
3. Gender Inclusion (GI)	3.1 Equitable Secondary School Enrolment	0.9	90.0%	Very Strong
URBAN GOVERNANCE AND LEGISLATION (UGL)				
1. Participation (P)	1.1 Voter Turnout	33.21%	33.21%	Under moderate

[Scale] Over 80%:Very Strong, Over 70%:Strong, Over 60%:Moderate Strong, Over 50%:Moderate, Under 50%:Under Moderate
Source: Survey team

[1] c.f. MEASUREMENT OF CITY PROSPERITY Methodology and Metadata https://unhabitat.org/sites/default/files/2019/02/CPI-METADATA.2016.pdf

As a result, although the unemployment rate, youth unemployment rate, and voter turnout were rated below the standard and low, indicators related to health and education were rated above the standard. This confirms that a certain level of quality of life is ensured in Aqaba. Overall, there were no indicators rated Moderate, and those rated above the standard were rated Moderate Strong or above. This indicates that there is a gap between indicators that have reached the standard level and those that have not. In the future, it is expected that the CPI index can be raised to the above-standard scale by raising the unemployment rate, youth unemployment rate, and voter turnout, which are currently below standard.

3) Benchmark setting

Future targets are benchmarked according to the result of assessment on Aqaba based on the CPI index. As shown in the table below, for each index scale, the target scale was set one level higher than the current rating. The numerical targets required to achieve them were also calculated. For the indices that already have a Very Strong rating, there is still room for improvement compared to other cities. We therefore recommend that continuous improvement.

Table 2-21 Benchmarks

Sub-Dimension	Indicator	Present Scale	Actual Data		Target Scale	Target Number
PRODUCTIVITY (P)						
1. Economic Strength (EG)	3.1 Unemployment Rate	Under moderate (23.8%)	15.7%	⇒	Moderate (50%+)	Under 7.4%
QUALITY OF LIFE (QOL)						
1. Health (H)	1.1 Life Expectancy at Birth	Strong (73.4%)	74.3years	⇒	Very Strong (80%+)	Over 76.6years
	1.2 Under-Five Mortality Rate	Moderate Strong (65.8%)	10 /per 1000 live births	⇒	Strong (70%+)	Under 8.3 /per 1000 live births
2. Education (E)	2.1 Literacy Rate	Very Strong (90.0%)	91.4%	⇒	Very Strong (80%+)	Over 95%
	2.2 Mean years of Schooling	Strong (74.3%)	10.4years	⇒	Very Strong (80%+)	Over 11.2years
EQUITY AND SOCIAL INCLUSION (ESI)						
2. Social Inclusion (SI)	2.2 Youth Unemployment	Under moderate (25.0%)	35.1%	⇒	Moderate (50%+)	Under 17.7%
3. Gender Inclusion (GI)	3.1 Equitable Secondary School Enrolment	Very Strong (90.0%)	0.9	⇒	Very Strong (80%+)	1.0
URBAN GOVERNANCE AND LEGISLATION (UGL)						
1. Participation (P)	1.1 Voter Turnout	Under moderate (33.21%)	33.21%	⇒	Moderate (50%+)	Over 50.0%

Source: Survey team

4) Integration into the master plan and future monitoring

Since we were only able to assess a limited number of data items, we are unable to assess Aqaba as a city as a whole. However, the assessment of the CPI index shows that many items are above the standard, indicating that the city may have a certain level of sustainability. On the other hand, there are also many items that belong to the middle or lower distribution in the ranking compared to other cities, showing Aqaba's relatively weak competitiveness.

Issues analyzed in this study that require attention when updating the Urban Development Master Plan include:

- Promoting job creation that contributes to increased productivity
- Further improvement of quality of life through better healthcare and education services
- Ensuring social equity and inclusion of youth and women
- Promoting public participation in municipal administration

It would be desirable that in the future a more accurate analysis be conducted by collecting and maintaining statistical data, including the currently missing data, to help identify priority areas, which was the original purpose of the project.

In addition, in order to develop Aqaba as a more sustainable city, it is desirable to regularly monitor the status of achievement of the benchmarks set as targets this time and Aqaba's position in comparison to other cities. Continuous improvement efforts are also required. Data management and monitoring are necessary not only for the assessment of the CPI, but also for the management of the operational status and achievement of the Urban Development Master Plan in general. In this regard, we will propose monitoring and operational methods in the area of management policy.

2.6.3 Adaptation to global issues such as decarbonization, digital transformation (DX), climate change, and inclusiveness

(1) Global trends

Global challenges include multiple key elements. Among them, decarbonization, digital transformation (DX), climate change, and inclusiveness have received particular attention. These challenges are not to be addressed in isolation, but rather are interrelated and closely interrelated. In the following, each of these trends and global initiatives are described.

1) Decarbonization

Decarbonization is a movement aimed at significantly reducing fossil fuel emissions and facilitating the transition to sustainable energy sources. Countries around the world have made commitments to achieve net-zero emissions by 2030 or 2050, based on targets agreed in the Paris Agreement; as of November 2021, when COP26 ended, 154 countries and 1 region had pledged to achieve carbon neutrality by 2050 or another timeframe. A wide range of efforts are underway to promote renewable energy, improve energy efficiency, and develop sustainable means of transportation. In particular, the cost of renewable energies such as solar and wind power has been declining, and their widespread use is accelerating. On the financial side, global ESG investments will increase to $35.3 trillion by 2020, and there is a growing global movement to require companies to disclose information on climate change.

2) Digital Transformation (DX)

DX is the process of leveraging advances in digital technology to transform the way business and society operate. DX is driving efficiency and innovation in the energy sector, transportation, manufacturing, and other industries. Examples include the introduction of smart grids and energy management systems, the development of automated driving technology, and factory automation. However, DX is also causing new problems, such as the widening digital divide and privacy concerns, and it is important to strike a balance between these issues. The market size of DX in Japan and around the world is progressing rapidly and is expected to exceed 6 trillion yen by 2030. In addition, DX is transforming business and creating new businesses.

3) Climate Change

Climate change refers to the effects of extreme weather events and rising sea levels caused by global warming. The past eight years have seen the highest average global temperatures on record, sea level rise and ocean heat at record levels, and this trend is expected to continue for centuries to come. In addition, Antarctica's sea ice extent has decreased to an all-time low, and Europe has set a record for glacier melting. The international community is working to reduce greenhouse gas emissions and develop adaptation measures to climate change through frameworks such as the Paris Agreement. However, concrete actions to achieve the goals are lacking, particularly the efforts of major emitting countries, which are the focus of this report. Urgent action is required as the frequency and impact of extreme climate events increase.

4) Inclusiveness

Inclusiveness refers to the equitable distribution of the benefits of economic growth and development to all people, especially the poor and socially vulnerable. Poverty reduction

and the elimination of inequality have been identified as key challenges for achieving the Sustainable Development Goals (SDGs), and inclusive policies and innovations are increasingly needed as disparities widen in the wake of the COVID-19 pandemic. Global Trends in Inclusiveness Economic inclusion programs are increasing in 75 countries, benefiting about 92 million people in about 20 million poor and vulnerable households. While carbon pricing is being introduced around the world, there is also a growing concern about so-called "carbon leakage," which occurs when production sites are relocated from areas with strict regulations to areas with less strict regulations, and imports increase from outside of regulated areas.

(2) Jordan’s trends and adaptation in ASEZ

Jordan is actively addressing global challenges, and the following is a summary of trends in decarbonization, digital transformation (DX), climate change, and inclusiveness.

1) Decarbonization

Decarbonization Jordan is taking steps to achieve a decarbonized society. Of particular note is the investment in Al Badiya, Jordan's first photovoltaic power generation project with storage batteries, coordinating supply and demand is essential for the spread of renewable energy generation, and optimizing the operation of storage batteries on the power plant side and utilizing the results of power data analysis will be important.

ASEZ is a low-tax, diversified development zones that also enjoy tax exemption benefits. This may encourage investment in renewable energy and contribute to the realization of a decarbonized society. Specifically, ASEZA could promote renewable energy generation by introducing battery-equipped photovoltaic projects like Jordan's "Al Badiya" project in ASEZ ASEZA should aim to combine economic growth and decarbonization in Jordan and should be able to attract investment from renewable energy sources, such as solar power and wind power, to the region.

2) Digital Transformation (DX)

Jordan is also focusing on digital transformation (DX) and has a thriving digital industry, attracting the world's attention with its excellent human resources and companies. In addition, the Central Bank of Jordan has launched the National Strategy for Financial Inclusion (2023-2028) to grow the economy from a financial perspective.

The promotion of DX within ASEZ may create new business opportunities and contribute to economic revitalization; it is important to provide a platform to promote DX, specifically through education and training in digital technology, development of digital infrastructure, and support for digital startups.

3) Climate Change

Jordan is also being affected by climate change, in particular, the drop in the water level of the Dead Sea has become a serious problem. The lake level is dropping by an average of about 1 meter per year, and in some places the water's edge has receded more than 1 km offshore. Some estimates suggest that the Dead Sea could disappear by 2050 if it continues to shrink at this rate.

As the ASEZ is the area directly feeling the effects of climate change, it is imperative that

climate change measures be incorporated into development plans for ASEZ, and specifically, that responses to the Sustainable Development Goals (SDGs), such as flood management and environmental management, be strengthened.

4) Inclusiveness

Regarding the inclusiveness of Jordan, Jordan has welcomed a large number of Palestinians, Iraqis, Syrians, and others fleeing wars and civil wars in the surrounding areas, and provides public services such as education and health care.

ASEZ should be a place where people from diverse backgrounds come together and should respect diverse cultures and values and aim for an inclusive society in which all people can participate. Specifically, inclusiveness could be strengthened through education, healthcare, equitable employment opportunities, and support for social minorities.

Chapter 3 Current Status and Challenges by Sector

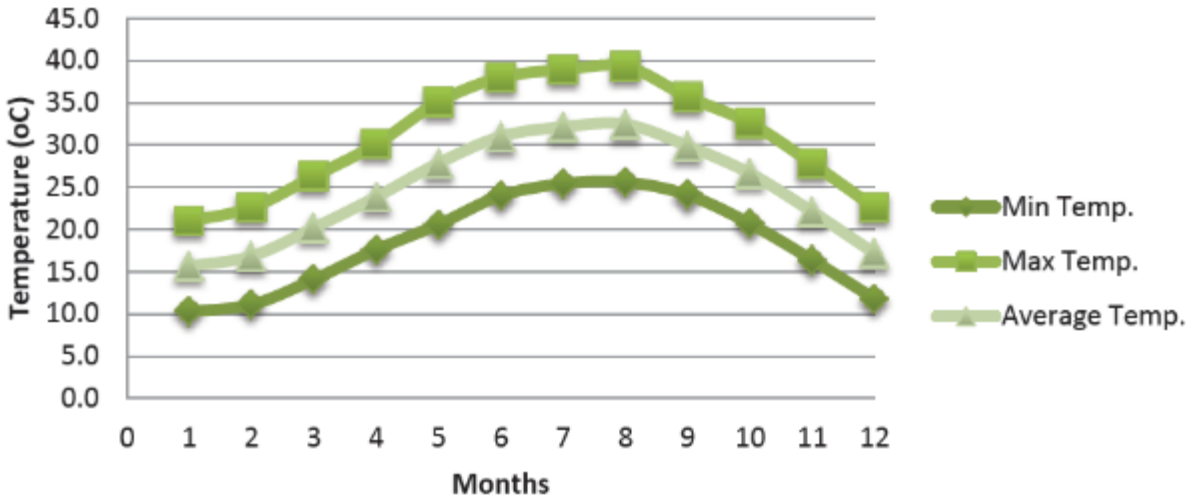
3.1 Natural Environment

3.1.1 Climate

Aqaba belongs to the subtropical desert climate in the Köppen climate classification.

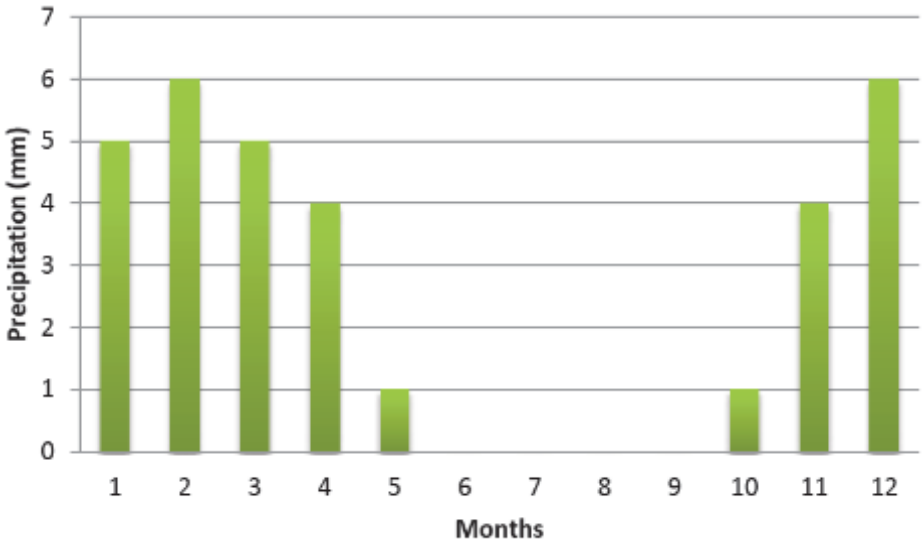
Aqaba has four seasons, with a minimum temperature of about 10°C and a maximum of about 23°C in winter (December to February), and a minimum temperature of about 25°C and a maximum of nearly 40°C in summer (June to August).

Wind direction is predominantly from the northwest to the west, with wind speeds of 1.4-3.3 m/sec being the most frequently observed, followed by wind speeds of 3.3-5.3 m/sec.



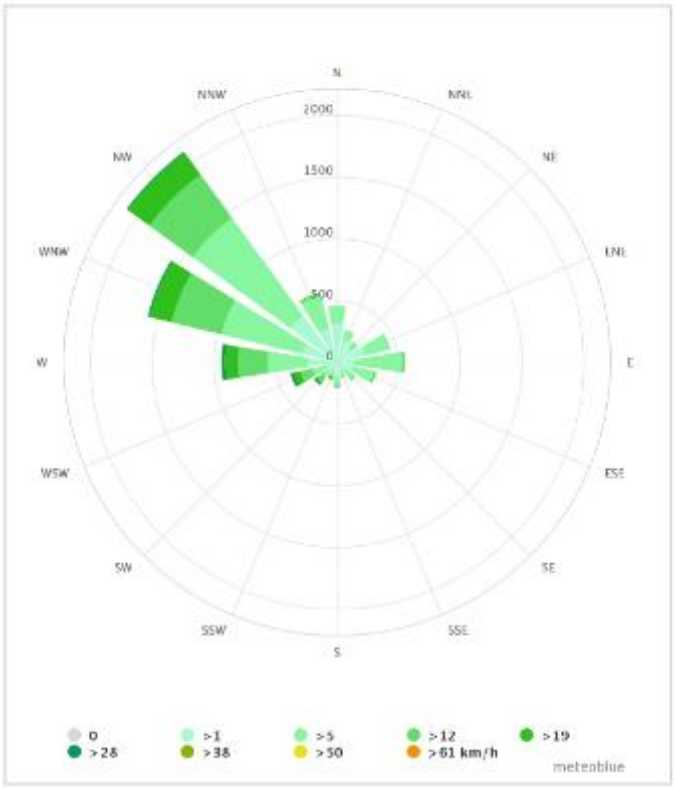
Source: Sustainable Energy and Climate Action Plan for Aqaba Special Economic Zone Authority

Figure 3-1 Monthly temperatures in Aqaba



Source: Sustainable Energy and Climate Action Plan for Aqaba Special Economic Zone Authority

Figure 3-2 Monthly precipitation in Aqaba



Source: Simulated historical climate & weather data for Aqaba - meteoblue

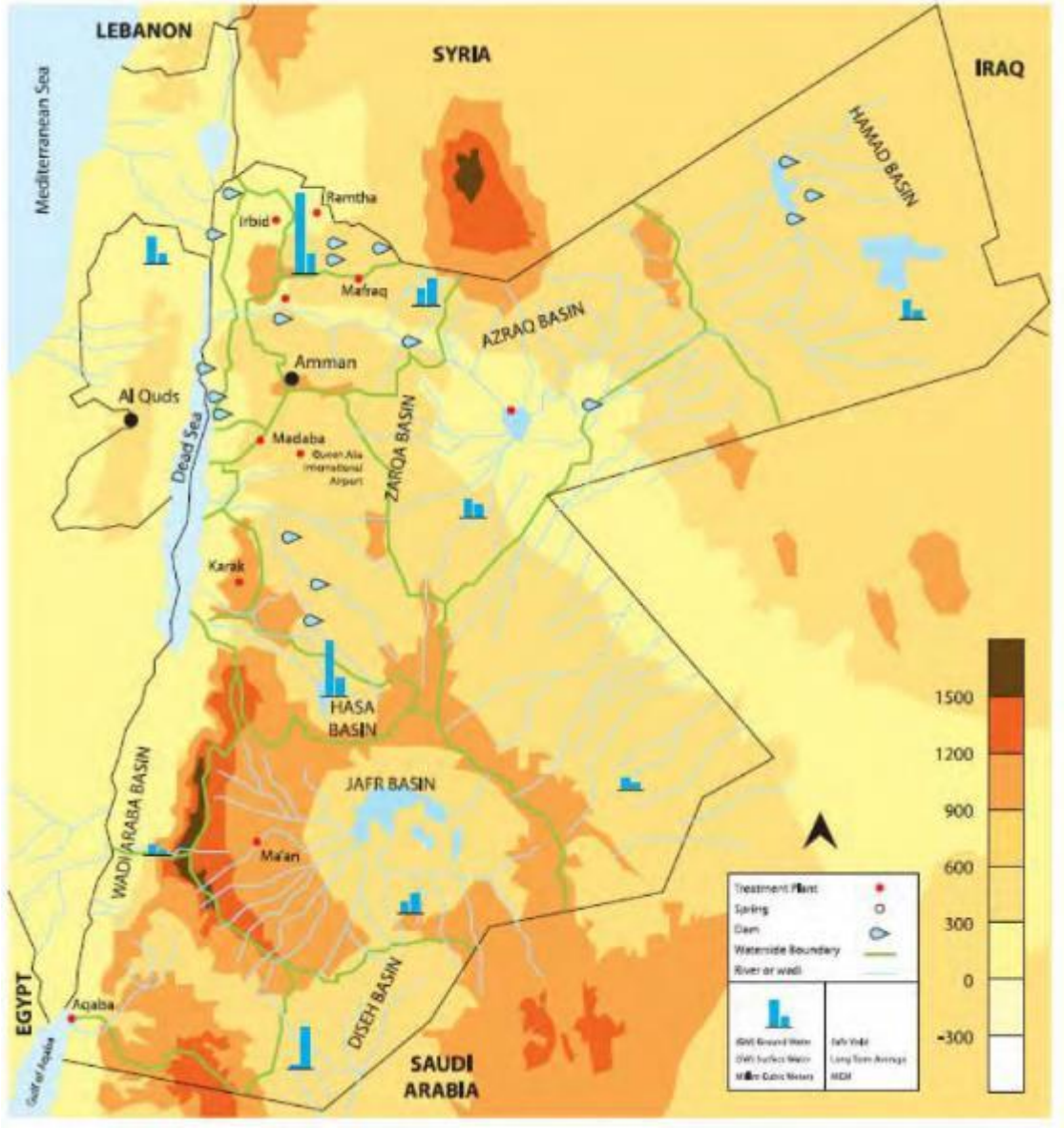
Figure 3-3 Wind direction and speed in Aqaba

3.1.2 Topography, Geology

The topographic map of Jordan is shown in Figure 3-4.

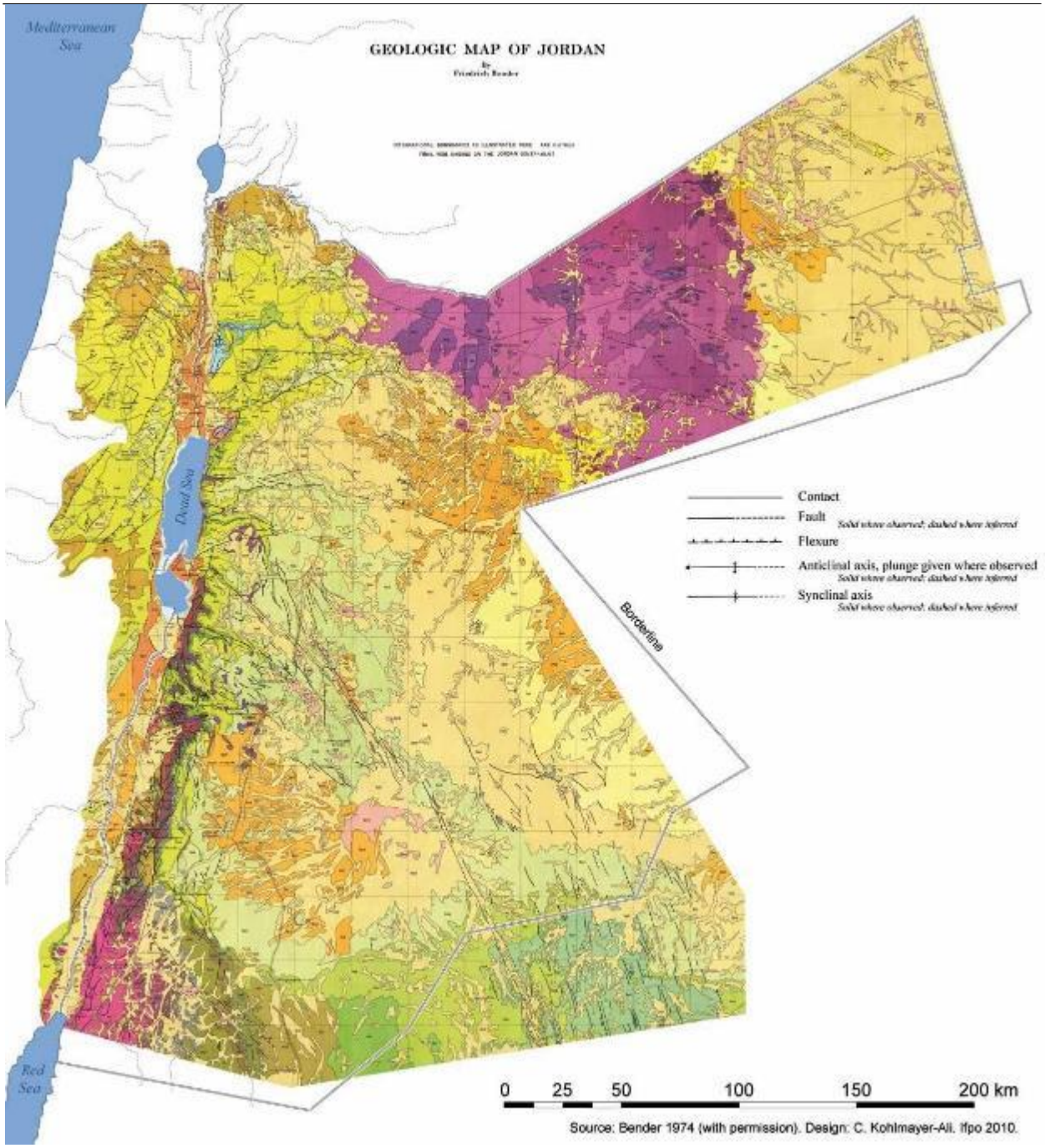
The Jordan Valley, which runs from the southern part of Lake Galilee through the Dead Sea to the Gulf of Aqaba, is flat and less than 300 m above sea level.

Chert limestone is distributed in the Jordan Valley, and granite is distributed around Aqaba.



Source: Ministry of Environment and UNDP (2014): Integrated Investment Framework for sustainable Land Management in Jordan

Figure 3-4 Topographic map of Jordan



Source: Kamal Jreisat, Tawfiq Yazjeen: https://books.openedition.org/ifpo/4861

Figure 3-5 Geological map of Jordan

3.1.3 Soil

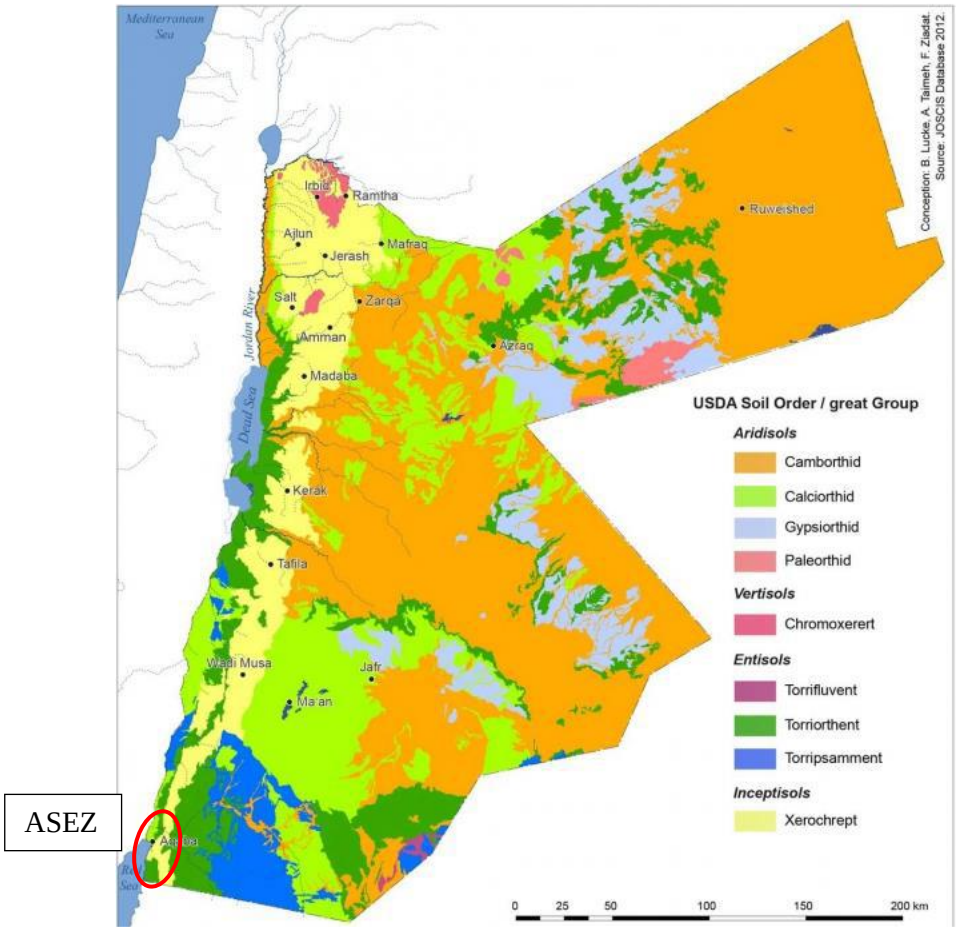
A soil map of Jordan is shown in Figure 3-6.

Inceptisols (xerochrept soils) are mainly distributed on the slopes and mountains of Aqaba, while aridisols or entisols are distributed on the plains.

Aridisols are soils formed in arid or semi-arid climates and are characterized by low organic matter content. Entisols are mainly shallow sandy sedimentary soils and are found in arid and semi-arid climates on steep or eroded slopes or in areas with abundant sandy rocks. Aridisols have subsurface formations of clay, calcium carbonate, silica, salts, and gypsum. Inceptisols are soils in semiarid to humid environments with generally moderate soil

weathering and development. Xerochrept soils are moderately developed, mostly red in Aqaba, with clay-rich B horizons, often rich in primary or secondary calcium carbonate.

These soils are not suitable for agricultural production unless irrigation water is available due to the arid climate.



Source: USDA 2012

Figure 3-6 Jordan soil map

3.1.4 Protected Area

A summary of the protected areas in Aqaba is shown in Table 3.1 and the locations are shown in Figure 3-7.

In the late 1970s, Jordan's first national systematic plan for protected areas was developed through a cooperative program between the Jordanian government (represented by the RSCN), International Union for Conservation of Nature and Natural Resources (IUCN), and the Worldwide Fund for Nature (WWF). According to the definition of the IUCN, a protected area is a clearly defined geographical area that is recognized, dedicated and managed through legal or other effective means to achieve the long-term conservation of nature with its associated ecosystem services and cultural values. Aqaba has the Qatar Nature Reserve, the Wadi Rum World Heritage Site, the Aqaba Marine Reserve and the Aqaba Marine Park, which are managed by the RSCN and/or the Aqaba Special Economic Zone Authority (ASEZA). Note that the Aqaba Marine Park was integrated with the establishment of the Aqaba Marine Reserve. The Qatar Nature Reserve is not located within

the ASEZ.

Table 3.1 Summary of Protected Areas in Aqaba

Name of Protected Area	Year Established	Area km2	Responsible organization	Summary
Aqaba Bird Observatory	2004	0.5	ASEZA	Jordan's first dedicated bird observatory with the main purpose of ecotourism and environmental education.
Wadi Rum Protected Area	2011	741.8	ASEZA	Protected area registered as a World Heritage Natural and Cultural Complex
Aqaba Marine Park	1997	3.4	ASEZA	Protected areas established for the purpose of comprehensively managing and protecting the marine resources and environment of the Aqaba coastal area. Integrated with the newly established Aqaba Marine Reserve.
Aqaba Marine Reserve	2020	2.8	ASEZA	Aqaba Marine Reserve was approved as a Protected Area by decree and Council of Ministers decision in 2020. The previous AQABA Marine Park has been integrated into the Aqaba Marine Reserve. The purpose of the establishment is to achieve a marine reserve that supports the protection of healthy coral reefs and marine ecosystems while supporting the socio-economic development of Aqaba.
Aqaba Mountain Area	-	59.8	The Royal Society for the Conservation of Nature (RSCN)	Pending registration as a protected area for terrestrial environment and inland waters.
Qatar Nature Reserve	-	109.9	The Royal Society for the Conservation of Nature (RSCN)	A nature reserve recommended by the European Commission as part of "Integrated Ecosystem Management in the Jordan Rift Valley"

Source: JICA study team



Source: Compiled by JICA study team based on World Database on Protected Areas (WDPA: https://www.protectedplanet.net/en) and ASEZA data.

Figure 3-7 Location of protected areas in Aqaba

3.1.5 Pollution Measures

(1) Air quality

Three monitoring sites and one mobile monitoring site have been established in Aqaba; the results of the 2022 air quality monitoring are shown in the table below.

Compared to the Jordanian standard of air quality, the maximum value of SO_2 at the port exceeded the standard.

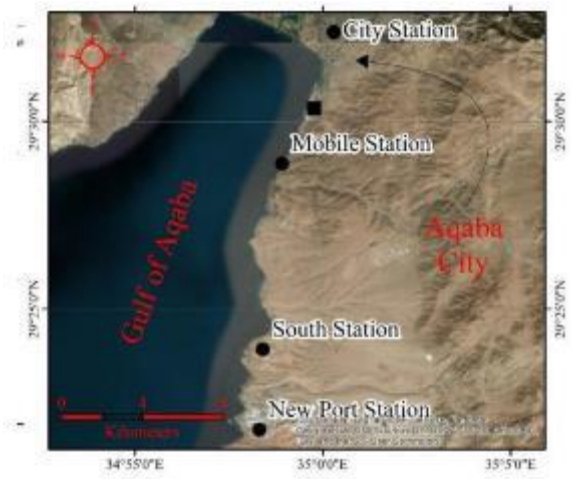
For PM_{10}, the maximum value at City Center, the maximum and average values at South Station, and the maximum, average, and minimum values at the port exceeded the standard values.

For PM_{10}, it is likely that the effect of flying sand and automobile exhaust is significant, but the port showed larger values than the other two locations (City center and South Station), suggesting that it may have been affected by industrial activities.

Table 3.2 Air Quality Monitoring Results (2022)

1 Hour	City Station			South Station			port			Jordan standards(1140/2006)	
	Max	Min	mean	Max	Min	mean	Max	Min	mean	Value	Number of acceptable standard exceedances
SO_2(ppm)	0.014	0.003	0.006	0.066	0.006	0.017	0.557	0.009	0.142	0.3	3 times/ any consecutive 12 months
PM10(mg/m^3)	0.8741	0.0628	0.27978	1.114	0.1272	0.51078	1.778	0.2649	0.74642	-	
NO_2(ppm)	0.0567	0.0201	0.0304	0.0269	0.0135	0.01913	0.0414	0.0151	0.0253	0.21	3 times/ any consecutive 12 months
CO(ppm)	4.83	0.94	2.52917	7.95	0.87	2.06875	-	-		26	3 times/ any consecutive 12 months
8 hours	City Station			South Station			port			Jordan standards	
	Max	Min	mean	Max	Min	mean	Max	Min	mean	Value	Number of acceptable standard exceedances
CO(ppm)	3.42	0.54	1.33083	2.8	0.67	1.18875	-	-		9	3 times/ any consecutive 12 months
24 hours	City Station			South Station			port			Jordan standards	
	Max	Min	mean	Max	Min	mean	Max	Min	mean	Value	Number of acceptable standard exceedances
SO_2(ppm)	0.017	0.002	0.003	0.011	0.004	0.006	0.068	0.003	0.017	0.14	1 time/ year
PM10(mg/m^3)	0.2789	0.0302	0.10068	0.501	0.068	0.16884	0.461	0.1369	0.26274	0.12	3 times/ any consecutive 12 months
NO_2(ppm)	0.0454	0.0062	0.01157	0.013	0.0045	0.00803	0.0205	0.01	0.01574	0.08	3 times/ any consecutive 12 months

Note: Red figures in the table indicate exceedances of the reference value for the country of Jordan.
Source: ASEZA data



Source: ASEZA data

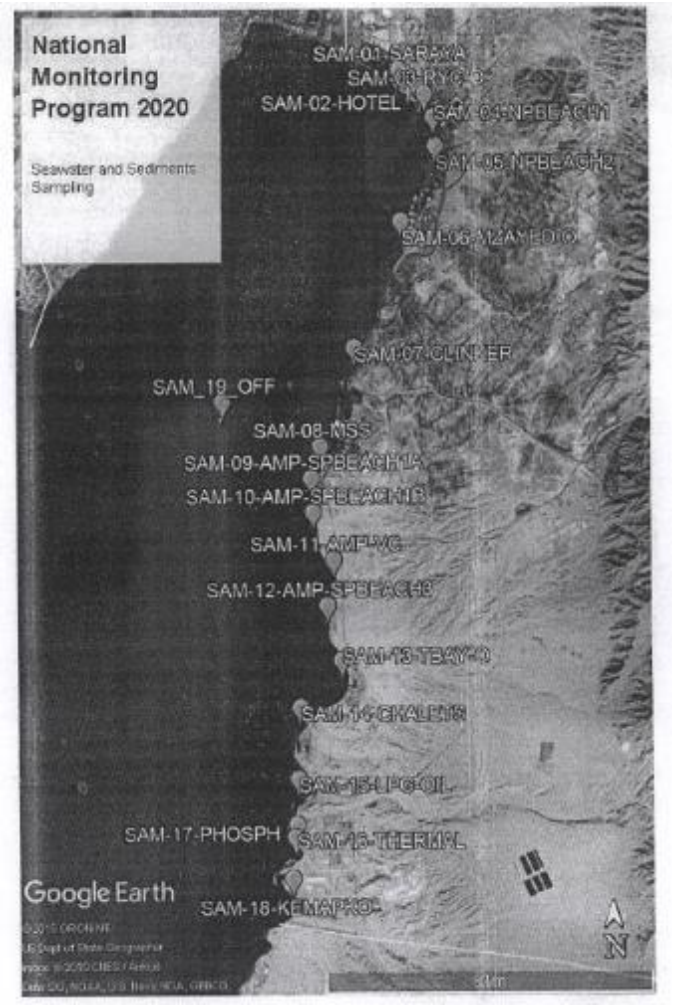
Figure 3-8 Location of Air monitoring Stations

(2) Water quality

In Aqaba, 18 monitoring survey points are located along the coast and one control point (point not affected by sewage from land) is located offshore about 3 km away from the land area. Water quality changes in the Gulf of Aqaba are monitored relative to the control point. No water quality standards have been established for the marine area.

The location map of water quality (seawater) monitoring and the results of water quality (seawater) monitoring in 2022 are shown below.

Since there are no survey locations with significantly high values in comparison to the control point, it is assumed that the influence of sewage from the land area has not occurred.



Source: ASEZA data

Figure 3-9 Water quality (seawater) monitoring points

Table 3.3 Water quality (seawater) monitoring results (2022)

		NH4	NO3	NO2	PO4	SiO2	Chlorophyll-a	HC	Temp	salinity	EC	PH	trans-Acetylene Dichloride	DO	E.faecalis
Unit		mg N/L	mg N/L	mg N/L	mg /L	mg /L	mg /L	mg /L	℃	g /L	μS/cm	-	-	mg /L	MPN/100㎖L
Al-Sarya	Max	0.68	0.44	0.21	0.07	2.54	0.44	0.001	27.29	40.72	63.41	8.35	0	7.22	9
	Min	0.25	0.14	0.01	0.02	1.3	0.15	0.001	19.38	40.54	56.46	8.3	0	6.49	9
Hotels	Max	0.72	0.4	0.2	0.08	2.93	0.45	0.001	27.31	40.71	63.44	8.35	0	7.23	9
	Min	0.25	0.15	0.01	0.02	1.34	0.14	0.001	19.38	40.57	54.07	8.29	0	6.52	9
RYC	Max	0.82	0.38	0.19	0.07	2.73	0.42	0.001	27.29	40.72	63.42	8.36	0	7.19	9
	Min	0.24	0.14	0.01	0.04	1.25	0.11	0.001	19.33	40.54	53.98	8.29	0	6.47	9
NPBEACH1	Max	0.84	0.37	0.29	0.08	2.62	0.44	0.001	27.3	40.71	63.44	8.36	0	7.25	10
	Min	0.18	0.13	0.02	0.03	0.79	0.13	0.001	19.34	40.57	53.99	8.29	0	6.41	9
NPBEACH2	Max	0.9	0.41	0.26	0.08	2.39	0.49	0.001	27.31	40.71	63.43	8.35	0	7.25	20
	Min	0.22	0.17	0.01	0.04	1.29	0.14	0.001	19.15	40.41	54.07	8.29	0	6.52	9
MZAYED-O	Max	0.88	2.42	0.25	0.08	2.94	0.86	0.001	27.31	40.72	63.41	8.36	0	7.27	9
	Min	0.18	0.06	0.01	0.04	1.21	0.18	0.001	19.38	40.55	54.01	8.29	0	6.39	9
CLINKER	Max	0.9	0.42	0.2	0.08	2.41	0.67	0.001	27.29	40.71	63.41	8.36	0	7.24	9
	Min	0.2	0.11	0.03	0.04	1.33	0.14	0.001	19.34	40.54	54.01	8.3	0	6.47	9
MSS	Max	0.76	0.39	0.15	0.08	1.73	0.38	0.001	27.34	40.71	63.49	8.35	0	7.25	9
	Min	0.16	0.17	0.02	0.02	1.21	0.12	0.001	21.34	40.52	56.31	8.28	0	6.52	9
AMP-SPBEACH1	Max	0.73	0.43	0.15	0.08	2.68	0.41	0.001	27.35	40.71	63.49	8.35	0	7.23	9
	Min	0.2	0.14	0.03	0.05	1.33	0.13	0.001	21.34	40.51	56.32	8.28	0	6.44	9
AMP-SPBEACH2	Max	0.66	0.4	0.14	0.09	2.24	0.39	0.001	27.36	40.73	63.5	8.36	0	7.2	9
	Min	0.18	0.12	0	0.04	1.3	0.1	0.001	21.34	40.53	56.31	8.29	0	6.49	9
AMP-V.C	Max	0.83	0.41	0.13	0.08	1.71	0.37	0.001	27.36	40.72	63.5	8.36	0	7.22	9
	Min	0.25	0.13	0.02	0.04	1.28	0.12	0.001	21.33	40.51	56.3	8.29	0	6.42	9
AMP-SPBEACH3	Max	0.79	0.42	0.15	0.08	1.83	0.38	0.001	27.35	40.72	63.49	8.36	0	7.26	9
	Min	0.22	0.15	0.04	0.05	1.28	0.13	0.001	21.34	40.53	56.32	8.28	0	6.47	9
Talabay inside	Max	0.6	0.45	0.14	0.08	1.82	0.37	0.002	27.37	40.7	63.49	8.35	0	7.22	9
	Min	0.17	0.22	0.02	0.04	1.22	0.14	0.001	21.33	40.7	56.3	8.28	0	6.43	9
CHALETS	Max	0.54	0.45	0.14	0.07	1.82	0.43	0.001	27.36	40.72	63.53	8.35	0	7.27	9
	Min	0.21	0.14	0.01	0.04	1.25	0.12	0.001	21.34	40.53	56.3	8.29	0	6.49	9
LPG- OIL	Max	0.78	0.42	0.16	0.08	1.76	0.38	0.001	27.35	40.72	63.5	8.35	0	7.24	9
	Min	0.24	0.17	0.02	0.04	1.22	0.13	0.001	21.35	40.51	56.32	8.29	0	6.49	9
THERMAL	Max	0.62	0.42	0.15	0.07	1.84	0.39	0.001	27.34	40.71	63.49	8.36	0	7.26	9
	Min	0.13	0.17	0.01	0.03	1.18	0.12	0.001	21.35	40.54	56.32	8.3	0	6.49	9
PHOSPH	Max	0.73	0.39	0.15	0.08	1.76	0.4	0.001	27.35	40.72	63.48	8.36	0	7.23	9
	Min	0.28	0.15	0.02	0.03	1.2	0.12	0.001	21.34	40.53	56.33	8.3	0	6.42	9
Kemapco-Camera	Max	0.71	0.41	0.13	0.08	1.73	0.36	0.001	27.34	40.71	63.49	8.35	0	7.25	9
	Min	0.23	0.16	0.01	0.04	1.3	0.11	0.001	21.34	40.53	56.32	8.3	0	6.4	9
Control site	Max	0.58	0.38	0.14	0.06	1.74	0.36	0	27.34	40.71	63.49	8.35	28	7.21	9
	Min	0.19	0.17	0.01	0.04	1.27	0.11	0	21.34	40.51	56.32	8.3	24	6.43	9

Source: ASEZA data

(3) Noise

As a baseline study, a noise field survey was conducted in January 2024. A summary of the noise field survey locations is shown in

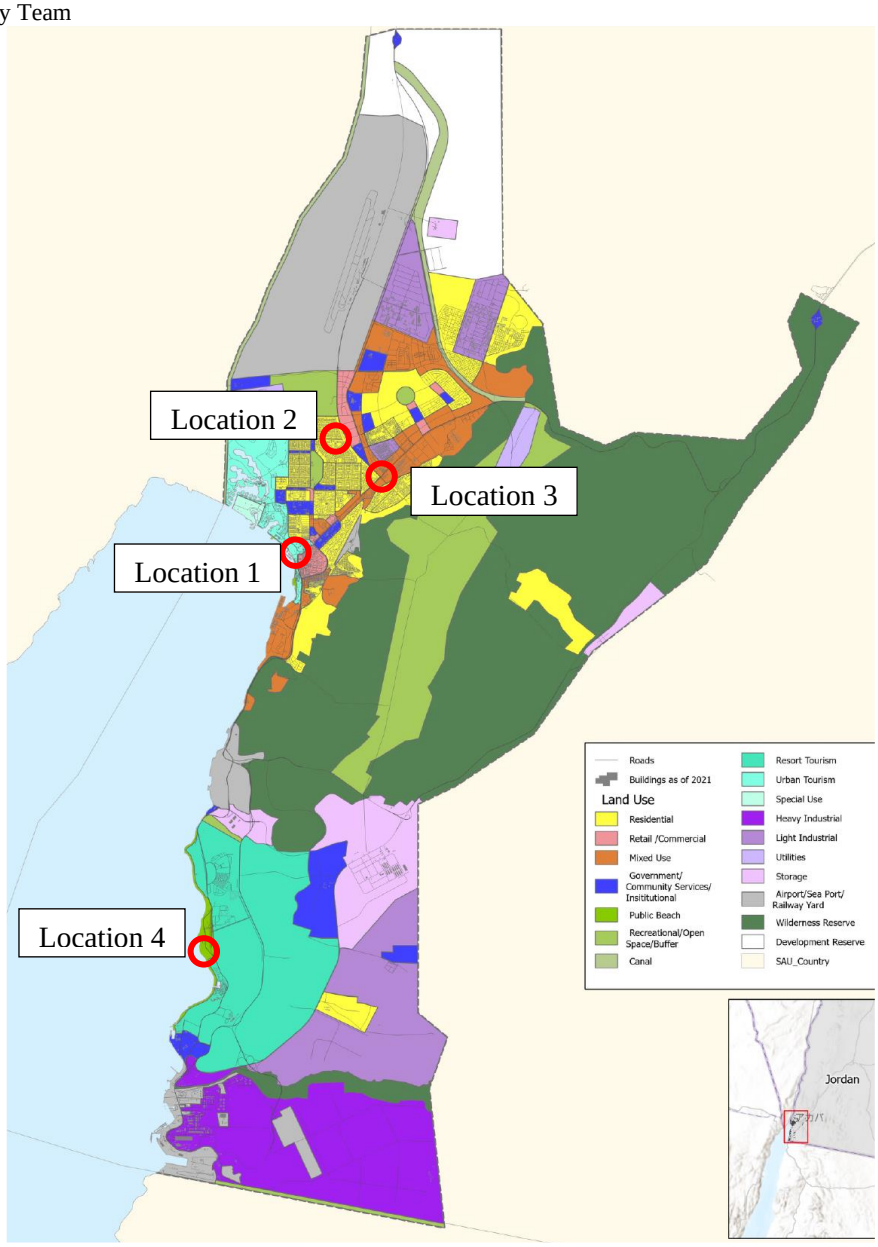
Table 3.4, the survey locations are shown on the map in Figure 3-10, and the survey results are shown in Table 3.5.
The results of the noise survey showed that the lowest noise level within the Aqaba urban area was at survey location 2, located in the residential area of Aqaba, 65.8 dB at day and 50.8 dB at night. The highest noise level was at Location 3, located along the main road, at 73.5 dB during the day and 69.6 dB at night. Location 4, located on Tala Bay outside of city center Aqaba, had noise levels of 50.3 dB at day and 48.7 dB at night, making it a quieter environment than city center Aqaba.

In comparison with Japanese noise standards, many of the sites were found to exceed the standards. The main noise source at the field survey locations was noise from traveling vehicles, likely due to heavy traffic or high travel speeds.

Table 3.4 Summary of the noise and vibration field survey locations

No.	Survey location	Reason for selection	Latitude/Longitude
Location 1	Aqaba town-1	To evaluate vibration and noise conditions on main roads in Aqaba	29°31' 44.09" N 35°00' 07.14" E
Location 2	Aqaba town-2	To evaluate noise and vibration conditions in residential areas of Aqaba	29°33' 15.95" N 35°01' 02.27"E
Location 3	Aqaba town-3	To evaluate noise and vibration conditions at the intersection of the Dead Sea Highway (Route 65) and the Desert Highway (Route 80), where heavy vehicles frequently pass.	29°33' 03.09" N 35°01' 38.46" E
Location 4	Tala Bay area	To evaluate noise and vibration conditions in a resort development area	29°24' 38.68" N 34°58' 48.68" E

Source: JICA Study Team



Source: JICA Study Team

Figure 3-10 Noise and vibration survey locations

Table 3.5 Result of the noise survey

Item	Unit	Time frame	Location 1	Location 2	Location 3	Location 4	EQS Japan		
			C	A	Main road	A	A	C	Main road
L_{Aeq}	dB(A)	Day	66.6	65.8	73.5	50.3	55	60	70
		Night	56.4	50.8	69.6	48.7	45	50	65

Time frame: (Daytime) 6:00 a.m. to 10:00 p.m., (Nighttime) 10:00 p.m. to 6:00 a.m.
A: Areas used exclusively for residential purposes
C: Areas used for commercial, industrial, etc., in conjunction with a significant number of residences.
Main road: Space in close proximity to a road carrying arterial traffic.
NPCC (1980) maximum permissible noise levels: Guideline values specified in National Pollution Control Commission (NPCC) Memorandum Circular No. 002 (1980)
EQS Japan: Environmental standard for noise (Ministry of the Environment, Japan)
Source: JICA Study Team

3.1.6 Ecosystem

(1) Terrestrial ecosystem

The total number of wildlife and plant species in Jordan is estimated to be about 4,000.

A total of 2,622 species of vascular plants have been recorded, representing about 1% of the world's flora.

There are 644 known animal species, of which 83 are mammals, 4 are amphibians, and 107 are reptiles. About 1,000 species of fish are known to inhabit the rich waters of the Gulf of Aqaba.

Located at the junction of the Mediterranean Sea and the Arabian Peninsula, Jordan is on one of the world's leading bird migration routes between Africa and Eurasia. More than 430 bird species belonging to 69 families and 21 orders have been recorded in Jordan. The majority of birds in Jordan are migratory and follow two main routes in the fall and spring. These routes include the Azraq Oasis Road and the Jordan Valley Road. The latter includes the Jordan Valley, the Dead Sea, Wadi Araba and the Gulf of Aqaba and is usually used by birds coming from Western Europe. Wadi Araba is characterized by high mountainous terrain that creates thermal currents that help large birds fly. Some of these large bird species use the mountain tops for nesting.

(2) Marine ecosystem

The Gulf of Aqaba is separated from other seas by two boundaries, the Bab el-Mandeb Strait, which separates the Red Sea from the Indian Ocean, and the Tiran Strait, which separates the Gulf of Aqaba from the Red Sea. The Gulf is recognized as a rare area with a coral reef ecosystem in the northern latitudes with high biodiversity.

The Gulf of Aqaba is home to a wide variety of invertebrates, including mollusks, crabs, and annelids/ annelids, and more than 348 species of fish, 151 species of hard corals, and 120 species of soft corals have been recorded. The Red Sea, of which the Gulf of Aqaba is a part, has a high percentage of endemic fish species, and seven species of fish are considered endemic to the Gulf of Aqaba.

(3) Vegetation

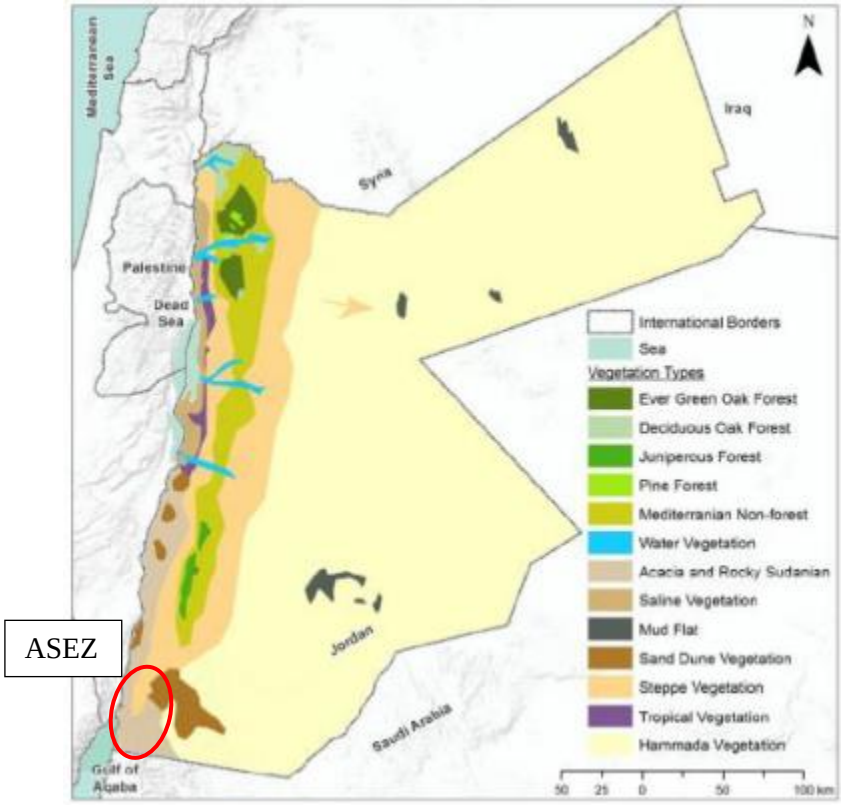
A vegetation distribution map of Jordan is shown in Figure 3-11.

Thirteen vegetation types have been identified in Jordan, of which four vegetation types are present in Aqaba: acacia and Sudanian rocky vegetation, sand dunes vegetation, steppe vegetation, and hamada vegetation. According to The Fifth National Report on the Implementation of the Convention on Biological Diversity (2014), the main vegetation zones within the ASEZ are Acacia and Sudanian rocky vegetation and sand dunes vegetation. This vegetation is limited to the granite foothills and the rocky areas of Wadi Araba, Wadi al-Yutum, and Wadi Rum in the Sudanian region. It is characterized by scattered acacia trees, which increase in density on the hard rocks at the foot of the mountains, forming acacia woodlands.

Sand dunes vegetation is found only in the Sudan region, especially in Wadi Araba and Wadi Rum. The vegetation consists of shrubs and bushes, mainly dune plants. In some places, the vegetation has reached its peak, especially near Gharandal along the road to Aqaba, where the vegetation reaches 3 meters in height. The dominant species is Haloxylon persicum.

The steppe vegetation is limited to the Irano-Turanian region and sometimes invades the Mediterranean or Saharan-Arabian regions. The composition of the vegetation varies with soil and other climatic differences, depending on its location with the Mediterranean region.

The Hammada vegetation covers most of the Saharan Arabian region of Jordan, with desert vegetation of gravel and pebbles.



Source: Jordanian Fifth National Report on the Implementation of the Convention on Biological Diversity, Ministry of Environment, Amman, Jordan,2014

Figure 3-11 Vegetation distribution map of Jordan

(4) Rare plants and animals

1) Mammals

Seventy-eight species of mammals belonging to 26 families have been recorded in Jordan. Endangered/Threatened species from IUCN and regional information are listed in Table 3.6.

Table 3.6 Endangered/threatened mammals inhabiting Aqaba

English name	Scientific name	Status	
		IUCN	Regional information
Goitered gazelle	*Gazella Subgutturusa*		vulnerable protection status
Dorcas Gazelle	*Gazella Durcas*	VU	
Arabian oryx	*Oryx Leucoryx*	VU	
Blanford's fox	*Vulpes cana*		Legally prohibited from hunting
Striped hyena	*Hyaena hyaena*	NT	
Nubian ibex	*Capra nubiana*	VU	
Mountain gazelle	*Gazella gazelle*	EN	
Greater horseshoe bat	*Rhinolophus ferrumequinum*		seriously declining in Jordan
long-fingered bat	*Myotis capaccinii*	VU	

IUCN: International Union for the Conservation of Nature
EN：Endangered
NT：Near threatened
VU: Vulnerable
Source: JICA study team

2) Birds

More than 225 bird species have been observed at the Aqaba Bird Observatory. Of these, endangered/threatened bird species according to IUCN and regional information are listed in Table 3.7.

Table 3.7 Endangered/threatened bird species in Aqaba

English name	Scientific name	Status	
		IUCN	Regional information
Arabian Babbler	*Turdoides squamiceps*		Limited distribution in Jordan
Bearded Vulture	*Gypaetus barbatus*	NT	
Dead Sea Sparrow	*Passer moabiticus*		Locally Threatened
Egyptian Goose	*Alopochen aegyptiaca*		First time in Jordan
Egyptian Vulture	*Neophron percnopterus*	EN	
Eastern Imperial Eagle	*Aquila heliaca*	VU	
Ferruginous Duck	*Aythya nyroca*		locally threatened
Golden Plover	*Pluvialis apricaria*		Rare in Jordan
Lesser Kestrel	*Falco naumanni*		Locally Threatened
Lesser White fronted Goose	*Anser erythropus*		First time in Jordan
Lichtenstein's Sandgrouse	*Pterocles lichtensteinii*		Rare in Jordan
Lappet-faced Vulture	*Torgos tracheliotos*	EN	

Marbled Duck	*Marmaronetta angustirostris*		Rare in Jordan
Purple Swamphen	*Porphyrio porphyrio*		Rare in Jordan
Richard's Pipit	*Anthus richardi*		Rare in Jordan
Red-footed Falcon	*Falco vespertinus*	NT	
Pallid Harrier	*Circus macrourus*	NT	
Red Kite	*Milvus milvus*	NT	
Sooty Falcon	*Falco concolor*	NT	
Sociable Lapwing	*Vanellus gregarius*		Rare in Jordan
Striated Heron	*Butorides striata*		Rare in Jordan
Striolated Bunting	*Emberiza striolata*		Limited distribution in Jordan
Saker Falcon	*Falco cherrug*	EN	
Steppe Eagle	*Aquila nipalensis*	EN	
Turkestan Shrike	*Lanius phoenicuroides*		Rare in Jordan
Whimbrel	*Numenius phaeopus*		Rare in Jordan
Pygmy Cormorant	*Phalacrocorax pygmeus*		Rare in Jordan

IUCN: International Union for the Conservation of Nature
EN：Endangered
NT：Near threatened
VU: Vulnerable
Source: JICA study team

3) Reptiles (terrestrial)

Approximately 37 reptile species have been recorded in Aqaba and Wadi Araba, representing about 35% of Jordan's herpetofauna. Most of these reptile species are restricted to southern Jordan. The reptiles of Aqaba are considered an important food source for mammals and birds. Endangered/threatened species according to the IUCN and regional information are listed in Table 3.8.

Table 3.8 Endangered/threatened reptiles (terrestrial) in Aqaba

English name	Scientific name	Status	
		IUCN	Regional information
Desert monitor	*Varanus griseus*		largest lizard in Jordan
	Cerastes cersates		Rare in Jordan
	Echis colorarus		Rare in Jordan
	Mabya vittata		Present in summer
	Bunopus tuberculatus		Rare in Jordan
	Uromastyx aegyptius microlepis		Rare in Jordan
	Chalcides ocellatus		Rare in Jordan

IUCN: International Union for the Conservation of Nature
Source: JICA study team

(5) AQABA MARINE RESERVE (AMR)

It was declared a protected area by the Jordan Network of Protected Areas (JNPAs) under the Protected Areas and National Parks Ordinance No. 29 of 2005.

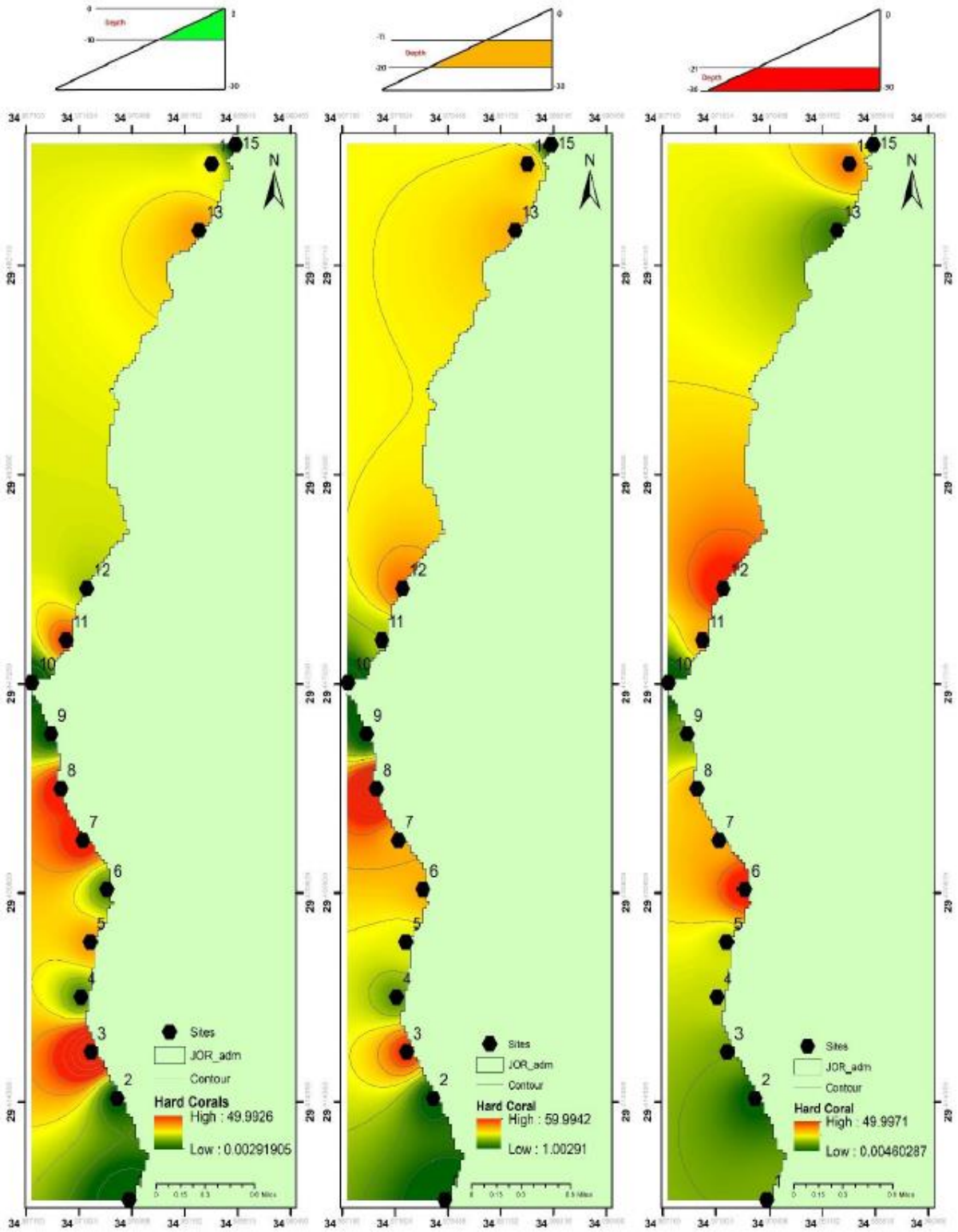
Under the auspices of the United Nations Development Program (UNDP), a survey and file

preparation for nomination to the JNPAs is underway, and a summary of the description is given below.

1) Coral

A total of 157 hard coral species were identified in the Gulf of Aqaba, all of which are found within the AMR. These species consist of 153 species of Anthozoa (Anthozoa, Scleractinia), one species of Organ Pipe Coral (Anthozoa, Alcyonacea), and three species of Anacardia (a generic name for hydrocorals of the order Hydrozoa Milleporidae). The 15 species of Hydrozoa discovered and photographed during the field survey are currently known to occur only in the Red Sea and are considered to be endemic to the Red Sea.

The distribution of hotspots of high diversity of hard corals identified in the AMR is shown in Figure 3-12 Hotspots of hard coral diversity.



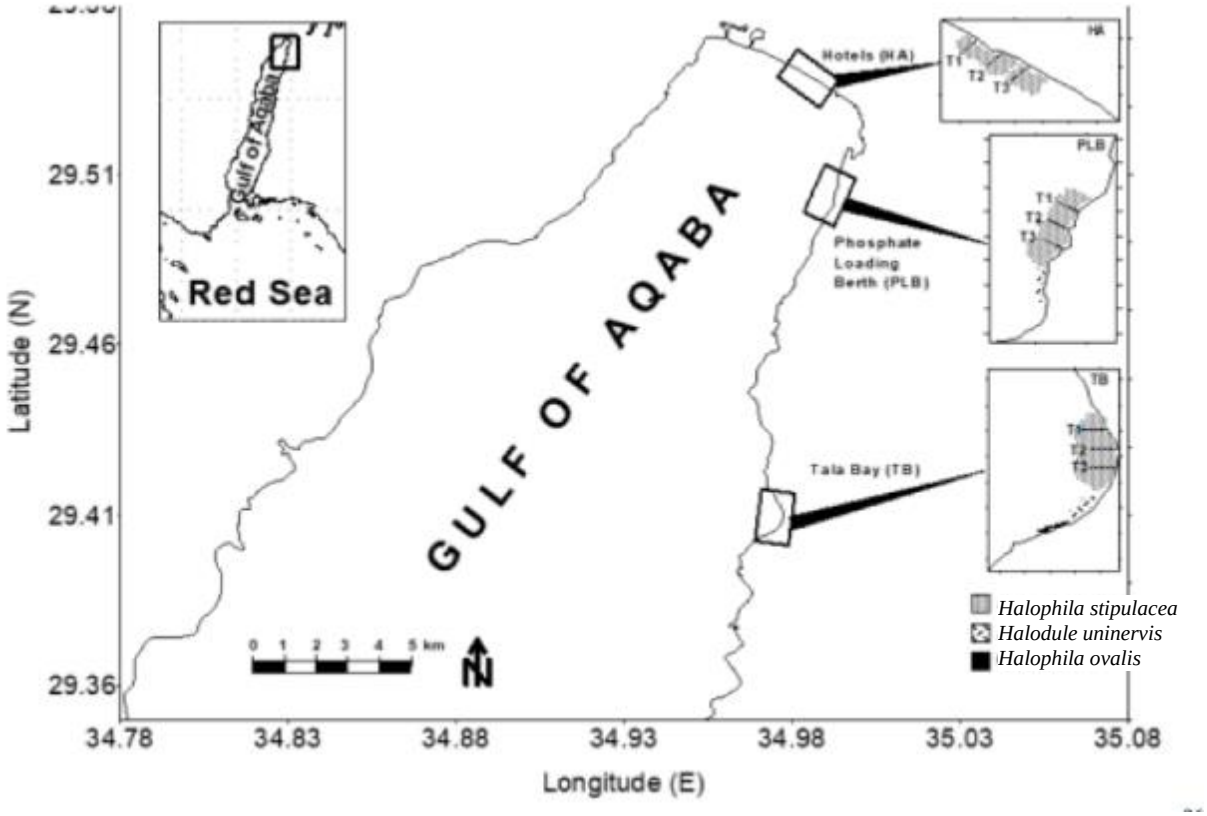
Source: AQABA MARINE RESERVE Nomination File
Note: The left figure shows the distribution up to 10 m depth, the middle figure shows the distribution at 10-20 m depth, and the right figure shows the distribution at 20-30 m depth.

Figure 3-12 Hotspots of hard coral diversity

2) Seaweed bed

The seagrass community along the AMR is small compared to the extent of coral reefs, with the largest seagrass community in Al-Mamlah Bay (Tala Bay), located at the southern end of the AMR. The variety of seagrass species is very rich, and the importance of biodiversity conservation has been pointed out. The distribution of seagrasses increases up to a depth of 12 m, after which it decreases.

Three species of seagrass have been identified: *Halophila stipulacea* , *Halodule uninervis* , and *Halophila ovalis* .



Source: AQABA MARINE RESERVE Nomination File

Figure 3-13 Location map of major seagrass beds along the Jordanian coast

3) Fish

The fish diversity in the Gulf of Aqaba is considered to be very high, with 507 species belonging to 109 families recorded to date. Eight families account for more than 41% of the fish species recorded in the Gulf of Aqaba, including Labridae (51 species), Pomacentridae (29 species), Epinephelidae (25 species), Apogonidae (24 species), Blenniidae (24 species), Gobiidae (21 species), Carangidae (17 species), and Syngnathidae (16 species). Of these, seven species are recognized as endemic and several are considered commercially important. More than 50% of the species recorded in Jordan are reef dwellers, testifying to the richness of the Gulf of Aqaba with its healthy coral reefs. The main endemic species identified in the Gulf of Aqaba are listed in

Table 3.9.

Table 3.9 Major endemic fish of the Gulf of Aqaba

Family	Scientific name	Status	
		IUCN	Regional information
Apogonidae	*Cheilodipterus lachneri*		Endemic
Pomacentridae	*Amblyglyphidodon flavilatus*	LC	Endemic
	Amphiprion bicinctus	LC	Endemic
	Chromis pelloura		Endemic
	Chromis trialpha		Endemic
	Pomacentrus albicaudatus		Endemic
Blenniidae	*Belenniella flaviumbrinus*		Endemic

IUCN: International Union for the Conservation of Nature
LC：Least Concern
Source: JICA study team

4) Sea turtle

T Three turtle species have been recorded in the Gulf of Aqaba, and a fourth species, the IUCN Red List endangered green turtle *Chelonia mydas*, is expected to be present. Loggerhead Caretta, a vulnerable species on the IUCN Red List, has been recorded in the Gulf of Aqaba, but this record is likely from a migratory individual that strayed in route to the Suez Canal. Leatherback *Dermochelys coriacea, an* IUCN Red List vulnerable species, has been identified, although records are scarce and rare. The most abundant and widespread species in the Gulf of Aqaba is the hawksbill turtle *Eretmochelys coriacea*, an IUCN Red List critically endangered species.

3.1.7 Natural Environmental Issues in the ASEZ

As mentioned above, the Gulf of Aqaba has a rich marine ecosystem with endemic species of fish, corals, and seaweeds, and is itself the largest tourism resource in the region. For the sustainable development of the region, it is necessary to prevent the increase of environmental burden due to urban development, etc., and to pay attention to the protection and conservation of the environment, including the marine environment, and adaptation to climate change, as well as the risk of pollution due to increased solid waste, sewage, exhaust gas, etc.

3.2 Socio-economic Trends

3.2.1 General Demographics

(1) Population of Aqaba Governorate

1) Population and Growth Rates

The populations of both the Hashemite Kingdom of Jordan and Aqaba Governorate are growing consistently. According to the latest 2015 census, the total population of Jordan is 9,531,000, an increase of more than 16 times from 586,000 in 1952 and at least four times from 2,133,000 in 1979. The population estimate as of the end of 2022, published by the Bureau of Statistics in January 2023, is 11,302,000. Although its average annual growth rate remained around 4 to 5% from 1952 to 1994, it shrank to 2.1% from 1994 to 2004. Subsequently, the rate of increase went up to 5.8% in 2004-2005 as the non-Jordanian population rose due to increased immigration and other factors. The percentage of non-Jordanians in the total population went up from around 7% in 1994 and 2004 to over 30% in 2015.

The population of Aqaba Governorate, where ASEZ is located, was 188,160 in 2015, which is a 2.4-fold increase from 79,839 in 1994. DOS estimated the population for 2022 to be 222,800. The average annual growth rate of Aqaba's population is rising approximately at the same rate as the growth rate of the nationwide population. In addition, the percentage of non-Jordanians increased from approximately 15% in 1994 and 2004 to more than 28% in 2015. The population in Aqaba accounts for approximately 2% of the nationwide population, and the rate stays unchanged.

The number of households also increased by approximately 2.8 times, from 13,756 in 1994 to 38,027 in 2015.

Table 3.10 Population of Jordan and Aqaba Governorate

Year	1952	1961	1979	1994	2004	2015	2022*
Population of the state of Jordan (persons)	**586,200**	**900,800**	**2,133,000**	**4,139,458**	**5,103,639**	**9,531,712**	**11,302,000**
Average annual growth rate (%)	-	4.9%	4.9%	4.5%	2.1%	5.8%	2.5%
(of which) non-Jordanians (persons)	-	-	-	314,965	392,273	2,918,125	-
Percentage of non-Jordanians (%)	-	-	-	7.6	7.7	30.6	-
Population of Aqaba **Governorate** (persons)	-	-	-	**79,839**	**102,097**	**188,160**	**222,800**
Average annual growth rate (%)	-	-	-	-	2.5	5.7	2.4
Proportion to total population (%)	-	-	-	1.9	2.0	2.0	2.0
Non-Jordanians (persons)	-	-	-	12,031	15,616	53,115	-
Percentage of non-Jordanians (%)	-	-	-	15.1	15.3	28.2	-
Jordanians residing abroad (persons)	-	-	-	177	130	134	-
Percentage of Jordanians living abroad (%)	-	-	-	0.2	0.1	0.1	-
Number of households in Aqaba Governorate (Households)	-	-	-	**13,756**	**18,144**	**38,027**	**45,610**
Average annual growth rate (%)	-	-	-	-	2.8	7.0	2.6

Source: Interactive Database, DOS, Population & Housing Census (including Non-Jordanians and Jordanians Abroad), Population Estimates for The End of 2022 is used for the estimated population of 2022.

2) Migration

The JICA study team observed the inter-governorate migration trends, comparing the number of respondents who currently reside in Aqaba Governorate but previously in other governorates (in-migration) and the number of those who currently reside in other governorates but previously in Aqaba Governorate (out-migration). In general, in-migrants into Aqaba outnumbered out-migrants, and almost all governorates, including the capital city of Amman have the trend of net migration, which could be caused by the influx of job opportunities.

By governorate, both in-migration and out-migration numbers were higher from/into Amman and Zarqa in the metropolitan area, Irbid in the north, Karak in the central area, and neighboring Tafilah and Ma'an. This indicates active migration between Aqaba Governorate and these governorates.

Table 3.11 Migration between Aqaba Governorate and other governorates (2015)

Governorate	In-migrants to Aqaba	Out-migrants from Aqaba	Difference between in-migrants and out-migrants
Amman	2,846	1,968	878
Balqa	166	180	-14
Zarqa	1,000	478	522
Madaba	181	49	132
Irbid	1,722	956	766
Mafraq	126	70	56
Jerash	111	37	74
Ajloun	309	103	206
Karak	1,609	604	1,005
Tafilahh	983	235	748
Ma'an	1,158	359	799
Outside The Country	773	150	623
Unknown	10	0	10
Total	133,695	127,890	5,805

Source: Prepared by JICA study team from DOS census data.

3) Non-Jordanians

The breakdown of the region of origin of the non-Jordanian population in Aqaba, which accounts for about 30% of the total population, in 2004 and 2015 is shown in the table below. Nearly 90% of the non-Jordanian population in both years are comprised of migrants from Arab-Asian countries (Palestine, Iraq, Syria, etc.) and Arab-African countries (Egypt and others). The number of non-Jordanians for all regions is generally on the rise, except for those from Europe.

Looking at their national origins, those from Egypt and Palestine are prominent in both 2004 and 2015, with many from Syria in 2015. The number of people from non-Arab Asian countries such as India, Bangladesh, Pakistan, and the Philippines also increased in 2015.

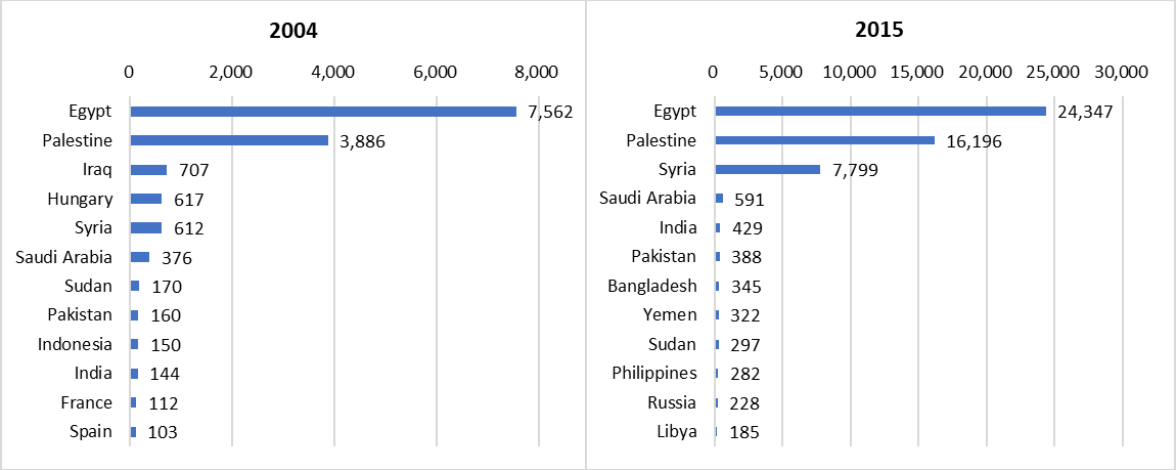
The most common reason for the non-Jordanian population to reside in Aqaba Governorate is job-related in both 2004 and 2015, accounting for 23,339 (45.1%) in 2015. Armed conflict in their home countries was added in 2015, accounting for 14,724 (28.5%) of non-Jordanian population.

The composition of the non-Jordanian population is categorized mainly into two groups: those who move from Arab African and non-Arab Asian countries for work, and those who move from surrounding Arab-Asian countries, which are in conflict, to escape from war. Those groups are assumed to move into the governorate often.

Table 3.12 Non-Jordanian Population by region of origin in Aqaba Governorate

	2004		2015	
local name	Total (persons)	Percentage (%)	Total (persons)	Percentage (%)
Arab-Asian countries	5,651	36.19	25,221	47.48
Arab African countries	7,765	49.72	24,916	46.91
Non-Arab Asian countries	883	5.65	1,724	3.25
Non-Arab African countries	4	0.03	139	0.26
Europe	1,224	7.84	824	1.55
America	63	0.40	195	0.37
Oceania	26	0.17	93	0.18
Other	0	0.00	3	0.01
plan	15,616	-	53,115	-

Source: Prepared by JICA study team from DOS census data.



Source: Prepared by JICA study team from DOS census data.

Figure 3-14 Non-Jordanian Population in Aqaba Governorate by Country of Origin (Top 12 Countries)

Table 3.13 Reasons for Non-Jordanians to Reside in Aqaba Governorate, 2015

Reason	2004		2015	
	Total (persons)	Percentage (%)	Total (persons)	Percentage (%)
Armed conflict in country of origin	0	0.0	14,724	28.5
work	8,037	64.8	23,339	45.1
Accompanying family members	2,598	20.9	8,222	15.9
Education	39	0.3	381	0.7
Sightseeing	1,695	13.7	189	0.4
Medical treatment	12	0.1	73	0.1
Other	29	0.2	4,776	9.2

Source: Prepared by JICA study team from DOS census data.

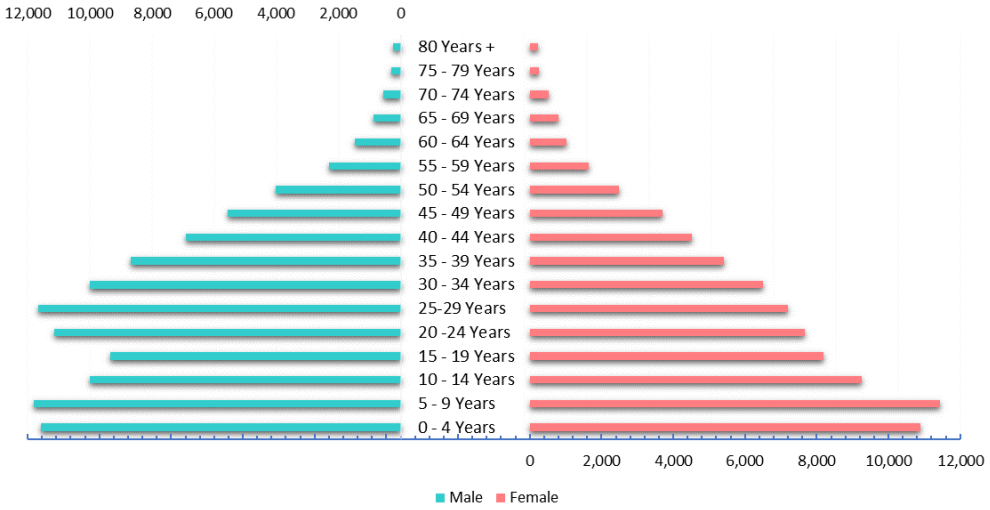
4) Population by Gender and Age Group

The percentage of the population in Aqaba Governorate by gender shows that males (56.6%) outnumber females (43.4%). When looking at by age group, the juvenile population (0-14 years old, 34.5%) and the working-age population (15-64 years old, 63.5%) make up 98% of the population, while the elderly population (65 years old and over) accounts for 2%. The population structure by age group indicates that the percentages of younger age groups are higher; those under 10 account for 24.3%, 10-19 account for 19.5%, the 20s for 20.0%, the 30s for 16.3%, the 40s for 11.0%, the 50s for 5.6%, the 60s for 2.2%, and the 70s or older for 1.1%.

Table 3.14 Population by Age Group within Aqaba Governorate

	1994		2004		2015	
	population	rate	population	rate	population	rate
0-14 years old	34,262	33.6%	39,380	38.6%	64,942	34.5%
15-64 years old	44,266	43.4%	60,443	59.2%	119,442	63.5%
65 years old and over	1,176	1.2%	1,686	1.7%	3,776	2.0%
Unknown	135	0.1%	588	0.6%		

Source: Prepared by JICA study team from DOS census data.



Source: JICA study team from DOS's 2015 census data.

Figure 3-15 Population Composition by Age Group in Aqaba Governorate (2015)

(2) Population by area

1) Population by District

In Aqaba Governorate, there are Aqaba District, including the former ASEZ area, and Quwaira District, each of which is divided into two sub-districts. Since the new ASEZ area is designated across two districts, the study will refer to the population distribution in Aqaba Governorate. Most of the area, except for the center of Aqaba, is a desert area dotted with settlements.

According to the 2015 census of the population by district, approximately 148,000 people, or 78.9% of the governorate's population, live in the urban area of Aqaba Sub-District,

which includes the central area of ASEZ. On the other hand, massive imbalance in population is not seen in Quwaira Sub-District, Wadi Araba Sub-District, and Dieseh Sub-District.

In comparison with the growth rates of the population in urban areas from 2004 to 2015, the rates in the rural areas are higher, and in particular, the rural area of Aqaba District show 7.3% growth in population.

Table 3.15 Population by District in Aqaba Governorate

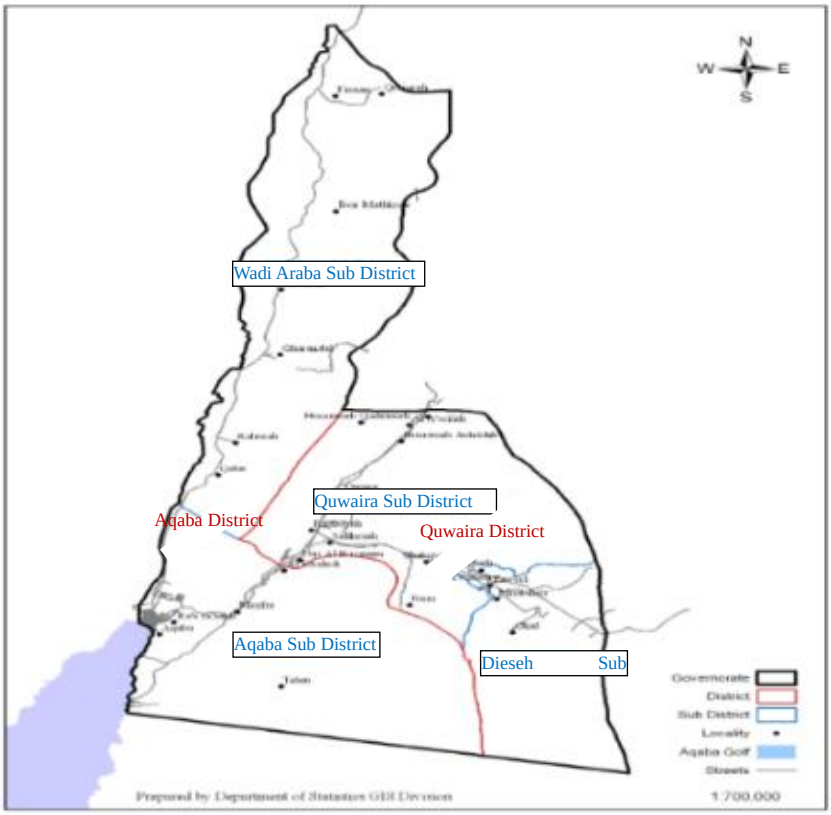
District	Sub District		1994		2004		2015		2021*
			population	rate	population	rate	population	rate	population
Aqaba	Aqaba	Urban	63,804	79.9%	80,059	78.4%	148,398	78.9%	173,140
		Rural	(Included above)	(Included above)	731	0.7%	1,116	0.6%	
	Wadi Araba	Rural	3,299	4.1%	4,175	4.1%	9,504	5.1%	11,010
Quwaira	Quwaira	Urban	12,736	16.0%	7,378	7.2%	11,842	6.3%	26,380
		Rural	(Included above)	(Included above)	5,873	5.8%	10,936	5.8%	
	Dieseh	Rural	(Included above)	(Included above)	3,881	3.8%	6,364	3.4%	7,370

Source: DOS, Population & Housing Census (includes Non-Jordanians and Jordanians Abroad)

Table 3.16 Urban and Rural Population Change (Average Annual Growth Rate from 2004 to 2015)

	Aqaba District	Quwaira District	Total Aqaba Governorate
Urban area	+5.8	+4.4	+5.7
Rural area	+7.3	+5.3	+6.0

Source: DOS, Population & Housing Census (includes Non-Jordanians and Jordanians Abroad)



Source: DOS

Figure 3-16 District Divisions within Aqaba Governorate

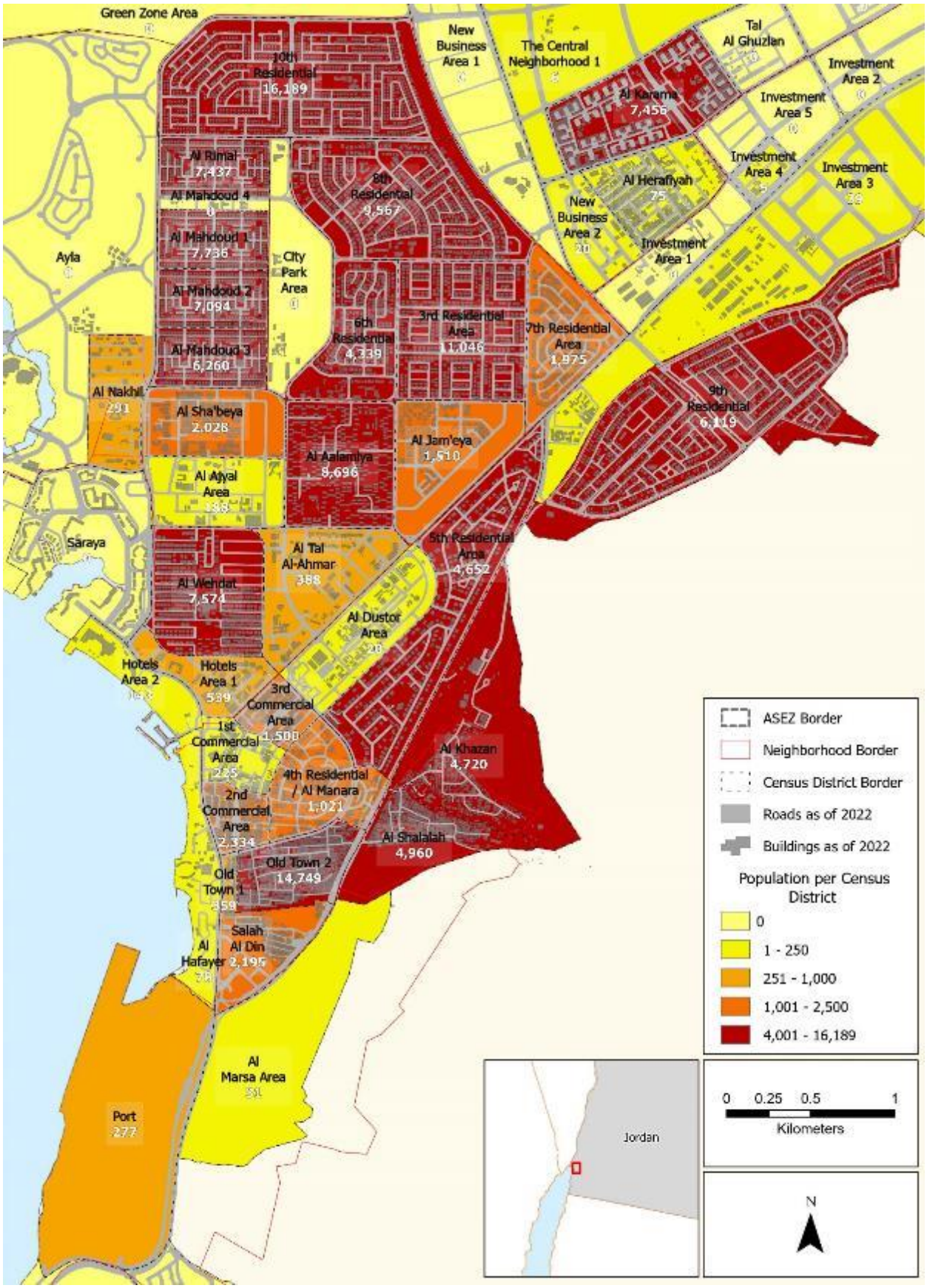
2) Population by Neighborhood

The population by Neighborhood in central ASEZ is shown in Figure 3-17 Population by Neighborhood in Central ASEZ (Central Area) (persons). It indicates that the population is concentrated in the residential land use areas in the hillside in the east and the areas in the north, which are properly guided as per land use regulations. Looking at the broader areas in Figure 3-18 Population by Neighborhood in Central ASEZ (Greater Area) (persons) shows that the area with dense population outside the city center is the Ashamiyyeh area in the northeast. This area is close to an industrial park, and many workers reportedly reside in the labor houses in the area. A small number of populations is also observed in some areas in the south.

A comparison of the male/female population in Figure 3-19 Population by Gender by Neighborhood in Central ASEZ (Central Area) (persons) shows that no significant gender difference is seen in the residential areas in the hillside in the east of the downtown or in the more densely- populated areas in the northern side. On the other hand, the male population is significantly larger in areas such as the 2nd Commercial Area、3rd Commercial Area、Old Town 2、SalahAl Din, presumably due to the fact that the area is a poor living environment with a high concentration of old small houses and is mainly inhabited by Egyptian migrant male foreign workers at low cost. A look at the broader areas in Figure 3-20 Population by Gender by Neighborhood in ASEZ center (broad area) (persons) reveals that only male residents are predominantly observed in northern and southern areas. In the Ashamiyyeh area, which has a large population center, the ratio of males to females is relatively balanced.

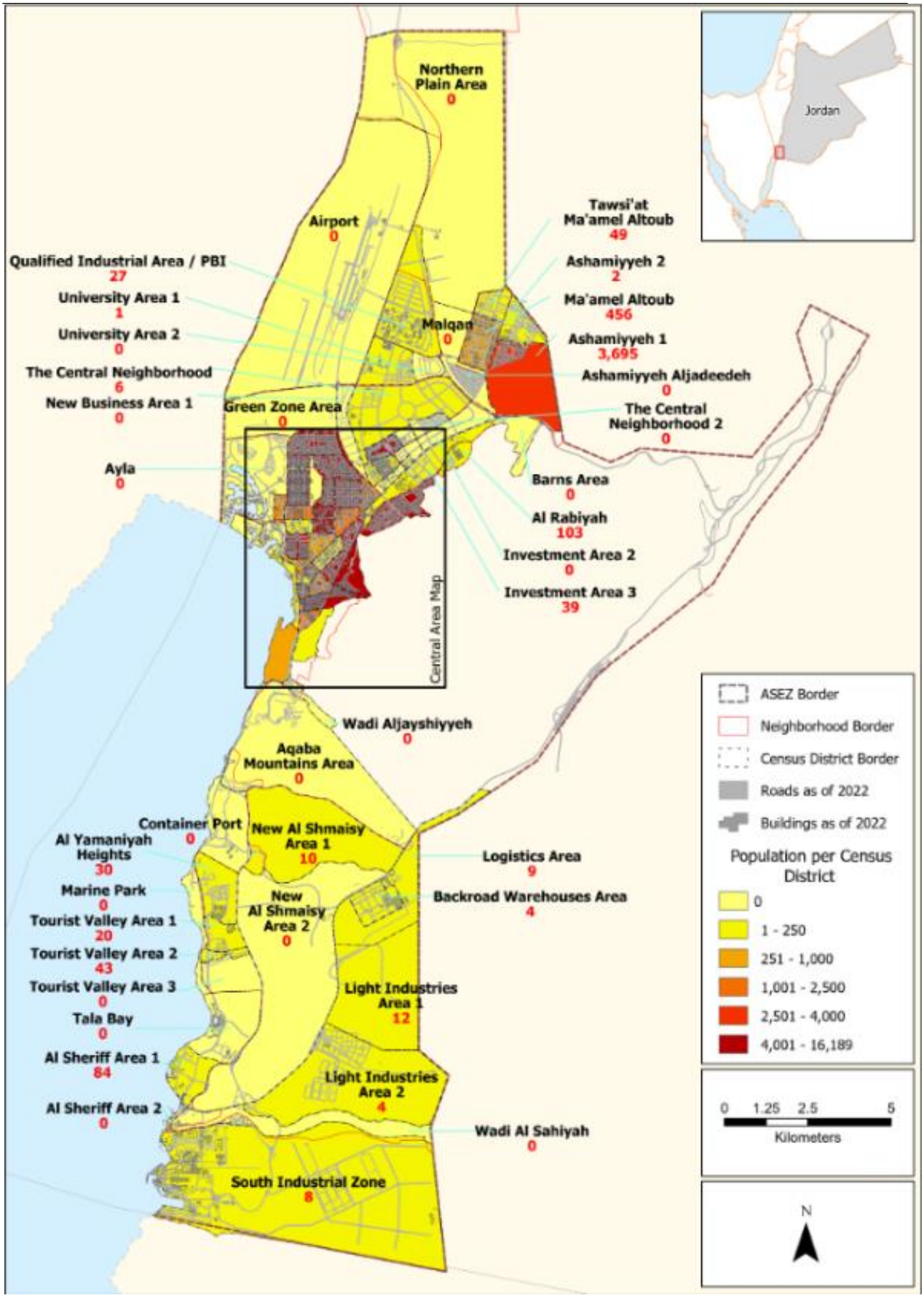
3) Population Density

Shown in Figure 3-21 Population Density by Neighborhood in Central ASEZ (persons/km2), Population density is higher in the city center, particularly in Al Rrimal、Al Mahdoud 1~3、Old Town 2, with more than 20,000 persons per square kilometer. Outside the center, shown in Figure 3-22 Population Density by Neighborhood (persons/km2), the density is generally low, at approximately 500 persons or fewer per square kilometer, except in the Ashamiyyeh area, which has 843persons/km^2.



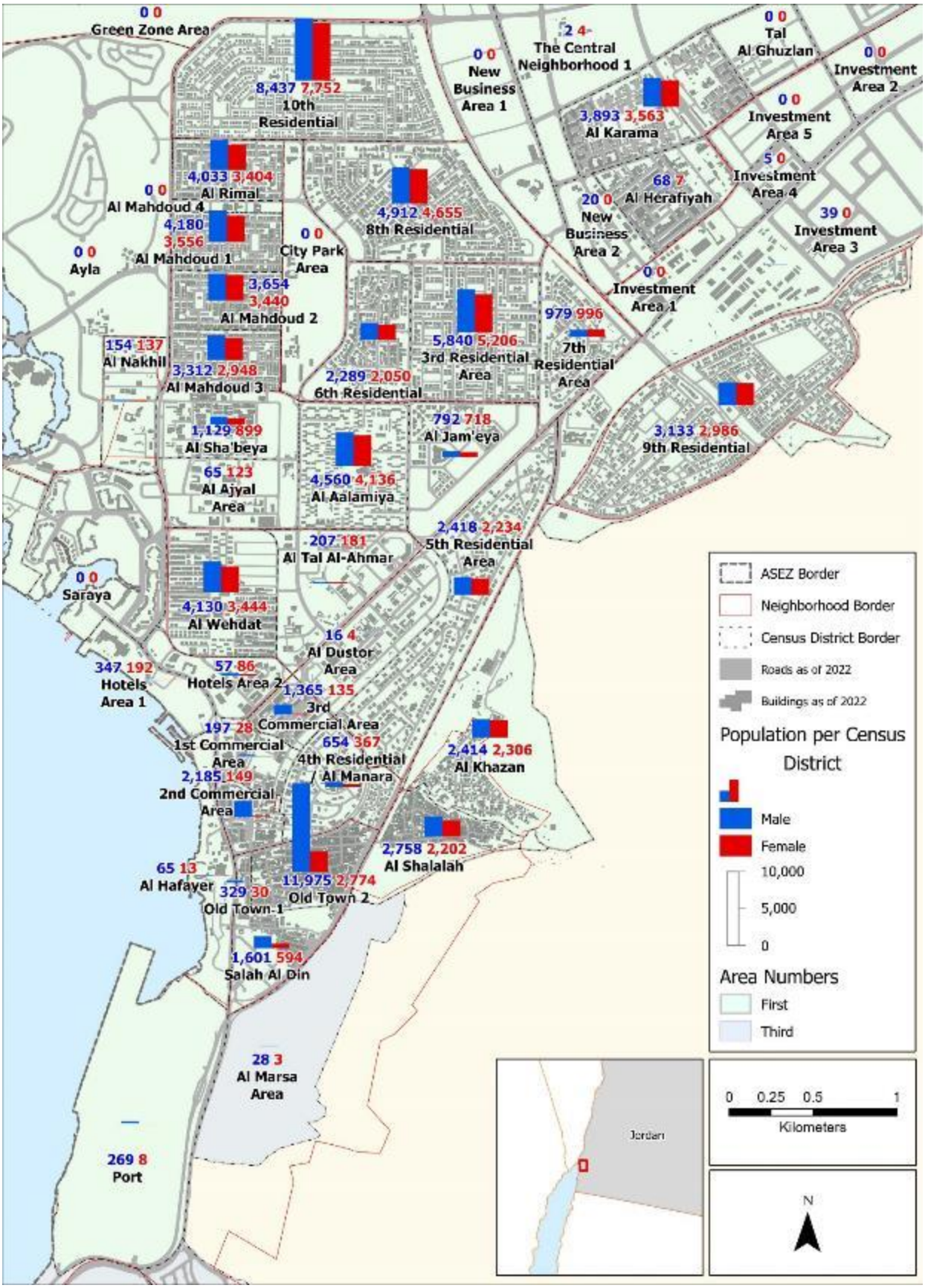
Source: JICA study team based on 2007 and 2015 census data from DOS.

Figure 3-17 Population by Neighborhood in Central ASEZ (Central Area) (persons)



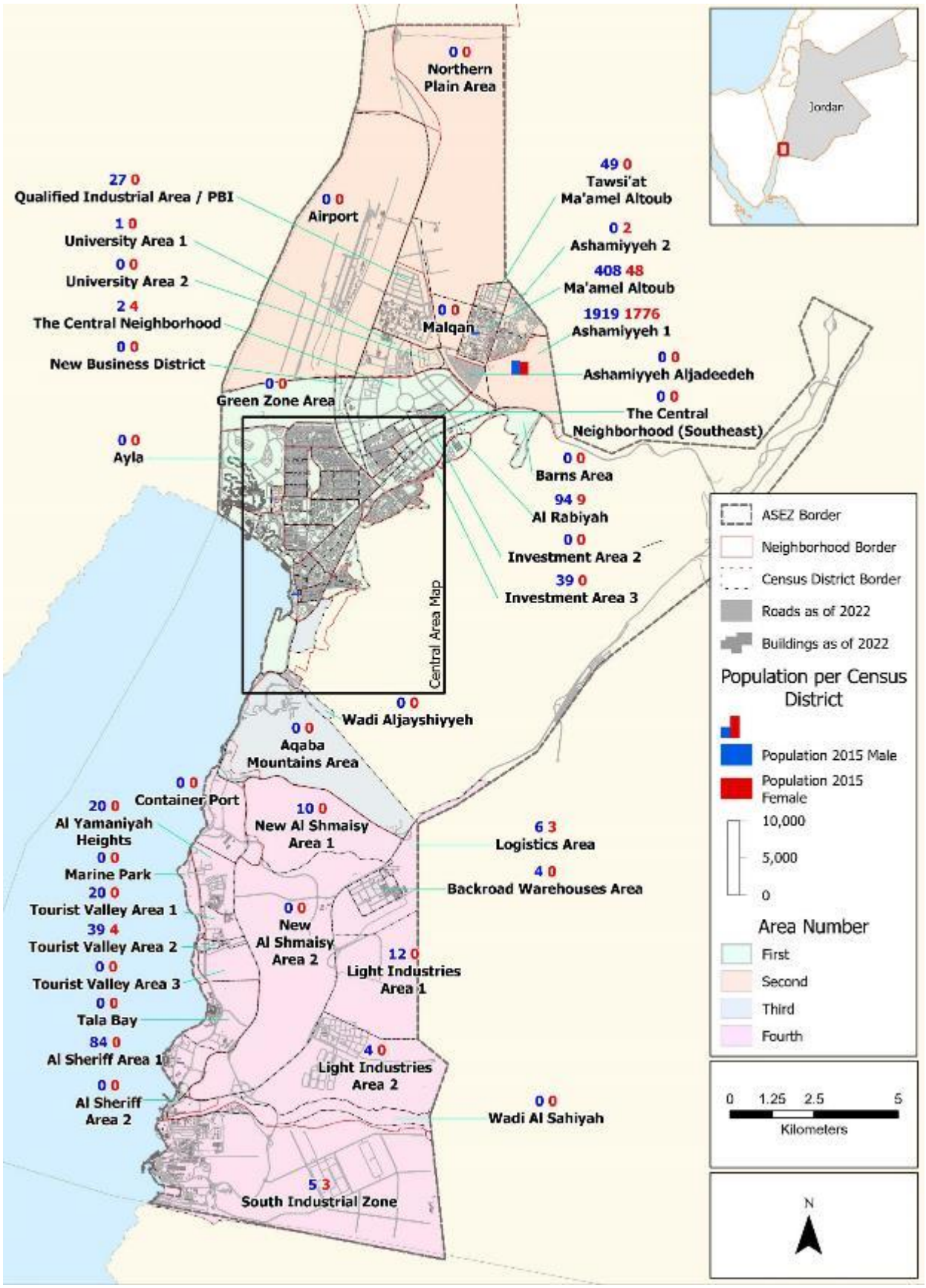
Source: JICA study team based on 2007 and 2015 census data from DOS.

Figure 3-18 Population by Neighborhood in Central ASEZ (Greater Area) (persons)



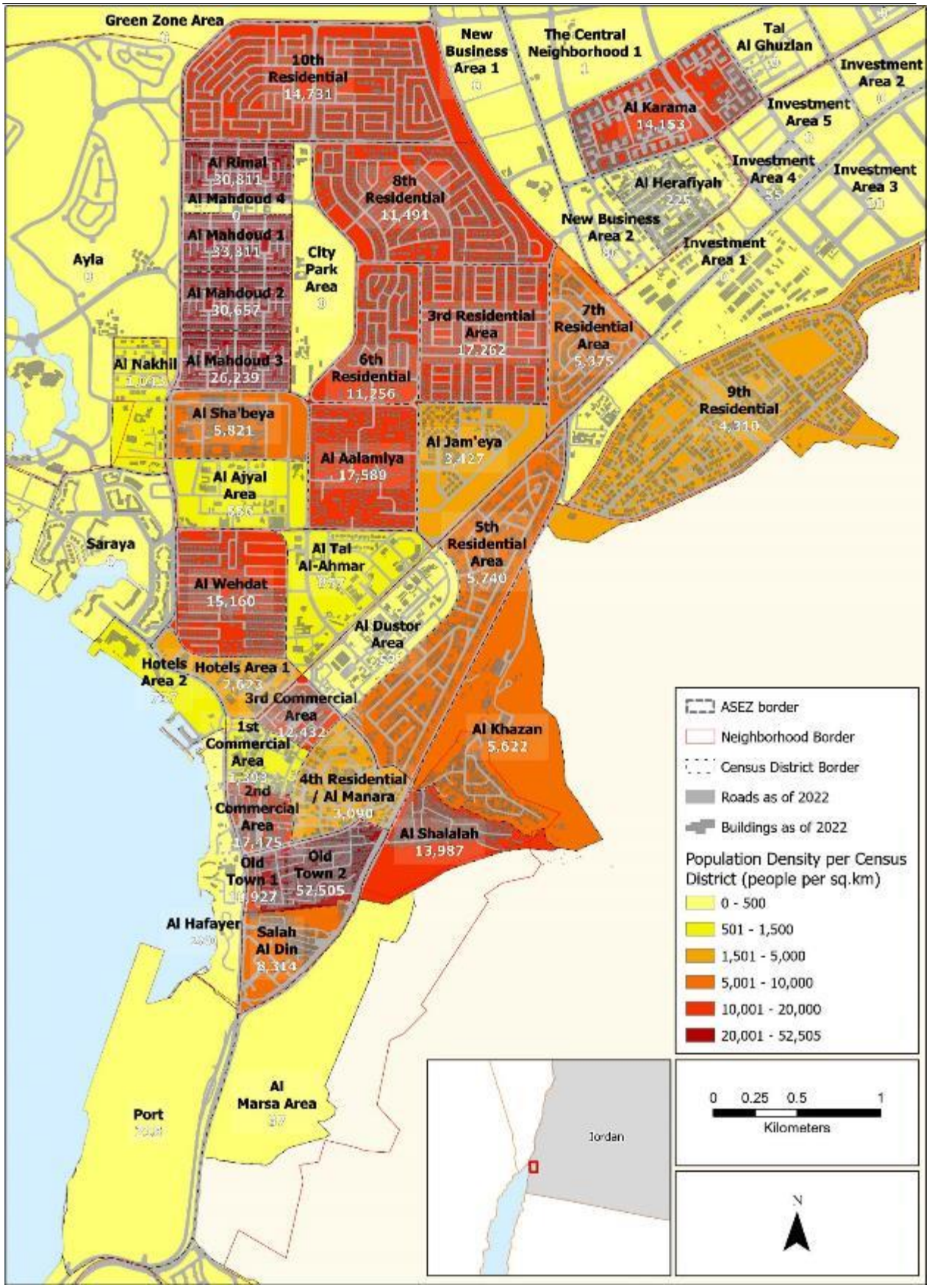
Source: JICA study team based on 2007 and 2015 census data from DOS.

Figure 3-19 Population by Gender by Neighborhood in Central ASEZ (Central Area) (persons)



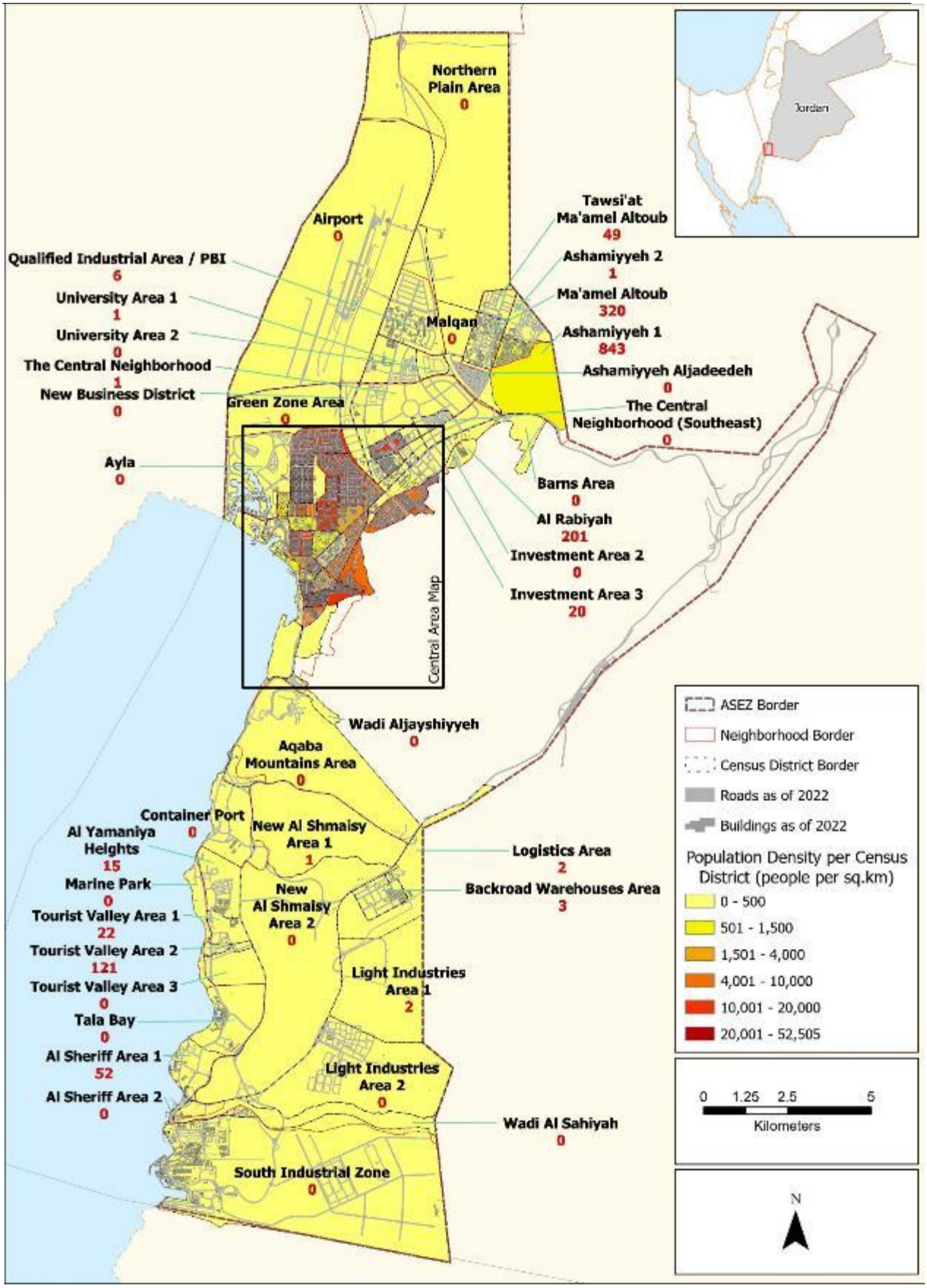
Source: JICA study team based on 2007 and 2015 census data from DOS.

Figure 3-20 Population by Gender by Neighborhood in ASEZ center (broad area) (persons)



Source: JICA study team based on 2015 census data from DOS.

Figure 3-21 Population Density by Neighborhood in Central ASEZ (persons/km2)



Source: JICA study team based on 2015 census data from DOS.

Figure 3-22 Population Density by Neighborhood (persons/km2)

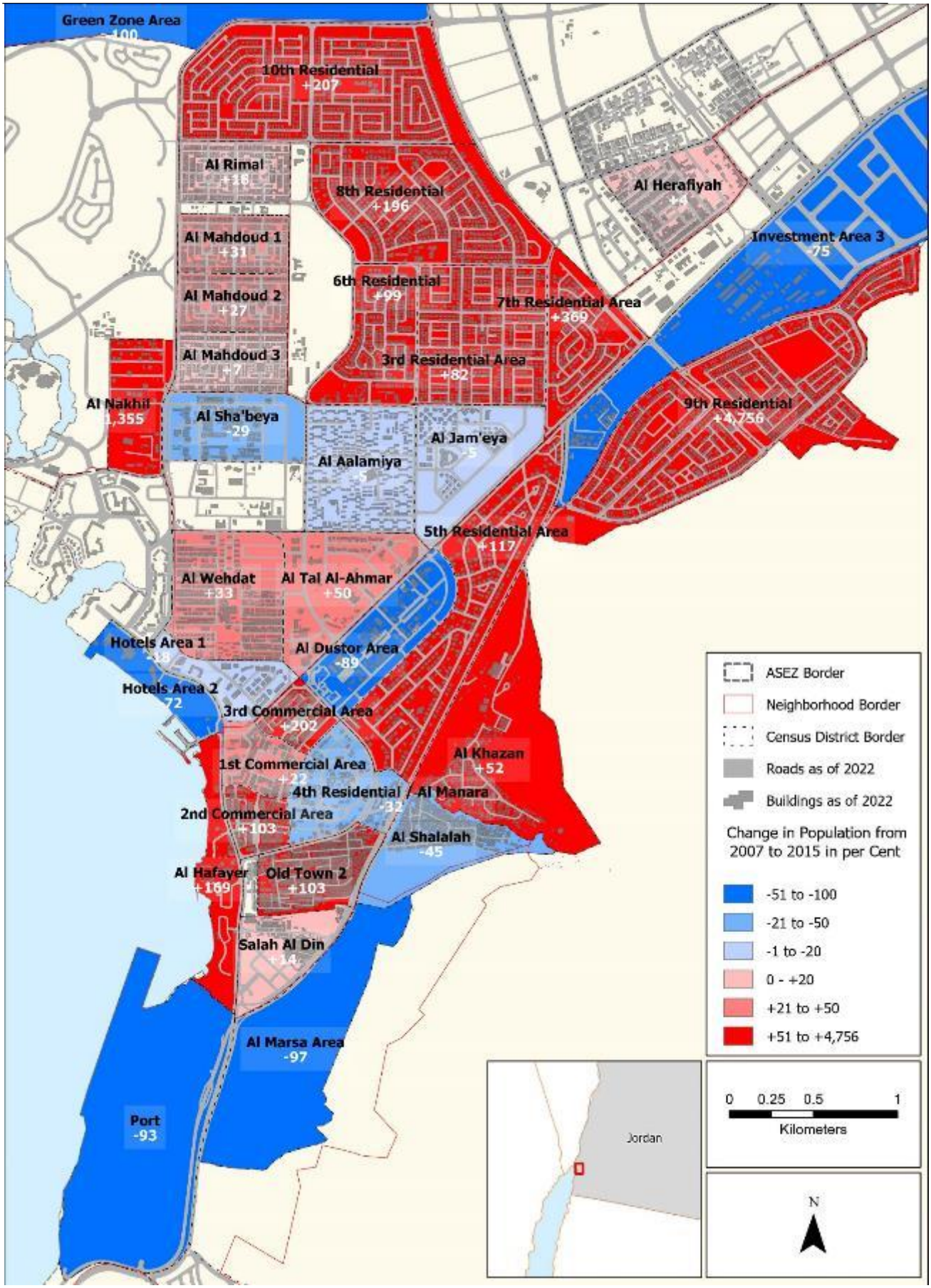
4) Secular Change

Population change rates have been identified in Figure 3-23 Population Change by Neighborhood in Central ASEZ (%) and Figure 3-24 Population Change by Neighborhood in ASEZ (%), to understand the changes in population growth between 2007 and 2015. The areas shown in red are where the populations have increased, and areas in blue are where they have decreased. The darker-colored areas are where the rates have risen by 50% or over in the eight-year period.

Areas experiencing significant population growth include those along the public beach in the city center, the hillside area in the east, and the northern area. A broader analysis reveals that the surrounding area of Ashamiyyeh in the northeast is undergoing noticeable changes, indicating a trend of housing spreading towards the east and northeast direction.

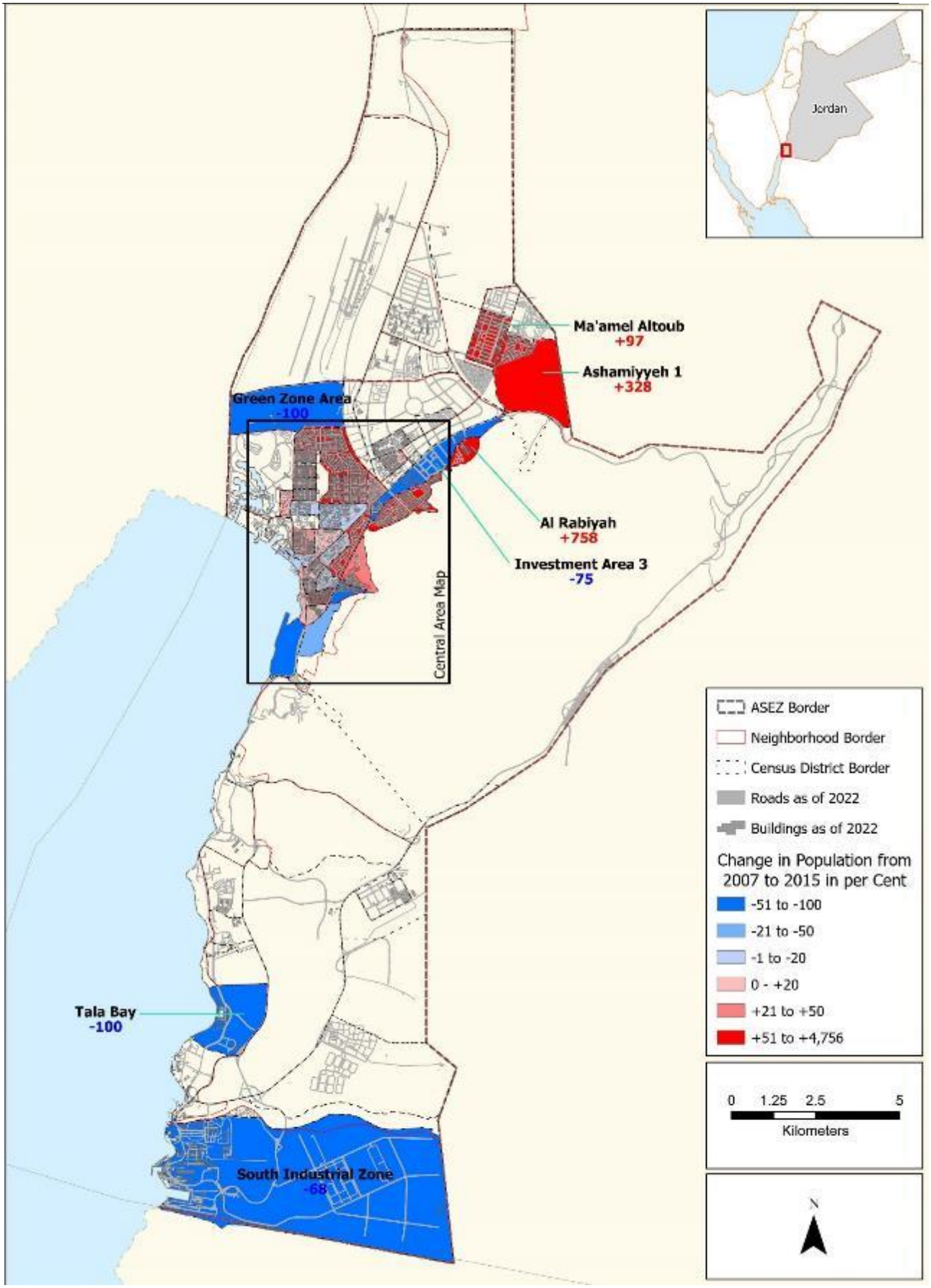
In Contrast, many blocks have experienced a decline in population. For example, Al Dustor area, Investment area 3, Green zone area and South Industrial area have all shown more than 50% decline in population compared to the significant growth in their neighboring areas. This is likely due to population relocation as a result of proper land use planning and development in the area. Hotels area 1 and 2, Al Marsa area, Port area (site for the Marsa Zayed project), and Tala Bay in the southern part of the city have seen developments of hotel resorts and large-scale resorts, which may have led to the relocation of residences.

Declines are also seen in the 4th Residential/Al-Manara and Alshallaleh areas adjacent to Old Town, and Al Sha'beya, the relatively older residential areas in the city center.



Source: JICA study team based on 2007 and 2015 census data from DOS.

Figure 3-23 Population Change by Neighborhood in Central ASEZ (%)



Source: JICA study team based on 2007 and 2015 census data from DOS.

Figure 3-24 Population Change by Neighborhood in ASEZ (%)

(3) Household and Housing

1) Household size

The average household size in Aqaba as of 2015 was 4.9 persons. A breakdown of the number of households per head of household is shown in the table below.

Table 3.17 Private Households by Number of Household Members

Number of Household Members	1	2	3	4	5	6	7	8	9	10+	Total
Number of Households	2,252	4,324	5,171	6,491	6,272	5,645	3,410	1,877	1,057	860	37,359
Ratio	6.0%	11.6%	13.8%	17.4%	16.8%	15.1%	9.1%	5.0%	2.8%	2.3%	100.0%

Source: JICA study team based on 2015 census data from DOS.

2) Housing

In terms of housing types in urban areas of Aqaba, Apartment account for the majority (88.9%), followed by Dar (8.7%), which is a private building housing a family, and a small number of Villa, which is a single story attached property with walls and a garden, and mobile homes. Vacancy rates were 30.0% for Apartments, 24.0% for Dar, and 40.0% for Villa.

According to the type of ownership of conventional housing with residents in urban areas as of 2015, rental (unfurnished) was the most common type of ownership at 49.2%, which together with rental (furnished) indicates that more than 50% of the housing units are rented. Housing owned by household members accounted for 41.6% of all housing units. As of 2004, company housing accounted for 15.3% of all housing units in which the number and percentage had decreased by 2015. The most common rent per month for rental housing is around 100-299 JOD.

The percentage of conventional housing in urban areas by year of laying fundaments shows that 56.8% of the total number of conventional housing units were built in an unknown year, indicating that the exact age of the housing units cannot be determined. After checking with experts at the University of Jordan, it was confirmed that buildings constructed prior to the enactment of the 2005 seismic-resistant buildings code are likely to have seismic problems, and since Aqaba is believed to have many older buildings, whose exact age cannot be ascertained, it is inferred that the city is highly vulnerable to earthquakes.

Concrete (35.3%) is the most common material used for the exterior walls of urban homes, followed by cement brick (35.2%), cut stone and concrete (14.9%), and cut stone (12.8%).

Table 3.18 Housing Unit Breakdown in Urban area (2015)

Type of Housing		Households			Housing Units		
		Collective	Private	Total	Total	Ratio	Vacancy rate
Conventional	Apartment	578	28,866	29,444	39,076	88.9%	30.0%
	Dar	7	2,985	2,992	3,846	8.7%	24.0%
	Villa	-	49	49	80	0.2%	40.0%
Mobile	Tent/ Hair Tent	-	87	87	88	0.2%	3.4%
	Caravan	2	8	10	35	0.1%	77.1%
Marginal	Barracks	-	41	41	83	0.2%	55.4%
Others*		19	166	185	747	1.7%	-
Total		606	32,202	32,808	43,955	100.0%	-

Source: JICA study team based on 2015 census data from DOS. (*Others include buildings under construction which the type of housing is not yet specified)

Table 3.19 Occupied Conventional Housing Units by Type of Tenure in Urban area (2004, 2015)

	2004		2015		Change in ratio
	Number	Ratio	Number	Ratio	
Owned by the Household or HH Member	5,310	33.9%	12,623	41.6%	+7.7%
Owned by a Relative	486	3.1%	377	1.2%	-1.9%
Rented (Unfurnished)	7,319	46.7%	14,924	49.2%	+2.5%
Rented (Furnished)	66	0.4%	1,003	3.3%	+2.9%
In Return for Work	2,388	15.3%	1,096	3.6%	-11.6%
Free	83	0.5%	189	0.6%	+0.1%
Others	4	0.0%	97	0.3%	+0.3%
Unspecified	0	0.0%	11	0.0%	0.0%
Total	15,656	-	30,320	-	-

Source: JICA study team based on 2004 and 2015 census data from DOS.

Table 3.20 Occupied Rented Conventional Housing Units by Monthly Rent Value (JOD)

	0-20JOD	20-49JOD	50-99JOD	100-149JOD	150-199JOD	200-299JOD	300-399JOD	400-499JOD	500JOD	Total
Monthly Rent Value	249	407	1,900	4,733	4,539	3,680	690	148	147	16,493
Ratio	1.5%	2.5%	11.5%	28.7%	27.5%	22.3%	4.2%	0.9%	0.9%	100.0%

Source: JICA study team based on 2015 census data from DOS.

Table 3.21 Conventional Buildings by Year of Laying Fundaments (2015)

	Before 1950	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2015	Unspecified
Amarah	3	20	29	147	681	746	1,021	1,392	3,051
Dar	50	3	48	18	104	257	365	658	4,314
Villa	0	0	0	0	1	11	22	30	16
Total	53	23	77	165	786	1,014	1,408	2,080	7,381
	0.4%	0.2%	0.6%	1.3%	6.1%	7.8%	10.8%	16.0%	56.8%

Source: JICA study team based on 2015 census data from DOS.

Table 3.22 Buildings by Main Material of External Walls in Urban area (2015)

	Cut Stone	Cut Stone & Concrete	Concrete	Cement Bricks	Mud Bricks & Stones	Others	Unspecified
Amarah	1300	1613	2338	1829	0	9	1
Dar	358	362	2214	2837	44	2	0
Villa	46	28	5	1	0	0	0
Establishment	144	139	569	445	8	188	0
Hotel/ Collective Housing Unit	19	20	7	12	0	5	6
Total	1,867	2,162	5,133	5,124	52	204	7
Ratio	12.8%	14.9%	35.3%	35.2%	0.4%	1.4%	0.0%

Source: JICA study team based on 2015 census data from DOS.

3) Household Income and Expenditure

The average annual household income in Aqaba is 10,303.3 JOD, lower than the national average of 11,241.9 JOD, being the sixth highest governate. The breakdown shows that income from employment (salary income), at JOD 5,774.8, is well above the national average and the highest among the governates, but below the national average in other categories.

The average annual household expenditure in Aqaba in 9,447.9JOD, lower than the national average of 12,236.3 JOD. The breakdown shows that Food Groups (32.7%), Housing, Water, Electricity and Gas (23.6%), and Transport (16.7%) account for a larger share of expenditures.

Table 3.23 Average of Annual Current Household Income by Source of Income (JOD)

	Income from Employment	Incomes from Own Private Work	Rentals Incomes	Property Incomes	Transactions Incomes	Average Total Income
Amman	4,803.5	1,281.0	2,450.9	175.4	3,944.4	12,657.2
Balqa	5,015.7	1,095.4	1,763.9	111.9	3,463.5	11,450.9
Zarqa	3,979.0	858.2	1,370.8	30.0	3,324.3	9,562.6
Madaba	4,403.4	736.0	1,558.3	6.0	3,710.1	10,413.9
Irbid	3,959.4	727.3	1,586.6	29.9	4,127.5	10,432.0
Mafraq	4,000.0	547.3	1,239.2	40.2	3,311.9	9,138.7
Jarash	4,141.2	822.2	1,050.2	2.2	3,061.7	9,077.6
Ajlun	3,845.7	392.2	1,041.6	10.1	4,756.6	10,050.6
Karak	4,828.1	785.7	1,230.1	9.8	4,877.3	11,755.3
Tafiela	4,921.7	514.8	1,245.4	36.7	3,414.6	10,133.2
Ma'an	4,334.5	515.1	1,299.8	50.9	3,374.8	9,575.9
Aqaba	5,774.8	560.6	1,255.9	0.8	2,711.3	10,303.3
Kingdom	4,490.5	980.3	1,861.5	94.2	3,813.3	11,241.9

Source: DOS, Household Expenditures & Income Survey 2017

Table 3.24 Average of Annual Household Expenditure (JOD)

Commodities and Services	Aqaba		Kingdom	
	Expenditure	Ratio	Expenditure	Ratio
Food Groups	3,135.3	33.2%	3,996.4	32.7%
Clothing and Footwear	311.7	3.3%	503.4	4.1%
Housing, Water, Electricity and Gas	2,634.9	27.9%	2,891.5	23.6%
Furniture, Carpets and Placemats	73.1	0.8%	153.2	1.3%
Household appliances	59.5	0.6%	96.2	0.8%
Housewares	18.9	0.2%	41.4	0.3%
Cleaning materials	105.9	1.1%	153.4	1.3%
Domestic services	53.3	0.6%	137.9	1.1%
Health	176.4	1.9%	497.3	4.1%
Transport	1,594.6	16.9%	2,037.7	16.7%
Communication	247.9	2.6%	344.6	2.8%
Recreation and Culture	109.5	1.2%	321.1	2.6%
Education	593.4	6.3%	570.8	4.7%
Miscellaneous goods and services	333.5	3.5%	491.3	4.0%
Total	9,447.9	100.0%	12,236.3	100.0%

Source: DOS, Household Expenditures & Income Survey 2017

According to the most recent poverty rate survey conducted by DOS in Household Expenditure and Income Survey 2010, the absolute poverty rate (Percentage of people who do not have enough income or spending level to afford minimum food and non-food necessities) in Aqaba was 19.2%, higher than the national average of 14.4% and Amman's 11.4%.

This indicator is called the headcount ratio, which is the number of people whose per capita expenditures fall below the absolute poverty line (JD.814 per year) divided by the total population of the country. When compared by province, Amman had the lowest poverty rate at 11.4%, followed by Karak at 13.4% and Zarqa at 14.1%. Ma'an had the highest poverty rate at 26.6%, followed by Ajlun at 25.6%, Balqa at 20.9%, and Jarash at 20.3%. Aqaba ranks in the middle of the pack.

Table 3.25 Absolute Poverty Rate (%)

	1997	2002	2006	2008	2010
Amman	19.6	9.2	9.4	8.3	11.4
Balqa	21.8	17.8	15.3	19.7	20.9
Zarqa	16.3	22.3	14.9	11.2	14.1
Madaba	23.9	10.7	10	14.9	15.1
Irbid	26	13.8	12.1	14.7	15
Mafraq	35.9	25.4	23	31.9	19.2
Jarash	19.2	18.4	16.7	20.3	20.3
Ajlun	17.3	9.7	17.7	13.3	25.6
Karak	13	12.2	21.7	17.1	13.4
Tafiela	24.3	10.6	19.1	21.1	17.2
Ma'an	37.3	24.1	12.7	24.2	26.6
Aqaba	17	15.2	15.5	11.8	19.2
Kingdom	21.3	14.2	13	13.3	14.4

Source: DOS, Household Expenditures & Income Survey

3.2.2 Society

(1) Social Environments

1) Human Development Index

Jordan's Human Development Index (HDI) in 2021 is 0.72 (ranked 102nd out of 191 countries), which is categorized as "high," the second highest of the four levels. Among neighboring countries, Israel and Saudi Arabia are classified as "very high," while Egypt and Lebanon are at the same level as Jordan.

Table 3.26 Human Development Indices for Jordan and Neighboring Countries (2021)

	Jordan	Israel	Saudi Arabia	Egypt	Lebanon	Iraq	Syria
Overall ranking	102	22	35	97	112	121	150
HDI	0.720 (High)	0.919 (Very high)	0.875 (Very high)	0.731 (High)	0.706 (High)	0.686 (Moderate)	0.577 (Moderate)
Life expectancy	74.3 years	82.3 years	76.9 years	70.2 years	75.0 years	70.4 years	72.1 years
Expected years of schooling	10.6 years	16.1 years	16.1 years	13.8 years	11.3 years	12.1 years	9.2 years
Average years of schooling	10.4 years	13.3 years	11.3 years	9.6 years	8.7 years	7.9 years	5.1 years
Purchasing Power Parity Gross National Income (GNI) per capita	9,924$.	41,524$	46,112$.	11,732$	9,526$.	9,977$.	4,192$
Gini coefficient	17.9	23.1	N/A	36.5	N/A	12.7	N/A
Gender inequality index	0.471	0.083	0.247	0.443	0.432	0.558	0.477

Source: prepared by study team based on Human Development Report 2021/2022, UNDP

1) Lifestyle-Related Indices

The following are various indices concerning Jordan and Aqaba Governorate extracted from the "Jordan Population and Family Health Survey 2017 to 2018" and "Jordan in Figures 2021" published by DOS.

- Sanitation: 98% of the households have access to safe drinking water and sanitary toilets.
- Smoking: 60% of households smoke cigarettes indoors regularly.
- Durable consumer goods: 99% of households own a television, 98% a cell phone, refrigerator, and/or satellite TV dish, 97% a washing machine, and 58% a car or truck.
- Insurance: 55% of households (63% in Aqaba) hold some form of health insurance.
- Poverty: 15.7% of the population lives below the international poverty line.
- Fertility: The total fertility rate is 2.7 (2.6 in Aqaba).
- Infant mortality rate: Although the rate of under-five deaths is improving, it is still 19 per 1,000 live births (10 in Aqaba), of which nearly 60% die within the first month of life.
- Vaccination: The coverage rate for necessary vaccines among infants aged 12 to 23 months is 86%. The rate in Aqaba Governorate is 76%, the second lowest after Ma'an

Governorate.

- Domestic violence: 26% (19% in Aqaba) of women aged 15 to 49 who are or were married have experienced domestic violence (18% for physical violence, 21% for psychological violence, and 5% for sexual violence).
- Waste: Per capita garbage collection is 0.9 Gm/day (0.25 Gm/day in Aqaba). Nationwide, 93% is processed by sanitary landfills, while in the south, 100% is disposed of in open landfills.

(2) Education

1) Enrollment Rate

The table below shows the percentage of school attendance by age group in Aqaba Governorate, broken down by educational stage and by nationality, namely Jordanian and Non-Jordanian. The rate among Jordanians is as high as 95% for those of compulsory school age and more than 75% for those of late secondary school age. On the other hand, the school enrollment rate among non-Jordanians is relatively low, and the rate of unschooled children is more than 17% among those of compulsory school age.

While no significant difference is identified in enrollment rates between male and female Jordanians, female enrollment rates among non-Jordanians are more than 5% lower than for males in all periods except in the compulsory education period, with the difference becoming larger as the educational level increases.

Table 3.27 Enrolment Rates by Age Group in Aqaba Governorate (2015)

	Jordanian (person)			Non-Jordanian		
	In school	Has attended school	No schooling experience	In school	Has attended school	No schooling experience
4-5 years old (equivalent to preschool education)	55.7%	0.6%	43.6%	44.5%	1.6%	**53.9%**
6-15 years old (equivalent to elementary and early secondary education) *Compulsory education	95.0%	2.4%	2.6%	82.6%	7.4%	**10.0%**
16-17 years old (equivalent to late secondary school)	75.8%	21.7%	2.5%	51.3%	36.7%	**12.0%**
18-29 years old (equivalent to higher education)	17.1%	78.2%)	4.7%	5.0%	65.0%	**30.1%**

Source: Prepared by JICA study team from DOS census data.

2) Educational Standards

The table below outlines the educational level of Jordanians in the productive-age population (15 to 64) in Aqaba Governorate. The overall percentage of those surveyed with no educational experience was 20.9%, with a higher percentage for women. Overall, 59% have completed secondary education or higher, and 18.2% earned a bachelor/associate degree or higher, with no significant differences seen between males and females. The overall literacy rate is 91.4%.

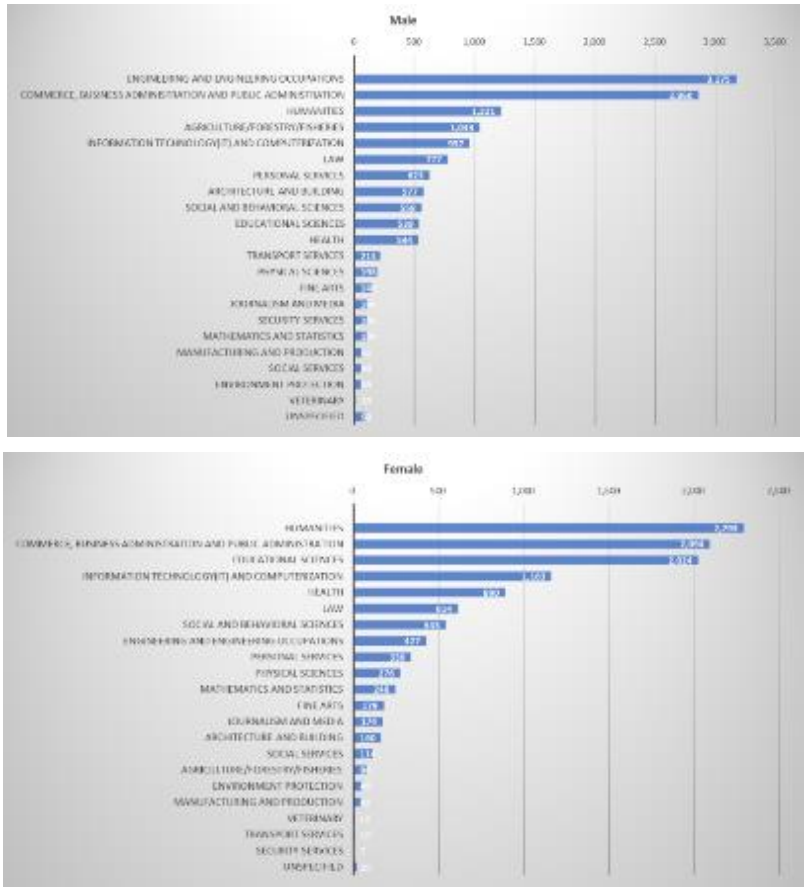
Table 3.28 Education level of productive-age Jordanians not currently in school in Aqaba Governorate (2015)

	Male		Female		Both	
	Number of people	Rate	Number of people	Rate	Number of people	Rate
No education (illiterate)	1,931	5.7%	4,390	13.6%	6,321	9.6%
No education (literate)	2,384	7.1%	5,069	15.7%	7,453	11.3%
Elementary education and below	10,922	32.5%	7,711	23.9%	18,633	28.3%
Job training	762	2.3%	120	0.4%	882	1.3%
Secondary education	11,034	32.8%	9,290	28.8%	20,324	30.9%
Intermediate specialist	2,792	8.3%	3,767	11.7%	6,559	10.0%
Bachelor's/associate's degree	5,260	15.7%	6,039	18.8%	11,299	17.2%
Master's degree or higher	445	1.3%	208	0.6%	653	1.0%

Source: Prepared by JICA study team from DOS census data.

3) Educational Field

In order to understand the capacity of human resources by sector in Aqaba Governorate, the population that has earned a university degree or higher in the governorate was organized by gender in terms of their educational field. Many students of both genders completed courses in commerce, business administration and public administration, humanities, information technology (IT) and computers; courses in engineering and engineering occupations, agriculture/forestry/fisheries are more common among male students and courses in educational sciences and health are more common among female students.



Source: Prepared by JICA study team from DOS census data.

Figure 3-25 Fields of education by population completing a university degree or higher in Aqaba Governorate (2015, persons)

(3) Work

1) Labor Force and Unemployment Rate

According to the 2015 census, Aqaba Governorate has a combined labor force of 68,531 workers and job seekers and an overall unemployment rate of 15.7%, which is the fourth lowest after Amman Governorate and its urban areas, Zarqa and Barqa Governorates. The unemployment rate by gender is 11.5% for men and 37.9% for women, with a higher unemployment rate for women as in other governorates. Note that the unemployment rate has been on the rise since 2015, and partly due to the COVID-19 pandemic, the overall unemployment rate for Jordanians alone is 24.1% (22.4% for men and 30.7% for women) according to the Labor Force Survey in 2021. Aqaba Governorate is the fourth lowest at 23.4% after Karak (18.6%), Ajlun (22.3%), and Zarqa (22.8%).

The unemployment rate by age group in Aqaba Governorate shows that the rate is more than 10% for the age groups of 29 and under and of 55 and above, indicating that it tends to be particularly high among the younger and older age groups. For women, unemployment rates are higher in all age groups, but similarly, unemployment rates are particularly high among younger and older age groups. Note that nationwide figures from the 2015 census and the 2021 Labor Force Survey do not show significant differences in unemployment rates by education level.

Table 3.29 Working population and unemployment rate by governorate, Jordan (2015)

Name of a governorate	Number of persons employed	Number of job seekers	Labor force	Unemployment rate (overall)	Unemployment rate (male)	Unemployment rate (female)
Amman	1,156,178	143,820	1,299,998	11.1%	8.5%	21.7%
Zarqa	316,144	54,364	370,508	14.7% %	11.8	32.5%
Balqa	139,248	24,638	163,886	15.0%	10.9%	30.5%
Aqaba	**57,751**	**10,780**	**68,531**	**15.7%**	**11.5%**	**37.9%**
Jerash	51,797	13,369	65,166	20.5%	13.5%	47.7%
Irbid	357,814	100,290	458,104	21.9%	15.7%	47.1%
Madaba	47,052	13,533	60,585	22.3%	15.8%	42.4%
Karak	84,091	27,028	111,119	24.3%)	16.0%	43.9%
Ajloun	37,172	13,318	50,490	26.4%	17.2%	53.1%)
Ma'an	34,145	12,765	46,910	27.2%	21.2%	46.1%
Tafilah	23,061	8,950	32,011	28.0%	18.8%	52.4%
Mafraq	89,452	41,183	130,635	31.5%	25.3%	53.6%
Jordan	2,393,905	464,038	2,857,943	16.2%	12.0%	33.4%

Source: Prepared by JICA study team from DOS census data.

Table 3.30 Working population and unemployment rates by 5-Year age groups in Aqaba Governorate (2015)

Age	Number of persons employed	Number of job seekers	Labor force	Unemployment rate (overall)	Unemployment rate (male)	Unemployment rate (female)
15 - 19	2,057	1,885	3,942	47.8%	44.0%	70.4%
20 -24	7,426	3,253	10,679	30.5%	22.5%	63.8%
25-29	11,090	2,106	13,196	16.0%	9.7%	42.4%
30 - 34	10,431	1,130	11,561	9.8%	5.4%	29.2%
35 - 39	8,938	748	9,686	7.7%	5.2%	21.5%
40 - 44	7,016	525	7,541	7.0%	4.8%	19.5%
45 - 49	5,157	420	5,577	7.5%	6.3%	17.2%
50 - 54	3,133	288	3,421	8.4%	7.5%	17.3%
55 - 59	1,466	184	1,650	11.2%	9.5%	30.2%
60 - 64	627	106	733	14.5%	13.3%	27.6%
65 - 69	243	67	310	21.6%	18.6%	56.0%
70 - 74	106	46	152	30.3%	25.9%	76.9%
75 - 79	45	12	57	21.1%	11.8%	100.0%
80 +	16	10	26	38.5%	30.4%	100.0%

Source: Prepared by JICA study team from DOS census data.

Comparing the labor force populations in 2004 and 2015, the total number has grown by 37,675 over the 11-year period, with the annual growth rate being 7.5%. Looking more in detail, the number of those employed has increased by 32,339 (annual growth rate:7.7%), job seekers by 5,336 (annual growth rate: 6.4%), and the overall unemployment rate has decreased by 1.9 percentage points. The labor force participation rate (or economic activity rate), which indicates the percentage of working people among the total population aged 15 and over was 55.6% in 2015, higher than the National average at 46.7%. However, the BCG report points out that target for job creation in ASEZ was not achieved, while the target was 70,000 and the actual number was 25,000.

Table 3.31 Changes in labor force and other populations in Aqaba Governorate

Year	Number of persons employed	Number of job seekers	Labor force	Economic activity rate	Unemployment rate (overall)	Unemployment rate (male)	Unemployment rate (female)
2004	25,412	5,444	30,856	49.7%	17.6%	13.3%	44.1%
2015	57,751	10,780	68,531	55.6%	15.7%	11.5%	37.9%
Fluctuation	+32,339	+5,336	+37,675	+6.0%	-1.9%.	-1.8%.	-6.2%
Increase Rate	7.7%	6.4	7.5%	-	-	-	-

Source: Prepared by JICA study team from DOS census data.

2) Type of Employment

In terms of employment status, over 80% of Jordanian men and women, as well as non-Jordanian women, in Aqaba Governorate have obtained permanent (or non-fixed term) employment. However, the percentage of non-Jordanian males with permanent employment is relatively low, and rates of temporary, daily, and casual employment are high. Unfortunately, data on employment status by governate are not available, so we refer to national figures from the Labor Force Survey 2021. For the type of employment, employed persons accounted for the highest percentage at 85.9%, followed by sole proprietors at 9.2%.

Table 3.32 Number of employees by length of employment in Aqaba Governorate, 2015

Nationality	Gender	Permanent employment	Temporary employment	Seasonal labor	Day laborers, temporary employees, etc.
Jordanian (person)	Male	20,612(80.1%)	3,887(15.1%)	299(1.2%)	925(3.6%)
	Female	4,427(81.6%)	852(15.7%)	48(0.9%)	98(1.8%)
Non-Jordanian	Male	11,704(46.5%)	10,034(39.9%)	618(2.5%)	2,795(11.1%)
	Female	9,311(86.9%)	841(7.9%)	408(3.8%)	151(1.4%)

Source: Prepared by JICA study team from DOS census data.

Table 3.33 Number of Jordanians by the type of employment (15 years old and over, 2021)

Sector	Male	Female	Overall
Employer	5.0%	1.2%	4.3%
Employee	83.5%	96.4%	85.9%
Sole proprietor	10.8%	2.2%	9.2%
Paid internship	0.1%	0.1%	0.1%
Participation in the family business	0.6%	0.1%	0.5%

Source: Prepared by JICA study team from Figure of Jordan, Labor Force Survey 2021

3) Type of Occupation

Although there is no specific data available for Aqaba Governorate, trends can be analyzed based on national data from the Labor Force Survey 2021. According to the data by sector, 38.8% of employed Jordanians work in the public sector while 60.4% work in the private sector. In terms of occupation, the majority were professionals (28.7%), followed by service and sales workers (28.3%), and craft and related distribution workers (12.9%). By industry, the survey showed that many respondents were engaged in public administration, national defense, and social security related industries (25.5%), wholesale trade, retail trade, and repair of motor vehicles and motorcycles (14.7%), education (12.8%), and manufacturing (10.8%).

According to the previous JICA study, "Data Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan 2021 (hereafter referred to as JICA Trade and Investment Survey 2021), there are gaps in the engagement status between Jordanians and non-Jordanians depending on the industry. In the tourism industry, Syrian refugee men are increasingly replacing Jordanians as the main labor force in restaurants and other service industries. Other characteristics of the major labor force include Egyptian men and Syrian refugee families in agriculture, Jordanian men and South Asian women (Bangladeshi, Sri Lankan, Indian, and Nepalese) in manufacturing, Jordanian and Egyptian men and Syrian refugee men in construction, and South and East Asian women in domestic work such as housekeeping.

The same study also indicates that as of 2010, the informal sector accounted for 44% of the employed population and 51% of the total private sector worldwide, according to a UN survey. Therefore, it is important to recognize the existence of large amount of informal sector in Jordan, which may not be reflected in the available data.

Table 3.34 Jordanian employment percentage by sector (15+, 2021)

Sector	Male	Female	Total
Public Sector	36.3%	49.3%	38.8
Private Sector	63.2%	48.1%	60.4%
International organization	0.5%	2.0%	0.8%
Family business	0.0	0.6%	0.1%

Source: JICA study team from Figure of Jordan, Labor Force Survey 2021

Table 3.35 Percentage of Jordanians employed by occupation (15+, 2021)

Type of occupation	Rate
Legislators, Senior officials, Managers	0.4%
Professions	**28.7%**
Engineers, Associate Engineers	6.8%
Clerks	5.1%
Service and salespersons	**28.3%**
Craft and related distribution workers	**12.9%**
Plant and machine operators, Assemblers	9.4%
Skilled workers in agriculture, forestry, and fisheries	1.5%
Casual laborers	6.9%

Source: JICA study team from Figure of Jordan, Labor Force Survey 2021

Table 3.36 Percentage of Jordanians employed by industry (15+, 2021)

Type of industry	Rate
Agriculture, Forestry, Fishing	1.9%
Mining and quarrying	0.7%
Manufacturing	**10.8%**
Electricity, gas, steam, and air conditioning supply	0.7%
Water, sewerage, waste management and remediation	0.5%
Construction	5.0%
Wholesale, Retail trade, Repair of motor vehicles and motorcycles	**14.7%**
Transportation and warehousing	6.8%
Accommodation, Food and beverage services	2.9%
Information and communication industry	1.8%
Finance and insurance	1.9%
Real estate business	0.4%
Professional, scientific, and technical activities	2.7%
Administrative and support services	1.7%
Public administration, National defense and social security related industries	**25.5%**
Education or schoolwork	**12.8%**
Health and Social welfare	5.4%
Arts, Entertainment and Recreation	0.4%
Other service activities	2.7%
Activities of households as employers, Service production activities for household self-sufficiency	0.3%
Activities of out-of-region organizations and groups	0.5%

Source: JICA study team from Figure of Jordan, Labor Force Survey 2021

4) Income Level

The table below presents the percentage of Jordanian workers by monthly income in Aqaba Governorate and the country. Notably, the percentage of Jordanian workers earning JOD 500 or more per month in Aqaba is the highest in the country, at 27.9%. Moreover, the percentage of those earning less than JOD 200 per month in Aqaba is the lowest in the country, at 1.3%, indicating that the income level in Aqaba is relatively high compared to other regions in Jordan. Additionally, data from the Labor Force Survey 2021 reveals that the average monthly wage by sector in the country is JOD 631 in the public sector and JOD 484 in the private sector, indicating that the average wage in the public sector is JOD 147 higher.

Table 3.37 Percentage of Jordanians' monthly income by governorate (15+, 2021)

Governorate	Less than JOD 200	JOD 200-299	JOD 300-499	JOD 500 or more
Aqaba	**1.3**	**16.6**	**54.2**	**27.9**
Karak	2.0	7.7	65.3	25.0
Tafilah	1.8	8.8	65.0	24.5
Amman	3.8	21.1	52.3	22.9
Madaba	4.1	21.1	56.6	18.2
Irbid	7.4	20.8	55.1	16.8
Balqa	5.3	22.0	57.0	15.6
Ma'an	2.6	11.4	71.0	15.0
Mafraq	5.1	19.0	61.5	14.5
Jerash	6.0	17.9	62.5	13.7
Ajloun	4.2	13.2	70.2	12.4
Zarqa	6.9	26.6	56.8	9.7
Jordan	4.9	20.3	56.2	18.6

Source: JICA study team from DOS Tables of Employment and Unemployment 2021.

Table 3.38 Average monthly wages of Jordanians by sector (15+, 2021)

Sector	Male (JOD)	Female (JOD)	Overall (JOD)
Public sector	662	579	631
Private sector	502	431	484

Source: JICA study team from Figure of Jordan, Labor Force Survey 2021

3.2.3 Economy

(1) Gross Domestic Product (GDP) and Gross Regional Domestic Product (GRDP)

1) Gross Domestic Product of Jordan

The following table presents data on changes in GDP and GDP per capita in Jordan over the last 10 years. Although GDP growth has generally hovered around the 2%-mark, nominal GDP in 2021 amounted to US$45,744.3 million. Between 2000 and 2009, Jordan experienced strong economic expansion, with an average GDP growth rate of 6.5%. However, the country has since been plagued by economic stagnation due to factors such as instability in the Middle East following the Arab Spring, financial deterioration brought on by the influx of refugees from Syria, and other factors. In 2020, Jordan's growth rate was -1.6% due to the severe impact of the COVID-19 pandemic on the country's tourism industry, which is one of the main drivers of its economy.

As the regional level, Saudi Arabia has the largest GDP in the Middle East and North Africa region, followed by Iran and Egypt. The United Arab Emirates (UAE), Iraq, and Algeria follow as the next largest economies, with similar sizes. Jordan has the 13th largest GDP in the region. It is important for Jordan to strengthen its economic ties with neighboring Middle Eastern and African countries to tap into nearby markets.

Table 3.39 GDP and GDP per capita of Jordan

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GDP (Nominal, USD million)	31,634.6	34,454.4	36,847.6	38,587.0	39,892.6	41,608.4	43,370.9	44,994.0	44,182.3	45,744.3
GDP (Nominal, JOD million)	22,460.5	24,462.7	26,161.8	27,396.8	28,323.7	29,542.0	30,793.3	31,945.7	31,369.4	32,478.4
GDP growth rate (annual rate, %)	2.4	2.6	3.4	2.5	2.0	2.5	1.9	1.9	-1.6	2.2
GDP per capita (Nominal, USD)	4,386.5	4,477.6	4,255.9	4,064.3	4,003.4	4,073.1	4,146.4	4,205.6	4,042.8	4,103.3
GDP per capita (Nominal, JOD)	3,114.4	3,179.1	3,021.7	2,885.6	2,842.4	2,891.9	2,943.9	2,986.0	2,870.4	2,913.3
GDP per capita Growth rate (annual rate, %)	1.0	-3.8	-8.1	-6.5	-2.8	0.0	-0.5	-0.3	-3.6	0.2

Source: Compiled by JICA study team from World Development Indicator (WB)

2) GDP Structure

Jordan's major industry is the tertiary sector, which is estimated to account for 45% of the country's GDP in 2021. The real estate sector makes a significant contribution to the GDP, followed by the secondary sector, which accounts for 24.2%, largely due to the manufacturing industry. The primary sector contributes only 4.9% to the GDP, likely because most of the country's land is covered by desert and only a small portion is suitable for cultivation. The Jordan 2025 plan aims to increase the share of GDP contributed by agriculture, industry, and construction by 2025.

In addition, according to the JICA Trade and Investment Survey 2021, approximately 1 million Jordanians, or about 10% of the Jordanian population, were living outside the country before the COVID-19 pandemic. Overseas remittances to Jordan in 2019 reached USD 3.7 billion, equivalent to about 10% of the country's GDP, making it one of the main sources of acquiring foreign exchange. Of those living abroad, 61.4% reside in Saudi Arabia, 14.1% in the UAE, and 12.5% in Qatar, with the majority reportedly working in the healthcare, IT, and financial sectors as highly skilled and qualified human resources. The Jordan Strategy Forum, a leading think tank on economic development in Jordan, has also conducted a study showing that the informal sector accounted for 15.2% of the country's GDP in 2015, or about JOD 4 billion.

Table 3.40 Estimated GDP contribution by sector, in real price terms (2021, 2016=100)

Industrial Segment	Industry	2021 Contribution rate (%)		2016 Contribution rate (%)	
		By industry	By industry sector	By industry	By industry sector
Primary industry	Agriculture, Hunting, Forestry, Fishing	4.9	4.9	4.5	4.5
Secondary industry	Mining and quarrying	2.2	24.2	1.8	24.6
	Manufacturing	17.4		18.0	
	Electricity and water	1.8		1.8	
	Construction	2.8		3.0	
Tertiary industry	Wholesale, Retail	7.9	45.0	8.2	44.3
	Restaurants, Hotels	1.3		1.4	
	Transportation, warehousing and telecommunications	8.4		8.5	
	Finance and Insurance	7.6		6.8	
	Real estate	11.2		10.9	
	Community, social and personal services	8.6		8.5	
Other	Government services, Bank fees, Taxes, etc.	25.8	-	26.6	

Source: JICA study team from Jordan Statistical Yearbook 2021.

Table 3.41 Estimated GDP growth by sector, in real prices (2021, 2016=100)

Industrial Segment	Industry	2016	2017	2018	2019	2020	2021
Primary industry	Agriculture, Hunting, Forestry, Fishing	3.8	4.8	3.2	2.6	1.6	2.8
Secondary industry	Mining and quarrying	-12.2	13.0	0.5	5.5	0.8	8.8
	Manufacturing	1.3	1.0	1.4	1.2	-2.7	2.3
	Electricity and water	11.0	2.5	2.2	1.8	-1.4	1.8
	Construction	0.9	-1.1	-0.3	-0.4	-3.8	3.8
Tertiary industry	Wholesale, Retail	1.5	1.6	1.3	1.0	-2.3	2.2
	Restaurants, Hotels	-1.0	1.1	1.0	1.2	-8.2	2.7
	Transportation, warehousing & telecommunications	2.9	2.7	3.2	3.2	-5.2	2.3
	Finance and Insurance	5.2	3.8	3.4	3.6	3.0	4.2
	Real estate	2.3	2.6	2.5	2.5	0.5	1.4
	Community, social and personal services	15.4	3.8	3.8	3.3	-3.3	1.0

Source: JICA study team from Jordan Statistical Yearbook 2021

3) Gross Regional Domestic Product of Aqaba Governorate

Since data on GRDP for Aqaba Governorate is not publicly available, the GRDP was estimated based on the contribution of Aqaba Governorate to GDP, as mentioned in the ASEZA budget report. In 2021, Aqaba's contribution to GDP is 13.7%, and therefore its GRDP is estimated at USD 6,267 million.

Table 3.42 Estimated GRDP of Aqaba Governorate

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
GDP (Nominal, USD million)	31,634.6	34,454.4	36,847.6	38,587.0	39,892.6	41,608.4	43,370.9	44,994.0	44,182.3	45,744.3
Aqaba Governorate's contribution to GDP (%)	20.6	20.6	20.6	13.5	14.0	14.0	14.0	14.2	13.6	13.7
Estimated GRDP of Aqaba Governorate (Nominal, USD million)	6,516.7	7,097.6	7,590.6	5,209.2	5,585.0	5,825.2	6,071.9	6,389.1	6,008.8	6,267.0

Source: Compiled by research team from World Development Indicator (WB), Budgets Law of Government Units, Jordan General Budget Department.

(2) Trade

Information on trade is summarized from JICA Trade and Investment Survey 2021.

1) Free Trade Agreement/FTA

Jordan has Free Trade Agreements (FTAs) with the United States, Canada, Mexico, Turkey, the European Union, Tunisia, Singapore, and the European Free Trade Association (EFTA) countries (Switzerland, Norway, Iceland, and Liechtenstein). However, the Trade Facilitation Indicators published by the OECD suggest that Jordan needs to improve areas such as trade procedures, governance and fairness, availability of information, and involvement of the trade community to enhance its trade relations with these countries and regions.



Source: JICA "Data Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan (2021)"

Figure 3-26 Interregional FTAs (light blue) and bilateral FTAs (dark blue)

Category	Organization	Year in Effect	Member States	Notes
WTO	World Trade Organization	1995	164 countries	Became a member state in 2000
Regional Economic Partnership	Great Arab Free Trade Area Agreement (GAFTA)	1998	18 countries (Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Palestine, Tunisia, UAE, Yemen, Jordan)	The tariff rate in the region has gradually declined since 1998, reaching 0 in January 2005 (Palestine is excluded from the obligation to reduce tariffs)
	Jordan-EU Union Agreement	2002	28 EU member states, Jordan	Agreement to phase out tariffs and barriers on industrial products, agricultural and marine products, dispute resolution, trade in services, establishment of companies, government procurement, intellectual property rights and investment protection
	Jordan-European Free Trade Association (EFTA) Free Trade Agreement	2002	5 countries (Switzerland, Norway, Iceland, Liechtenstein, Jordan)	Agreement to phase out tariffs and barriers on industrial products, agricultural and marine products, government procurement, intellectual property rights, competition, government assistance and dispute resolution
	Agadir Agreement	2007	4 countries (Egypt, Tunisia, Morocco, Jordan)	Aim to revitalize intra-regional trade and promote exports to the EU market by applying cumulative rules of origin among the 4 countries
Bilateral Economic Partnership	Jordan-US Free Trade Agreement	2001	2 countries (Jordan, US)	-
	Jordan-Singapore Free Trade Agreement	2006	2 countries (Jordan, Singapore)	-
	Jordan-Canada Free Trade Agreement	2012	2 countries (Jordan, Canada)	-
REP in negotiation	Jordan-Southern South America Common Market (MERCOSUR) Free Trade Agreement	-	-	-

Source: JICA "Data Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan"

Figure 3-27 FTA Overview

2) Export

a) Export value and sector

In 2018, Jordan's exports were dominated by the consumer goods, which accounted for 55.6% of exported products, followed by crude materials and other intermediate consumer goods, which represented 42.3% of exports. However, the export of high value-added goods, such as parts and accessories, and capital goods were minimal. Although Jordan actively exported primary industry products, including fertilizers (12.4%), light industries such as clothing and sewing (27.1%), food (11.5%), and pharmaceuticals (9.6%), which fall under the consumer goods category, there was less active export of industrial products in the heavy industry and IT sectors, indicating a lack of competitiveness in those areas.

Table 3.43 Jordan's export trends in 2014~2018 (JOD)

	2014	2015	2016	2017	2018
Export Total	5,6163,028	4,797,583	4,394,175	4,490,734	4,661,721
First: Consumer Goods	*(2,712,726)*	*(2,684,860)*	*(2,559,946)*	*(2,574,119)*	*(2,591,309)*
A. Current Consumer Goods					
- Foodstuffs	818,567	776,858	629,098	585,113	535,890
- Pharmaceutical Products	423,676	398,805	467,675	446,911	446,626
- Garments and Textiles	958,002	1,025,261	1,038,905	1,141,776	1,262,678
- Other Current Consumer Goods	344,685	307,652	239,582	251,795	229,817
B. Durable Consumer Goods					
-Small Motor Vehicles for Passengers	-	-	720	-	-
- Other Durable Consumer Goods	167,795	176,282	183,965	148,522	116,296
Second: Crude Materials and Other Intermediate Consumer Goods	*(2,311,060)*	*(1,986,736)*	*(1,742,349)*	*(1,814,059)*	*(1,973,138)*
- Fuels Including Crude Petroleum	184	0.8	189	219	70,810
- Crude Phosphates	332,964	371,630	330,694	281,975	261,772
- Crude Potassium	-	-	-	-	-
- Fertilizers	726,981	586,029	439,901	479,405	577,402
- Construction Materials	94,585	98,972	107,046	114,443	94,911
- Other Intermediate Goods	1,156,343	930,102	864,516	938,016	968,240
Third: Parts and Accessories					
- Parts and Accessories for Aircraft	-	-	-	-	14.5
- Parts and Accessories for Transport Equipment Except Aircraft	8,414	8,338	7,788	5,070	4,515
- Parts and Accessories for Other Machines and Equipment	8,971	10,307	7,390	5,859	4,455
Fourth: Capital Goods					
- Transport Equipment except Small Motor Vehicles	4,127	1,899	2,623	2,169	654
- Other Capital Goods inc. Machinery	116,171	104,879	72,277	79,474	82,977
- Live Animals for Breeding	1,131	323	866	1,131	1,845
Fifth: Other Goods not Classified Elsewhere in H.S.	425	238	933	8,849	2,809

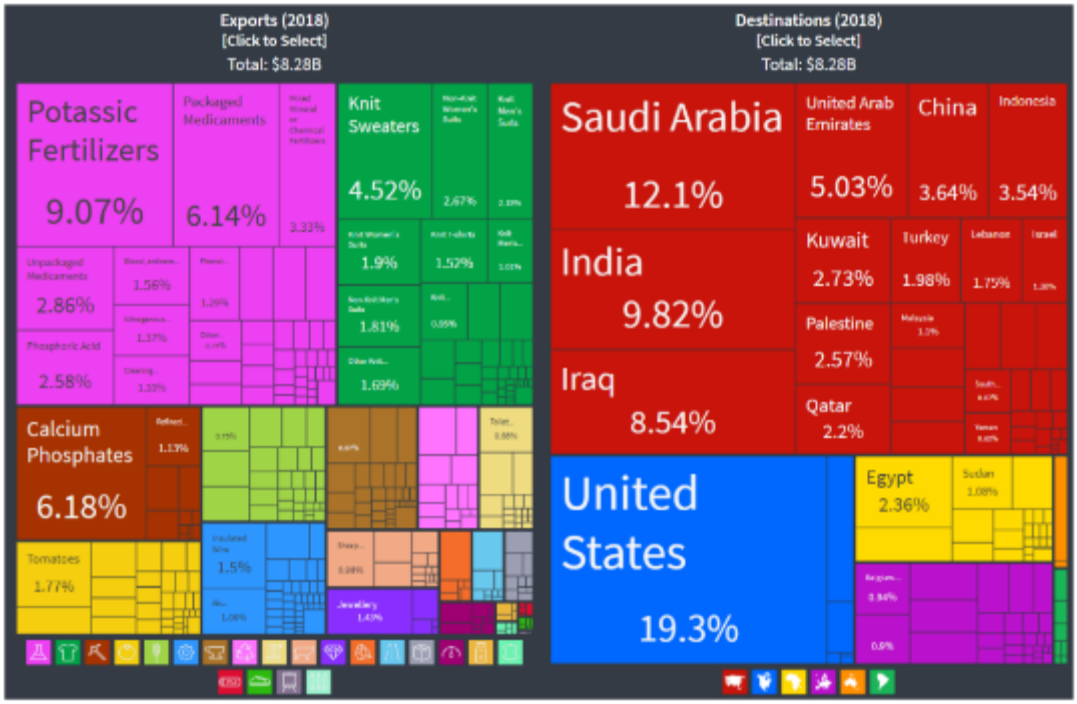
Source: JICA "Data Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan (2021)"

b) Export destinations and items

In terms of export destinations by country, the United States accounted for the largest share at 19.3%, followed by Saudi Arabia at 12.1%, India at 9.82%, Iraq at 8.54%, the UAE at 5.03%, and China at 3.64%. Given the geographical distance and economic size, exports to Egypt and Iran are small, and it is assessed that these countries have great potential for trade promotion in the future. The Two-Year Priority Plan for 2020-2021 (2018) indicates priority measures to strengthen exports through support for manufacturing and service-providing companies, as well as developing new export markets through networking with market suppliers in the UAE, Saudi Arabia, Qatar, Kuwait, and African countries.

Regarding export items, fertilizer, crude calcium phosphate, and packaged pharmaceuticals consistently make up a significant proportion of Jordan's exports, with a combined share of

21.39% in 2018. This trend has remained consistent in the following years as well, as indicated by the provided table.



Source: JICA "Data Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan (2021)"

Figure 3-28 Relationship Chart between Jordan's Major Export Products and Major Export Destinations (FY 2018, in value terms)

The following table shows the status of export industries that were short-listed as having future growth potential in the JICA Trade and Investment Survey 2021 on promotion of trade and investment.

The survey highlights the bias in Jordan's export destinations for its products and services as a vulnerability in the country's trade structure. For instance, clothing and textiles, which account for over 20% of exports, are primarily exported to the North American region, while most pharmaceutical products are concentrated in Saudi Arabia and other neighboring Middle Eastern countries. The survey also points out that major manufacturing industries such as sewing and pharmaceuticals rely completely on imports for raw materials, and any disruptions in the supply chain leading to the inability to procure raw materials could impede domestic production.

Table 3.44 Characteristics of Jordan's export commodities

Industry	Summary
Agriculture	・ Vegetables and fruits are the main product categories. ・ Most of the exported products go to the MENA market, and the top two export counterparts for both vegetables and fruits are Saudi Arabia and Kuwait. ・ Exported vegetables include tomatoes, peppers, cucumbers, cabbage, and lettuce, and exported fruits include peaches, melons, dates, strawberries, apricots, and avocados.
Food Processing	・ The country exports a diverse range of products such as tobacco mainly, prepared food products, livestock feed, processed vegetables and meat products, nuts, confectionery, and beverages. ・ At least half of exports go to Iraq, Saudi Arabia, and the UAE, predominantly the MENA market, but exports to the markets in Latin America, Africa, and Europe are growing in the last five years. ・ Imports from Jordan are declining in the Iraqi market due to the rise of Turkey.
Chemicals (Fertilizers, Chemicals, Cosmetics)	・ Fertilizers: Potassium chloride, Potassic fertilizers, Diammonium phosphate, Nitrogenous fertilizers, etc. are exported. Exports to the MENA market are growing, but those for other areas are levelling off or declining. Transaction value is declining worldwide as prices fall. The top three export destinations are India, China, and Turkey. In India and China, imports from Jordan are limited and the country has little presence, but in Turkey it has become second in a market share only to competing Egypt and Russia. ・ Inorganic chemicals: Phosphoric acid and polyphosphoric acids, Potassium nitrate, Fluorine (bromine), Inorganic acids, Bromides and bromide oxides of non-alkali metals, and others are exported. As with fertilizers, in addition to rapidly growing South Asia's share of inorganic chemicals including phosphoric acid made basically from its domestic phosphorus resources, export to East Asia is increasing, and the new markets in Central Asia are also developed. On top of India and China, exports go to the markets in MENA countries such as UAE, Saudi Arabia, and Israel, and to EU countries including Spain. Phosphoric acid and other inorganic chemicals are versatile and used in a variety of secondary products from food additives to pharmaceuticals, detergents, and industrial applications such as metals and semiconductors. Therefore, the global market for the chemicals is expected to have large opportunities to keep expanding, and inorganic chemicals continue to grow in the Indian market, with exports from Jordan also increasing significantly. ・ Organic chemicals: Exported products include Halogenated phenols, organic compounds, vitamins. Jordan is one of the world's three largest exporters of halogenated phenol, with most of it going to East Asia (More than 70% are exported to China, Taiwan, and South Korea). ・ Cosmetics: Mainly skin care and hair care products derived from the Dead Sea are exported largely to Saudi Arabia, Iraq, and Algeria. In recent years, brisk export to Europe, North America, MENA, and East Asia is seen with the high growth rate.
Garment	・ The U.S. and Canada account for 70% to 80% of the markets for the products, but in recent years, European and East Asian markets are also growing. Major clients are currently U.S. brands and retailers (Gap, JCPenney, Levi Strauss & Co., Liz Claiborne, Calvin Klein, Tommy Hilfiger, Walmart, Kmart, Limited, Sears, Columbia, Victoria's Secret, etc.). ・ The RCA index, which indicates Jordan's comparative advantage, is very high at 7.15, but the country relies on foreign workers for its labor force, making it difficult to employ Jordanians.
Pharmaceuticals Medical supplies	・ Most exports go to the MENA market, but other markets are also growing, with brisk exports to the U.S. While the top three counterparts are Saudi Arabia, Iraq, and the U.S., the competitors are Europe, UAE, and India. ・ This is a leading export sector in Jordan whose manufacturing industry is relatively weak, and an important domain as well, creating job opportunities for Jordanian women.

Source: prepared by the study team based on JICA "Date Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan I (2021) "

3) Import

a) Import value and sector

In 2018, Crude materials and Other intermediate consumer goods, which is categorized into the second group, accounted for 55.0% of the imported products, presenting the largest share. In addition, Consumer goods categorized into the first group, accounted for 26.6%, followed by, Parts and accessories and Capital goods, at 16.3%. In particular, the volume of imports of fuel (including crude oil), food products, and other capital goods is high.

Table 3.45 Jordan's Export Trends in 2014~2018 (JOD)

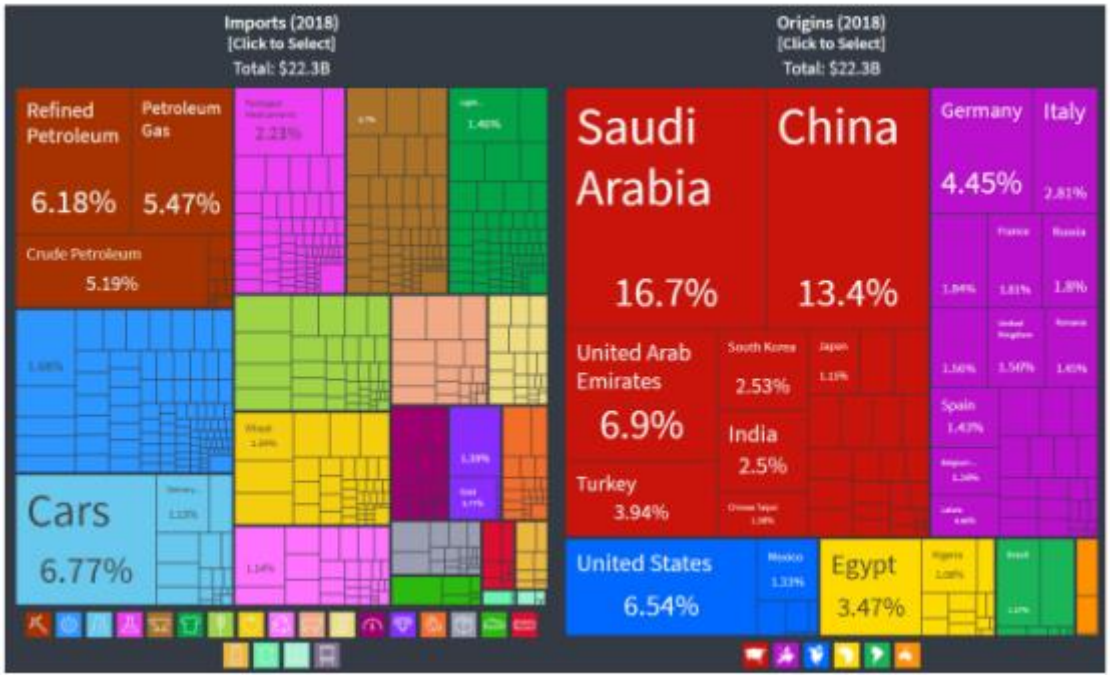
	2014	2015	2016	2017	2018
Import Total	16,280,188	14,537,182	13,693,251	14,098,357	13,447,715
First: Consumer Goods Subtotal	*(4,375,962)*	*(4,523,791)*	*(4,710,098)*	*(4,559,688)*	*(3,582,468)*
A. Current Consumer Goods					
- Foodstuffs	1,767,080	1,800,905	1,720,663	1,681,932	1,612,954
- Pharmaceutical Products	365,121	385,344	418,595	377,633	385,549
- Other Current Consumer Goods	1,055,897	1,065,909	1,159,024	1,026,257	934,617
B. Durable Consumer Goods					
-Small Motor Vehicles for Passengers	726,534	792,172	920,543	1,000,853	230,691
- Other Durable Consumer Goods	461,328	479,459	491,270	473,011	418,654
Second: Crude Materials and Other Intermediate Consumer Goods	*(9,593,091)*	*(7,460,861)*	*(6,591,324)*	*(6,780,761)*	*(7,417,365)*
- Fuels Including Crude Petroleum	4,349,404	2,443,663	1,926,850	2,373,576	2,955,717
- Fertilizers	35,161	32,499	33,482	25,711	23,59
- Construction Materials	250,063	260,912	251,618	124,845	149,992
- Other Intermediate Goods	4,958,461	4,723,786	4,379,372	4,256,627	4,288,062
Third: Parts and Accessories	*(562,733)*	*(605,913)*	*(472,479)*	*(615,155)*	*(621,540)*
- Parts and Accessories of Aircraft	141,654	99,493	148,685	166,110	149,435
- Parts and Accessories of Transport Equipment Except Aircraft	112,616	122,859	116,768	108,319	93,405
- Parts and Accessories of Other Machines and Equipment	308,462	383,560	207,025	340,725	378,698
	(1,481,320)	*(1,672,364)*	*(1,701,792)*	*(1,889,369)*	*(1,573,688)*
Fourth: Capital Goods	191,220	287,508	267,620	206,284	197,208
- Transport Equipment except Small Motor Vehicles	1,286,400	1,381,758	1,430,776	1,678,024	1,371,812
- Other Capital Goods inc. Machinery	3,699	3,098	3,395	5,060	4,667
- Live Animals for Breeding	267,080	274,251	217,556	253,382	252,652
Fifth: Other Goods not Classified Elsewhere in H.S.					

Source: JICA" Data Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan (2021)"

b) Export destinations and items

In terms of import destinations by country, Saudi Arabia accounted for the largest share at 16.7%, followed by China at 13.4%, the UAE at 6.9%, the U.S. at 6.54%, Germany at 4.45%, Turkey at 3.94%, and Egypt at 3.47%.

In terms of imports, a significant portion is attributed to passenger cars, refined petroleum, petrochemical gas, and crude oil, accounting for 6.77%, 6.18%, 5.47%, and 5.19%, respectively.



Source: JICA "Data Collection Survey on Promotion of Trade and Investment in the Hashemite Kingdom of Jordan (2021)"

Figure 3-29 Relationship Chart between Jordan's Major Imported Products and Major Import Destinations (FY 2018, by value)

4) Cargo Handling by Customs

Based on data received from the customs office, the volume and value of imports and exports by border customs and the items handled by Al Aqaba Customs (sea, air, land) are summarized. Note that the data for the countries of origin and destination could not be received, so the data is only for the status of cargo handled.

In terms of cargo volume by customs in 2022, Al Aqaba Customs handled 51% of the total, followed by Al Omari Custom on the Saudi border at 23%, the private industrial free zone near the Saudi border - Al-Shidiyah at 9%, and 4% at King Hussein Bridge Customs on the Palestinian border.

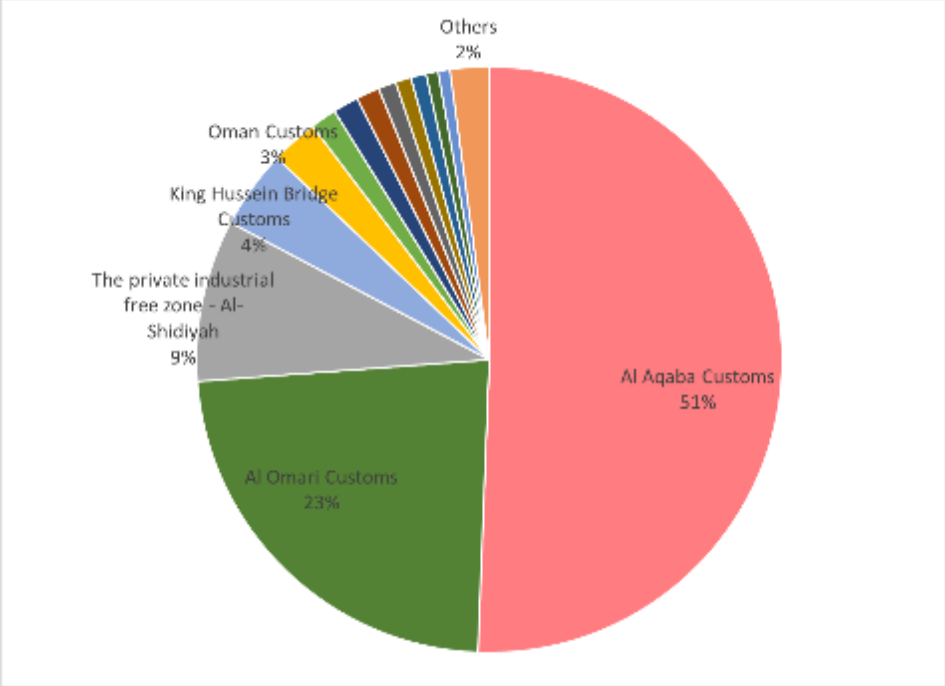
In terms of cargo value by customs in 2022, 48% of the total is handled by Al Aqaba Customs, followed by 11% by Zizia Airport Customs (Queen Alia Airport), 11% by Al Omari Custom on the Saudi Arabian border, and 7% by Oman Customs. Al Omari Custom at the Saudi border, and 7% at Oman Customs.

The top five commodities handled at Al Aqaba Customs by weight are (1) Mineral Products, (2)Products of the Chemical or Allied Industries, (3)Vegetable Products, (4)Prepared Foodstuffs; Beverages, Spirits and Vinegar; Tobacco and Manufactured Tobacco Substitutes, (5)Articles of Stone, Plaster, Cement, Asbestos, mica or Similar Materials; Ceramic Products； Glass and Glassware, the top five products accounting for 85.2% of the total. In value terms, the top five products are (1) Mineral Products; (2) Products of the Chemical or Allied Industries; (3)Vehicles, Aircraft, Vessels and Associated Transport Equipment； (4) Vegetable Products; and (5)Machinery and Mechanical Appliances ； Electrical Equipment ； Parts Thereof; Sound Recorders and Reproducers, Television Image and Sound Recorders and Reproducers, and Parts and Accessories of Such Articles, accounting for 70.8% of the total.

Table 3.46 Jordan's Cargo volume by customs (thousand tons)

01_CUO_COD	02_CUO_NAM_ENG	2018	2019	2020	2021	2022
	Total	57,416	54,982	50,425	54,705	51,769
220	Al Aqaba Customs	25,465	28,061	36,027	25,592	26,206
216	Al Omari Customs	6,960	7,619	3,134	16,523	12,009
228	The private industrial free zone - Al-Shidiyah	4,058	4,084	4,248	4,523	4,624
208	King Hussein Bridge Customs	1,785	2,565	1,561	2,011	2,245
211	Oman Customs	7,126	4,318	1,262	1,654	1,342
205	Al Karama Customs (Ruwaishid)	412	609	765	510	748
222	King Abdullah II Ibn Al-Hussein City customs	626	663	616	631	733
226	Jaber Customs	107	685	511	691	667
233	Jordan Valley crossing Customs	341	278	251	404	510
224	Passenger Ships - Al Aqaba Customs	410	411	206	324	449
219	Al Mudawara customs	564	584	116	61	441
267	Ghor Numeira Customs Center	383	416	360	350	344
206	Customs Free Zone - Al Zarqa (goods)	332	312	260	315	339
900	Al Aqaba Special Economic Zone Customs	1,496	3,343	272	153	237
266	Al Zarqa Free Zone (Vehicles) Customs	217	272	274	307	235
241	Al Hassan Industrial City Customs - Irbid	130	178	141	162	180
275	Oman Customs / Public warehouses	6,662	168	163	250	147
215	Customs Clearance Airport - Zizia	83	80	82	65	71
255	Al-Raqim Customs	37	40	35	49	54
273	Al Dhalil Customs	53	56	42	45	47
253	Customs of Jordanian-Syrian Free Trade Zone					45
223	Durra Customs	36	79	17	28	45
203	Al Mafraq Customs	11	18	22	20	22
296	Airport/Mashta Free Zone Customs Center	3	9	16	11	10
264	Private Free Zone/ Industry & Information Technology	9	12	7	7	7
259	Al-Hussein bin Abdullah II Industrial City	75	92	13	7	6
234	Al Queerah Private Free Zone Customs Center	12	15	14	9	4
286	Ammon Customs Center	0	0	1	2	2
232	Wadi Araba Crossing Customs	2	4	2	1	1
212	Capital Post Customs Center	0	0	0	0	0
214	Passenger Airport Customs - Zizia	9	10	5	1	
201	Al Ramtha Customs	13				

Source: JICA study team from Customs data



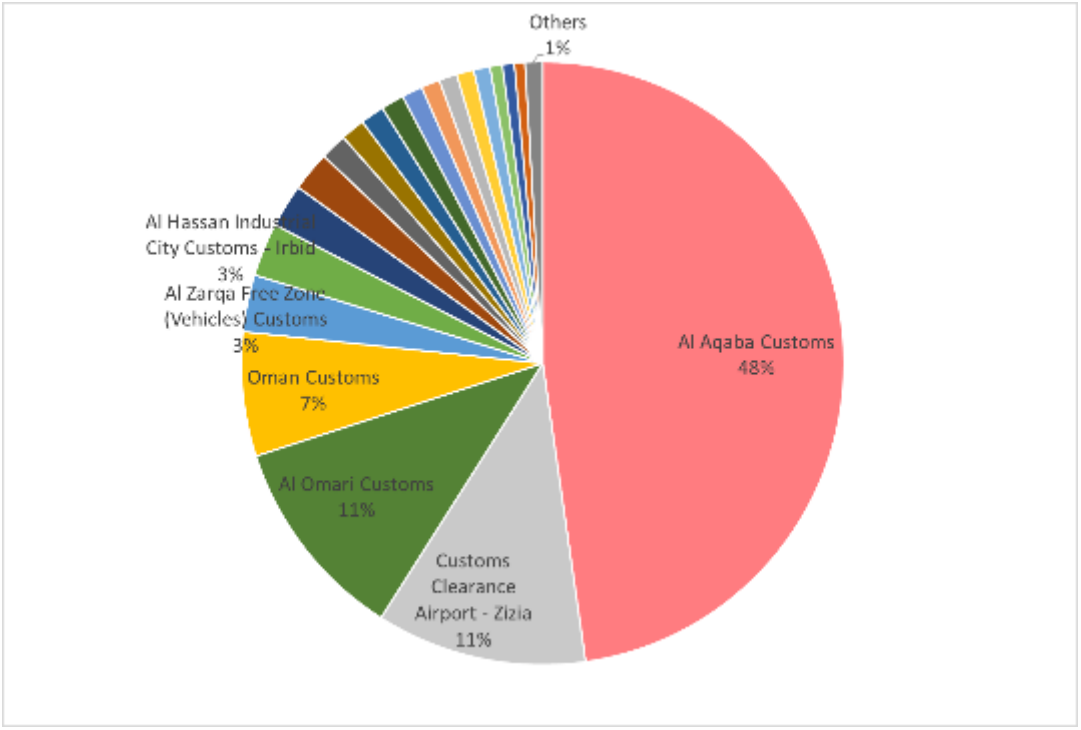
Source: JICA study team from Customs data

Figure 3-30 Percentage of Cargo volume by customs (FY 2022)

Table 3.47 Jordan's Cargo value by customs (million JD)

01_CUO_COD	02_CUO_NAM_ENG	2018	2019	2020	2021	2022
		31,938	**33,796**	**32,338**	**35,963**	**45,446**
220	Al Aqaba Customs	13,640	15,096	16,968	16,018	21,690
215	Customs Clearance Airport - Zizia	3,582	3,657	3,245	4,133	5,131
216	Al Omari Customs	2,798	2,997	2,467	3,919	5,003
211	Oman Customs	2,933	2,706	1,899	2,433	3,023
266	Al Zarqa Free Zone (Vehicles) Customs	1,589	1,687	1,558	1,419	1,389
241	Al Hassan Industrial City Customs - Irbid	750	981	844	1,330	1,302
222	King Abdullah II Ibn Al-Hussein City customs	877	812	757	855	1,056
255	Al-Raqim Customs	460	455	390	863	972
228	The private industrial free zone - Al-Shidiyah	318	469	461	617	649
273	Al Dhalil Customs	581	579	470	527	591
205	Al Karama Customs (Ruwaishid)	333	308	362	453	582
206	Customs Free Zone - Al Zarqa (goods)	702	656	483	574	561
226	Jaber Customs	72	462	374	540	506
224	Passenger Ships - Al Aqaba Customs	399	455	186	309	455
267	Ghor Numeira Customs Center	237	275	275	304	439
900	Al Aqaba Special Economic Zone Customs	750	426	322	254	421
233	Jordan Valley crossing Customs	216	256	234	288	399
275	Oman Customs / Public warehouses	286	254	237	350	300
208	King Hussein Bridge Customs	177	202	176	226	291
296	Airport/Mashta Free Zone Customs Center	121	289	267	269	258
219	Al Mudawara customs	196	194	37	15	133
223	Durra Customs	32	123	27	39	82
203	Al Mafraq Customs	31	49	52	45	59
264	Private Free Zone/ Industry & Information Technology	60	75	44	49	52
286	Ammon Customs Center	5	3	16	57	50
253	Customs of Jordanian-Syrian Free Trade Zone					31
259	Al-Hussein bin Abdullah II Industrial City	184	167	78	20	13
232	Wadi Araba Crossing Customs	5	9	6	4	4
234	Al Queerah Private Free Zone Customs Center	17	30	27	29	3
212	Capital Post Customs Center	1	1	0	1	1
214	Passenger Airport Customs - Zizia	576	122	73	24	
201	Al Ramtha Customs	10				

Source: JICA study team from Customs data



Source: JICA study team from Customs data

Figure 3-31 Percentage of Cargo value by customs (FY 2022)

Table 3.48 Cargo volume in Al Aqaba Customs (thousand ton)

MINERAL PRODUCTS	4,923
PRODUCTS OF THE CHEMICAL OR ALLIED INDUSTRIES	4,452
VEHICLES, AIRCRAFT, VESSELS AND ASSOCIATED TRANSPORT EQUIPMENT	2,924
VEGETABLE PRODUCTS	1,626
MACHINERY AND MECHANICAL APPLIANCES; ELECTRICAL EQUIPMENT; PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODUCERS, AND PARTS AND ACCESSORIES OF SUCH ARTICLES	1,435
TEXTILES AND TEXTILE ARTICLES	1,294
PREPARED FOODSTUFFS; BEVERAGES, SPIRITS AND VINEGAR; TOBACCO AND MANUFACTURED TOBACCO SUBSTITUTES	1,171
BASE METALS AND ARTICLES OF BASE METAL	957
LIVE ANIMALS; ANIMAL PRODUCTS	771
PLASTICS AND ARTICLES THEREOF; RUBBER AND ARTICLES THEREOF	617
PULP OF WOOD OR OF OTHER FIBROUS CELLULOSIC MATERIAL; RECOVERED (WASTE AND SCRAP) PAPER OR PAPERBOARD; PAPER AND PAPERBOARD AND ARTICLES THEREOF	341
MISCELLANEOUS MANUFACTURED ARTICLES	251
ARTICLES OF STONE, PLASTER, CEMENT, ASBESTOS, MICA OR SIMILAR MATERIALS; CERAMIC PRODUCTS; GLASS AND GLASSWARE	242
ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLEAVAGE PRODUCTS; PREPARED EDIBLE FATS; ANIMAL OR VEGETABLE WAXES	189
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL; CORK AND ARTICLES OF CORK; MANUFACTURES OF STRAW, OF ESPARTO OR OF OTHER PLAITING MATERIALS; BASKETWARE AND WICKERWORK	173
Miscellaneous Section	123
FOOTWEAR, HEADGEAR, UMBRELLAS, SUN UMBRELLAS, WALKING STICKS, SEAT-STICKS, WHIPS, RIDING-CROPS AND PARTS THEREOF; PREPARED FEATHERS AND ARTICLES MADE THEREWITH; ARTIFICIAL FLOWERS; ARTICLES OF HUMAN HAIR	84
PTICAL, PHOTOGRAPHIC, CINEMATOGRAPHIC, MEASURING, CHECKING, PRECISION, MEDICAL OR SURGICAL INSTRUMENTS AND APPARATUS; CLOCKS AND WATCHES; MUSICAL INSTRUMENTS; PARTS AND ACCESSORIES THEREOF	81
RAW HIDES AND SKINS, LEATHER, FURSKINS AND ARTICLES THEREOF; SADDLERY AND HARNESS; TRAVEL GOODS, HANDBAGS AND SIMILAR CONTAINERS; ARTICLES OF ANIMAL GUT (OTHER THAN SILKWORM GUT)	17
ARMS AND AMMUNITION; PARTS AND ACCESSORIES THEREOF	10
NATURAL OR CULTURED PEARLS, PRECIOUS OR SEMI-PRECIOUS STONES, PRECIOUS METALS, METALS CLAD WITH PRECIOUS METAL, AND ARTICLES THEREOF; IMITATION JEWELLERY; COIN	7
WORKS OF ART, COLLECTORS' PIECES AND ANTIQUES	0
総計	**21,690**

Source: JICA study team from Customs data

Table 3.49 Cargo value in Al Aqaba Customs (million JD)

MINERAL PRODUCTS	8,570
PRODUCTS OF THE CHEMICAL OR ALLIED INDUSTRIES	7,697
VEGETABLE PRODUCTS	3,938
PREPARED FOODSTUFFS; BEVERAGES, SPIRITS AND VINEGAR; TOBACCO AND MANUFACTURED TOBACCO SUBSTITUTES	1,142
ARTICLES OF STONE, PLASTER, CEMENT, ASBESTOS, MICA OR SIMILAR MATERIALS; CERAMIC PRODUCTS; GLASS AND GLASSWARE	972
BASE METALSBASE METALS AND ARTICLES OF BASE METAL	762
WOOD AND ARTICLES OF WOOD; WOOD CHARCOAL; CORK AND ARTICLES OF CORK; MANUFACTURES OF STRAW, OF ESPARTO OR OF OTHER PLAITING MATERIALS; BASKETWARE AND WICKERWORK	556
VEHICLES, AIRCRAFT, VESSELS AND ASSOCIATED TRANSPORT EQUIPMENT	477
TEXTILES AND TEXTILE ARTICLES	402
PLASTICS AND ARTICLES THEREOF; RUBBER AND ARTICLES THEREOF	368
PULP OF WOOD OR OF OTHER FIBROUS CELLULOSIC MATERIAL; RECOVERED (WASTE AND SCRAP) PAPER OR PAPERBOARD; PAPER AND PAPERBOARD AND ARTICLES THEREOF	348
MACHINERY AND MECHANICAL APPLIANCES; ELECTRICAL EQUIPMENT; PARTS THEREOF; SOUND RECORDERS AND REPRODUCERS, TELEVISION IMAGE AND SOUND RECORDERS AND REPRODUCERS, AND PARTS AND ACCESSORIES OF SUCH ARTICLES	310
LIVE ANIMALS; ANIMAL PRODUCTS	302
MISCELLANEOUS MANUFACTURED ARTICLES	147
ANIMAL OR VEGETABLE FATS AND OILS AND THEIR CLEAVAGE PRODUCTS; PREPARED EDIBLE FATS; ANIMAL OR VEGETABLE WAXES	147
FOOTWEAR, HEADGEAR, UMBRELLAS, SUN UMBRELLAS, WALKING STICKS, SEAT-STICKS, WHIPS, RIDING-CROPS AND PARTS THEREOF; PREPARED FEATHERS AND ARTICLES MADE THEREWITH; ARTIFICIAL FLOWERS; ARTICLES OF HUMAN HAIR	32
Miscellaneous Section	20
PTICAL, PHOTOGRAPHIC, CINEMATOGRAPHIC, MEASURING, CHECKING, PRECISION, MEDICAL OR SURGICAL INSTRUMENTS AND APPARATUS; CLOCKS AND WATCHES; MUSICAL INSTRUMENTS; PARTS AND ACCESSORIES THEREOF	8
RAW HIDES AND SKINS, LEATHER, FURSKINS AND ARTICLES THEREOF; SADDLERY AND HARNESS; TRAVEL GOODS, HANDBAGS AND SIMILAR CONTAINERS; ARTICLES OF ANIMAL GUT (OTHER THAN SILKWORM GUT)	8
ARMS AND AMMUNITION; PARTS AND ACCESSORIES THEREOF	0
NATURAL OR CULTURED PEARLS, PRECIOUS OR SEMI-PRECIOUS STONES, PRECIOUS METALS, METALS CLAD WITH PRECIOUS METAL, AND ARTICLES THEREOF; IMITATION JEWELLERY; COIN	0
WORKS OF ART, COLLECTORS' PIECES AND ANTIQUES	0
総計	**26,206**

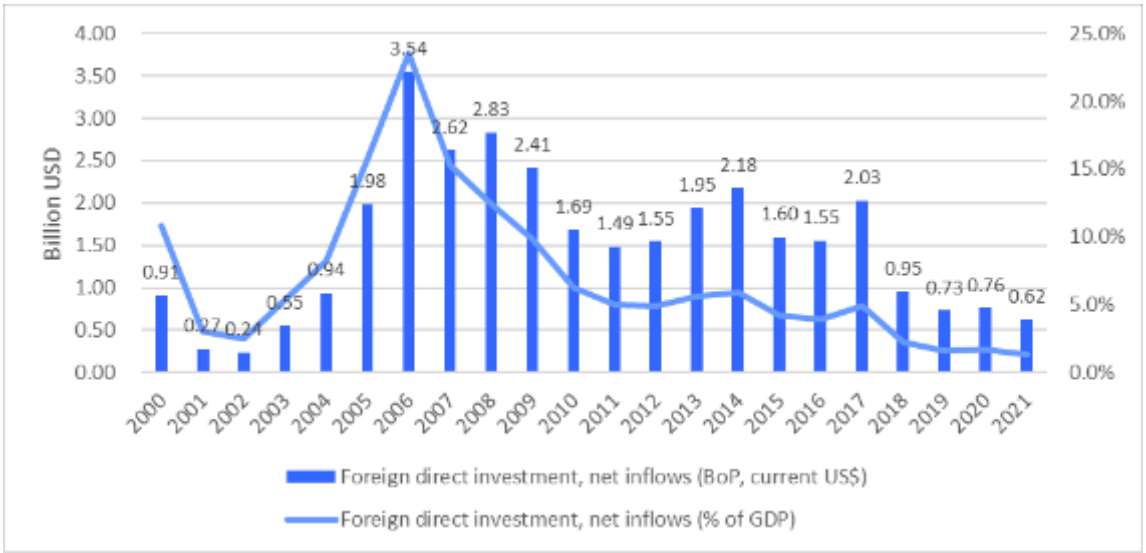
Source: JICA study team from Customs data

(3) Investment

1) Foreign Direct Investment (FDI)

The amount of foreign direct investment (FDI) in Jordan had been on a significant upward trend since 2000, thanks to focused efforts such as the introduction of FDI in the garment industry to industrial parks, reaching a peak of approximately USD 3.5 billion in 2006. However, it has been on a downward trend since then. The decline in FDI was triggered by the global financial crisis in 2008 and further exacerbated by the worsening situations in the Middle East, such as the Arab Spring in 2011 and the closure of borders with Iraq and Syria in 2015. In recent years, a decline in investment from Gulf countries due to falling oil prices and a rise in raw material prices and production costs, along with the impact of COVID-19 pandemic and other factors, have also affected FDI, which decreased to about 600 million USD in 2021.

According to the JICA Trade and Investment Survey 2021 on the promotion of trade and investment, Jordan is expected to become a business hub for the reconstruction of both Iraq and Syria. As a result, investment is increasing with prospects for reconstruction demand. To promote foreign direct investment, the Jordanian government has minimized restrictions on non-Jordanian investors and treated foreign and domestic investors equally, except in cases where certain restrictions apply. In addition, the government actively implements public-private partnership (PPP) projects, particularly for domestic infrastructure development. The London Initiative, a Jordanian donors meeting held in London in 2019, focused on tourism, technology, logistics, and professional services as sectors where the country has comparative advantages in the Middle East.



Source: Compiled by the study team from International Monetary Fund, Balance of Payments database, supplemented by data from the United Nations Conference on Trade and Development and official national sources.

Figure 3-32 Foreign Direct Investment in Jordan

2) Business Environment

According to the World Bank's Doing Business 2020, the Jordan's business environment ranks 75th out of 190 countries, rising from 104th in 2018. The country ranks sixth among the 20 countries in the MENA region, indicating that while it has an advantage over other countries when it comes to Getting Credit Positive, it lags behind in Dealing with Construction Permits, Protecting Minority Investors, starting a Business, and Enforcing Contracts. The United Arab Emirates has the highest ranking as a business environment in the MENA region, followed by Bahrain, Morocco, Saudi Arabia, and Oman. (Table 3.50 Ranking of MENA countries in WB Doing Business 2020)

It should be noted that the State of Jordan has been promoting efforts to improve the business environment through measures such as Jordan 2025 and JEGP. Although there have been gradual improvements, many areas still require improvement, including the high cost of business development, complexity, lack of transparency in licensing and approval, and limited access to financial services. Continuous improvements are necessary to create attractive business environment.

Table 3.50 Ranking of MENA countries in WB Doing Business 2020

	Overall	Starting a Business	Dealing with Construction Permits	Getting Electricity	Registering Property	Getting Credit Positive	Protecting Minority Investors	Paying Taxes Positive	Trading across Borders	Enforcing Contracts	Resolving Insolvency Positive
United Arab Emirates	16	1	1	1	2	3	2	6	9	1	5
Bahrain	43	6	4	9	3	6	4	1	6	4	2
Morocco	53	5	3	3	9	9	3	5	3	5	4
Saudi Arabia	62	4	5	2	4	5	1	7	7	3	17
Oman	68	3	7	4	6	14	9	4	4	6	7
Jordan	**75**	**11**	**15**	**8**	**8**	**1**	**12**	**8**	**5**	**10**	**9**
Qatar	77	10	2	5	1	9	17	2	10	12	12
Tunisia	78	2	6	6	12	7	8	12	8	8	3
Kuwait	83	7	9	7	5	9	4	3	15	7	10
Malta	88	8	8	10	17	14	4	9	1	2	11
Djibouti	112	12	12	15	14	12	11	17	13	16	1
Egypt	114	9	11	11	16	4	7	19	16	20	8
Palestine	117	19	16	12	11	2	14	13	2	13	17
Iran	127	20	10	14	7	7	16	18	11	9	13
Lebanon	143	14	17	16	13	12	14	14	14	14	14
Algeria	157	15	14	13	19	17	19	20	17	11	6
Iraq	172	16	13	17	15	18	13	16	19	18	17
Syria	176	13	18	19	18	16	10	11	18	19	15
Libya	186	18	18	18	20	18	20	15	12	17	17
Yemen	187	17	18	20	10	18	18	10	20	15	16

Source: Compiled by research team from World Bank, Doing Business 2020

1) Investment in ASEZ

The targeted investment amount in ASEZ, as set in the former Aqaba Strategic Plan was USD 9 billion as of 2020. However, the actual amount reached USD 12 billion in 2017. About 80% of the investment was allocated for tourism development, with significant funds being directed in large-scale resort development projects such as the Ayla project (site size:

430 ha, expected total investment: USD 2 billion), the Saraya project (site size: 63 ha, expected total investment: USD 1.5 billion), the Marsa Zayed project (expected total investment: approximately USD 10 billion), and the Al Matal High Resort, among others. It is expected that investments in these projects will continue to be made.

3.2.4 Socioeconomic Issues in ASEZ

(1) Creation of a safe, secure, and comfortable living environment to accommodate population growth

1) Challenges

The population and the number of households in Aqaba Governorate have been increasing and the trend is expected to continue in the future. Population growth has been accompanied by higher population density in central residential areas and higher population growth rates in suburban areas. In order to meet the increasing demand for housing while controlling uncontrolled urban expansion into the suburban areas, it is desirable to create an efficient and comfortable living environment while clarifying the urban structure in consideration of the future population and transportation network, etc.

In addition, social issues such as an increase in the non-Jordanian population due to refugees and immigrants, the existence of old and low earthquake-resistant housing stock, and a poverty rate that is higher than the national average are observed. Therefore, it is desirable to promote efforts to realize a society in which everyone can live safely and securely.

2) Efforts toward Improvement

Efforts to improve the issues are as follows.

- Clarification of urban structure in consideration of future population and transportation network, etc.
- Expansion of housing and urban facilities and services in response to changes in population structure
- Ensuring safe and comfortable housing
- Expanding support for improving poverty rates

(2) Improvement of medical care and educational standards to foster healthy lifestyles

1) Challenges

Jordan's Human Development Index and Livelihood Index are not low compared to those of developed countries, although there is room for improvement. In terms of medical care, it is desirable to create an environment where children are born and raised in good health, and where each citizen can live a healthy and vigorous life through health promotion and improvement of the medical care system. In terms of education, the latest census shows that the school enrollment rate for both men and women is increasing, which is considered to be an improvement. However, the school enrollment rate for non-Jordanians is low, and interviews with local residents indicated a disparity in educational quality between public high schools and private schools, making it desirable to ensure an environment where people can receive quality education equally. It is therefore desirable to ensure an environment that allows students to receive high-quality education on an equal basis.

2) Efforts for Improvement

Efforts to improve the issues are as follows.

- Promotion of community development that takes health, medical care, and welfare into consideration
- Ensuring equal educational opportunities and improving the quality of education

(3) Creation of jobs to receive workers in Jordan

1) Challenges

The high unemployment rate is an issue not only in Aqaba but also in the entire country of Jordan, and it can be read from the country's top plan that the creation of employment opportunities is an urgent issue. Aqaba has a relatively lower unemployment rate than other governorates, which suggests that it is a region where many people move in for the purpose of employment, and thus it can be said to be a recipient of employment. On the other hand, economic indicators such as GRDP and FDI in Aqaba are not well understood, and the region does not have a specific position or vision in terms of industry within the country. Another problem is the difference in unemployment rates between men and women. As the working-age population of Jordan increases, expectations for Aqaba as a source of employment are expected to increase, and it is desirable to create employment with equal opportunities.

2) Initiatives for Improvement

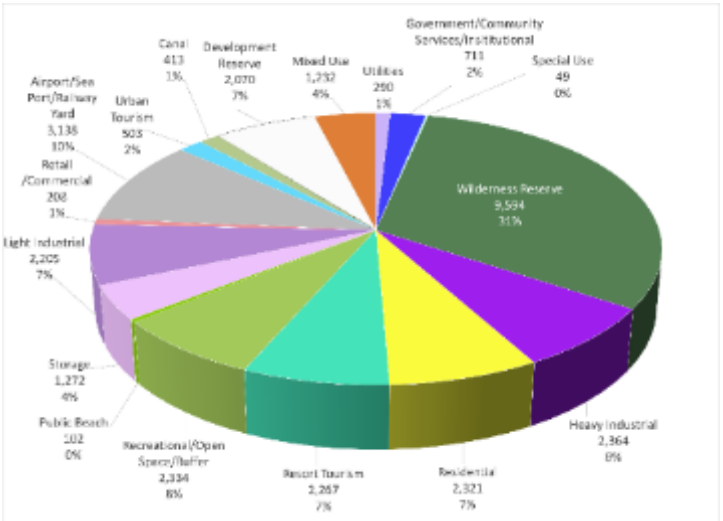
- Creation of jobs and improvement of unemployment rate in response to the increase in the working-age population
- Improvement of opportunities for women to enter society and employment rate

3.3 Land Use

3.3.1 Current Land Use Plan

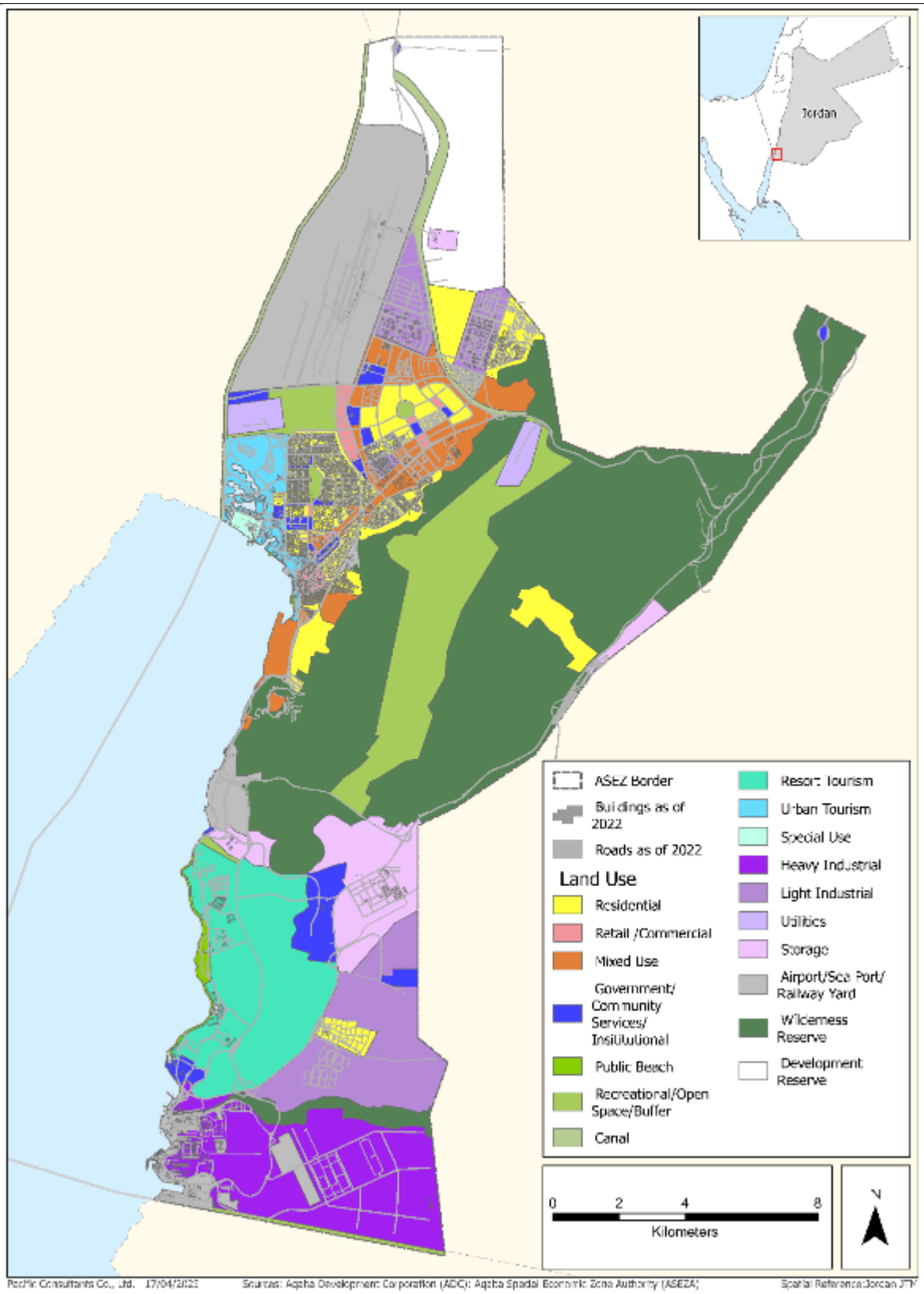
The current land use plan is shown in the figure on the next page, most recently updated in 2012. The features of the land use plan are as follows.

- Retail/Commercial land use is designated in the City-Central, City-North, City-South, and Al-Manara neighborhoods in the downtown and CBD of the city, as well as in the New Business District along Airport Street.
- Mixed Use land use is designated mainly along Al-Hussein BinAli Street, Jordan Valley Highway, South Beach Highway, and Mecca Street as a buffer from the arterial road to the Residential land use.
- Residential land use is designated behind the retail/commercial land use in downtown area, and behind the Mixed-use land use in the "Central area". In addition, it is designated adjacent to Industrial land use in several interior areas like Ashamiyyeh.
- The shoreline near downtown and South Beach are designated as Public Beach land use, and the land behind them is designated as Urban Tourism and Resort Tourism land use.
- Government, Community Services, and Institutional land use are designated as sites for public facilities and services in each of the above land uses.
- The part of the land east to the airport and the south industrial port is designated for industrial uses such as Heavy Industrial and Light Industrial, as well as Utility, Storage.
- Adjacent areas inside Residential areas are designated as Recreational and Open Space.
- The eastern hills are designated as Wilderness Reserve and the valleys are designated as a Buffer.
- A huge area east to the airport is designated for Development Reserve.
- Except for Wilderness Reserve and Airport/Sea port/Railway, the largest land is designated for Heavy Industrial and Recreational/Open Space/Buffer, followed by Residential, Resort Tourism, etc.



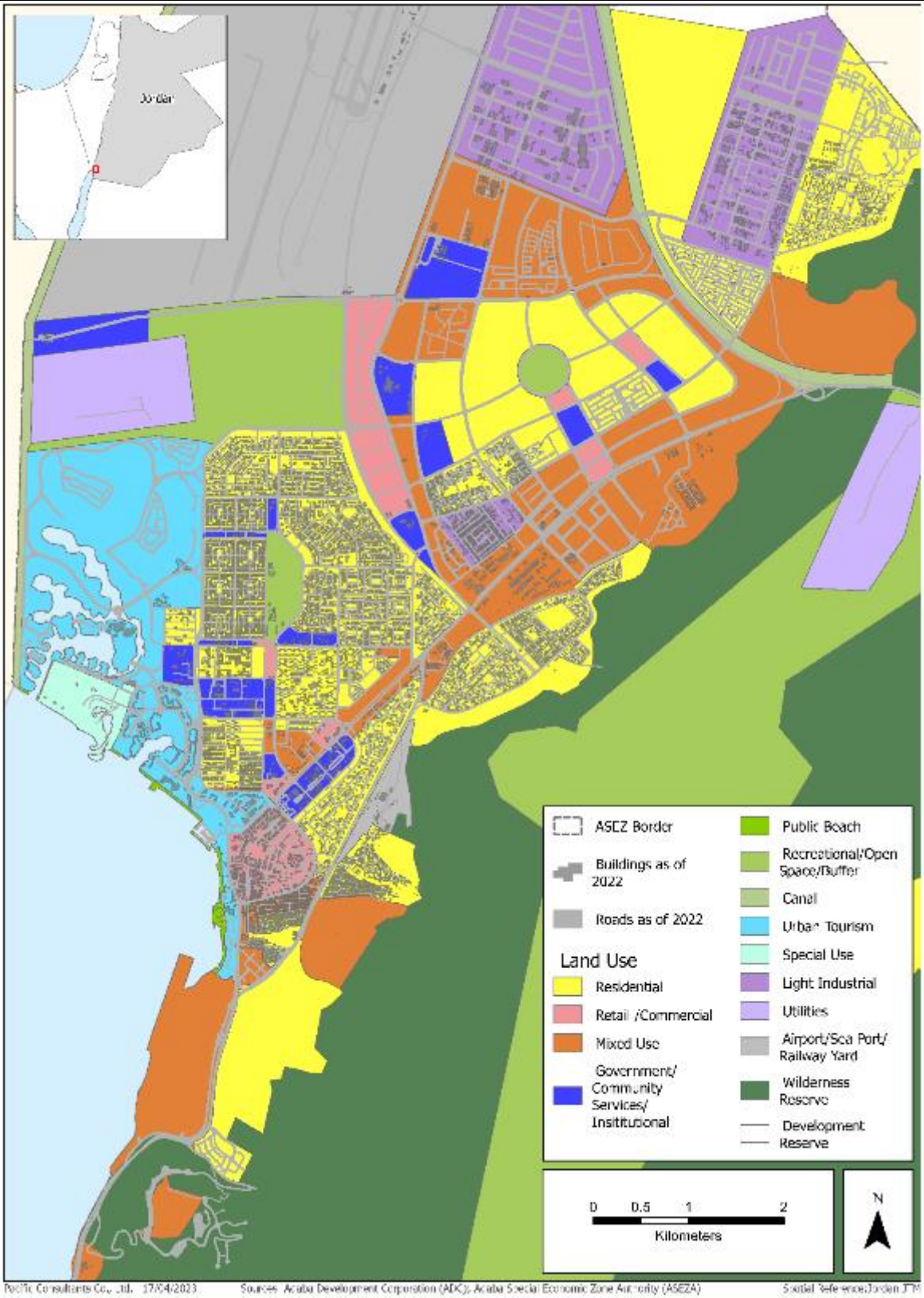
Source: JICA study team

Figure 3-33 Land use share (excluding the new expansion area)



Source: JICA study team

Figure 3-34 Current Land use plan (Whole city)



Source: JICA study team

Figure 3-35 Current Land use plan (City center)

3.3.2 General Land Use Condition

(1) Spatial growth and expansion

The following figure illustrates the expansion of urban development (residential land development) using aerial photographs. The following is the trend.

- Retail/Commercial in the center of the city and Residential to the north have been mostly developed, while the residential area in the northeastern has been only partly developed.
- The New Business District (Retail/Commercial) is marked by underutilized land.
- Mixed Use along Al-Hussien BinAli Street and east of Jordan Valley Highway is mostly underutilized.
- Urban Tourism is being developed in stages, while Resort Tourism development is limited to some areas along the coast.
- While the airport and port are being developed as transportation and logistics terminals, the rail yards are currently not being actively utilized.
- Industrial sites such as Heavy Industrial and Light Industrial, as well as Utility, Storage, and Development Reserve are only partially developed in relation to the planned sites.
- Recreational and Open Space, which are designated in the center of and adjacent to Residential, are currently underutilized.

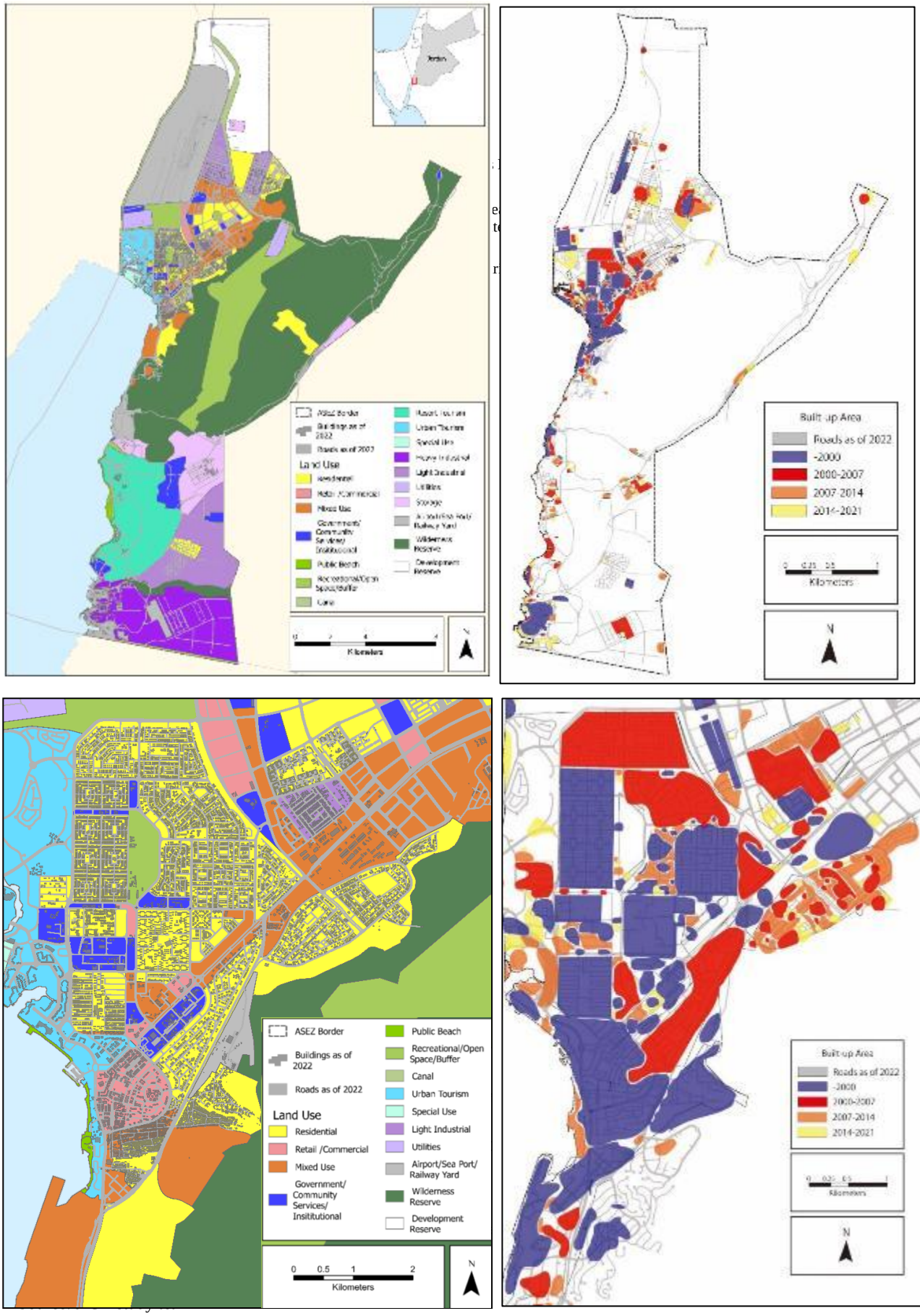
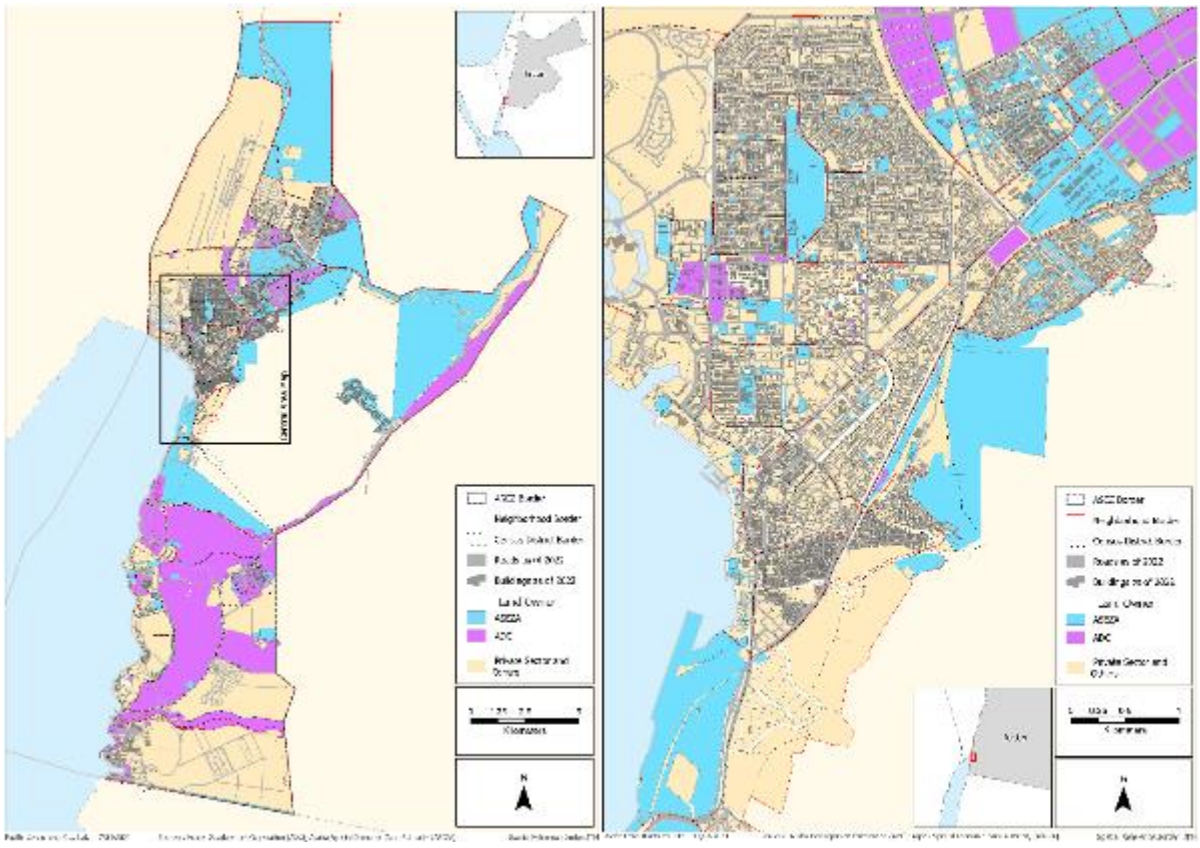


Figure 3-36 General Land Use Condition (City center)

(2) Land ownership

The figure below shows land ownership by sector. The following can be seen.

- The developed land is basically owned by the Private Sector, while the undeveloped land is owned by ASEZA or ADC.
- Mixed Use undeveloped land along Al-Hussien BinAli Street is owned by the Private Sector and remains in the possession of the operator and has not been developed.
- Of the Resort Tourism east of Truck Road on the east side of South Beach, most of the land east of Truck Road is owned by the private sector but has not been developed, and residential development can be seen in some areas owned by ASEZA and ADC.
- Container terminals and the Port of Aqaba are owned by ADC.



Source: JICA study team

Figure 3-37 Land use share (excluding the new expansion area)

(3) Issues related to land use

1) Characteristic and Issues of the current land use

The following issues can be identified regarding land use.

■ Waterfront
- Most part of the beach near the center of the city are secured as gated resort facilities by private operators and are closed to the public, or difficult for residents to use freely.
- Public beaches" have been developed in the northern and southern areas, but the length of these beaches is only about 550 m in Al-Ghandour Beach in the north and about 7 km in Yamaniya Beach and South Beach in the south, which is only 26.4% of the total coastline.

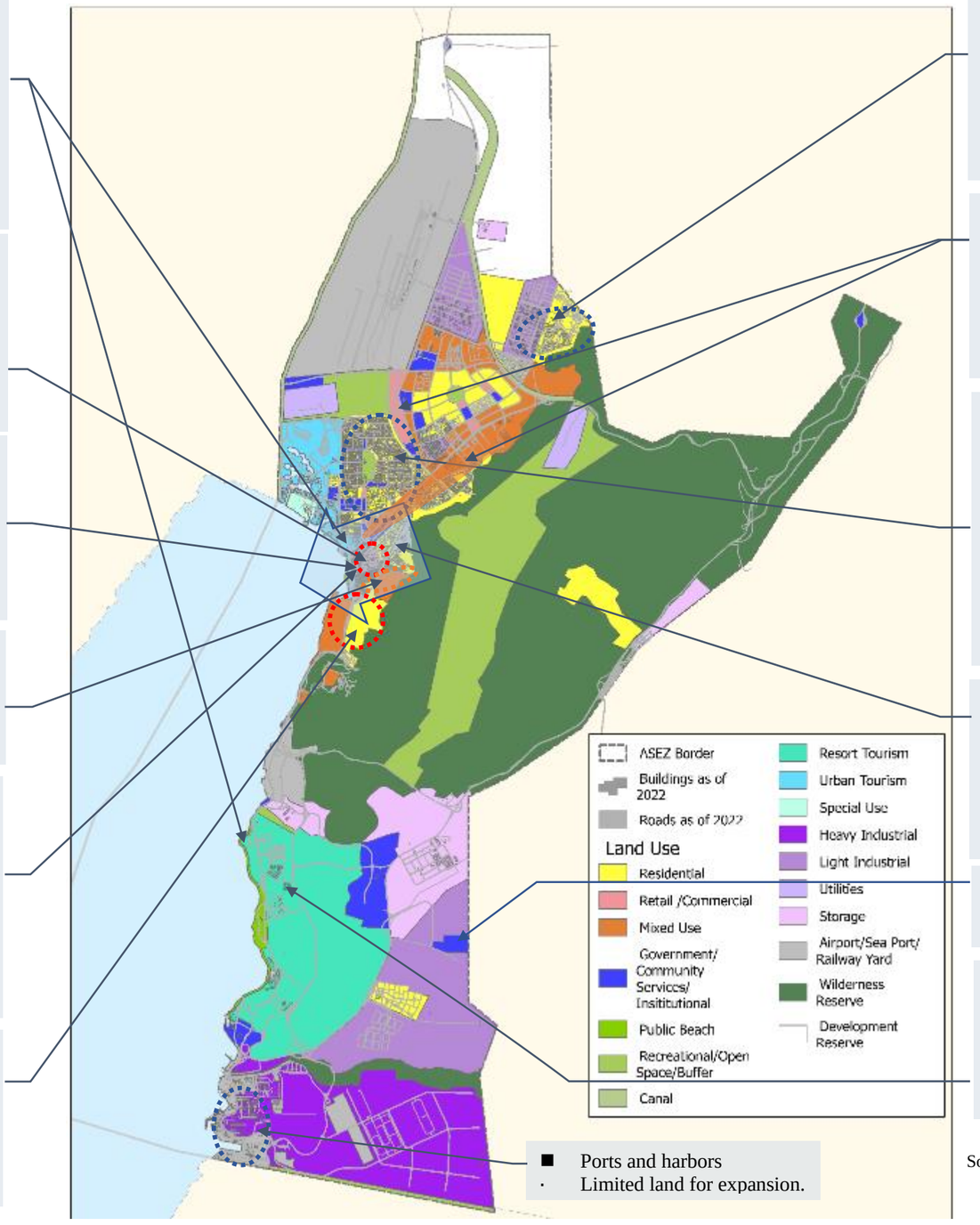
■ Downtown
- The downtown area designated as "Retail/Commercial" has a large concentration of commercial businesses but lacks diversity of business types and store types.
- There is a lack of space that symbolizes the center of the city, and there is a lack of design that shows the symbolism of the city.

■ Al Hafayer Area
- Currently, the area is covered with molokheiya fields.
- The landowners in the hinterland of the beach are mixed, and the connection from K. Hussein St. to the beach will be lost both visually and as a pedestrian network if the land owned by private developers is developed disorderly.

■ Old Town District
- The neighborhoods adjacent to downtown, such as Alafran and Alshallaleh, have many deteriorated buildings in the form of tenements and have a dilapidated atmosphere.

■ Historical Remains
- In the Aqaba Castle area, the Aqaba Museum is being renovated and tenants are being sought for the commercial facilities surrounding Revolt Plaza, but there are still many vacant stores.
- The Aqaba Castle, the ruins of Ayla, and other historical remains have not been sufficiently preserved and utilized. They are scattered throughout the town, and there is little continuity between them and the surrounding area.

■ Marsa Zayed Development
- The area around the cruise terminal and the eastern hinterland are planned to be developed by Marsa Zayed, but it is taking time to be realized.
- The area is adjacent to Downtown and Old Town, so it is necessary to develop the area by considering the connection and harmony with the surrounding.



■ Ports and harbors
- Limited land for expansion.

■ Industrial sites and residential areas for workers
- The industrial sites and residential areas for employees are developed in a sprawling manner away from the center of the town.
- The area is developed on the north side of Wadi Yutum Canal and is not well connected to the highway network leading to the city center.
- There is a risk of flash floods and other disasters.

■ Underutilized land
- The city has a large amount of underutilized land, mainly in the mixed-use land use along arterial roads, which reduces the liveliness of the city.
- The New Business District between Airport St. and Jordan Valley Hwy. is also underutilized except for AZESA and adjacent land.

■ Residential area
- The residential area is mainly composed of three-story buildings, and stores providing daily services are located in each neighborhood.
- Although sidewalks are provided in the residential area, the pedestrian network is not sufficient, and there is a lot of on-street parking including on the sidewalks.
- The City Park is underdeveloped, and the land set aside for open space in the center of each Neighborhood remains unused and underutilized in many areas, leading to the lack of open spaces in the residential area.

■ Views of the ocean
- The elevated topography on the east side provides beautiful views of the ocean, but the height of buildings has not been controlled to take advantage of this.
- There are some places in the downtown area that have views to the ocean, but they may be lost due to future development.

■ Landfill area
- Concerns about environmental pollution due to dumped waste.

■ South Beach Resort Area
- In the hinterland of South Beach, private developers are developing villa-type houses for sale.
- The development is spreading like sprawl, but infrastructure such as sewage systems and urban functions have not been sufficiently developed.

Source: JICA study team

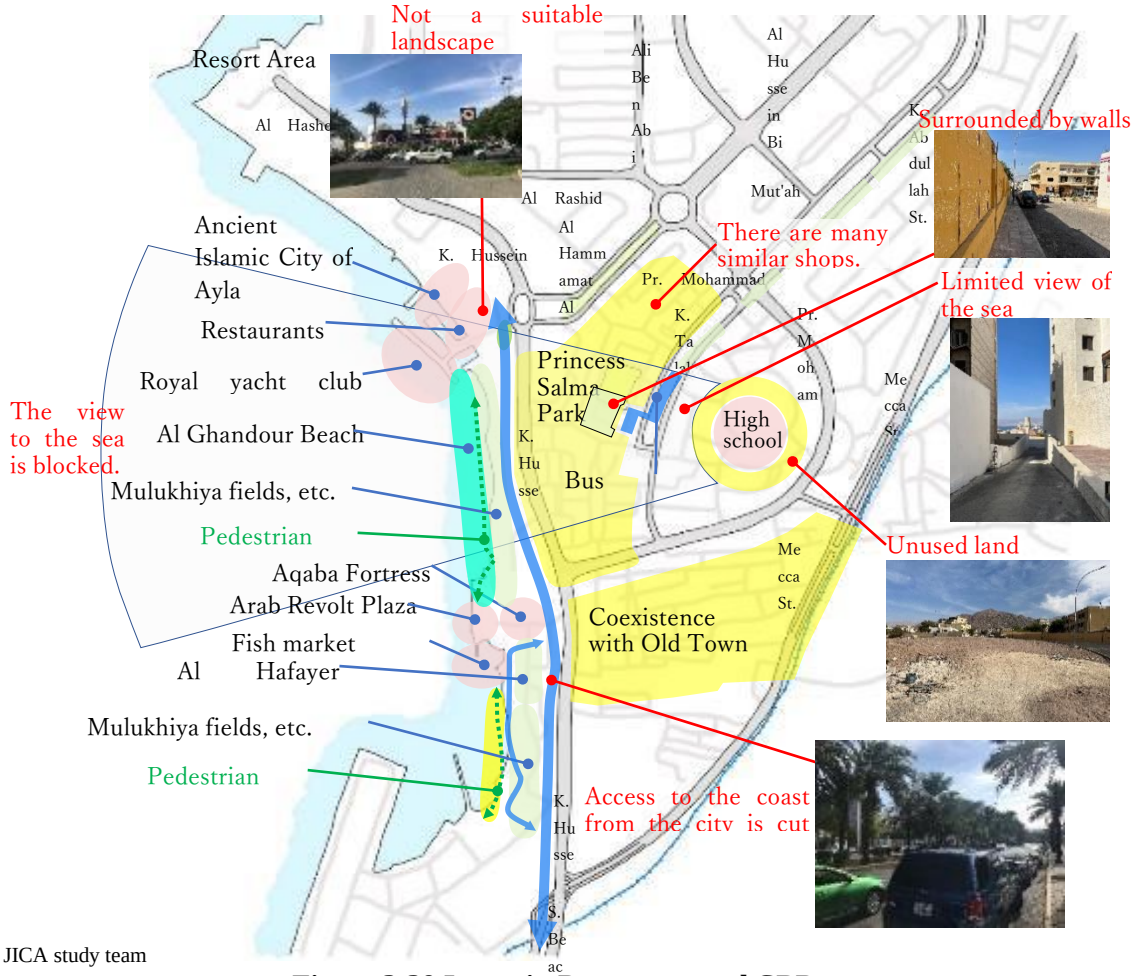
Figure 3-38 Issues related to land use

Issues in specific areas are as the following.

a) Downtown＆CBD

In the downtown area (CBD), which is considered as the “gateway” or “heart” of Aqaba and the most visited part of the city, several issues can be identified.

- The area around Ayla Circle is marked by chain stores and underutilized land and does not have a suitable landscape or functions as a gateway.
- K.Hussein.St. separates the town from the waterfront, making it difficult for pedestrians to cross to and from the waterfront smoothly and safely.
- The mid-rise buildings along K.Hussein.St. limit the view to the ocean.
- Although many commercial establishments are located in the downtown area, making it convenient to procure daily necessities, many of the stores are similar in business type, making the area less attractive for shopping.
- Many underutilized plots are in the east of K. Talal St., lacking continuity of streetscapes.
- Princess Salma Park is surrounded by walls and is not open to the surrounding community.
- Parking lots and parking spaces are scattered throughout the downtown, making it difficult to walk through the area as vehicle traffic lines divide the pedestrian flow lines.



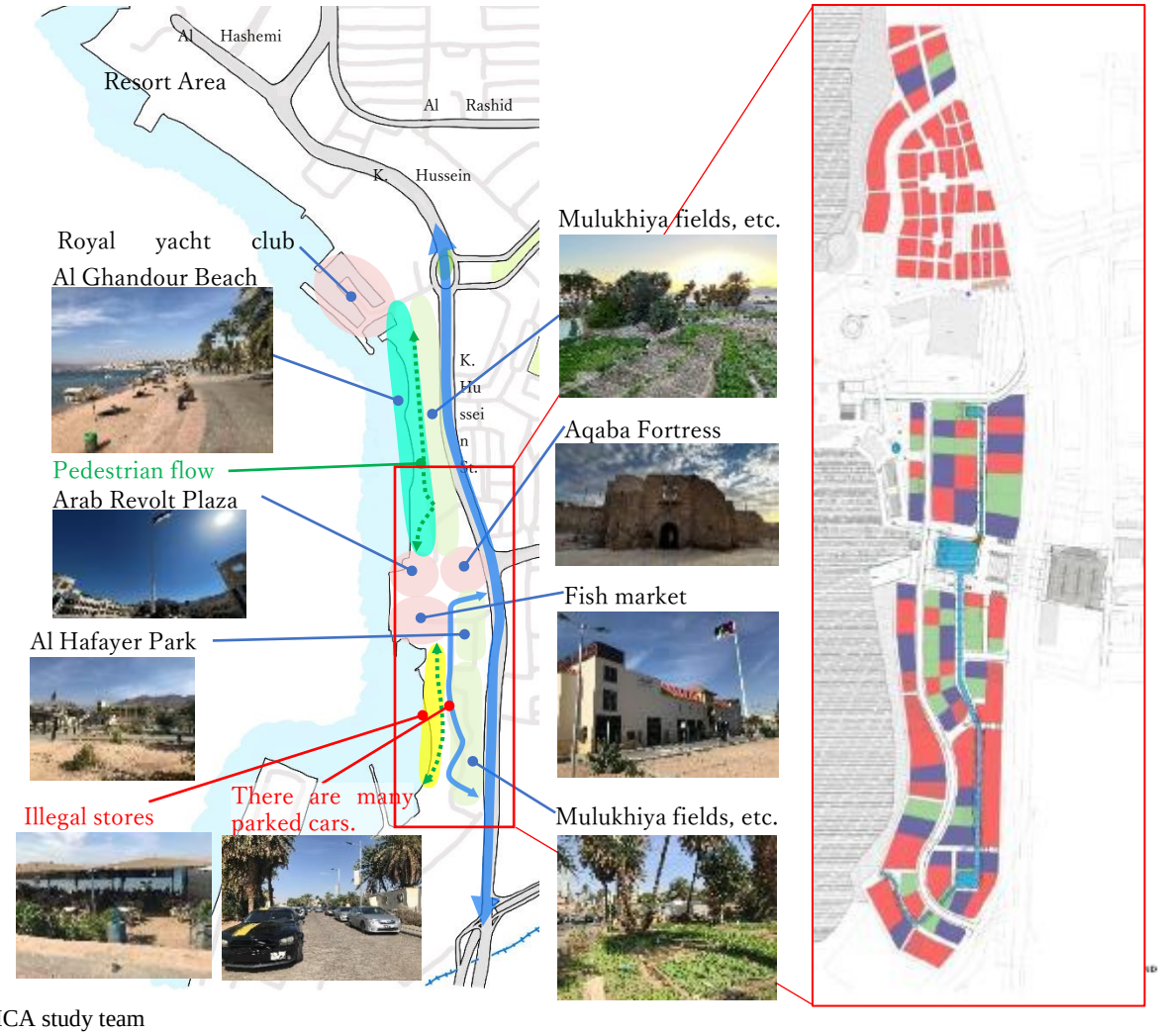
Source: JICA study team

Figure 3-39 Issues in Downtown and CBD

b) Al Hafayer

Along the coastline, including the Al Hafayer area, several issues can be identified.

- Al Hafayer is the only place in Downtown where both residents and tourist can easily access the seaside, and "feel" the sea. Together with Arab Revolt Plaza and Aqaba Fortress, it forms a valuable identity of the "good old Aqaba".
- Al Hafayer is the only place in Downtown of Aqaba where people can stroll around on the beach, but the pedestrian facilities are uncomfortable and not barrier-free.
- The hinterland of the beach is currently used as a field for growing molokheiya and other crops, preserving the view of the sea from K. Hussein St. However, some hotels and restaurants are being built without unity, affecting the view and the landscape of the area.
- South of Arab Revolt Plaza, restaurants are illegally occupying and operating on the beach. Additionally, many cars visiting the coastline are parked on the road, disturbing the comfortable walking environment.
- The west side of K. Hussein St. is subdivided into different plots with different owners, making cooperation with the private sector essential to promote integrated development. If this area is developed in an unregulated manner, the most precious environment in downtown Aqaba may be lost.



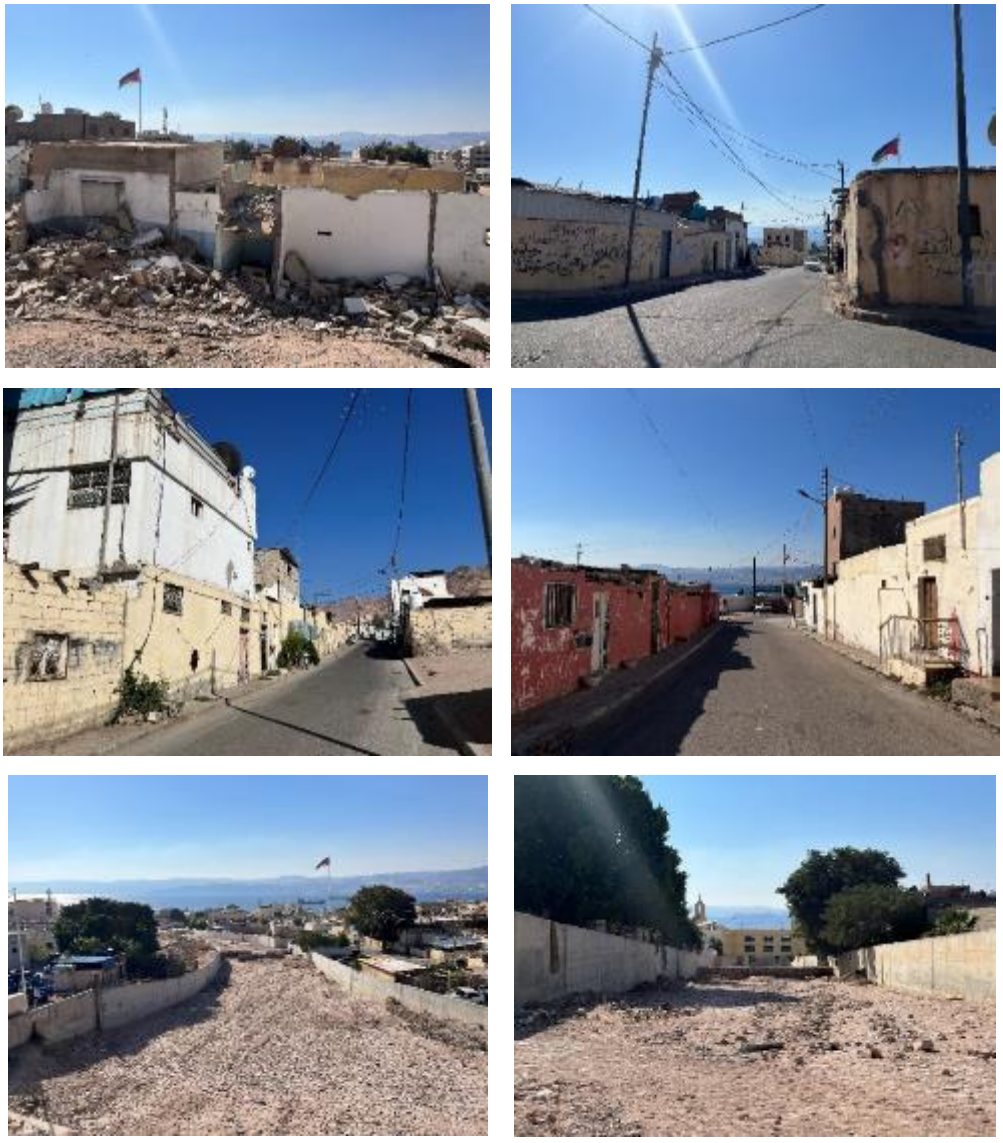
Source: JICA study team

Figure 3-40 Issues in Al Hafayer

c) Old town

In the Old Town, the following issues can be identified.

- Old Town extends to the east and west of Mecca St on the southeast side of downtown and is bounded by arterial roads such as K. Hussein St, Mecca St, and Pr. Mohammad.
- The streets in the district consist of divided roads without sidewalks or with narrow ones, and there is alley inside the divided roads. Many buildings are built facing those alleys.
- Most of the buildings used as residences are low-rise, with few detached houses and many in the form of tenements. This structure of the district is a feature not found in other districts of Aqaba.
- Many of the buildings are dilapidated, with roofs that are not watertight, and exterior walls have collapsed (or peeled off), making the living environment difficult.
- The Canal has been constructed in an east-west direction on the south side of the district and flows to the south of the Fish Market.



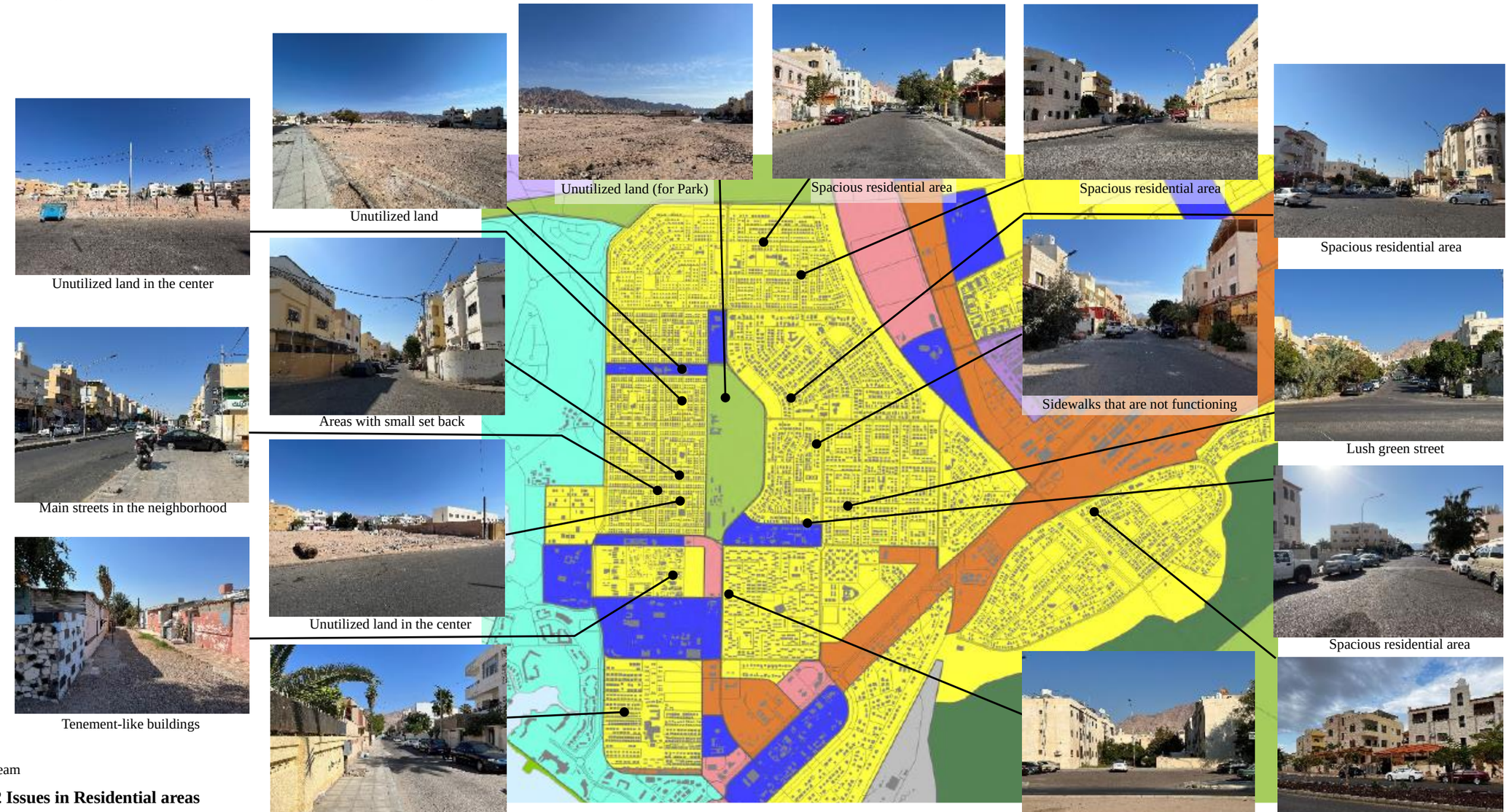
Source: JICA study team

Figure 3-41 Issues in Old town

d) Residential areas

The existing residential neighborhoods that spread across the north side of Downtown exhibit the following characteristics and issues:

- Housing characteristics vary by neighborhoods, likely due to the timing and intent of the development.
- Most residential buildings are three stories high, with older neighborhoods having smaller building footprints. The Al Sha'beya neighborhood consists of low-rise, tenement-like buildings that are noticeably dilapidated and unattractive. The Al Aalamiya neighborhood consists of a group of multi-unit residential buildings that are larger in scale than other neighborhoods.
- Residential buildings are set back from the street boundary, but exterior walls and fences are located on the street boundary in almost all residences, and the setback space is often used for private purposes. Sidewalks are provided on almost all roads, but they do not function as spaces for walking, as they are occupied by parked vehicles and other residents along the road, and some pavement is damaged.
- The center of the existing residential neighborhoods is planned to be developed as a park, but currently large areas of space remain unutilized.
- While mosques and schools are located in the center of each neighborhood, the adjacent areas or the entire center of each neighborhood are often unused, giving the area a somewhat desolate appearance.
- In each neighborhood, there are several stores that sell food and goods for daily living.



Source: JICA study team

Figure 3-42 Issues in Residential areas

2) Planning Issues

- Due to the current land use plan and the Design Standards, which specify detailed uses for each site (see Chapter 2), the types and designs of buildings that can be constructed in each district are strictly regulated. As a result, in residential and commercial areas, buildings of similar size and shape are ultimately developed, creating a uniform streetscape. On the other hand, the lack of land use complexity and diversity leads to reduced convenience and attractiveness.
- The lack of housing diversity is particularly noticeable, with only one type of land use designated for residential areas and similar Design Standard criteria applied across the board. This uniformity is considered a key factor preventing the planned development of diverse housing options.
- On the other hand, in areas without clearly defined purposes, such as Mixed Use or Resort Tourism zones, there is no clear policy on the concept of mixed-use (e.g., combining commercial, industrial, and residential uses). As a result, these areas have developed into patchwork-like zones with different uses inconsistently mixed within each district.
- In the Commercial/Retail and Mixed Use areas designated along major roads, there are numerous undeveloped lands, leading to an excessive amount of space relative to the population size.
- Industrial sites and residential areas for their employees are being developed on the mountainsides in the suburban areas, but they have little relationship with the city center, resulting in inefficiencies in the provision of daily living services.
- Although vacant areas can be seen in various places, parks and open spaces for recreation and relaxation have not been planned and arranged. Each district has its own height limit and setback rules for buildings,but these effects are limited to private spaces and do not contribute much to improving the attractiveness of public spaces.
- Aqaba's overall identity and the places that should be emphasized in urban development are not clearly defined, so the land use guidance and height guidance are not aimed at promoting their preservation and utilization.

3) Operational Issues

- The status of development and land use since then has not been monitored against the land use plan established in 2012, and although development applications and permits have been processed based on the guidelines, they have not been organized as data over time, so development trends (land use and building area by use) cannot be determined.
- GIS or other similar tools are not utilized to capture vacant land, making it difficult to determine the population and business capacity of the town.
- Although opportunities for architectural review based on the guidelines are provided, the results are not organized in a systematic manner over time. Guidance on the design of buildings and other structures is provided based on guidelines developed in 2000. However, since there is no overall policy on land use, even if the guidance is followed, the guidance tends to be mitigated on a case-by-case basis for individual sites or

development district as a result of payments by the project owner.

- There is no concept of conforming to new rules in places that have already been developed, and there is no recognition that new rules will be created in anticipation of buildings being rebuilt in the future.

3.3.3 Land Use Planning and Operational Issues in ASEZ

This section summarizes the issues identified from the land use issues described above.

(1) Creation of urban identity and attractiveness

- Clarify the city's identity as a city
- Improvement of the attractiveness of the downtown area as a gateway to the city
- Utilize the waterfront area and improve accessibility and visibility
- Promote utilization of Old Town neighborhoods
- Identify and promote utilization of underutilized land and vacant homes
- Integrate and improve circulation of the downtown area, historic sites, gated resorts, and large-scale projects
- Improvement of efficient, recreational and social facilities for residents and tourists

(2) Development of land use plans that harmonize tourism, industry, and residences in a functional manner

- Establishment of various land use rules and provision of housing styles
- Improving quality of life through proper arrangement of public space
- Attracting target industries and securing industrial sites suitable for commuting, etc.
- Creation of work and residential environments suitable for highly skilled personnel and new work styles

(3) Promotion of appropriate development management

- Appropriate understanding of development trends and current status of urban use and issues as a guiding plan

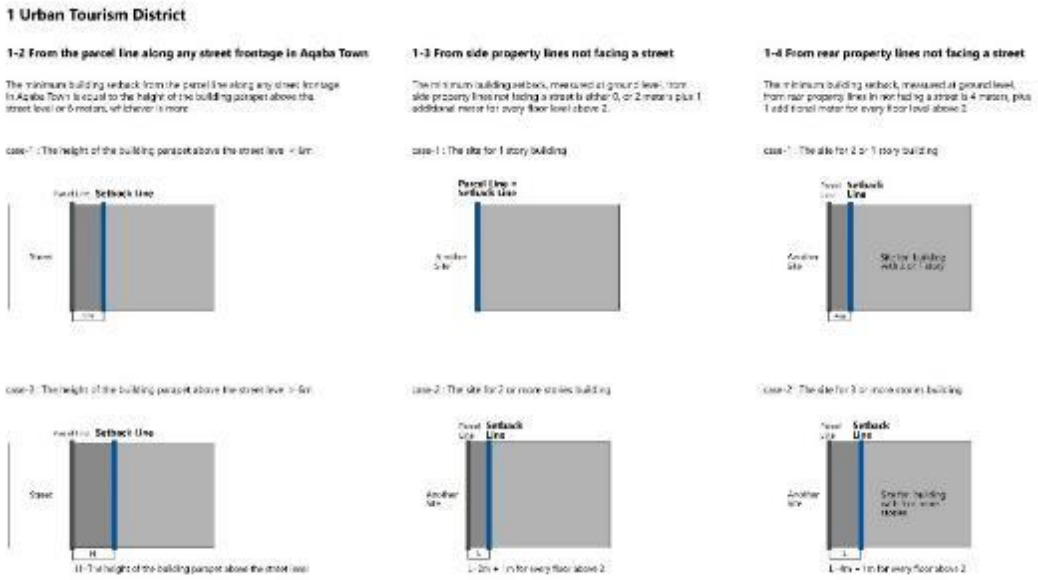
3.3.4 Landscape and Urban Design Issues in ASEZ

This section summarizes the operation of existing design guidelines, issues in landscape and building administration, and proposals based on these issues that have been identified in the study.

(1) Structure and contents of the Design Guidelines

- The current guidelines are based on the Gensler Master Plan, and the development zones, land uses, road network, and current conditions by zone, as defined in the guidelines, need to be updated to reflect the updated Master Plan.
- There are several qualitative provisions governing designability and quantitative provisions for collective provisions in the current guidelines. However, there are only few references, such as diagrams or photographs to explain them, and most of them are

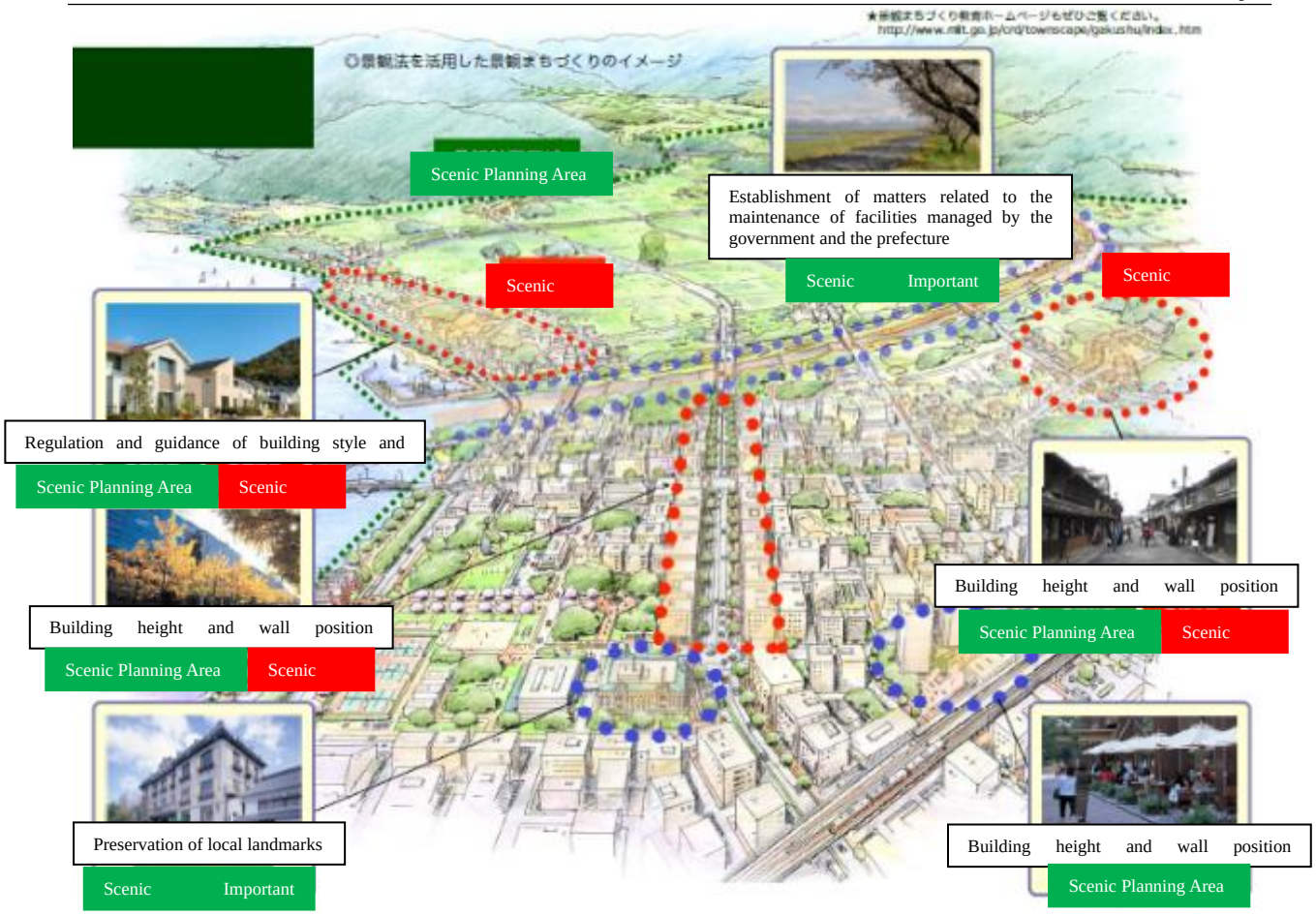
written explanations. This makes it difficult to maintain consistency in screening criteria for qualitative statements such as "traditional" or "Islamic". Moreover, quantitative standards for height restrictions, setbacks, etc., require the determination of applicable regulations by reading and interpreting multiple conditions presented only in writing for each planned site. The difficulty of this process makes it frequent for designers to rework their designs. To ensure that the image of the urban space that ASEZA aims for can be shared consistently with developers and designers, and to promote development projects smoothly and without rework, we propose that the revised guidelines include additional design references for qualitative provisions and illustrations to help understand quantitative criteria.



Source: Developed by JICA Study Team based on the Design Guidelines

Figure 3-43 Explanatory diagram of the setback provisions in the Design Guidelines (draft)

- The current guidelines include some of the basic ideas underlying the formulation and implementation of the guidelines, such as the urban development philosophy of ASEZ based on the Gensler Master Plan, the geographic location of Aqaba, and its architectural and landscape characteristics. The guidelines, therefore, do not provide a unified understanding and sharing of the direction of the master plan, the image of the urban structure and townscape that ASEZ as a whole should aim for, and the landscape planning policies. The revised guideline needs to include an introductory chapter that not only presents the overall philosophy, urban structure, and landscape planning axes, resources, zoning, and other concepts, but also includes a section that presents graphical documentation of these concepts.



Source: https://www.mlit.go.jp/crd/townscape/gakushu/data3/leaflet07.pdf

Figure 3-44Illustrative image of landscape town planning using the Landscape Law in Japan

(2) Operation of the Design Guidelines

- The Guidelines are a tool to support the realization of the principles set forth in the Master Plan, and since the current Guidelines encompass a wide range of fields, the Guidelines are being reviewed for updating, including architectural practice using the Guidelines and the bylaws that accompany the Guidelines. In addition to the Directorate of Urban Studies and Planning and the Licensing Directorate, it is necessary to establish a working group for updating the guidelines within ASEZA as a whole, and to collaborate across organizations and in multiple fields.
- In addition to the Guidelines, the current ASEZA design and construction review process requires compliance with detailed land use plans for each neighborhood in the ASEZ, as well as individual bylaws such as the Design Standards, a set of rules that summarize building regulations. However, the relationship between these and the guidelines is currently not clear from the ASEZA website or the text of the guidelines, and the information lacks comprehensiveness. It would be desirable for developers/designers to post all relevant regulations together on ASEZA's website, etc., so that they can obtain necessary information voluntarily and centrally in the early planning stages and be able to obtain information when new regulations are added.

(3) Mega Project

- On the other hand, for the design and construction of large-scale development projects, such as the Ayla Resort, Saraya, the Guidelines do not specify building restrictions, but rather require individual consultation between the developer/designer and the Mega Project Study Department within ASEZA. During the consultation process, the developer/designer and the Mega Project Study Department within ASEZA will discuss the building restrictions. Throughout consultation, the Mega Project Study Department will review the project plans submitted by the developer to ASEZA, taking into consideration Jordanian laws and regulations, ASEZA's direction for development in the region, and plans of past projects, etc. If necessary, the Mega Project Study Department may also consider the use of colors and designs that are not permitted under these Guidelines.

(4) Capacity building

- In discussions with stakeholders within ASEZA (Urban Planning Department, Mega Project Department, Zoning Committees Affairs Department, Licensing Directorate, etc.) about updating the design guidelines, some staff members were reluctant to update the guidelines once they had been established, while others were willing to allow additions to the guidelines but not changes. The reasons for such reactions include a sense of crisis that changing the contents from the current guidelines will negate the existing streetscape or transform it all at once, or a perception that many buildings and structures will become nonconforming and will have to be forcibly rebuilt. In some cases, there was a perception that a large number of buildings and structures would become existing nonconforming and would have to be forcibly rebuilt. When updating the guidelines, it is important to carefully explain that the guidelines do not deny existing streetscapes, that this is a long-term effort to gradually introduce new guideline concepts as buildings and infrastructure are updated, and that the update will be considered in cooperation with practitioners, and to gain understanding at the site level. It is important to gain understanding at the field level while proceeding.
- Currently, ASEZA does not have a database of information on mega-projects, nor of documents related to the review and approval of each building plan in ASEZ. In addition, there is a tendency for the work of architectural administration to be individual, as there is often insufficient handover from predecessors. It is proposed that, with the update of the Urban Design Guidelines, a database of past projects should be created as much as possible, so that all staff members can equally share their knowledge. This will enable efficient and systematic implementation of building administration based on the updated design guidelines and will lead to the establishment of an effective system to realize the landscape town planning and urban design that should be aimed for.

3.4 Tourism Development

3.4.1 Current Situation of Tourism in Jordan

(1) National Development Plan

1) Jordan 2025 a National Vision and Strategy (2015-2025)

"Jordan 2025 a National Vision and Strategy (2015-2025)" formulated by the Jordanian government in March 2014 is the highest national economic development plan established by the country of Jordan with a planning period from 2015 to 2025. It aims to (i) achieve an economic growth rate of 7.5% by 2025 and (ii) reduce the poverty and unemployment rates to 8% and 9.17% respectively. To achieve this vision, the government has established eight priority clusters, including tourism, based on the concept of industrial clusters to develop the private sector and recover from economic crisis caused by the political instability in the Middle East region; and identified priority projects and action plans.

In particular, the tourism and event cluster, which currently accounts for only about 6% of Jordanian employment (approximately 50,000 people) (as of 2014), has the potential to grow to 18%. In addition to developing new products such as families, medical care, and wellness tourism for the Arab region, it aims to increase employment opportunities for Jordanians through enhancing vocational training and education in tourism and event clusters. In addition, to diversify tourism, proposals have been made to attract MICE tourism is proposed as a venue for conferences and events and as a hub for diplomacy and humanitarian assistance in the Middle East.

2) Economic Modernisation Vision (2023-2033)

The "Economic Modernization Vision" is a vision for the modernization of the Jordanian economy formulated by the Jordanian Royal Palace in January 2022 under the initiative of the current King Abdullah II of Jordan, and under the slogan "A Better Future", sustainable economy is at the center of the vision, and 2033 is set as the target year of the plan. It has two pillars: (i) accelerating growth by maximizing Jordan's economic potential, and (ii) improving the quality of life for all citizens.

Eight priority areas are defined to realize this vision, and more than 30 0 initiatives are planned to be implemented, and each plan has specific goals, implementation processes, KPI, the responsible bodies and related organizations are indicated.



Source： Economic Modernization Vision

Figure 3-45 Eight Priority Areas of the Economic Modernization Vision

In particular, the development of "Destination Jordan", including the "tourism industry", is positioned as one of the eight priority areas, with the goal of "positioning Jordan as a major tourism and film production destination" and it lists (i) tourism and (ii) film production as subsectors. In the tourism subsector, 25 initiatives are planned, including development of cultural and natural tourism, medical and wellness tourism, religious tourism, etc.

The Economic Modernization Vision sets the following KPIs to be achieved by 2033.

Table 3.51 KPIs of the tourism industry in the " Economic Modernization Vision "

KPI	2021	2033	evolution/year
Tourism			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.9	2.8	+10%
Employment (k FTE[1])	50.6	149.6	+9.5%
GDP/employee (k JOD)	17.5	18.6	+0.5%
Exports (Billion JOD)	1.5	6.9	+13.6%

Source: Economic Modernization Vision

3) Jordan Tourism Strategy (2021-2025)

The "Jordan Tourism Strategy 2021-2025" formulated by the Ministry of Tourism and Antiquities (MoTA) in January 2020 is a five-year national tourism development strategy formulated after the outbreak of COVID-19. With a vision of achieving economic growth through sustainable tourism and mitigating the impacts from the COVID-19, the strategy aims to highlight the uniqueness of Jordan's history and heritage and it sets out five measures: (i) developing products and experiences that exceed the expectations of domestic and international tourists, (ii) public-private partnerships, (iii) community inclusion, (iv) conservation of Jordan's cultural heritage, and (v) investment promotion and competitiveness enhancement.

4) Tourism Sector Green Growth National Action Plan (2021-2025)

The Tourism Sector Green Growth National Action Plan 2021-2025, formulated in July 2020 by the Ministry of Environment (MoEnv), Government of Jordan, states that sustainable development will be achieved through mitigation of shocks such as COVID-19, strengthening capacity to recover from severe economic, and strengthening resilience. The tourism sector will contribute to achieve SDGs through five pillars such as (i) Strengthening natural resources, (ii) sustainable economic growth, (iii) social development and poverty reduction, (iv) efficient use of resources, and (v) responding to and adapting to climate change.

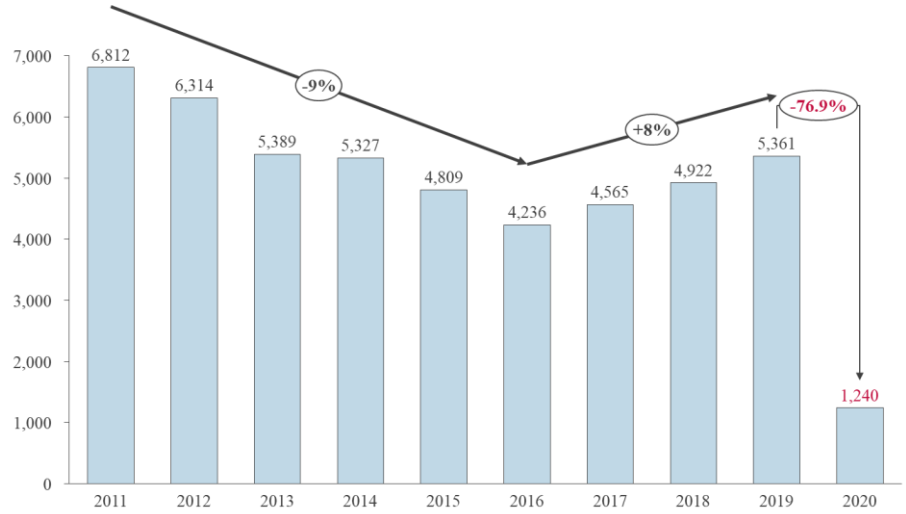
Under these goals, 12 specific action plans have been established, including the expansion of ecotourism in protected areas and the promotion of cooperation with other tourism products, and the improvement of tourism products and services in the Petra region.

[1] FTE: Full Time Equivalent

(2) Tourism Market Trends

Regarding Jordan's tourism market, the number of visitors to Jordan has been decreased since 2011 due to the Lehman shock in 2008, as well as political instability in the Middle East region because of the Islamic State (ISIL), Syrian war, the conflict in Palestine, etc. In response, the Jordanian government implemented various measures to recover the tourism industry, such as revision of visa conditions. Although the number has been increased since 2017, due to the impacts from COVID-19, the number of visitors to Jordan was decreased by 79% to 1.2 million in 2020, from 5.3 million in 2019.

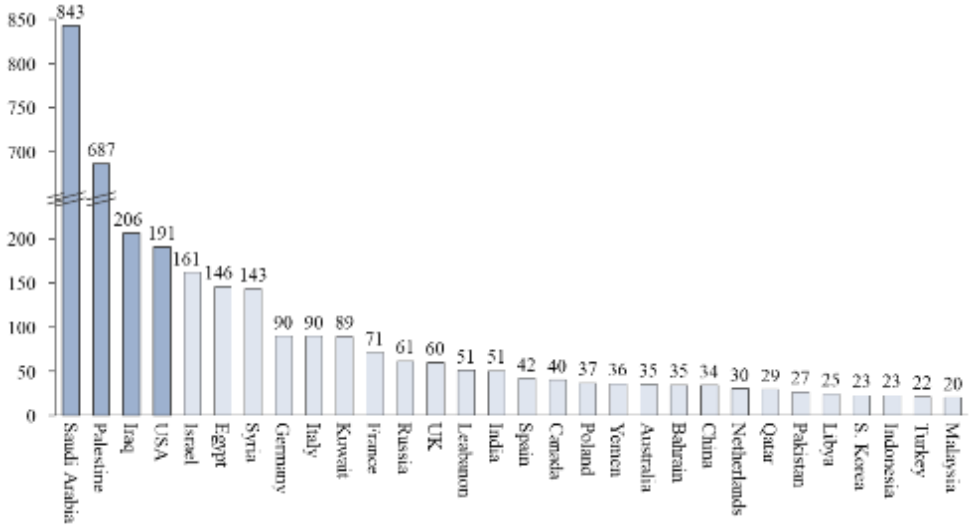
To analyze the statistical data, the analysis in this chapter mainly refers to the data before 2019. Because the data before 2019 without the impacts from COVID-19 has well represented the actual status of tourism in the region.



Unit: thousand (persons), Source: MoTA

Figure 3-46 Number of visitors to Jordan

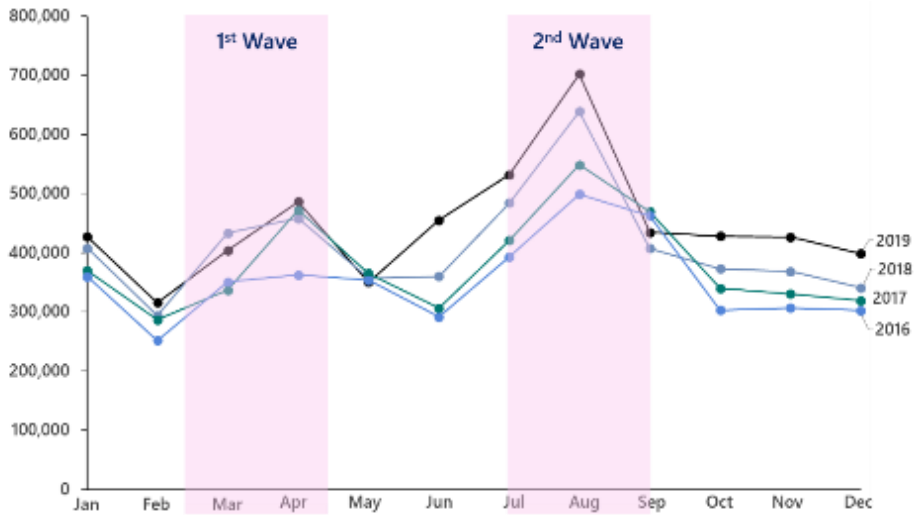
Looking at the number of visitors to Jordan by country, Saudi Arabia leads Jordan's top 30 source markets, followed by Palestine, Iraq, and the United States of America (USA). According to the data from JTB (Jordan Tourism Board), the tourists from KSA and Palestine visit Jordan with various purposes of entertainment tourism, including experiencing large-scale events such as music concerts, city tours of Amman and other large cities, and shopping. In 2019, 842,551 tourists visited to Jordan from KSA and 687,000 from Palestine.



Unit: thousand (persons), Source: MoTA

Figure 3-47 Top 30 Countries by Visitor to Jordan (2019)

Regarding the seasonality, there are two major peaks in Jordan such as (i) easter holiday, when the number of visitors from Europe and the United States increases, and (ii) the summer vacation season when the number of visitors from the Arab world increases. Main purpose of the visitors from the Arab world are VFR[2], especially the visitors from Saudi Arabia.



Source: MoTA

Figure 3-48 Seasonal fluctuations in the number of visitors in Jordan

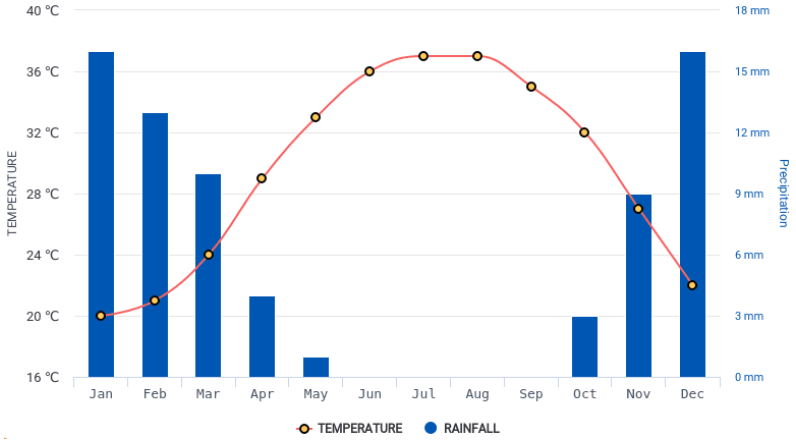
3.4.2 Current Situation of Tourism in ASEZ

Aqaba is Jordan's only port city, next to the border with Saudi Arabia, Israel, and Egypt, as well as the tourist gateway in the south of Jordan that receives LCCs from European cities.

[2] VFR (Visiting friends and relatives): Travel for the purpose of visiting friends and relatives.

(1) Natural conditions

Aqaba, located on the shores of the Red Sea, boasts a mild climate with minimal rainfall all year round, making it an ideal winter retreat for long-stay visitors from Europe, the United States, and Russia.



Source: Meteorological agency Jordan

Figure 3-49 Temperature and precipitation in Aqaba by month

(2) Main tourism resources

Aqaba is a world-famous destination for diving enthusiasts and beachgoers during the summer season, attracting tourists from the Arab world and domestic visitors. However, despite the city's rich cultural heritage, including ancient ruins such as the oldest Christian church, the ruins of Islamic Ayla, the Mamluk fortress, and the old town with its local inhabitants, these sites are not well recognized by tourists.

The tourist destination that combines Aqaba, Wadi Rum and Petra is called the Golden Triangle of southern Jordan tourism. Wadi Rum, which is a UNESCO World Heritage Site, is under the jurisdiction of ASEZA and located about one hour by car from the city center of Aqaba. In the park of Wadi Rum, there are the ruins of house of the Lawrence in Arabia and a stone bridge, and it is one of the popular tourist spots to enjoy tours by 4WD vehicles and stargazing at glamping facilities.



Red Sea	Wadi Rum (UNESCO World Heritage)	Petra (UNESCO World Heritage)

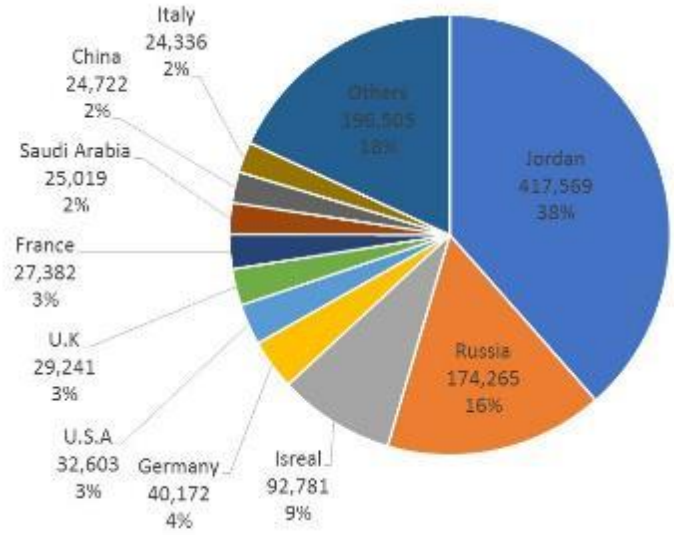
Source: ASEZA, JICA study team

Figure 3-50 Tourism resources in the Golden Triangle

(3) Tourism Market Trends

A breakdown of the number of hotel arrivals in Aqaba reveals that around 40% of the total visitors' domestic tourists, indicating that Aqaba is primarily positioned as a destination for Jordanians, while Petra and Wadi Rum attract international tourists.

However, it's worth noting that the tourism statistics provided by MoTA are based on data from border posts, while ASEZA's statistics rely on hotel data. This means that if a tourist checks in and out of a hotel in Aqaba multiple times during their trip, after staying overnight in Wadi Rum or Petra, they will be counted as multiple visitors from their source market. As a result, this hotel data only shows the share of hotel arrivals by source market and does not accurately reflect the actual number of visitors.

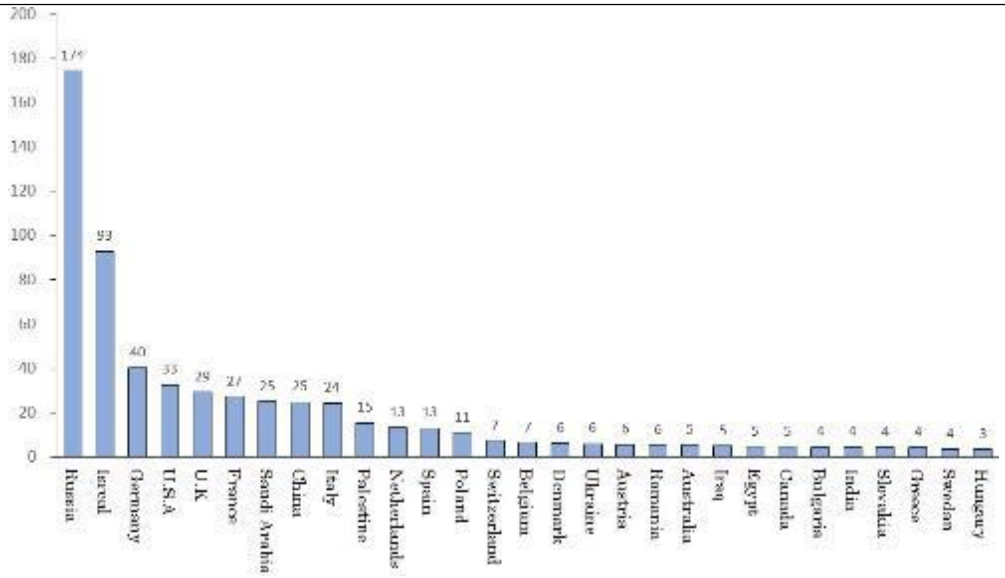


Unit: 1,000 (times), Source: ASEZA

Figure 3-51 Number of Hotel Arrivals in Aqaba (2019)

1) Overseas Markets

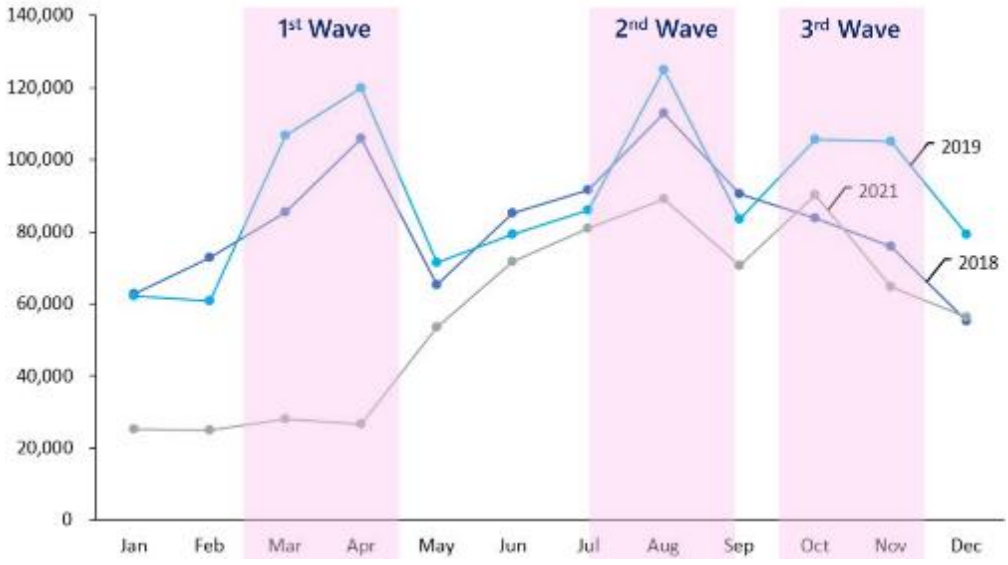
As of 2019, Russia was the top in terms of the hotel arrivals in Aqaba. This is because winter resort destination has moved to Aqaba after an accident of Russian airplane suspected of being caused by explosives in Sharm el-Sheikh, Egypt in October 2015, which had attracted many tourists from Russia. However, the Russian market has been completely extinguished since Russia's invasion of Ukraine in 2022, and the current tourism market in Aqaba has changed significantly.



Unit: 1,000 (times), Source: MoTA

Figure 3-52 Top 30 countries by Number of Hotel Arrivals in Aqaba (2019)

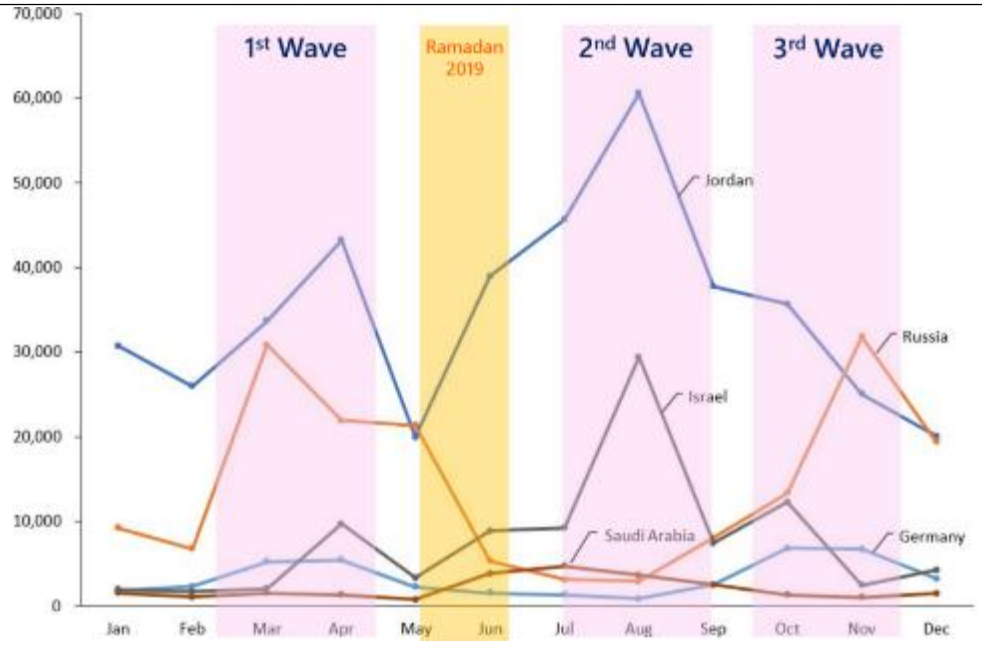
Aqaba also shares a border with Saudi Arabia and the number of visitors from Saudi Arabia ranks first in Jordan as a whole (Figure3-40). On the other hand, in terms of the number of hotel arrivals in Aqaba, Saudi Arabia ranks second next to Europe and the United States and it shows that Aqaba has not been able to attract enough tourists from Saudi Arabia. This may be partly due to the lack of accommodation facilities for the wealthy class and the limited number of tourism products and facilities that can attract long-stay visitors or families.



Unit: times, Source: ASEZA

Figure 3-53 Seasonal variations in Number of Hotel Arrivals in Aqaba

As mentioned above, in addition to the two major peaks in seasonal fluctuations in Jordan: Easter, holiday when the number of visitors from Europe and the United States increases, and during the summer vacation season when the number of visitors from the Arab world increases, Aqaba also has another peak in autumn, which is an advantage compared to other regions to regulate seasonality. This is presumed to be in response to the fact that the number of tourists to Petra, which forms the same tourist destination with Aqaba as the Golden Triangle, has a peak in September-November, and they also visit Aqaba.



Unit: person, Source: ASEZA

Figure 3-54 Seasonal variation of the number of Hotel Arrivals in Aqaba by source market

Regarding the seasonality in the number of hotel arrivals in Aqaba by source market, the visitors from Europe and the United States tends to increase in Easter holiday, which is the high season in Petra and Wadi Rum, and in September- November.

2) Domestic Market

In contrast, in August, tourists from Jordan and from Arab countries such as Israel and Saudi Arabia and neighboring countries tend to increase. This implies that developing tourism services and infrastructure that meets the needs of different seasons and markets can be an effective strategy for promoting tourism in Aqaba.

When proceeding with tourism development, the domestic market is sometimes neglected. However, as mentioned earlier, Aqaba has been recognized mainly as a destination for Jordanians. Therefore, it is important to develop tourism services and infrastructure that meet the needs of the domestic market. This will not only strengthen the sustainability and resilience of the destination, but also prepare the external incidents, such as decrease of international tourists due to external factors such as COVID-19 in recent years.

(4) Foreign Investment

Currently, there are large resort complexes in Aqaba such as Ayla Resort, which was built with private sector funds by EBRD, and Saraya Aqaba developed by (Eagle Hills) in Abu Dhabi, Additionally, the Marsa Zayed project, large-scale resort in total 2,078,415m^2, is currently underway at the old port of Aqaba, which was relocated to the south and is being developed by the same capital as Saraya Aqaba (some condominium areas have partially opened).



Ayla Project	Saraya Aqaba Project	Marsa Zayed Project

Source：ASEZA

Figure 3-55 Tourism MEGA Projects in ASEZA

The regulation in Jordan stipulates that foreign investors who purchase land and conduct business in the country must establish a Special Purpose Company (SPC) with a Jordanian-registered company, and at least 51% of the total land must be owned by the Jordanian company. However, within Aqaba, which is designated as a Special Economic Zone (SEZ), 100% ownership of land by foreign companies is permitted. This provides a significant incentive to attract foreign investors to invest in Aqaba's urban development sector.

(5) Tourism Promotion Strategies

Since 2020, due to the COVID-19, the Jordanian government, like other countries, has imposed strict entry restrictions and quarantines on international visitors. This, as mentioned above, led to a significant decline in international tourists, which severely hit the country's tourism sector. In fact, many hotels and restaurants in Jordan have closed, and a huge number of jobs in the tourism sector have been temporarily lost.

To alleviate this situation, the Jordanian government's Ministry of Tourism and Antiquities (MoTA) has been launched a campaign called "Jordan Paradise" since August 2020 as a promotional measure for the domestic market rather than the overseas market subject to COVID-19 entry restrictions. The program is continuing in January 2023, with the government subsidizing the full cost of transportation and 50% of accommodation for domestic travel on specific days of the week to areas affected by COVID-19, such as Aqaba, Wadi Rum and Petra. ASEZA also supports folk events and concerts as part of the promotion of the Golden Triangle called "Hawa South".

In addition, to actively capture not only the senior segment, which has been the main segment of the tourism market so far, but also the younger generation X segment, the company is expanding its direct low-cost carrier (LCC) routes between Aqaba's international airport and cities in Europe and the Middle East.

(6) Human resources and employment in the tourism industry

Although the above-mentioned "Economic Modernization Vision" targets for increasing the number of full-time direct jobs in the tourism sector across Jordan from 50,600 in 2021 to 149,600 by 2023 as one of the KPIs of the tourism industry, most of the jobs in the tourism sector are indirect employment belonging to the informal sector, and in Jordan, there are no official employment statistics for each sector compiled by the government, and consequently, it is difficult to grasp the actual situation of employment accurately.

To estimate the number of jobs in the tourism sector, a method assumes that each hotel room creates one formal employment and three non-regular jobs. The ASEZA and BCG report

also adopted this calculation method, estimating that the number of formal employments in the tourism sector in Aqaba is around 6,200.

Out of the total number of employees in the tourism sector, women only make up around 15%, which is relatively low compared to other industries. This is largely due to the perception that providing services related to alcohol is not culturally acceptable for women in Islamic countries.

On the other hand, it should be noted that the above figures give the number of jobs and do not represent the number of Jordanians employed in the tourism sector. Indeed, for the reasons mentioned above, many of the people employed in Aqaba's tourism sector are migrant workers from Islamic countries with low labor costs, such as Egypt, Pakistan, Bangladesh, and Indonesia. Many of the employees in restaurants, bars, etc., that serves alcohol are migrant workers from semi-English-speaking non-Islamic countries such as India and the Philippines.

In contrast, highly educated Jordanians, as a labor from quasi-English-speaking country, are flowing out to Europe, the United States and other high-salary neighboring countries such as Israel, Saudi Arabia, Qatar, and the UAE, and the tourism sector is one of the most hollowed-out industrial sectors in Jordan.

(7) Current State of Tourism Infrastructure

1) Hotel

In Aqaba, there are several large 4-5 stars class hotels located in downtown and Tala Bay on South Beach, as well as luxury hotels such as the latest large resort hotels mentioned above. The number of 4-5-stars hotels rooms already exceeds the number of rooms in hotels around the Dead Sea (about 2,500 rooms). Looking at the seasonality in the occupancy rate of hotels in Aqaba, the occupancy rate of hotels with higher ratings, mainly 4-5 stars hotels, tends to increase around Easter holiday and September-November, when tourists from Europe and the United States increase.

On the other hand, during the summer vacation season, when tourists from Jordan and from Arab countries such as Israel and Saudi Arabia and neighboring countries increase, the occupancy rate of hotels with a three-star class or less tends to increase, clearly showing the preference of hotels corresponding to the market.

For 4-5-star hotels, the room occupancy rate in high season is already over 80%, already exceeding capacity. In addition, many 4-5-star hotels are around 20-30 years old, aging facilities are observed in some hotels. To meet the needs of these markets, the construction of new hotels and the further increase in the number of rooms are required, and the construction of large-scale resort complexes such as the Marsa Zayed, which is currently being planned, is also supported by these needs. In addition, projects for these large-scale complex resorts include a marina for private cruisers for the wealthy class and the sale of condominiums and are being developed as destinations for long-stay resorts.

The occupancy rate of hotels with 3 stars or less is around 40% on average throughout the year, which is below the general breakeven point of about 50%, and while an analysis is possible to assume that there is an oversupply in terms of room capacity, these hotels with 3 stars or less are often managed by SMEs and they lack sufficient know-how to attract tourists through digital marketing, etc., which is one of the reasons for the low occupancy

rate, and it is also important to develop a business environment for hotels with 3 stars or less to access the market from the perspective of tourism development in the region.

Aqaba Hotels		
Hotel	Rooms	Beds
5 deluxe	493	583
5 stars	1,752	2,586
4 stars	867	1,709
3 stars	322	677
2 stars	818	1,777
1 stars	459	1,226
Under Classification	788	1,752
TOTAL	**5,499**	**10,310**



Source: ASEZA

Figure 3-56 Seasonal variations in hotel occupancy rate in Aqaba

2) Tourism-related facilities

Aqaba has its own Tourist Information Centre (TIC) in the airport and in the center of downtown, but tourist use is limited. Although the area around the ruins of the Mamluk fortress along the coastal area of the downtown has been developed as a public park, including Arab Revolt Plaza, Fish Market, Aqaba Museum, and cruise port, many of the spaces for shop are still closed because there is no tenant.

ASEZA's tourism directorate currently has a plan to renovate the old city hall building as a new TIC and a local ethnographic museum.

3) Other public facilities

Many cruise ships from Scandinavia and the Mediterranean visit at Aqaba port, and the International Passenger Terminal is currently being developed with the construction of a large resort complex at the Marsa Zayed, which is being planned on the site of the former central port.

Aqaba also serves as an important air gateway for tourism in the southern part of Jordan, with an international airport. Several economic development plans have proposed constructing a new exhibition facility adjacent to the airport area, which will serve as a base for MICE tourism. In line with the political context of the Middle East, the SOFEX military industry exhibition is planned to be held every two years. The Saraya project includes the Al Multaqa Conference Center, which can accommodate approximately 2,000 people.



Tala Bay Grand Hotel



Arab Revolt Plaza



Aqaba International Conventions Centre

Source: ASEZA, JICA study team

Figure 3-57 Major facilities in ASEZ

4) Public Transport

According to the Aqaba Airport Company, the number of passengers at Aqaba international airports was around 144,000 per year in 2019. Currently, flights that have been suspended due to the influence of COVID-19 has been almost recovered, and LCC flights from EU countries such as Italy, Switzerland, Greece, the UK and Germany, as well as major cities in the Middle East such as Turkey and Abu Dhabi, have been re-operated. In addition, many overseas cruise ships from Scandinavia and the Mediterranean Sea visit to the Aqaba port.

Regarding inter-city transportation in Jordan, in addition to long-distance buses that connect cities, several private bus companies operate sightseeing buses exclusively for tourists to visit major tourist attractions.

On the other hand, regarding inner-city transportation in Aqaba, although there are some transportation services such as buses and taxis, but the routes and fares are unclear to the tourists, and it is not highly convenient for them to use. To improve the situation, ASEZA is currently planning to reconstruct long-distance bus terminal located in the center of downtown.



King Hussein International Airport



Cruise ship visiting in the Aqaba Port



A Long-Distance Bus in Jordan (Alpha)

Source: ASEZA, JICA study team

Figure 3-58 Tourism resources in the Golden Triangle

5) Leisure facilities and services

Regarding leisure facilities, Ayla, large-scale resort complex, has golf course, marinas, and some commercial facilities such as restaurants and boutiques. On the south beach, there is the BERENICE Beach Club, established through PPP with ADC, which offers services such as scuba diving, snorkeling, and cruising in the Red Sea for tourists who stay in hotels in the downtown area that do not have a private beach.



Ayla Golf Club	Entertainment in the Red Sea	BERENICE Beach Club

Source：ASEZA, JICA study team

Figure 3-59 Tourism resources in the Golden Triangle

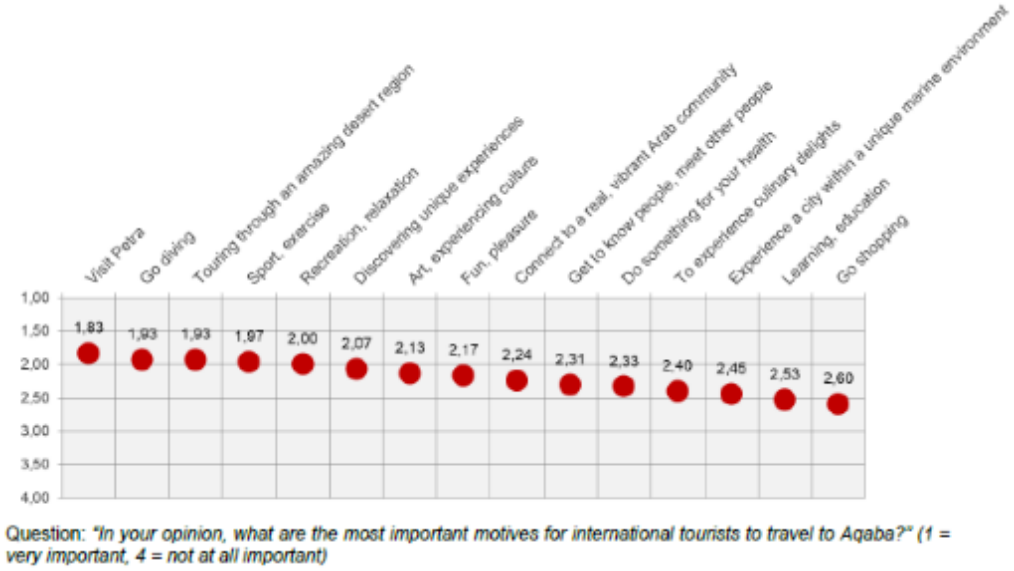
(8) Review of tourism development plans

1) A Strategic Plan for Aqaba Tourism (2002-2007)

The "A Strategic Plan for Aqaba Tourism " is a five-year tourism development plan formulated in August 2002 that targets 2007, with the support of USAID. In Aqaba, no policy documents related to tourism development have been prepared after this plan. The plan targets three pillars to develop (i) entertainment and amusement, (ii) market access, and (iii) promotion. Based on these pillars, it has formulated short-term (2002-2004), and medium-term (2005-2007) action plans related to the development of experiential activities such as nightlife, shopping, and sports, the improvement of access from major European cities by opening new routes by air and sea, and the improvement of the negative image of Jordan and the Middle East. Actions related to the urban planning field include the development of facilities in the South Beach and the construction of exhibition and convention facilities, which have not been realized yet.

2) Assessment of Aqaba ‘s Positioning and Proposals for Positioning

This document is formulated in July 2022 as a research report for the brand strategy of Aqaba tourism by GIZ's ongoing "Employment Promotion Project for Micro, Small and Medium Enterprises (MSMEs) on Digital Transformation and Product Development Innovation: Digital Transformation and Product Development and Innovation Employment-oriented Micro, Small & Medium Enterprises (MSMEs) Promotion Project”. This study investigates the motivation for the visit of visitors who visited Aqaba and confirmed that many tourists visit Aqaba for diving.



Source: GIZ, Assessment of Aqaba 's Positioning and Proposals for Positioning

Figure 3-60 Motivation for the visit of visitors who visited Aqaba

On the other hand, the report cites Wadi Rum and Petra as landmarks of Aqaba tourism and recognizes that Wadi Rum and Petra are inseparable in the development of tourism in Aqaba.

3.4.3 Challenges on Tourism Development in ASEZ

(1) SWOT Analysis

The results of SWOT analysis to confirm status of the tourism development in Aqaba are shown in the table below.

Table 3.52 SWOT Analysis of Tourism Development in Aqaba

	Positive Factors	Negative Factors
Internal Conditions	**Strength**	**Weakness**
	・Aqaba is positioned as an international gate way in Jordan with international airport and port. ・Aqaba is a base to visit the world heritage sites, such as Wadi Rum and Petra, that consist destination of the "Golden Triangle". ・LCCs, such as RYANAIR, easyJet and WIZZ, directly connect cities in Europe and the Middle East. ・Historical heritages are located inside downtown. ・The Red Sea is a world-famous diving destination. ・Attractive beach along the Red Sea. ・A dynamic semi-arid mountain scenery. ・Smooth road connections to other region in Jordan and neighboring countries, such as Israel, Egypt and Saudi Arabia. ・Political stability. ・ASEZA is single autonomous entity to manage tourism, infrastructure, etc.	・Limited number of rooms of high-demand 4-5 stars hotels. ・Coastal area near downtown is not attractive to the tourists and there is no physical respiration between sea and downtown. ・Tourists cannot enjoy shopping and there are few spaces where they can walk comfortably in the downtown. ・The southern beach area and downtown are separated by ACT ・No comfortable public transportation for Tourists. ・Labor force depends on low-cost migrant workers and low employment rate of women in the tourism industry. ・Tourists' average length of stay is limited as 2.4 nights of Jordanian and 2.1 nights of non-Jordanian (in 2019). ・Very few local souvenirs and most of them are imported. ・Jordanian labor costs are relatively high. ・High cost of electricity and potable water for tourism usage.
External Conditions	**Opportunity**	**Threat**
	・Active foreign investment to the tourism sector, such as Ayla, Saraya, and Marsa Zayad. ・Geographical characteristics as a winter resort close to Europe. ・Aqaba attracts the world's top high spender countries, including Gulf countries, Russia, USA, Germany, etc. ・Potential of MICE, especially for meetings and incentives. ・Synergy with other neighbor destination, such as NEOM, Al-Ula.	・Outflow of tourism human resources to the high-wage labor market, such as Saudi Arabia, Europe and USA. ・Cost competitiveness for tourists to choose destinations is relatively low. ・Increased solid waste and sewage due to increased tourist and increased pollution risk due to lack of treatment facilities. ・Increased disaster risk due to climate change. ・Unstable situation in the region.

Source：JICA Study Team

1) Inputs to Urban Planning M/P

Although Aqaba is a town facing the Red Sea, the downtown and the beach are separated by many private buildings and large hotels with private beaches. This not only reduces its attractiveness as a beach resort, but the roads and streets are not designed for pedestrians, and there are few areas where tourists can enjoy shopping and walking. Additionally, the old town is an important tourist resource where tourists can experience daily life in an Arab country. However, the disorderly construction and unclean roads make it difficult to enjoy.

The South Beach where beautiful coral reefs remain and the downtown are completely separated by the Aqaba Container Terminal (ACT) from the viewpoint of urban relations, and there is no public transportation connecting them.

Moreover, solid waste separation collection systems and solid waste treatment plants with waste incineration facilities are not available in any municipality in Jordan. All solid wastes are directly dumped at landfill sites located at the outskirts of each city, and no measures have been taken to prevent groundwater contamination.



Aqaba Downtown



Aqaba Container Port (ACT)



Solid Waste Landfill

Source：ASEZA, JICA study team

Figure 3-61 Urban issues related to Tourism

2) Competitiveness

Aqaba faces competition from Sharm el-Sheikh in Egypt, which is also located on the Red Sea. However, following a recent air accident, tourists from markets like Russia, who used to visit Sharm el-Sheikh, have started to come to Aqaba instead. Moreover, Aqaba is the only city with coral reef beaches developed as a resort on the Red Sea coast, giving it a significant advantage as a diving destination.

As stated earlier, Aqaba is the air and sea gateway to the Golden Triangle of southern Jordan tourism, which includes the UNESCO World Heritage-listed sites of Wadi Rum and Petra. It is also the only port city on the Red Sea that attracts many cruise ships for tourism.

3) Sustainability

From the perspective of sustainable tourism development, the biggest concern due to the increase in number of tourists and the urban development is the negative impact on the environment. As mentioned above, Aqaba's greatest tourism resource is the rich Red Sea marine environment, and if the rich marine environment is lost due to urban development, Aqaba's tourism will not be able to survive. Furthermore, to conserve the marine environment, it is essential to develop infrastructure related to waste treatment and sewage treatment as a part of urban development.

3.5 Industrial Development

3.5.1 Current Situation of Industry in Jordan

(1) National development plan

1) Jordan 2025 A National Vision and Strategy (2015-2025)

In addition to tourism and event clusters, seven priority industry clusters are listed in the "Jordan 2025 National Vision and Strategy" mentioned above as priority industry clusters: construction and engineering, transportation and logistics, healthcare, life sciences, digital business services, education services, and financial services.

In particular, the number of jobs in the life science cluster is currently only about 8,000, but the pharmaceutical industry is growing at an annual rate of about 25%, and pharmaceuticals are the third largest export product after fertilizers and apparel. On the other hand, Jordan's share of pharmaceuticals in the MENA region is only about 6%, leaving a lot of room for development. Jordan has a high proportion of doctors per population, and it is effective to combine the biotechnology and pharmaceutical industries with medical facilities and develop them as clusters.

For digital business services cluster in the MENA regions, it is expected that the ICT-related market will expand to 120 billion USD in two years (2015-2017). On the other hand, although Jordan had 16,000 direct employment opportunities (as of 2013), due to the outflow of Jordanian highly skilled human resources to outside of Jordan, Jordanian employment in digital business services clusters has shrunk at an annual rate of 2.5 percent from 2007 to 2013.

2) Economic Modernisation Vision (2023-2033)

Regarding eight priority areas of the “Economic Modernization Vision”, those related to industrial development, other than "Destination Jordan" related to the tourism mentioned above, development of the "High Value Industries" and the "Future Service" is also targeted in the vision. Among them, "High Value Industries" has set the goal of "developing Jordan into a regional industrial hub through the growth of exports of high-quality and valuable products” and is designed to develop nine sub-sectors such as agriculture and food security, mining, manufacturing, food processing, chemicals, pharmaceuticals, textiles, engineering products and transportation and logistics. In addition, the "Future Service" targets to "Achieve excellence in services sectors to enhance national development and increase exports of services on regional and global levels", it lists five subsectors such as ICT/Digital Economy, creative industries, financial and markets, healthcare, and retail, trade, and commerce.

The vision sets the following KPIs for each sub-sector of "High Value Industries" and "Future Service" to be achieved by 2033.

Table 3.53 KPIs for "High Value Industries" and "Future Services"

KPI	2021	2033	evolution/year
High Value Industries			
Agriculture and Food Security			
Direct economic impact of sector for Jordan GDP (Billion JOD)	1.48	2.97	+6.0%
Employment (k FTE)	76.0	144.0	+5.5%
GDP/employee (k JOD)	19.5	20.7	+0.5%
Exports (Billion JOD)	0.8	1.6	+6.0%
Mining			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.7	2.1	+10.0%
Employment (k FTE)	9.3	27.5	+9.5%
GDP/employee (k JOD)	72.6	77.1	+0.5%
Exports (Billion JOD)	1.0	3.4	+10.5%
Manufacturing			
Direct economic impact of sector for Jordan GDP (Billion JOD)	5.3	11.1	+7.0%
Employment (k FTE)	217.3	479.1	+6.8%
GDP/employee (k JOD)	24.2	23.1	-0.4%
Exports (Billion JOD)	4.8	19.8	+12.5%
Food Production			
Direct economic impact of sector for Jordan GDP (Billion JOD)	1.5	2.9	+6.0%
Employment (k FTE)	37.7	71.5	+5.5%
GDP/employee (k JOD)	38.5	40.9	+6.0%
Exports (Billion JOD)	0.9	4.3	+14.4%
Chemical Production			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.6	1.4	+7.0%
Employment (k FTE)	21.0	44.5	+6.5%
GDP/employee (k JOD)	29.4	31.2	+0.5%
Exports (Billion JOD)	1.5	5.4	+11.4%
Pharmaceuticals			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.5	1.7	+10.0%
Employment (k FTE)	5.4	16.0	+9.5%
GDP/employee (k JOD)	99.2	105.3	+0.5%
Exports (Billion JOD)	0.2	2.1	+20.3%
Textiles			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.4	1.3	+10.0%
Employment (k FTE)	76.0	224.7	+9.5%
GDP/employee (k JOD)	5.6	5.9	+0.5%
Exports (Billion JOD)	1.3	5.2	+12.0%
Engineering Industries			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.3	0.6	+7.0%
Employment (k FTE)	10.0	21.2	+6.5%
GDP/employee (k JOD)	26.4	28.0	+0.5%
Exports (Billion JOD)	0.2	0.6	+10.3%
Transport, Mobility and Logistics			
Direct economic impact of sector for Jordan GDP (Billion JOD)	1.6	2.9	+7.0%

KPI	2021	2033	evolution/year
Employment (k FTE)	93.6	158.4	+4.5%
GDP/employee (k JOD)	17.5	18.5	+0.5%
Exports (Billion JOD)	0.4	0.9	+8.0%
Future Services			
ICT/Digital Economy			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.9	3.9	+13.0%
Employment (k FTE)	24.7	101.0	+12.4%
GDP/employee (k JOD)	36.7	38.9	+0.5%
Exports (Billion JOD)	0.2	4.5	+30.7%
Creative Industries			
Direct economic impact of sector for Jordan GDP (Billion JOD)	0.6	1.4	+8.0%
Employment (k FTE)	10.4	24.8	+7.5%
GDP/employee (k JOD)	54.1	57.4	+0.5%
Exports (Billion JOD)	0.1	1.6	+24.8%
Financial Services and Markets			
Direct economic impact of sector for Jordan GDP (Billion JOD)	2.3	4.6	+6.0%
Employment (k FTE)	26.0	49.3	+5.5%
GDP/employee (k JOD)	88.6	94.1	+0.5%
Exports (Billion JOD)	0.1	0.3	+10.7%
Healthcare			
Direct economic impact of sector for Jordan GDP (Billion JOD)	1.0	2.2	+7.0%
Employment (k FTE)	74.8	158.6	+6.5%
GDP/employee (k JOD)	13.0	13.8	+0.5%
Exports (Billion JOD)	0.2	0.6	+10.1%
Retail, Trade and Commerce			
Direct economic impact of sector for Jordan GDP (Billion JOD)	2.4	3.8	+4.0%
Employment (k FTE)	265.2	399.9	+3.5%
GDP/employee (k JOD)	9.0	9.6	+0.5%
Exports (Billion JOD)	0.3	1.5	+13.9%

Source: Economic Modernisation Vision

3.5.2 Current Situation of Industry in ASEZ

(1) Geographical conditions

Aqaba is a port city that faces the Red Sea since built in ancient times and remains the only coastal city in Jordan. Following independence in 1946, 6,000 km^2 of desert area in Jordan and 12 km of coastline of Aqaba owned by Saudi Arabia was exchanged in 1965 through territorial exchange negotiations between Saudi Arabia and Jordan led by King Hussein. This exchange shows the geopolitical significance of Aqaba in Jordan.

In particular, the Port of Aqaba is also the gateway for transborder logistics not only to Jordan but also to Iraq, Syria, and parts of Saudi Arabia. 90% of the cargo handled by the Aqaba Container Terminal (ACT) is destined for Jordan and the remaining 10% is for transborder logistics between these neighboring countries.

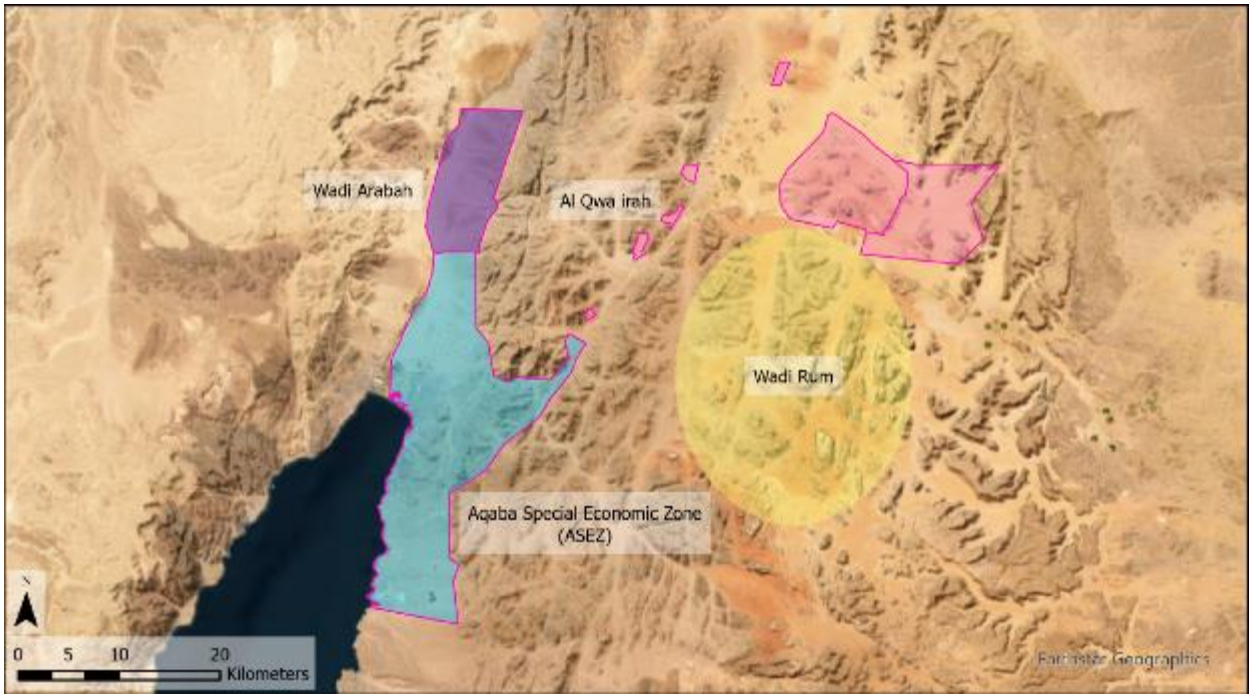
As for exports from Jordan, many products produced in Amman and other northern regions

are exported not only from the port of Aqaba in the south, but also from the port of Haifa in Israel to Europe and the United States via the Mediterranean Sea without passing through the Suez Canal. According to discussions with PBI, the developer of the Aqaba International Industrial Estate (AIIE), this is because land transportation costs in Jordan are relatively higher than sea transportation costs. Jordan's logistics sector has not been well organized or modernized, and an efficient logistics system has not been developed. Even when transported by container, it is often one-sided[3], and the cost of fuel in Jordan will be relatively high.

Based on the geographical conditions of Aqaba, urban development planning should consider not only the macro level within ASEZ, but also the broader perspective of industrial development and logistics in the Middle East region and Jordan as a whole.

(2) Natural conditions

Aqaba is formed in a narrow fan between the Red Sea in the west and the mountains in the east. Until the above-mentioned territorial exchange between Saudi Arabia and Jordan, the border between Saudi Arabia and Jordan was the south end of the old port, and the urban area of Aqaba has not expanded much from the current downtown area.



Source: JICA Study Team using Google Earth

Figure 3-62 Topographical conditions of M/P target areas and surrounding areas

(3) Major Industries

1) Manufacturing Industry

In ASEZ, the Aqaba International Industrial Estate (AIIE), an industrial park with a total area of 1,700,000 m^2, was developed at the initiative of the Government of Jordan, and the

[3] In logistic terms, load cargo only one-way.

Chinese company PBI, as a developer of SPCs, it operates and manages tenant companies. AIIE has about 130 companies as tenants and about 8,000 people working, including factories for garment, food processing, petrochemicals (plastic products), solar panels, ED luminaires, Armored vehicles, etc., and warehouses of logistics companies are also located as a tenant.

For the garment factory, under the OEM[4] with major sports brands such as NIKE and Adidas, produces sportswear in AIIE using recycled polyester fabric as raw material imported from Taiwanese textile manufacturers and exported final products in containers from the port of Aqaba to destination such as Europe and the United States.

Regarding garment industry, in addition to AIIE's Taiwan-owned companies, Bangladeshi-owned companies have large factories in ASEZ, and this factory employs more than 3,500 workers.

Considering this situation, the BCG report[5], which will be described later, positioned the garment industry as one of the potential industries in Aqaba.

2) Agriculture

Water scarcity is a common issue in the Middle Eastern countries. Aqaba is also affected by it, as it is in a semi-arid region with an annual rainfall of less than 50 mm. Due to this, the area surrounding ASEZ and Wadi Araba is not suitable for rainfed agriculture. The crops grown here are mainly dry agriculture, such as dates and olives. However, the region around Wadi Rum, situated on the east side of Aqaba, has access to groundwater. This groundwater, sourced from Disi, serves as a source of drinking water for ASEZ and is also transferred via a pipeline to Amman for drinking purposes. In the summer, melons and watermelons are cultivated around Disi using this groundwater.

3) Fishery

Regarding fisheries, although Aqaba faces the Red Sea, the production of fisheries is relatively small, less than 600 tons, and no industrial clusters have been formed such as seafood processing industries for export, and fishes are mainly consumed by domestic. Fisheries are not even a priority sector in the above mentioned "Economic Modernization Vision" based on this situation.

(4) Investment Incentives

The following investment incentives mainly apply to the economic activities by companies registered in ASEZ, which is designated as a Special Economic Zone (SEZ) of Jordan.

- Duty-free import of goods from the national customs territory and overseas (except automobiles and petroleum)
- 5% income tax on net profit generated from activities inside the ASEZ or outside Jordan except for banking, insurance and land transport services.

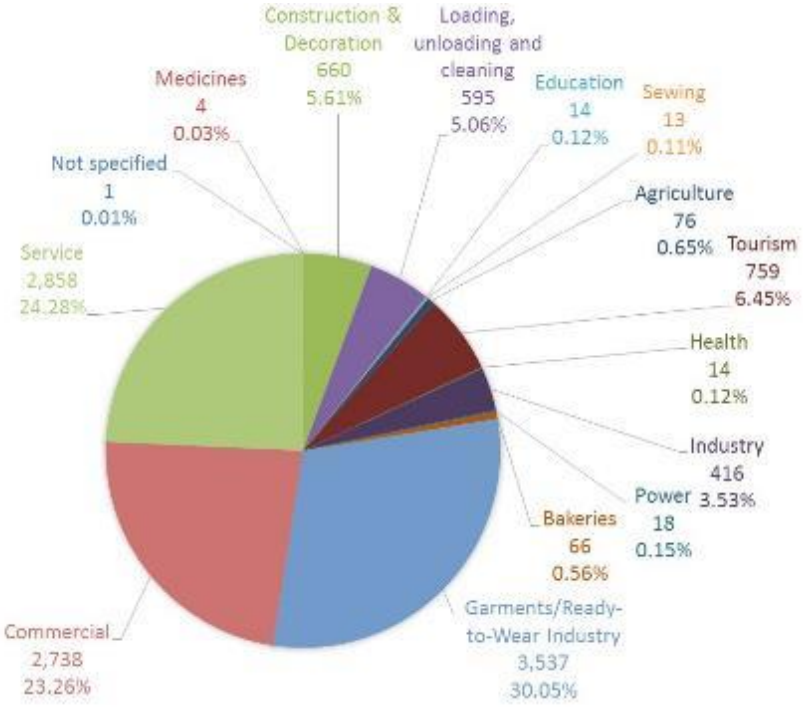
[4] Original Equipment Manufacturing (OEM): Companies that manufacture products from other brands
[5] FCDO ACES programme "Current state analysis" step of the Aqaba Special Economic Zone (ASEZ) project, Boston Consulting Group (BCG), 2019-2021

- Exemption form sales tax on final consumption of goods and services, except for 7% sales tax limited to the final consumption of selected (13) goods and (3) services.
- Exemption from social service tax
- Exemption from annual land and building taxes on utilized property
- Exemption from taxes on distribution of dividends and profits on activities in the ASEZ and outside Jordan.
- Free trade access to the EU, US, Singapore and most Arab Countries
- Streamlined labor and residency procedures (up to 70% in foreign labor)
- No foreign equity restrictions on investment in tourism, industry, retail, and other commercial services (100% foreign ownership allowed)
- Full repatriation of profits and capital
- No foreign currency restrictions and full repatriation of profits and capital

(5) Human Resources and Employment Status by Industry

In Aqaba, employment is hollowing out not only in the tourism sector but also in other industry sectors. While around 2,000~3,000 Jordanians living in Aqaba are working in Eilat in Israel crossing the Jordan-Israel border every morning, 70-80% of the workers in the factories of the garment industry mentioned above are migrant workers from Islamic countries with low labor costs such as Egypt, Pakistan, and Bangladesh.

The figure below shows the breakdown of formal employment of foreigners registered in ASEZ by industry. Large number foreign workers are working in garment industry, service industry, and commerce industry. In another word, these industries are the sector where foreign workers are filling the hollowing out of Jordanian employment.



Unit: person, Source: ASEZA Data: September 2022

Figure 3-63 Aqaba's Number of Employed Persons (Foreign Nationality) by Industry (2022)

As mentioned in the chapter on tourism development, highly educated Jordanians are flowing out to Europe and the United States, as well as countries with high salary levels such as Israel, Saudi Arabia, Qatar, and UAE, and Saudi Arabia is actively recruiting Jordanian workforce.

In the industrial development of Aqaba, to create jobs for Jordanians in the future, it should be noted that the basic strategy of industrial development is to foster knowledge-intensive industries[6] that can receive such highly skilled human resources, rather than labor-intensive industries formed by foreign workers with low labor costs.

(6) Current State of Industrial Infrastructure

As previously mentioned, Aqaba has King Hussein International Airport to the north, the Aqaba Container Terminal (ACT) to the center, and the South Industrial Port to the south, providing infrastructure that serves as a gateway for import, export, and logistics throughout Jordan.

Aqaba International Industrial Estate (AIIE), a 1,700,000 m^2 industrial zone developed by the Jordanian government, is also located in Aqaba. The tenant companies within the AIIE are operated and managed by PBI.

Additionally, a new industrial zone is being developed by ADC and PBI, the developer of AIIE, at the Quwaira Industrial Zone, which is located approximately 50km from Aqaba city along the Desert Highway. This new zone will span a total area of 1,839,000 m^2, foster an investment of 1 billion USD, and create 6,500 jobs over the next 15 years.

Moreover, ASEZA plans to develop five industrial zones along the Desert Highway, including the Quwaira Industrial Zone, and sites have already been identified.



Aqaba Container Terminal (ACT)	Aqaba International Industrial Estate (AIIE)	Quwaira Industrial Zone

Source：ASEZA, JICA study team

Figure 3-64 Industrial Areas in ASEZ

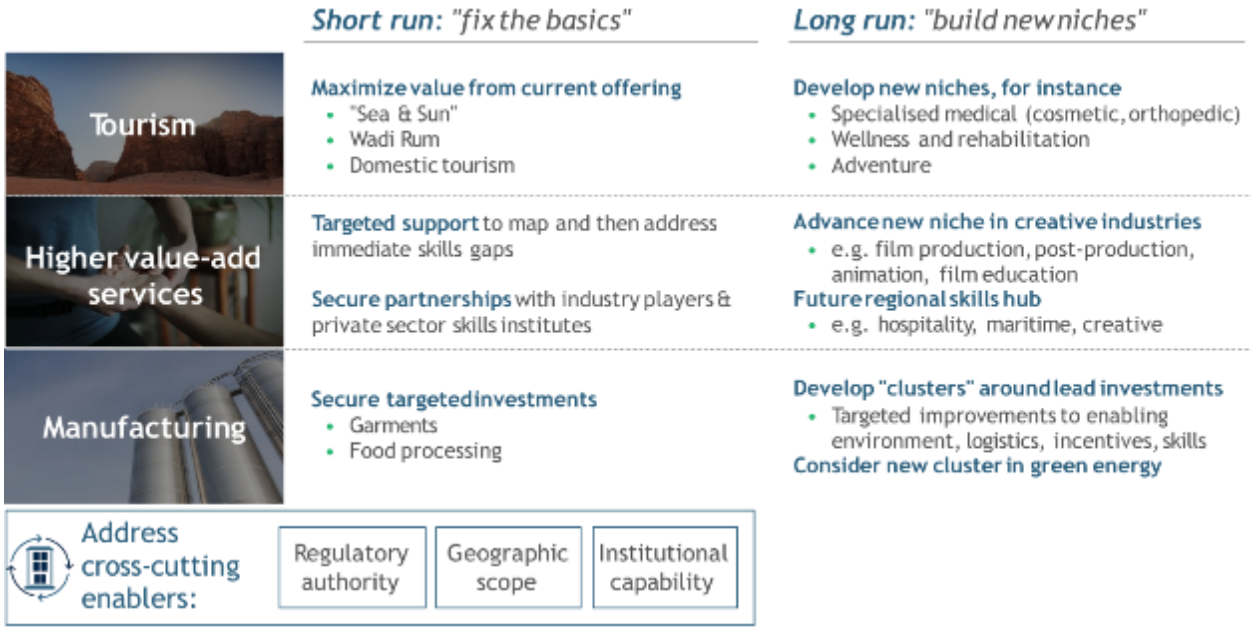
(7) Review of the BCG Report

BCG had conducted a survey on the development of ASEZ since 2019 under the influence of COVID-19 comparing ASEZ with Tanger (Morocco) and Dubai (UAE) in the MENA region which are ranked top 10 SEZs of the world by foreign direct investment (FDI). In the

[6] Knowledge-intensive industries: fine chemicals, functional polymers, pharmaceuticals, aerospace development, content development, AI development, software development, semiconductor development, marketing, design, Engineering, consulting, etc.

Phase 1 of the survey, they target three priority areas for the development of ASEZ such as (i) tourism development, (ii) high value-added services, and (iii) manufacturing.

Table 3.54 Targets related to the development of ASEZ identified in BCG survey



Source: BCG Study Report

Among these priority areas, in (iii) manufacturing, the garment industry is considered as one of the potential industries in ASEZ.

While several foreign-owned garment factories have already been built in Aqaba under the FTA between the USA and EU, Jordan's geopolitical advantage is limited. This is because countries such as Mexico, Honduras, Guatemala, El Salvador, and Peru, which are closer to final consumption destinations than Jordan, have also signed the FTA with the USA. Similarly, countries like Morocco and Tunisia have signed the FTA with the EU. Furthermore, most workers in these sectors consist of foreign workers from Bangladesh and Pakistan, making it unlikely that the garment industry will contribute significantly to job creation for Jordanians in the future.

3.5.3 Challenges on Industrial Development in ASEZ

(1) SWOT Analysis

The results of SWOT analysis to confirm status of the industrial development in Aqaba are shown in the table below.

Table 3.55 SWOT Analysis of Aqaba Industrial Development

	Positive Factors	Negative Factors
Internal Conditions	**Strength**	**Weakness**
	・Aqaba has an international airport and only port in Jordan. ・5% income tax on net profit generated from activities inside the ASEZ or outside Jordan except for banking, insurance and land transport services comparing with 20% in Jordan. ・Duty-free import of goods from the national customs territory and overseas (except automobiles and petroleum) ・Free Trade Agreements (FTAs) with USA, EU, Arab region, etc. ・No foreign equity restrictions on investment in tourism, industry, retail, and other commercial services (100% foreign ownership allowed). ・Relatively well-educated workforce comparing with other regions. ・Smooth road connections to in Jordan and to neighboring countries. ・Large empty land for new industrial zones is available in Aqaba.	・Local economy highly depends on the tourism sector, with few alternatives of other sectors, current: 80% area on tourism, 17% services, 3% Industry. ・Women employment rate (12%) is lower than national level (15%). ・Logistics industry has not well organized. ・Consequently, transportation costs in Jordan are relatively high. ・Limited coastal line for port and industrial development. ・Labor market depends on low-cost migrant workers. ・Lack of concrete industrial development plan, on national and local level. ・Lack of high-skilled workers. ・Lack of solid waste and sewage treatment facilities. ・Lack of public transportation system for commuting. ・Lack of appropriate working and living environment. ・Cost competitiveness is relatively low (labor cost, transportation, energy). ・Limited water resource (Annual rainfall less than 30 mm)
External Conditions	**Opportunity**	**Threat**
	・Geographical location with more than 300 sunny days. ・Geographical location close to Europe, comparing with Asia and South America.	・Outflow of high-educated human resources to the high-wage labor market, such as Israel, Saudi Arabia, Europe, and USA. ・Intense competition with other SEZ with larger ports, such as Morocco, Tunisia, and Turkey. ・Risk of environmental pollution due to outflow of hazardous substances from port facilities. ・Increase of disaster risk due to climate change. ・Unstable situation in the region.

Source: JICA Study Team

1) Inputs to Urban Planning M/P

In the area of Wadi Araba along the Dead Sea Highway north of ASEZ, there is King Hussein International Airport, the air gateway to southern Jordan, AIIE with a total number of 8,000 employees, garment factory with more than 3,500 workers, hospital, university, large resort complexes, Ayla and Saraya Aqaba, are also located in the adjacent area. In addition, in the area along the Desert Highway north of ASEZ, ASEZA has plans to develop five industrial parks including Quwaira Industrial Zone to generate 6,500 employees next 15 years.

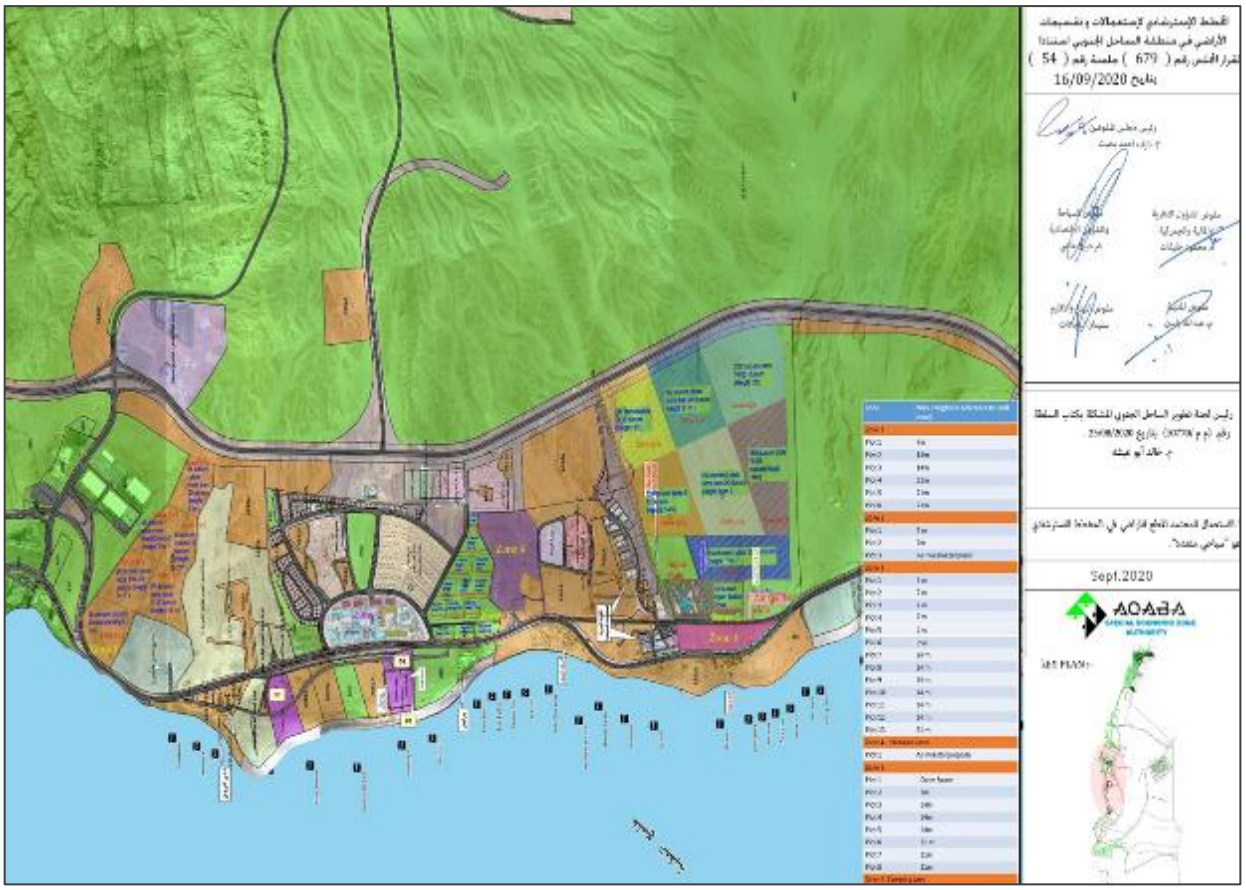
At the site of the old port located on the south side of downtown, a large resort complex project “Marsa Zayed” are underway to develop, including an international passenger terminal where cruise ships and other passenger ships arrive. In the future, it will become a huge city with 13,000 people will move during peak time in the morning and 25,000 people during daytime.

In addition, as mentioned above, the south area of ASEZ next to the old port, which was merged into Jordan after the territorial exchange negotiations between Saudi Arabia and Jordan in 1965, has a large undeveloped land. After the territorial transfer to Jordan, an industrial park was constructed in the South Industrial Port and its hinterland with a phosphate fertilizer factory, etc., and since 2006, the Aqaba Container Terminal (ACT) has been established between ADC and the Danish port operator under a concession agreement for 15 years. Fortunately, south area has not been developed so far, and consequently, beautiful beaches with coral reefs along the coastline remain.

On the other hand, recently, large resort projects such as Tala-Bay have also been constructed, and private developers have developed some residential areas for sale.

Aqaba does not have public transportation to bring commuters and tourists between north and south areas, and the development of mass transportation systems such as LRT and BRT are required urgently.

In addition, in the south area of ASEZ, some residential areas developed by private developers are spreading like a sprawl without installing infrastructure such as sewerage, and formulation of comprehensive urban plan will be required, and a zoning plan has already been approved by ASEZA.



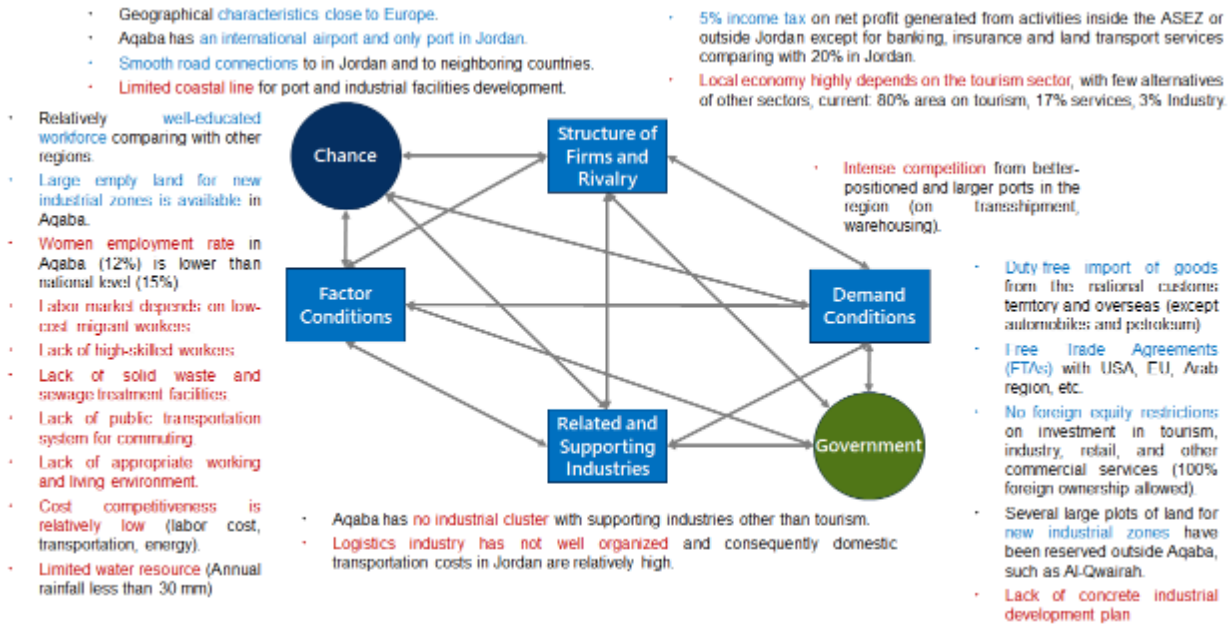
Source: ASEZA

Figure 3-65 ASEZA's zoning plan for the south area

2) Competitiveness (Cluster Analysis/M. Porter Diamond Model)

In 1990, M. Porter, a professor at Harvard Business School, presented the diamond model[7] in "The Competitive Advantage of Countries" as a model for analyzing the competitiveness and external competitive environment of specific industries in a country or region. M. Porter's diamond model can provide model to analyze competitiveness of a country or region based on four aspects such as (i) factor conditions, (ii) demand conditions, (iii) firm strategy, structure, and rivalry, and (iv) related and supporting industries.

After classifying the results of the above-mentioned SWOT analysis of Aqaba's industrial development by four aspects according to this model, ASEZ has various business incentives for investment and as a quasi-English-speaking country, ASEZ has an advantage in terms of (i) factor conditions that enables to mobilize high-level human resources and cheap foreign workers. On the other hand, Aqaba does not have an industry with wide (iv) related and supporting industries other than tourism. In fostering knowledge-intensive industries that will receive highly skilled human resources, which will be the basic strategy for Aqaba's industrial development mentioned above, it is necessary to develop a completely new industries from zero, and to do so, not only the actions taken by the private sector and ASEZA, but also strong initiatives at the national level will be required and it is necessary to develop infrastructure related to human resource development such as education and research institutions under the long term development plan.

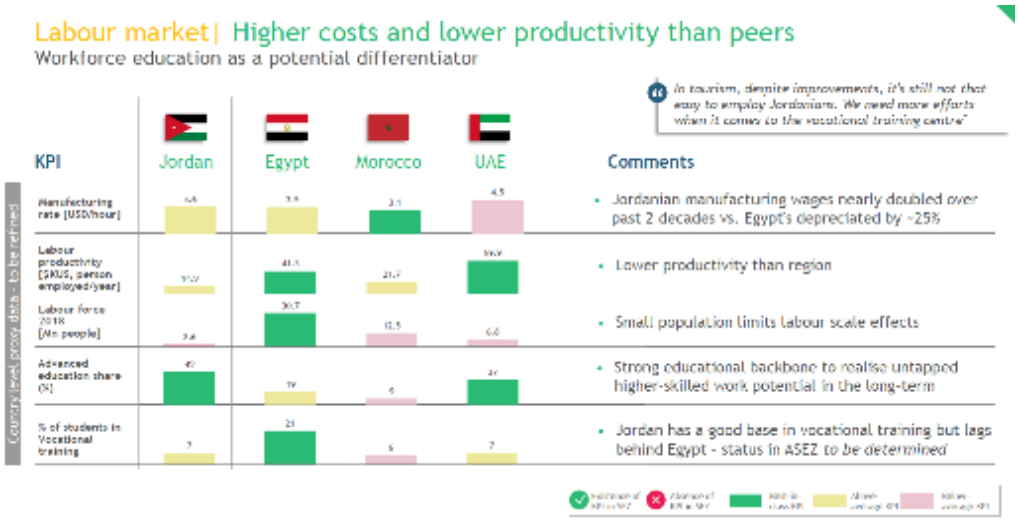


Source: JICA Study Team

Figure 3-66 ASEZ Competitive Diamond Analysis

[7] The Competitive Advantage of Nations, M. Porter, 1990, Harvard Business School

Table 3.56 Situation of Labor market in ASEZ



Source：BCG Study Report

3) Sustainability

As mentioned above, along the coastline next to the old port, there are beaches with beautiful coral reefs, which is the most important tourist resource in Aqaba. On the other hand, some residential areas are being developed without infrastructure such as sewage system.

In these areas, solid waste landfill site for Aqaba is located close to the coast, and all solid wastes produced from Aqaba are dumped directly into the natural environment without any treatments, and some garbage spread out by the wind around the area. Once it rains, it is a direct threat not only in terms of groundwater contamination but also direct pollution to the marine environment from landfill sites.

In June 2022, at least 10 people were killed and more than 251 injured when a 25-ton tank containing chlorine fell off a ship at South Industrial Port, and residents and customers stayed in Tala Bay resort had to evacuate.

In addition, there are no drainage system on the streets in the downtown of Aqaba, and consequently, flood occurred in several areas during rainfall.

When ASEZA develops sustainable urban development plan in Aqaba, zoning and infrastructure development plans considering environmental sustainability and disaster risk are required.



Solid Waste Landfill	Hazardous Accident at Southern Port	Flood in Aqaba Downtown

Source：ASEZA, JICA study team

Figure 3-67 Tourism resources in the Golden Triangle

3.6 Transport and Logistics

3.6.1 Overview of the Transport and Logistics Planning

(1) Goals and plans in the previous plan

Revisiting the ASEZA Master Plan that served as a guiding principle for the development of Aqaba and ASEZ, “Improve the effectiveness of the Port of Aqaba” was among the eight goals of the Masterplan, and hence the relocation of the port infrastructure from the north coastal area (currently called as “old port area”) to near the southern border (currently as “southern industry zone”) was implemented as one of the flagship projects for the Masterplan.

The physical plan for the transport thus focused on creating and developing new road infrastructures to serve the new port and separating the logistics movement from the transport movements in the city center. The backroads were developed on the mountainside away from the coastline that directly connects the container terminal/ the southern industry port with the desert highway which is a strategic corridor that stretches 330 km in length in a north-south direction reaching the capital city Amman.

The projects that were set forth in the ASEZA Master Plan is as shown below:

Table 3.57 Projects in the ASEZA Master Plan

Items	Image	Descriptions
Main Port Development		・Relocate general cargo to multi-purpose terminal in Industrial Port. ・Convert inner harbour to cruise ship and fast ferry terminal and mixed-use hotel, retail, entertainment and residential. ・Convert phosphate and grain terminals into business incubator complex.
Container Port Expansion		・Relocate Coast Road to improve yard operations. ・Relocate passenger jetty farther south. ・Expand container berths north and south. ・Expand yard area to south. ・Expand across Coast Road into wadi.
Southern Industrial Zone		・Convert the old timber terminal to a multi-purpose terminal. ・Improve parallelization and circulation. ・Expand site capacity to the east

Items	Image	Descriptions
Road Development for Aqaba Town and Old Port		・Widen the truck bypass through town and provide sight and sound buffers. ・Install grade-separated intersection at the truck bypass and Sharif bin Hussein intersection. ・Relocate the Coast Road around the Container Port to consolidate the Container Port yard areas. ・Add truck route parallel to the Coast Road from the Main Port to the Container Port. ・Simplify interchanges and eliminate crossovers between truck road and Coast Road.
Road Development for Southern Area		・Build an Upper Coast Road as a through road to the Southern Industrial Zone and Saudi Arabia. ・Build a connector road between the Coast Road and Upper Coast Road at commercial center site. ・Upgrade the Back Road to the Southern Industrial Zone. ・Provide an access road into the Southern Industrial Zone expansion area. ・Simplify the Back Road, Coast Road, and Upper Coast Road interchange.

Source: ASEZA Master Plan

(2) Current situation and issues to be considered when updating the Masterplan

The projects outlined in the ASEZA Master Plan have been implemented and in a general view, the objectives were achieved, particularly with regards to establishing a new industrial area and port facility on the southern border, and efficiently separating logistics movements away from the city center.

However, in addition to the current and future transport and logistics challenges facing Aqaba, there are also planning-related issues that need to be addressed when updating the Masterplan. The following points were raised and discussed between the JICA study team and ASEZA during meetings and Technical Working Groups (TWGs):

1) Aligning the transport strategies coherently with the urban development goals

The ASEZA Master Plan set forth a vision: “To create an oasis for commerce; destination for tourism; an incubator for technology; a center for environmental research and protection” and eight goals to be achieved; however, did not establish clear linkage between vision/ goals and the individual projects or initiatives. The updated plan needs to have a strategy for transportation, which bridges the vision/ goals and the projects/initiatives and establish rationale for the development. As an example of a transport plan that is consistent with the vision and goals of urban development, a case of Helsinki, Finland is introduced on the next page.

2) Addressing the transport challenges comprehensively

The ASEZA Master Plan consists of the following components: land use plan; area development directions for residential areas, coastal zone, and industrial zones; highway and road network plan, infrastructure development plans for the port, roads, and utilities. The important transport challenges that are usually addressed in a typical urban masterplan – such as road safety, mobility for the residents and visitors, and regional connectivity – are not addressed in the ASEZA Master Plan. In addition, there are elements that are not included in the Masterplan, most notably the public transport, transport facilities, and traffic management policy. Therefore, the transport strategy needs to address the challenges in a comprehensive manner, while also covering the infrastructure, transport service, and traffic management aspects.

3) Creating synergy with the land use and area development

Urban transport and urban development are significantly interlinked: changing land use or spatial development can result in changes in travel behaviour, and, conversely, the convenience and efficiency of the transport system can influence the vitality of the city, which in the long run affects the city's growth. Therefore, it is essential that the transport plan and the city spatial development plan is well-aligned and consistent.

Reference: Coherent and effective transport planning, case of Helsinki, Finland

Helsinki city serves as a good reference model for a coherent and efficient planning. In its city vision, transport strategy, and transport programs are neatly aligned to each other.

(i) City Vision

In the Helsinki Strategy (2017-2021), the vision is stated as follows: "Helsinki's vision is to be the world's most functional city."

Following this vision, four main themes were set, which are:

- Securing sustainable growth, the most essential task of the city
- Developing services
- Responsible management of finances the foundation of a prosperous city:
- Helsinki strengthens and diversifies its promotion of interests



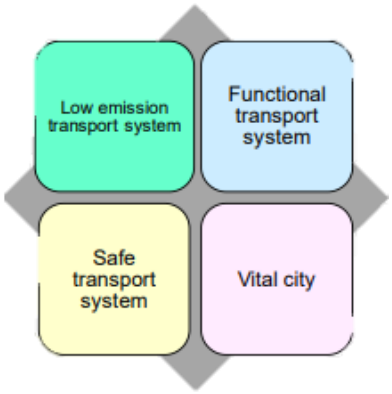
Source: Helsinki City (2017): "Helsinki city strategy 2017–2021"
https://www.hel.fi/en/decision-making/decision-making/strategy-and-economy/strategy

Figure 3-68 Vision and Themes of Helsinki Strategy (2017-2021)

(ii) Transport Strategy

In the Helsinki Intelligent Transport System Development Programme 2030 which sets the strategy as well as the programs for transport until 2030, it states the goals as following: "Together with the ecosystem, the vital Helsinki will create the world's most functional, efficient and safe carbon neutral transport system. Helsinki will use intelligent systems to cost-effectively address the diverse needs of people and logistics and support their sustainable choices. Everybody will feel safe in traffic."

In relation to this goal, four pillars are set forth as shown in the figure below.



Source: Helsinki City (2019): "Helsinki Intelligent Transport System Development Programme 2030"
https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-16-19-en.pdf

Figure 3-69 Four Pillars of the Goals for Helsinki's Transport Program

(iii) Transport Projects/ Programs

In the Helsinki Intelligent Transport System Development Programme 2030, 7 packages of measures are selected with specific budget for investment and operation.

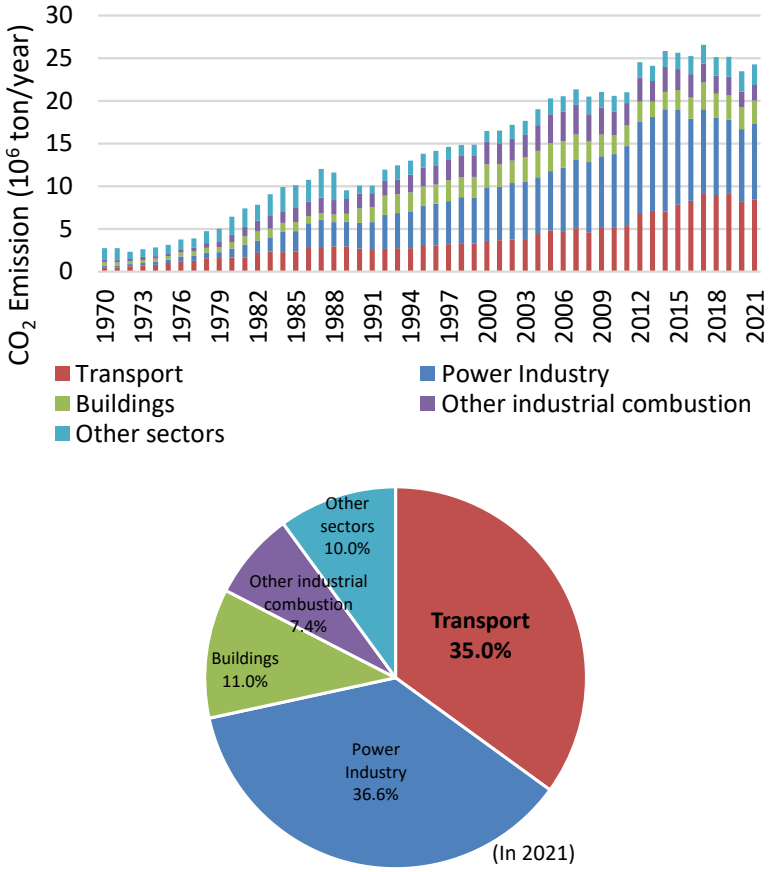
Table 3.58 Transport investment programme of Helsinki

Package of measures	Investments ('000 EUR)	Operating costs ('000 EUR)
1. Developing the collection of traffic data	1,250	380
2. Developing situational awareness, monitoring and statistical awareness	2,000	180
3. Interactive and collaborative Traffic Management 2.0	1,500	123
4. Developing traffic light control	1,050	130
5. Economic instruments		150
6. Public transport system that utilizes automation	100	180
7. Physical and digital infrastructure for self-driving vehicles	1,500	100
Total	**7,400**	**1,243**

Source: Helsinki City (2019): "Helsinki Intelligent Transport System Development Programme 2030"
https://www.hel.fi/static/liitteet/kaupunkiymparisto/julkaisut/julkaisut/julkaisu-16-19-en.pdf

4) Contributing to CO_2 emission reduction

As shown in Figure 3-70, the total volume of CO_2 emission in Jordan in 2021 is 24.3 million tonnes. It has been increasing since 1970s, and, especially, the increase in the emission from transport and power industry sectors is significant. In 2021, the shares of power industry sector and transport sector are 36.6% and 35.0%, respectively. The top share is power industry sector, but it should be noted that the top share among the power-consuming sectors that exclude power industry is transport. Jordanian government declared in 2016 14% reduction of greenhouse gas by 2030 and revised the goal in 2022 to 31% reduction by 2030. To achieve the goal, it is extremely important to attempt to reduce it from the top share sectors. Therefore, the transport strategy needs to address the challenges when updating the masterplan, which leads more use of public transport, energy-efficient vehicles, non-motorized modes, etc. and less use of private vehicles.

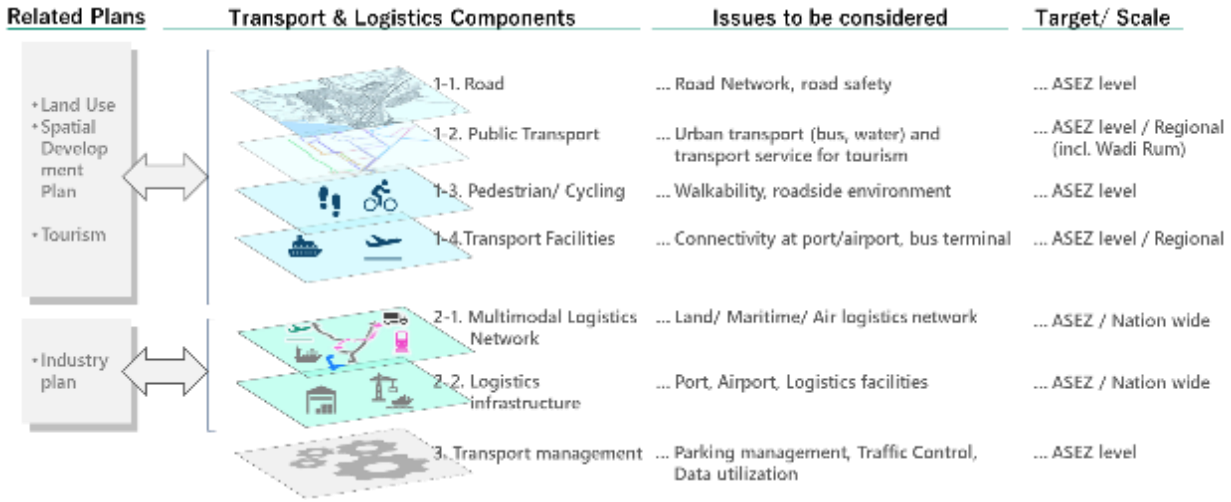


Source: Crippa M., Guizzardi D., Banja M., Solazzo E., Muntean M., Schaaf E., Pagani F., Monforti-Ferrario F., Olivier, J.G.J., Quadrelli, R., Risquez Martin, A., Taghavi-Moharamli, P., Grassi, G., Rossi, S., Oom, D., Branco, A., San-Miguel, J., Vignati, E. CO_2 emissions of all world countries – JRC/IEA/PBL 2022 Report, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/07904, JRC130363

Figure 3-70 CO_2 Emission by Sectors in Jordan

(3) Proposed component and structure of transport and logistics planning

Following the points raised above, the structure and the components of the transport and logistics plan is proposed as shown in the figure below. The transport section would compose of four layers: road, public transport, pedestrian and cycling, and transport facilities, while the logistics section would compose of two layers: multimodal logistics network, and logistics infrastructure. Binding all the layers together across transport section and logistics section would be the transport management layer, which also considers data utilization and smart city approach.



Source: JICA study team

Figure 3-71 Proposed structure and components of the transport and logistics plan

3.6.2 Transport

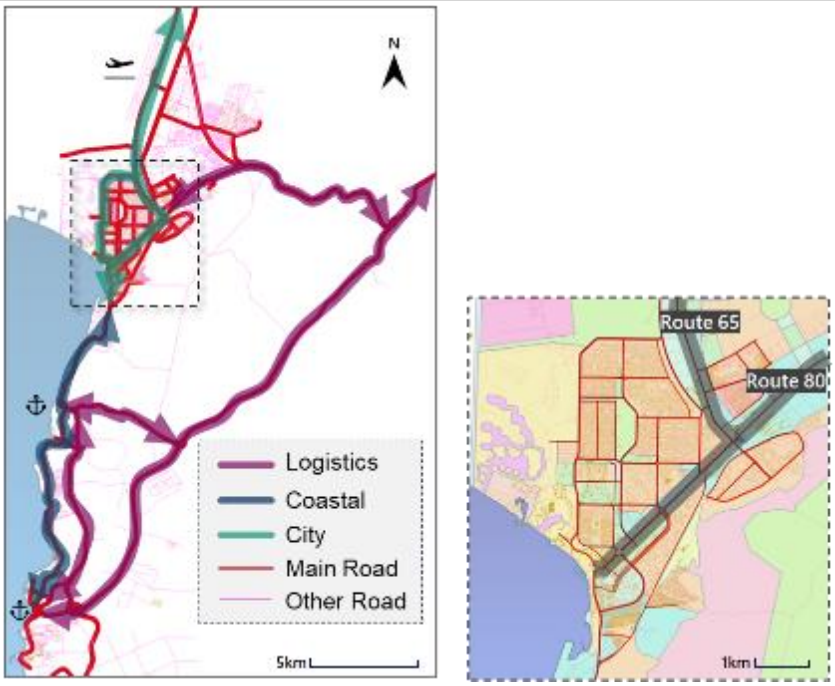
This sub-section explains the current situation of the transport in Aqaba along the four components: road, public transport, pedestrian and cycling, and transport facilities.

(1) Road transport

1) Overview of the situation

As previously mentioned, the road network in ASEZ is structured so that the logistics movement does not enter and interfere with the transport movement in the downtown and residential area. The national roads and the regional roads that are managed by ASEZA and ADC are generally well maintained and is sufficient to serve the needs of travellers on private vehicles, or logistics by cargo vehicles.

The compact structure of the city and the relatively sufficient traffic capacity, with main roads having multiple lanes, mean that currently the traffic congestion is not an issue in Aqaba, unlike the situation in the capital city Amman. However, the strong preference for using private vehicles, limited alternative options such as public transport, limited control over the on-street parking, and expansion of built environment due to growth of the city would be a source of concern for the future.



Source: JICA study team

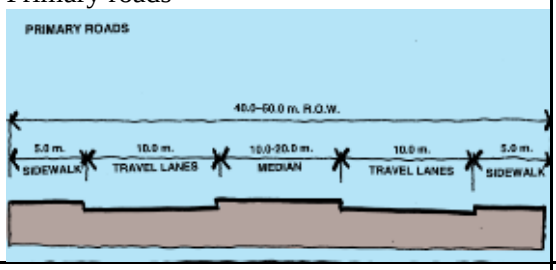
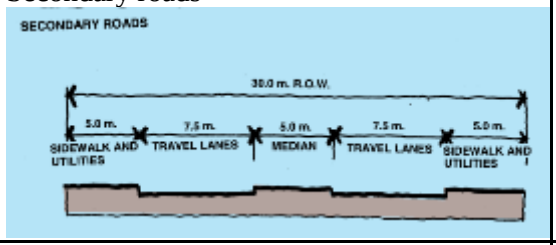
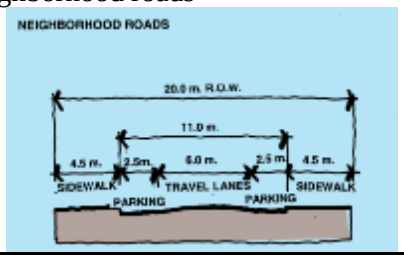
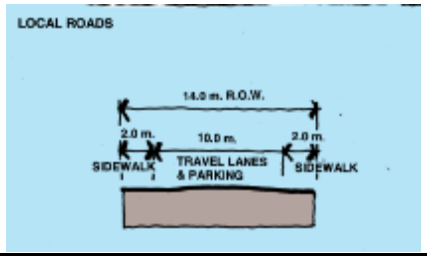
Figure 3-72 Simplified Structure of the Current Road Network

2) Road design guideline

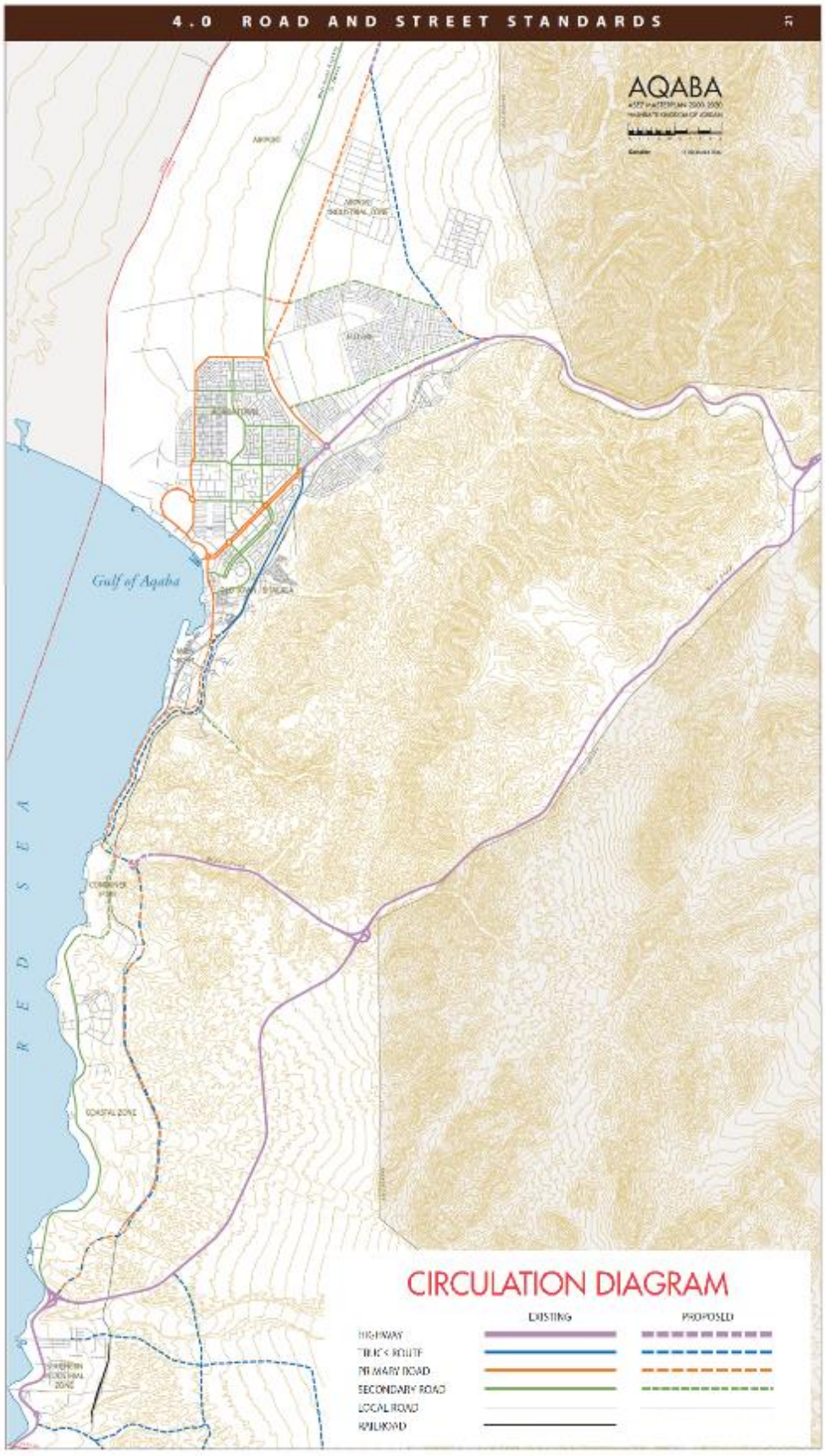
Design of the road follows a design guideline of ASEZA. According to it, the network of roads and streets within the ASEZ is divided into a hierarchy of five types: national, primary, secondary, neighbourhood, and local roads. National roads include the Dead Sea Highway, the Desert Highway, and the Back Road Bypass to the Southern Industrial Zone. Primary roads include the Sharif Hussein bin Ali Boulevard leading to downtown Aqaba, the Malik Hussein Boulevard along the Aqaba Corniche, the truck bypass through Aqaba Town, and the Coast Road leading to the Southern Industrial Zone. Secondary roads distribute traffic from the primary roads around the perimeters of residential, commercial, and industrial areas. They include the Amir Muhammad downtown loop, Abdullah bin Hussein Avenue along the government district, and Amir al Hasan Avenue in the northern residential areas. Neighbourhood roads are the main circulators within residential, commercial, and industrial areas. Local roads provide access to individual development sites within residential, commercial, and industrial areas.

In principle, cross sectional elements of roads and streets in ASEZ should be designed according to the dimensions and structures set in the guideline, as shown in the table below. It needs to be noted, however, that the guideline is not applied to the roads that have existed before the ASEZA Master Plan.

Table 3.59 Road section design according to road classification

Classification	Descriptions
Primary roads 	Primary roads are designed as dual carriageways, with 10 meters of pavement divided into two to three travel lanes in each direction, a 10-meter-wide landscaped median, and 5-10-meter-wide parkways containing pedestrian walkways on each side. Total right-of-way width is 40-50 meters.
Secondary roads 	Secondary roads are designed as dual carriageways, with 7.5 meters of pavement divided into two travel lanes in each direction, a 5-meter-wide landscaped median, and 5-meter-wide parkways with pedestrian walkways on each side. Total right-of-way width is 30 meters.
Neighborhood roads 	Neighbourhood roads are designed as two-lane undivided roadways, with 3 meters of travel lanes, a 2.5-meter-wide parking lane on each side, and 4.5-meter-wide parkways with sidewalks on each side. Total right-of-way width is 20 meters.
Local roads 	Local roads are designed as two-lane undivided roadways, with 3-meter-wide travel lanes, a 2-meter-wide parking lane on each side, and 2-meter-wide parkways with sidewalks on each side. Total right-of-way width is 14 meters.

Source: ASEZA Design Guideline 2001



Source: ASEZA Design Guideline 2001

Figure 3-73 Road Classification Map Set in the ASEZA Design Guideline 2001

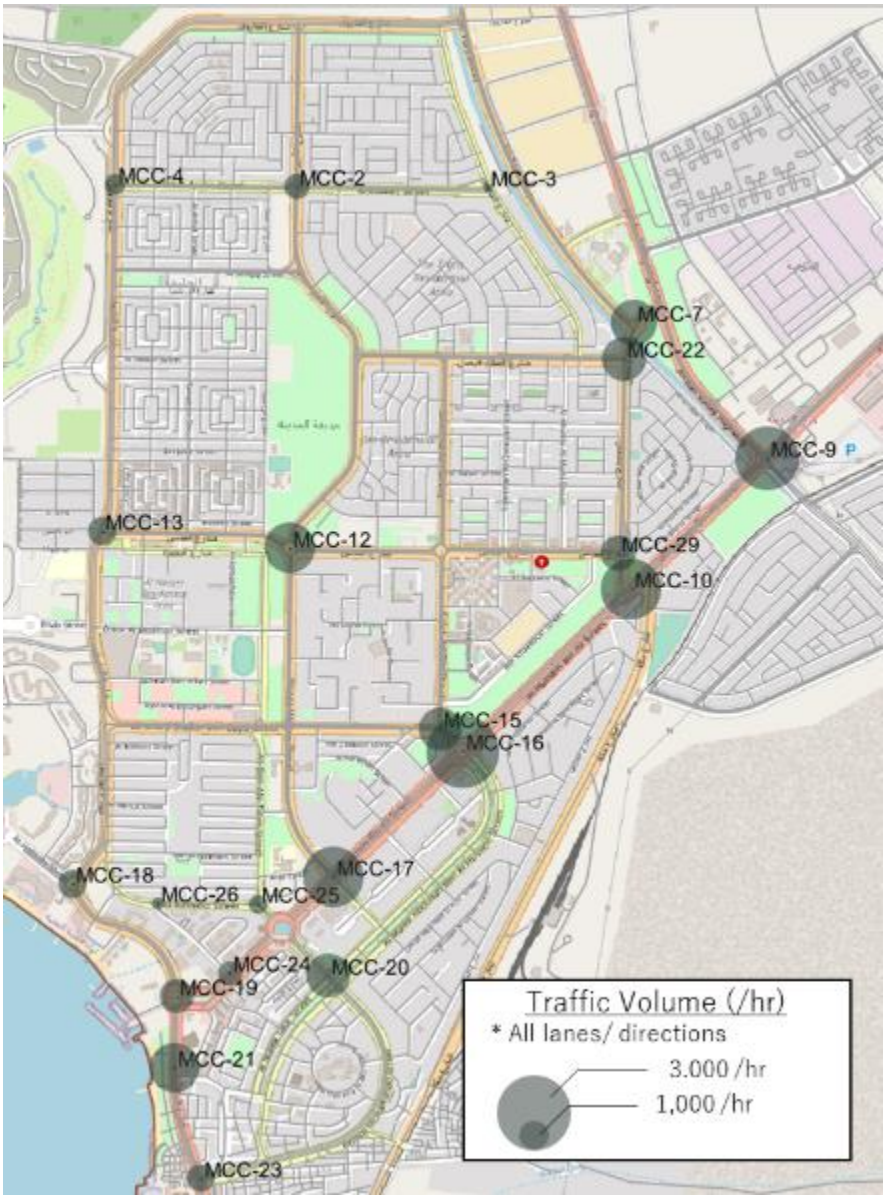
3) Traffic volume

a) Traffic audit survey in 2017

Traffic audit survey was conducted by ASEZA in 2017, counting the traffic volume at major intersections in morning, daytime, and evening peak hours. The figure below indicates the overview of the result of traffic survey in the morning peak hours, and the table below shows the number of vehicles counted at each approach of intersection in the morning peak hours.

As could be inferred from the figure and the table, the national road of Sharif Hussein bin Ali Boulevard is the most used road with high traffic volume level in the downtown area.

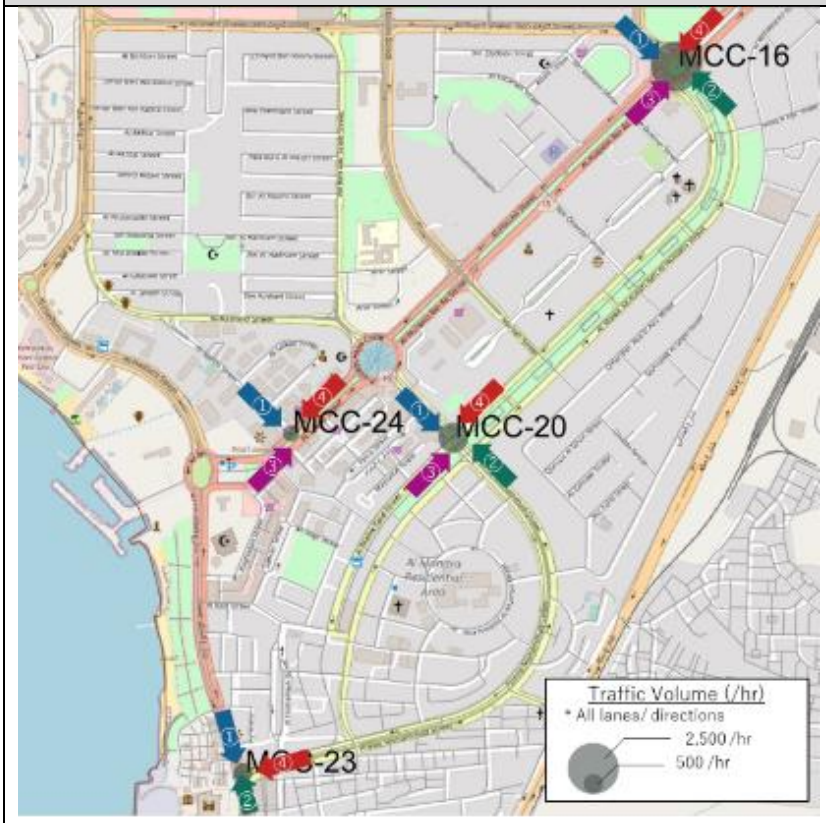
The survey estimates that the traffic volume in the target area would increase by 49.0% in 2032. However, clear explanation on the basis of the estimation is not provided, and this traffic volume increase rate is uniform across all intersections, which means this forecast does not take into account different land use patterns or development scenario by districts.

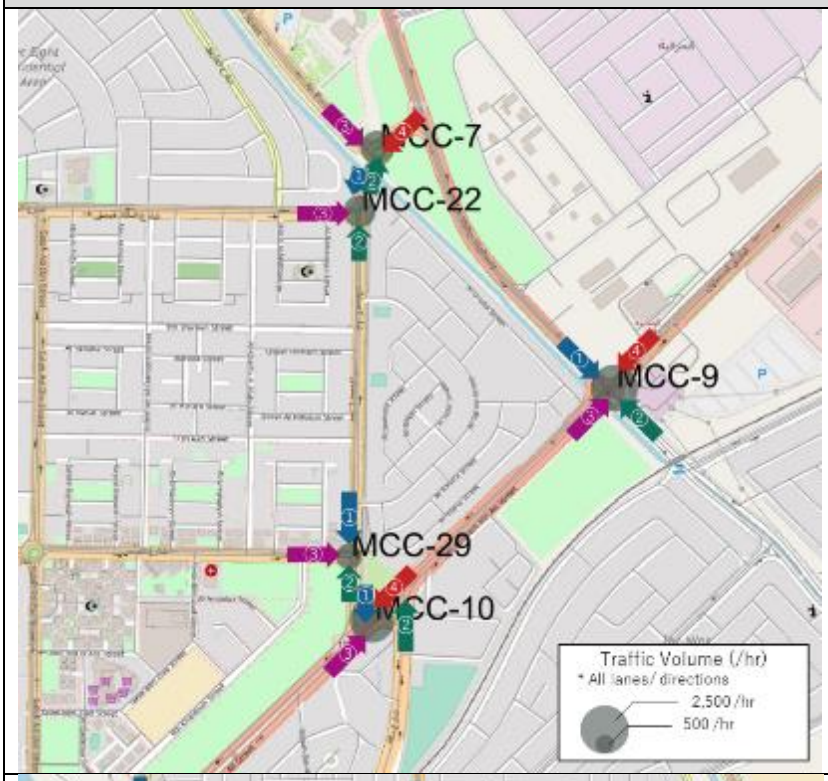


Source: Created by the JICA study team based on ASEZA traffic audit survey 2017

Figure 3-74 Overview of the Traffic Volume at Major Intersections (Morning Peak)

Table 3.60 Number of Vehicles Counted at Major Intersections (Morning Peak)

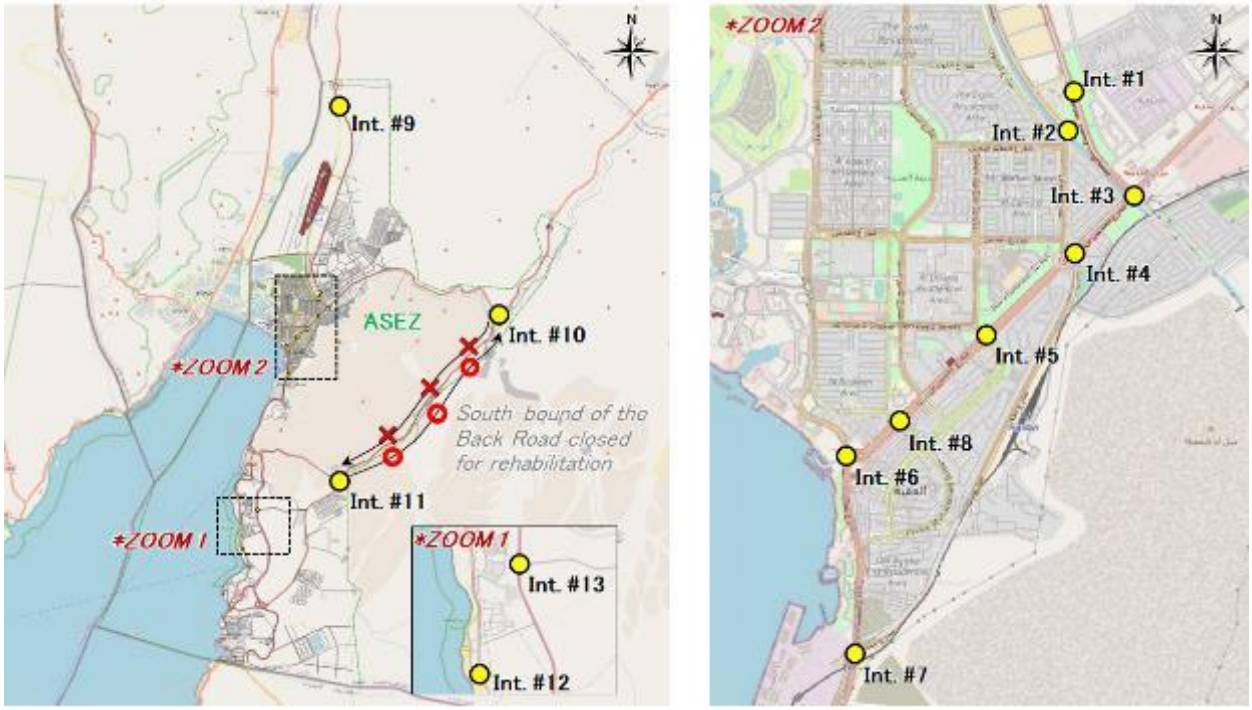
Map	Section	Direction	Vehicles /hr
	MCC-16	1	560
		2	386
		3	707
		4	853
	MCC-24	1	49
		3	351
		4	432
	MCC-20	1	592
		2	249
		3	409
		4	275
	MCC-23	1	316
		2	458
		4	200
	MCC-15	1	314
		2	968
		3	198
	MCC-17	1	498
		2	105
		3	708
		4	798
	MCC-18	1	631
		2	279
		3	75
	MCC-19	1	172
		2	645
		4	375
	MCC-25	1	217
		2	119
		3	319
	MCC-26	2	76
		3	293
		4	54
	MCC-28	1	111
		2	289
		3	17
		4	259

Map	Section	Direction	Vehicles /hr
	MCC-7	2	799
		3	364
		4	441
	MCC-22	1	186
		2	474
		3	858
	MCC-29	1	494
		2	336
		3	400
	MCC-10	1	142
		2	515
		3	781
		4	673
	MCC-9	1	514
		2	610
		3	727
		4	346
	MCC-2	1	208
		2	315
		3	176
		4	181
	MCC-3	1	153
		2	79
		3	80
	MCC-4	1	308
		2	164
		4	257
	MCC-12	1	215
		2	191
		3	684
		4	684
	MCC-13	1	167
		2	408
		4	408

Source: Compiled by the JICA study team based on ASEZA traffic audit survey 2017

b) Traffic survey in 2023

To confirm the current traffic condition at major intersections in ASEZ, a traffic survey was conducted in July 2023 in this study. Locations of the survey are 13 intersections in total: 5 intersections on Sharif Hussein bin Ali Boulevard, which is the busiest road in the city center, and 8 intersections on the Dead Sea Highway, the Desert Highway, the Back Road, and other important roads (see Figure 3-75).

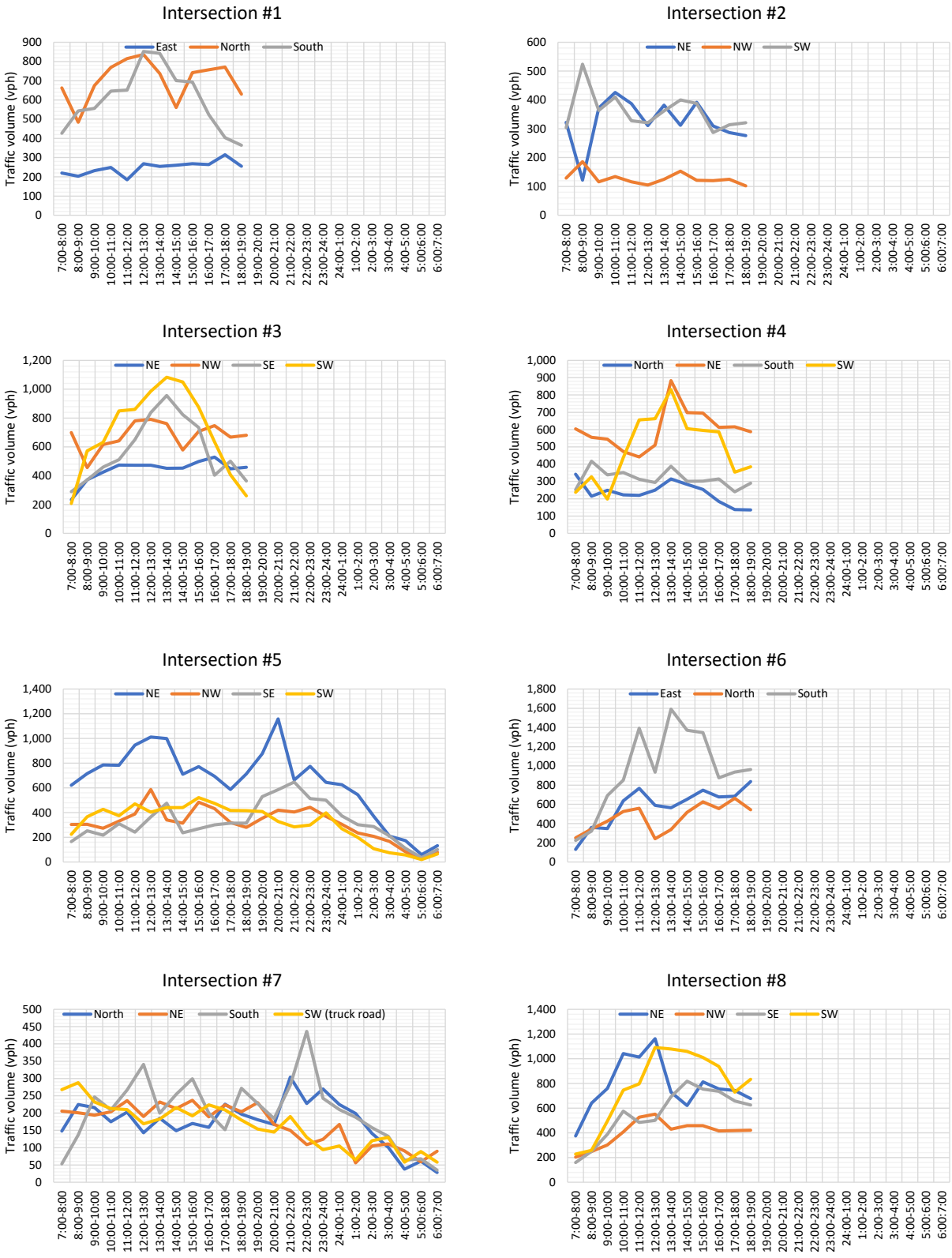


Source: Created by the JICA Study Team (Map data: OpenStreetMap (https://www.openstreetmap.org))

Figure 3-75 Locations of Traffic Survey in July 2023

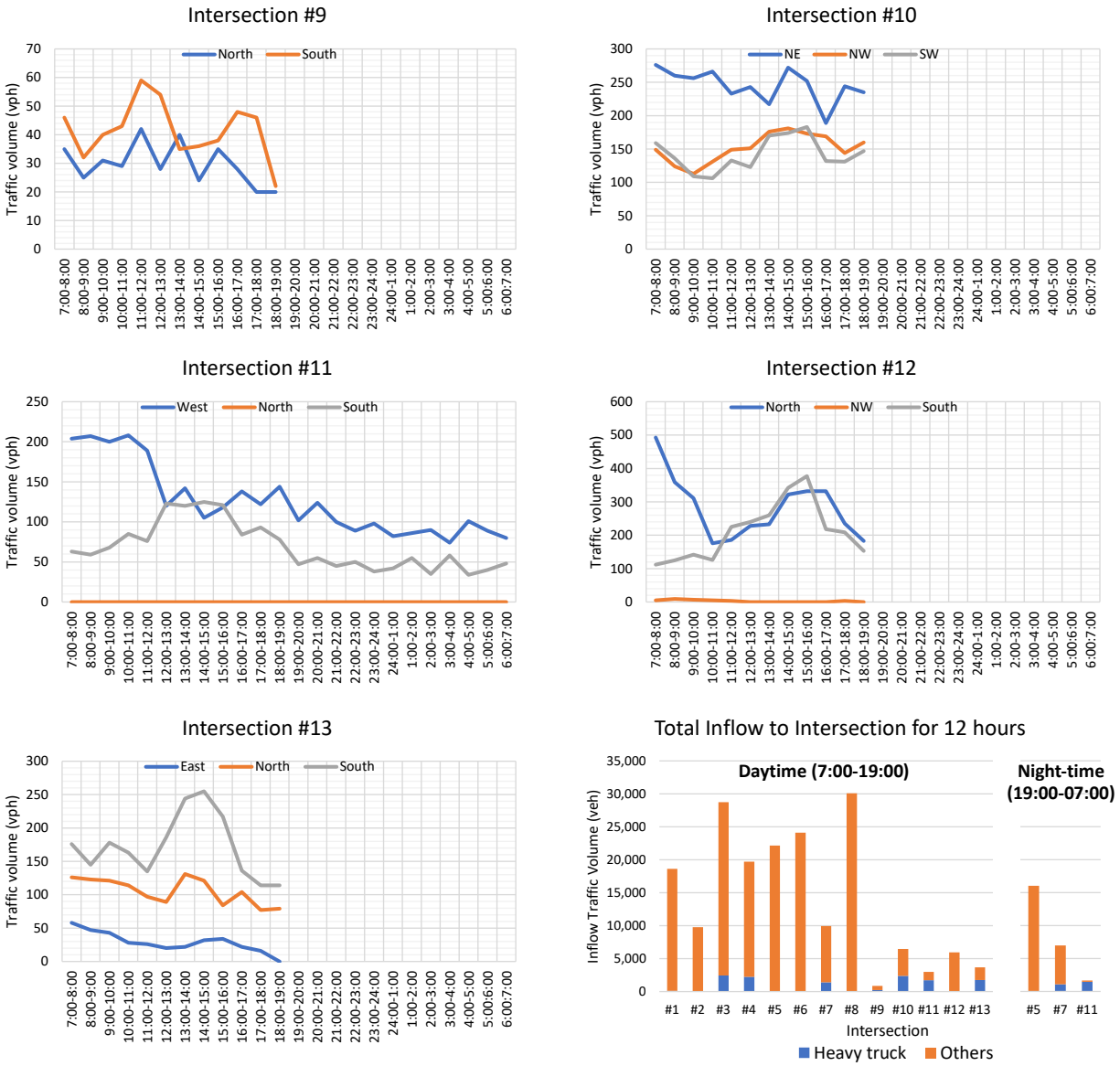
During the traffic survey period, the Back Road was under rehabilitation, and the south-bound direction was closed. Therefore, it should be noted that the traffic survey results of most intersections of the survey were affected, and, especially, results of Intersections # 3, 4, 7, 10, 11, and 13 should be carefully interpreted when analyzed, as the traffic demand of the south-bound of the Back Road might flow into the city center and directly affect those intersections.

The traffic survey at Intersections #5, #7, and #11 was conducted for 24 hours, and the survey at other intersections was conducted for 12 hours in daytime (07:00-19:00). The hourly volumes of each approach counted in the traffic survey are summarized and indicated in Figure 3-76 and Figure 3-77.



Source: Created by the JICA Study Team

Figure 3-76 Results of Traffic Survey in July 2023 (1)

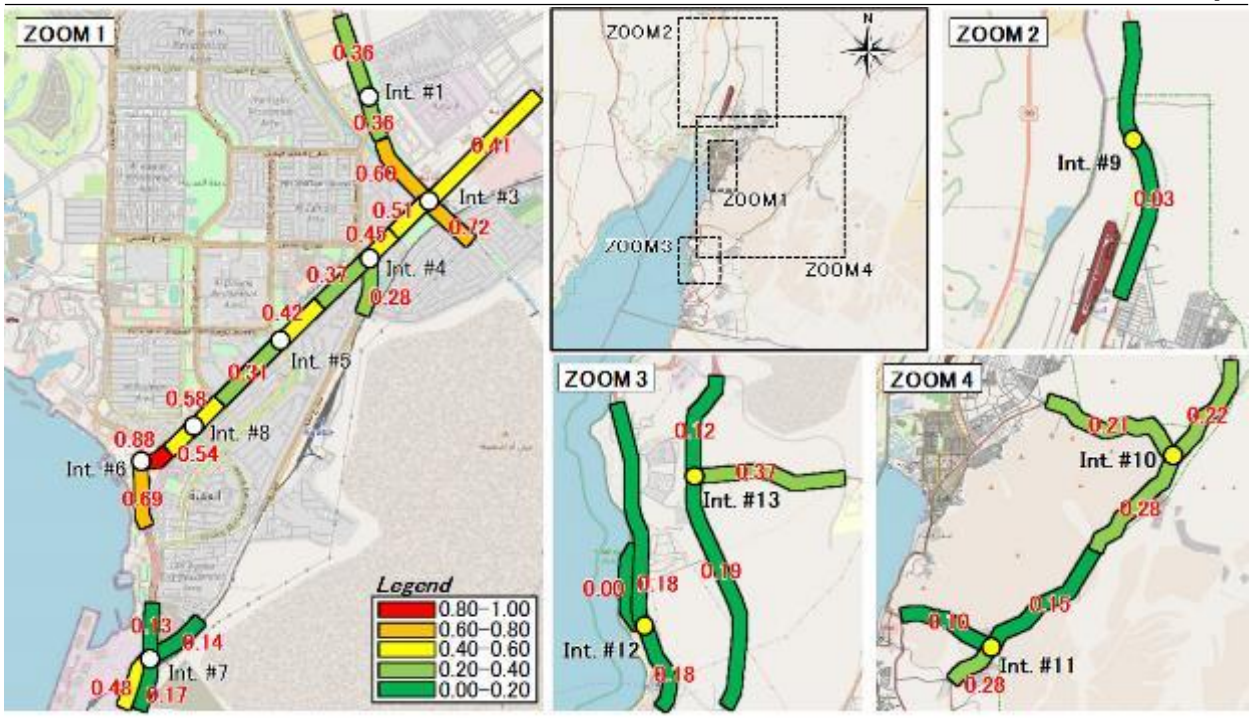


Source: Created by the JICA Study Team

Figure 3-77 Results of Traffic Survey in July 2023 (2)

As shown in the traffic survey result, traffic volume of each approach of intersection is not of the level of traffic congestion. However, Intersection #3 has significantly more traffic than other intersections, where traffic from three major arterial roads (Sharif Hussein bin Ali Boulevard, the Desert Highway, and the Dead Sea Highway) is concentrated. Intersections #5, 6, and 8, which are located on Sharif Hussein bin Ali Boulevard in the commercial area, also have significantly more traffic, and traffic congestion is concerned in the near future.

To confirm the traffic condition, ratio of 12-hour traffic volume to 12-hour traffic capacity for both directions (hereinafter "V_{12}/C_{12}") in daytime (7:00-19:00) was analyzed for major arterial roads where the intersections of the survey are located. The results are shown in Figure 3-78.



Source: Created by the JICA Study Team (Map data: OpenStreetMap (https://www.openstreetmap.org))

Figure 3-78 V_{12}/C_{12} of Major Arterial Roads in Daytime (7:00-19:00)

In general, major arterial roads in Aqaba are still capable for the road traffic without traffic congestion. However, V_{12}/C_{12} in the commercial area (downtown) is relatively high, and it is considered that a traffic management or the enhancement of road network is required. V_{12}/C_{12} is not so high at Intersection #3. However, 8.8% of inflow traffic to the intersection in total is heavy vehicle, and traffic safety and residential environment are concerned when the city center area is expanded in the future.

(2) Public Transport

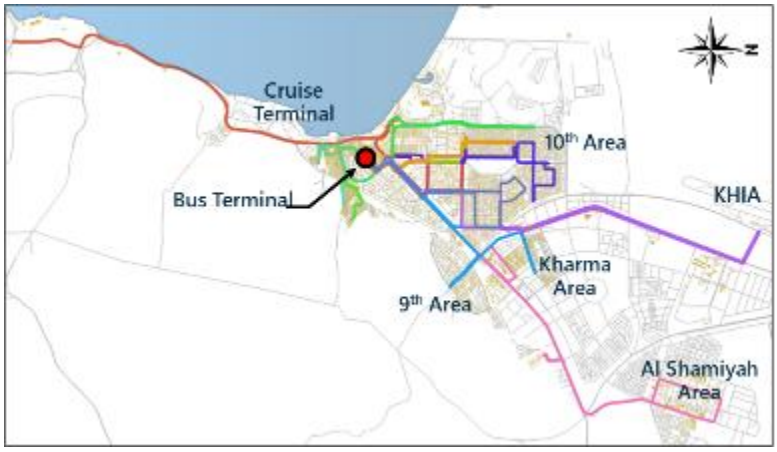
1) Overview of the situation

Except taxi, bus is the only public transport system available in Aqaba. Currently, 89 buses are operated by Aqaba Transport Company and private operators across 16 authorized bus routes. Out of these 16 routes, 7 routes are operated by the Aqaba Transport Company which owns 71 buses, whereas other 7 routes are operated by 12 private operators that own 18 buses individually. The other 2 routes are authorized, but currently not operated. ASEZA is the administrative agency that implements regulations and permits regarding public buses. There is no particular basis for revoking the license, since the license for public bus operation does not specifically stipulate business requirements on bus operation, maintenance, etc. However, in response to complaints from bus users, ASEZA's Transportation Committee investigates the actual situation and can issue cancellation measures.

There are no designated bus stops nor a regular timetable for operation; passengers can hop in from the roadside along the route basically anywhere. The operation schedule is not fixed; the bus typically leaves the terminal when some passengers are onboard. This uncertain and unreliable nature of the bus operation is the hindering factor for the usage of the service.

Most of the bus routes start or end at the bus terminal at King Talal Street in the commercial area of the city center, which is the hub & spoke concept of bus network formulation. It requires passengers who want to transit to another line to go to the bus terminal first, which decreases the convenience of bus use, especially, transfer.

The bus routes were planned and licensed at the inauguration phase of ASEZ, and thus the routes are not necessarily compatible with the current situation in Aqaba, and there is some overlap of service routes. Lack of coordination among private operators and Aqaba Transport Company, as well as the limited control over the service level for private operators, are a challenge facing ASEZA and Aqaba Transport Company. There are raised awareness in ASEZA and relevant organizations for the need to rearrange the routes and also improve the management of the service level, but no agreement or decision has been made.



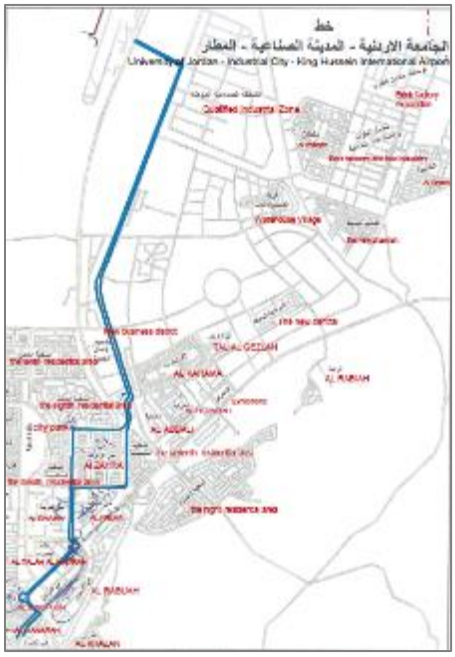
Source: Created by the JICA Study Team

Figure 3-79 Registered Public Bus Network in Aqaba

2) Bus route information

The route map of each bus service and its information is compiled in the table below.

Table 3.61 Bus Route Information (1/4)

Route name	Downtown-residential-south beach	Downtown-Port gate 3
Map		
Operator	Aqaba Transport Company	Aqaba Transport Company
Number of buses	34	1 (*Currently not operational)
Route name	**University of Jordan - Industrial City KH Int'l Airport**	**Downtown-Al Mahdood-Western tenth**
Map		
Operator	Aqaba Transport Company	Aqaba Transport Company
Number of buses	11	3

Source: Compiled by the JICA study team based on the data from ASEZA

Table 3.62 Bus Route Information (2/4)

Route name	Downtown-third-seventh-eighth-sixth	Downtown-Al Remal-Tenth
Map		
Operator	Aqaba Transport Company	Aqaba Transport Company
Number of buses	6	6

Route name	Downtown-Ninth-Al Karama residential	Downtown – Al Mahdood Line
Map		
Operator	Aqaba Transport Company	Private
Number of buses	2	5

Source: Compiled by the JICA study team based on the data from ASEZA

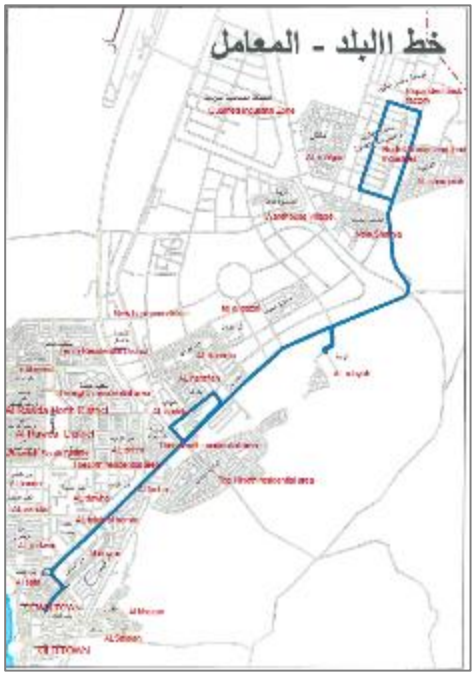
Table 3.63 Bus Route Information (3/4)

Route name	Downtown – Al Mahdood Line (2)	Downtown-residential-Al Khazan
Map		
Operator	Private	Private
Number of buses	2	1

Route name	Al Shalalah Route	Downtown-Salahuddin Route
Map		
Operator	Private	Private
Number of buses	1	1

Source: Compiled by the JICA study team based on the data from ASEZA

Table 3.64 Bus Route Information (4/4)

Route name	Al Alamiah – Al Mahdood Line	Downtown-laboratory Line
Map		
Operator	Private	Private
Number of buses	6	4

Source: Compiled by the JICA study team based on the data from ASEZA

3) Number of bus users on routes operated by Aqaba Transport Company

Transport Aqaba Company compiles annual total number of the passenger of each route operated by the Company as shown in the table below. However, detail and quality data on the number of passengers – e.g., hours/monthly ridership, number of passengers by origin and destination, and attribute of users – are not available.

Table 3.65 Number of Passengers by Routes Operated by Aqaba Transport Company

Route Name	Number of passengers	
	2021	2022 (~Sept.)
University route	83,537	177,273
Tenth route	114,328	170,224
Ninth route	26,916	46,539
Al Mahdood route	194,290	124,295
Al Karama route	42,558	38,205
Al Alamiah residential and third area route	28,637	31,602
Al Maameel route	-	4,988
Total	**490,266**	**593,125**

Source: Compiled by the JICA study team based on the data from ATC

4) Satisfaction for the transport system in Aqaba

Satisfaction questionnaire survey on transport system (public transport and taxi) was conducted by ASEZA in the past. The findings from the questionnaire survey are outlined below:

Questionnaire items:

0) Please specify the gender/ Age Group:

1) To what degree are you satisfied with the availability of public transport

☐Not satisfied completely ☐dissatisfied somewhat ☐fair ☐somewhat satisfied ☐ satisfied ☐completely satisfied

2) I use public taxis:

☐ Daily ☐ weekly ☐ several times a week ☐ rarely

3) How to evaluate the performance of public taxi, its cleanliness and comfort level:

☐Excellent☐ very good ☐ good acceptable ☐weak

4) Commitment to the prescribed tariff for the fare and the operation of the tariff meter:

☐Excellent ☐ very good ☐ good acceptable ☐ ☐ weak

5) Are you satisfied with the discipline during the trip in terms of (general appearance, smoking, compliance with traffic laws):

☐Not satisfied completely ☐ dissatisfied somewhat ☐ dissatisfied somewhat satisfied ☐ somewhat satisfied ☐ satisfied ☐ completely satisfied

6) I want to have public transport in the area, using smart apps?

☐ yes ☐ no

7) Do you want to benefit from the electronic payment service instead of cash?

☐ yes ☐ no

8) Do you think that Aqaba needs to apply smart solutions to serve the transport system as one of the most important tourist destinations in the Kingdom?

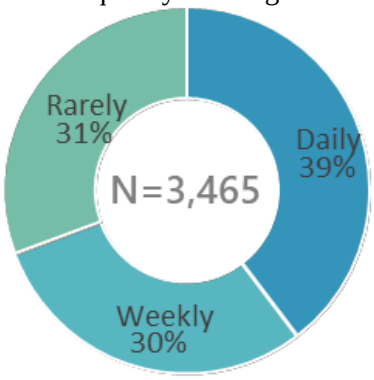
☐ yes ☐ no

9) Are there any proposals that may contribute to raising the level of transportation in Aqaba? Mention it.

_____

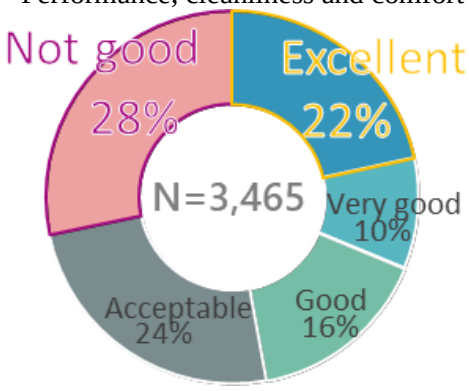
a) Responses to questions regarding taxis in Aqaba

Frequency of using taxi



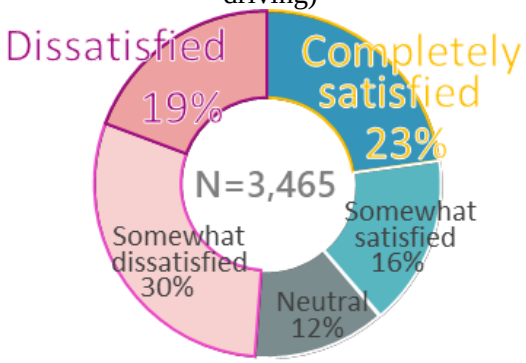
- 39% is the daily user of the taxi

Performance, cleanliness and comfort



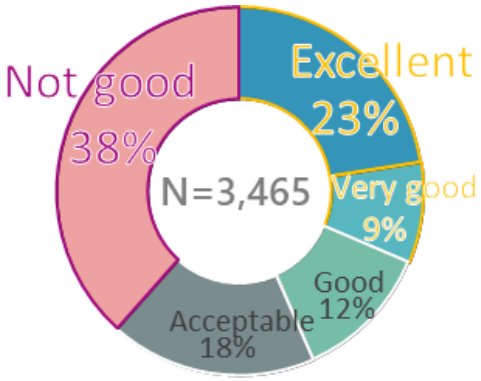
- "Not good" was the most frequent response

Discipline of drivers (appearance, smoking, driving)



- Nearly half of the respondents perceived the driver's discipline as dissatisfactory or somewhat dissatisfactory.

Compliance to tariff and usage of meter



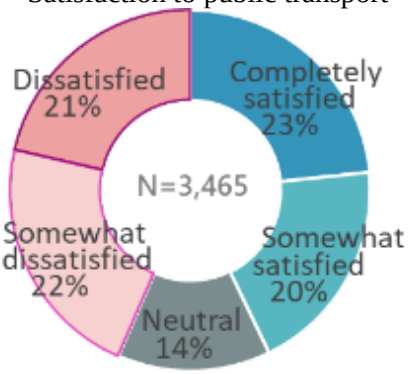
- 38% of respondents indicated that the drivers' compliance to tariff and their usage of meter is not good.

Source: Compiled by the JICA study team based on the data provided by ASEZA

Figure 3-80 Responses to Questions Regarding Taxi

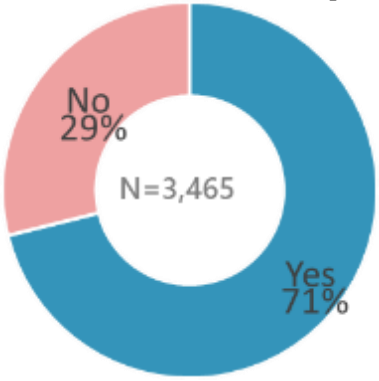
b) Responses to questions regarding public transport in Aqaba

Satisfaction to public transport



- Satisfaction level for public transport is very mixed

Support to smart solutions for transport system



- Majority of respondents are supportive for implementing smart solutions for transport system

Source: Compiled by the JICA study team based on the data provided by ASEZA

Figure 3-81 Responses to Questions Regarding Public Transport

c) Responses to open questions regarding public transport situation in Aqaba

Respondents were asked to express suggestions for raising the level of the transport system in Aqaba. The JICA study team classified the responses according to the essence of the response. Most frequent responses are listed in the table below.

Table 3.66 Suggestions by Respondents for Raising the Level of Transport System

Transport modes	Types of responses	% of responses
Taxi	Usage for Smart Applications and services ・ *"Need Smart Apps like Uber or Careem"*	19%
	Driver's attitude, appearance, driving behaviour ・ *"Not adhere to traffic rule"* ・ *"Not good moral of the drivers"*	12%
	Unfixed fares, unreliable pricing system ・ *"Drivers do not use price meter"* ・ *"The prices were unfair"*	7%
	Uncomfortable riding experience ・ *"Driver is smoking, and car is not clean"* ・ *"Want camera inside the car to monitor the driver for security"*	7%
Public Transport	Coverage of public transport ・ *"There are no bus service in Ninth Area"* ・ *"No route that connects directly to the southern side"*	18%
	Smart transport applications and technology ・ *"Want bus information through applications"* ・ *"Cashless payment should be promoted"*	10%
	Services reliability and frequency of the bus ・ *"Want regular route and schedule"* ・ *"The frequency of the service is low"*	6%
	Fleet condition ・ *"There are buses with very old vehicles"* ・ *"The air-conditioning system should be installed and turned on all buses"*	3%

Source: Compiled by the JICA study team based on the data provided by ASEZA

5) Operation management of the bus system

Aqaba Transport Company has the monitoring system that collects the real time locational data of their bus fleets. The location of buses is monitored in the monitoring room inside the Aqaba Transport Company compound. Aqaba Transport Company uses this system to check if there are no irregularity in the operation, and buses are not deviating from the licensed route.





Source: JICA study team

Figure 3-82 Bus monitoring system in Aqaba Transport Company

(3) Pedestrian and Cycling

1) Overview of the situation

Ensuring a safe and comfortable walkable/ cyclable environment is crucial for creating circulation inside the city and catalysing urban activity. Also, promotion of active transport, i.e., walking, and cycling, would contribute to promoting health for the residents, as well as moving towards environmentally sustainable city.

As explained above, pedestrian space is specified in the ASEZA design guideline, but there is no plan for pedestrian movement, while there is no guideline or plan for the cycling road and is developed seemingly in ad hoc basis. In order to reap the benefits of promoting walking and cycling, it is important to set a general principle for guiding development towards pedestrian and cyclist-friendly urban environment that considers the circulation of people, attraction for the pedestrian and cyclists, as well as integration with the land-use plan.

2) Walking environment in Aqaba

Regarding the walking space in Aqaba, walkways and pedestrian spaces are generally secured along the major roads of primary roads, secondary roads, and neighbourhood roads, as is also stipulated in the design guideline. The design dimension for the walkway is specified in the design guideline (see Table 3.59). However, despite fairly well-developed and maintained walkways along the roads, it needs to be noted that walkability is limited in some locations due to physical blockage by street furniture such as street signage or garbage bins, or cars parked on streets; and lack of shades to protect from the severe sun beam.

3) Overview of the situation for cycling

For cycling, a dedicated lane for cycling is being installed along Al-Farouk Street from 2020. This cycling lane is a blue-painted lane on side of the road separated from the roadway with low steel bars.

According to ADC, cycling lanes are being installed in three phases. First phase would connect the airport and the downtown. The second phase would connect downtown and southern coastal zones. The third phase would aim to expand the cycle lanes to whole city to create circulation.



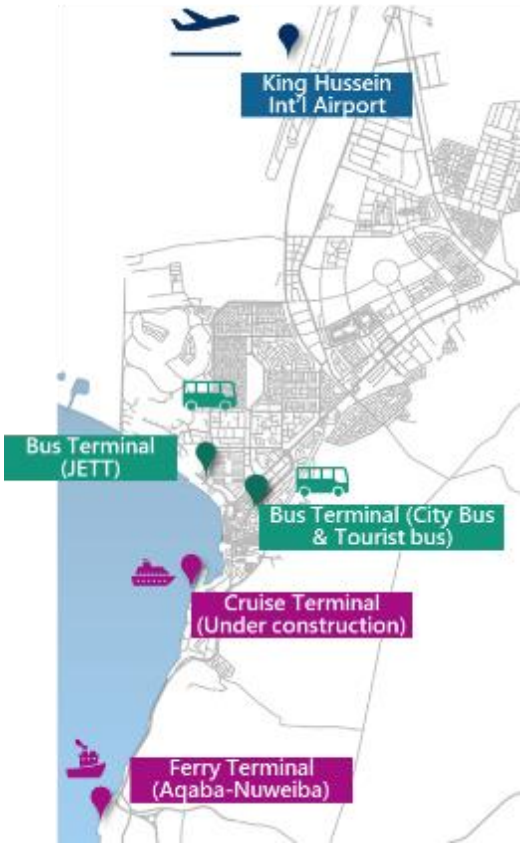
Source: JICA study team

Figure 3-83 Bicycle Lane along Al-Farouk Street

(4) Transport facility

1) Overview of the situation

Connecting transport facilities, such as bus terminals, passenger ferry terminal, and airport, is an important issue for convenience of visitors to Aqaba.



Source: JICA study team

Figure 3-84 Major Transport Facilities in Aqaba

2) Passengers and Tourists by Sea

The ferry terminal in the middle port area receives ferry passenger traveling to and from Nuweiba, Egypt. The cruise terminal, which is located in the old port area receives international cruise ships. The figure below shows the trend of number of passengers and tourists by sea.

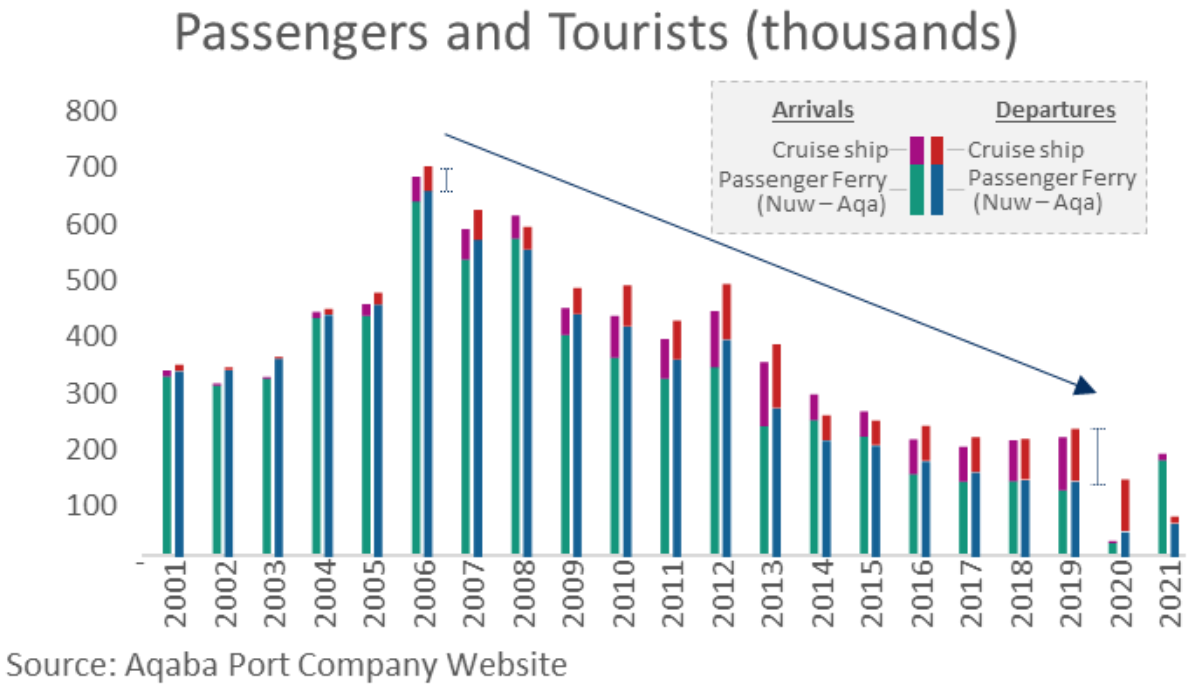


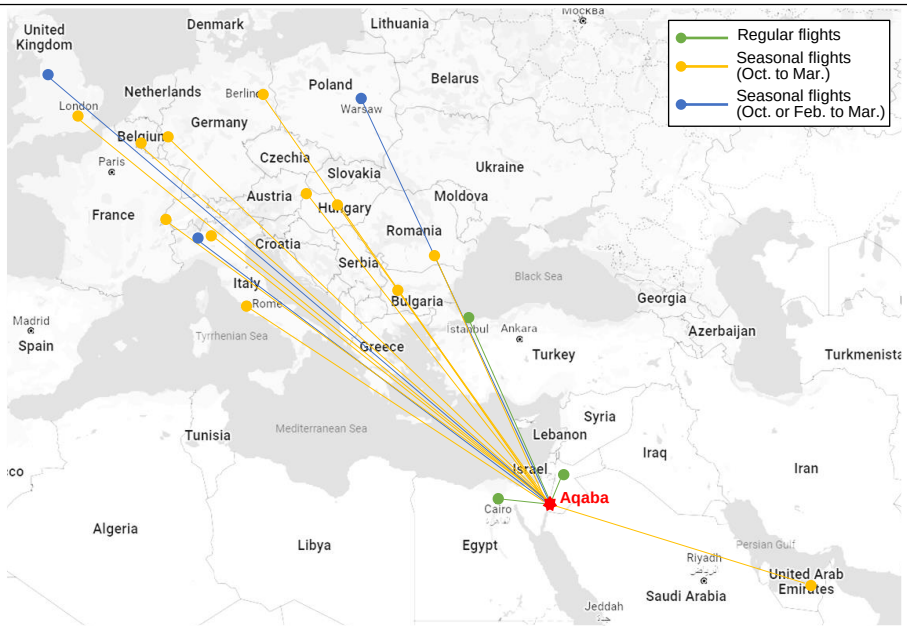
Figure 3-85 Passenger and Tourists by Sea

3) Passengers and Tourists by Air

King Hussain International Airport operates 24 hours with one 3,000 m * 45 m runway. It is not limited by traditional bilateral landing rights and said to be able to handle an annual capacity of 2 million passengers.

ADC established the Aqaba Airports Company as a step to transform the airport's activities into a commercial airport, especially after the revitalization of tourism and the growing interest in using the airport as a regional center for air cargo operations.

King Hussein International Airport have direct regular flights to Cairo, Istanbul, and Amman, and also seasonal flights connecting European cities. Around 200,000 people use King Hussein International Airport annually.



Source: JICA study team

Figure 3-86 Direct Flights from King Hussein International Airport

Table 3.67 Information of Direct Flights Connecting Aqaba

Destination	Frequency (Seasonal/Regular)	Trips per week
Egypt/Cairo	Regular	Monday, Thursday & Friday /1trip a day
Istanbul	Regular	Monday, Wednesday & Friday /1trip a day
Jordan/Amman	Regular	Everyday /1trip a day
Austria/Vienna	October to March	Monday & Friday/1trip a day
Belgium/Brussels Charleroi	October to March	Sunday /1trip a day
Bulgaria/Sofia	October to March	Tuesday, Thursday and Sunday /1trip a day
Germany/Berlin	October to March	Monday & Saturday/1trip a day
Germany/Cologne	October to March	Wednesday & Saturday /1trip a day
Hungary/Budapest	October to March	Tuesday & Saturday /1trip a day
Italy/Milano (Bergamo)	October to March	Wednesday, Friday & Sunday /1trip a day
Italy/Rome (Ciampino)	October to March	Thursday & Sunday /1trip a day
Romania/Bucharest	October to March	Monday, Tuesday, Friday & Saturday /1trip a day
Switzerland/Geneva	October to March	Tuesday & Saturday /1trip a day
United Arab Emirates	October to March	Wednesday & Saturday /1trip a day
UK/London Gatwick	October to March	Tuesday & Saturday /1trip a day
Poland/Warsaw	December to March	Tuesday & Saturday /1trip a day
Italy/Milano (Malpensa)	February to March	Tuesday & Saturday /1trip a day
UK/Manchester	February to March	Monday & Friday /1trip a day

Source: https://www.flightsfrom.com/explorer/AQJ?mapview (data collected in January 2023)

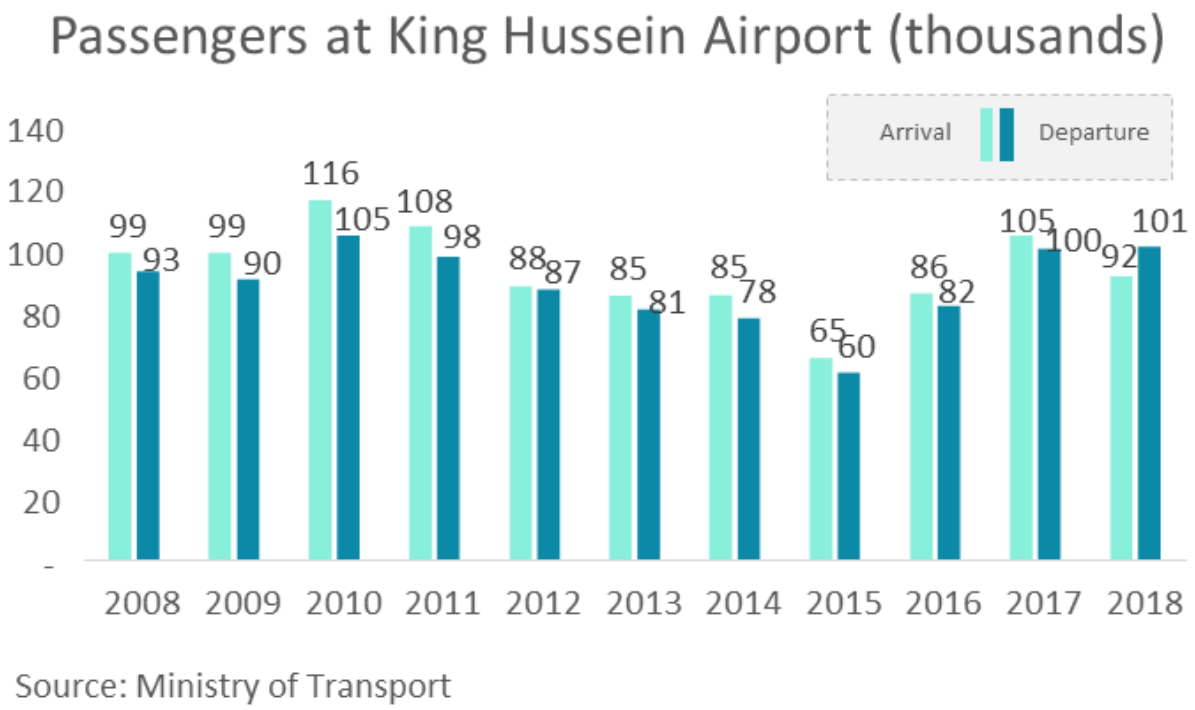


Figure 3-87 Annual passengers at King Hussein Airport

4) Inter-city bus

The regular bus service is provided by independent owner-operator, largely to Amman, through the Desert Highway, but also to other destinations, such as Al-Karak and Irbid. Routes start and end at the King Abdullah Bin Al-Hussein inter-city terminal. One of the major long distance bus operators, JETT operates 23 services a day to Amman, one service a day to Wadi-Rum, and one service a day to Petra.

3.6.3 Logistics

(1) Multimodal logistics network

1) Overview of the situation

The strategic positioning of Aqaba highlights the importance of improving the logistics condition, not only for Jordan but for the adjacent countries (including Saudi Arabia, Syria and Iraq).



Source: JICA study team

Figure 3-88 Overview of the Logistics Routes

Logistics cargo flow is well separated with urban activities at the city center; the heavy-duty trucks predominantly move through the backroad that connects to the Desert Highway, which is the preferred travel route to/from Amman and the hinterland regions.

The railway is currently not used since the port was relocated to the southern border. However, ADC is now conducting a feasibility study on railway to rehabilitate and use it to carry goods to and from the port.

2) Logistics volume

a) Container handling at Aqaba Container Port

The container handling volume is shown blow. Container throughput has almost tripled in the ten years period from 2001 to 2010 but has been stable since then. Port call has been decreasing from 2009.

It needs to be noted, that ADC has announced in January 2023 the inauguration of direct shipping line service that connects the United States directly with Aqaba. This is expected to catalyse export to and the import from the United States. Previously without the direct service, the goods going to and coming from the United States had to tranship at other country's ports such as Jeddah in Saudi Arabia, incurring additional cost and time, which in turn impacted the competitiveness of Jordan goods in the United States market. Thus, there

is an expectation that this would lead to improved access to the market of the United States, and enhancing investment and businesses related to export to the United States.

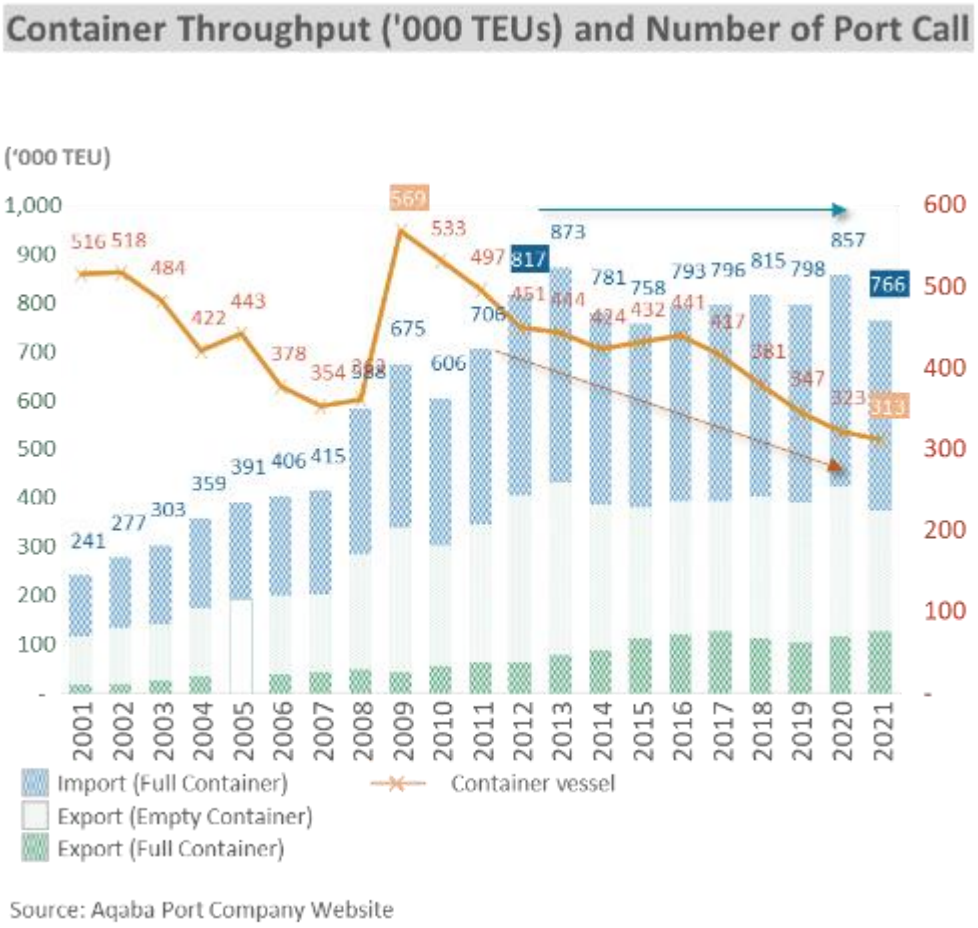
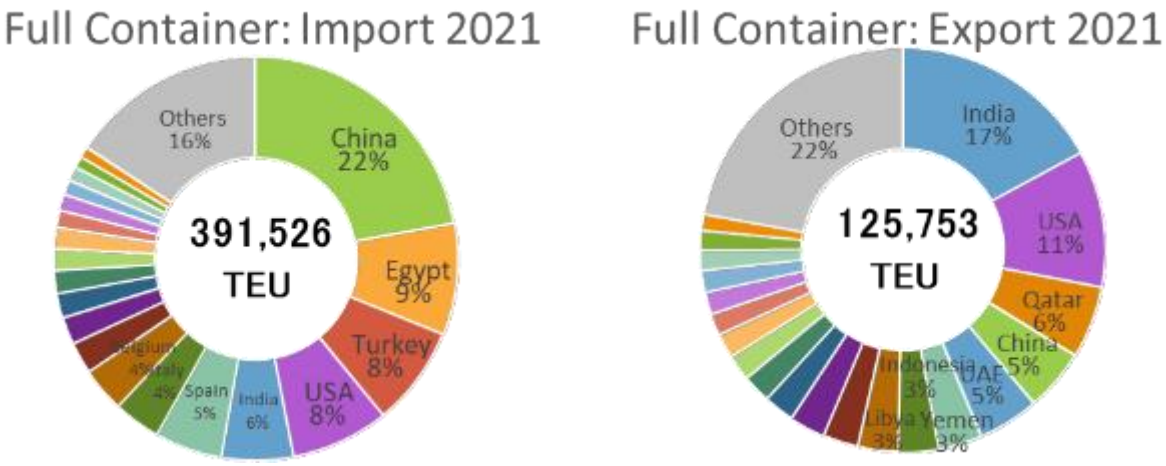


Figure 3-89 Container throughput and number of ports call



Source: Aqaba Port Company website

Figure 3-90 Container Volume by Country (Import and Export in 2021)

b) General and bulk cargo handling at Aqaba Port

The general and bulk cargo handling volume is shown blow. The handling volume has stagnated in recent years Notably, export volume has declined significantly since 2011/2012.

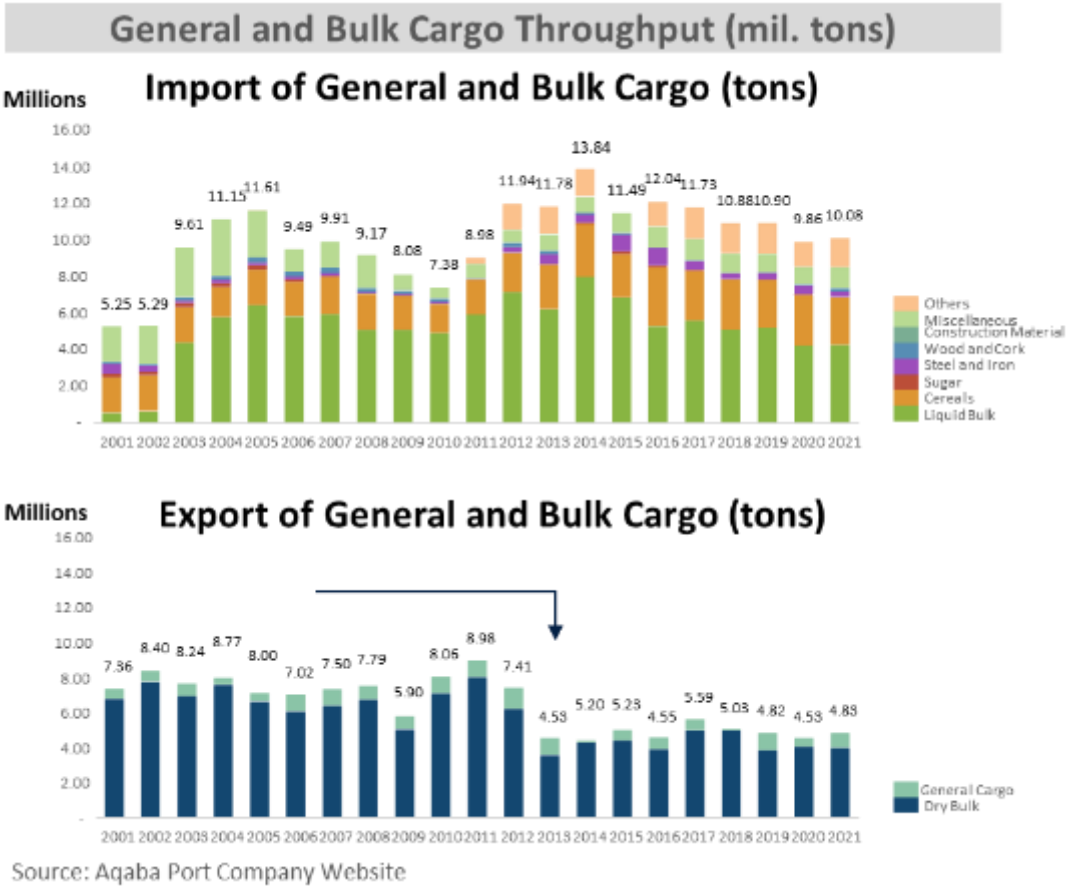
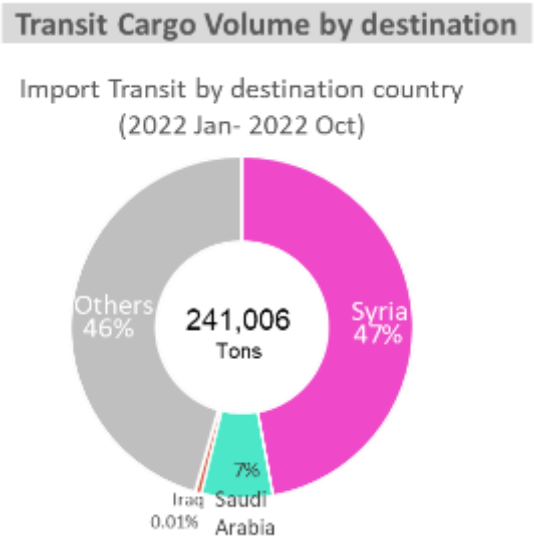


Figure 3-91 General and Bulk Cargo Throughput



Source: Aqaba Port Company Website

Figure 3-92 Transit Cargo Volume by Destination

(2) Logistics infrastructure

1) Port facility information

The figure below shows the port facility along the coast of Aqaba. The plans (⑬ - ⑮) in the figure are long-term plans, although no specific studies are currently underway.



Source: JICA study team based on ADC documents (AQABA Your Gateway to the Levant Region – Commitment for Excellence)

Figure 3-93 Locations of Existing Port Facilities

The table below explains the status of existing port facilities.

Table 3.68 Overview of Existing Port Facilities (North Port Area)

No.	Image	Description
1		**<u>Cruise Terminal</u>** As part of the Marsa Zayed project, the old port has been converted into a cruise terminal, and a passenger terminal has been built to accommodate international cruise ships. Currently, buses for optional tours and taxis for individual travellers are used when international cruise ships arrive at the port. *There are no public transportation services, such as buses as there are no facilities for residents or other travellers in the vicinity.

Table 3.69 Overview of Existing Port Facilities (Middle Port Area)

2		**Container Terminal** ADC has entered into a strategic partnership with APM Terminal to improve the efficiency of the container terminal and established Aqaba Container Terminal (ACT) in 2006 (with a share of 49% ADC and 51% APM). In 2013, a modern terminal with a total length of 1,000 meters, a water depth of over -14 meters, and a facility capacity of 1.3 million TEUs was built. A memorandum of understanding has been signed with the government to renew the concession from 2031 to 2046.
3		**Ferry Terminal** The existing ferry terminal has two berths and serves ferries between Egypt (Nuweiba Port) and Aqaba Port. According to the current port master plan, a new ferry terminal is planned to be built in the New South Port area. However, this is a long-term plan and no specific studies have been carried out.
4		**Cement Berth and Rice Berth (Mu'tah Berth)** Cement Berth and Rice Berth (Mu'tah Floating Berth) are located in the Middleport area. The use of these berths has been suspended due to safety issues such as firefighting equipment.

Table 3.70 Overview of Existing Port Facilities (New South Port Area)

5		**RoRo and General Cargo Terminal (Aqaba New Port)** Nine berths are currently in operation, with quay depths ranging from 13 to 15 meters. In addition to livestock, coal, grain, RoRo, and general cargo, the Jordan Industrial Ports Company temporarily handles sulfur. It has an annual handling capacity of 36 million tons.
6		**Dry Bulk Terminal (Industrial Terminal)** The terminal was developed under a BOT agreement signed by ADC and the Jordan Industrial Ports Company. The Jordan Phosphate Mines Company and the Arab Potash Company have a 30-year concession to operate the terminal. It is equipped with three berths (total length 670 meters, water depth 11.5 to 21 meters), warehouses, and unloading and conveying systems, and has a processing capacity of 10 million tons per year. The complex handles industrial products such as fertilizer, potash, sulfur, liquid ammonia, and other chemicals.
7		**Phosphate Terminal** The terminal was developed under a BOT agreement between ADC and Jordan Phosphate Mines Company, the terminal commenced operations in 2013, and the concession of 30 years of operation has been granted. The terminal has one berth, a quay length of 250 meters, a water depth of 21 meters, and an annual throughput of 6 million tons. It is equipped with three unloaders with a throughput of 2,000 tons per hour per unit. There is also an unloading and storage station with a

		capacity of 300,000 tons.
8		**LNG Terminal** With a grant from the Kuwait Fund for Arab Economic Development, ADC constructed and operated a dedicated liquefied natural gas (LNG) terminal with a capacity of 420,000 m³ (15 million cubic feet) daily. The floating LNG storage and regasification unit (FSRU) docked at the berth has a storage capacity of 160,000 m³ and converts LNG to gas for delivery. Sheikh Sabah LNG Port is responsible for the operation and management of the terminal.
9		**Oil Terminal** The terminal has an annual handling capacity of 20 million tons, a quay length of 140 meters, and a water depth of -24 meters. It is equipped with 11 pumps for pumping and 13 automatic double platforms for tank loading. The storage capacity for petroleum derivatives is planned to increase from the current 50 million m³ to 150 million m³ upon the completion of the third phase, and further improvements are planned to achieve 24-hour operation.
10		**LPG Terminal** ADC constructed the LPG (Liquefied Petroleum Gas) terminal in cooperation with the Ministry of Energy and Mineral Resources. It is managed and operated by the Aqaba Ports Management and Operation Company (ACPOM), which has executed a subcontracting agreement with the Jordan Petroleum Refinery Company to receive and handle oil and gas vessels. With a berth length of 185 meters and a draft of 11 meters, the facility has an annual throughput of 4 million tons and can receive 20,000-dwt class tankers.
11		**Marine Services Harbor** The Aqaba Port Marine Services Company was established to maintain the harbor and provide related marine services. The company is a consortium of ADC, Lamnalco, a UAE company, and the National Shipping Lines Company. The term of the contract is 15 years, and its objectives include the development and operation of marine services and the improvement of security, maritime safety, and environmental protection.
12		**Specialized Marine Services** The facility provides services to vessels in the local area. The operator, Aqaba Ports Marine Services Co, manages four tugboats and one mooring boat.

Source: ADC Annual Report (2019)

2) Port Masterplan by ADC

a) Gap analysis between capacity and forecast demand

ADC have completed a study for updating the Aqaba Port Masterplan in January 2020. In the study, capacity analysis and a future demand forecast were made for the following terminals within the Port of Aqaba: (1) the North Port Area where cruise ships call, (2) the Middle Port Area where cement berths, container terminals, and ferry terminals exist, and (3) the New South Port Area where RoRo and general cargo terminals, dry bulk terminals,

liquid bulk terminals, and other terminals are located. The gap between the capacity and the forecast was assessed and hence several development options were examined.

Table 3.71 Gap Analysis between Capacity and Forecast Demand

Facility	Facility Capacity	Forecasted Demand (2030)	Forecasted Demand (2040)
Container Berth Capacity Storage Capacity Gate Capacity	**1.02 million TEUs** 1.02 million TEU 1.53 million TEU 2.26 million TEU	1.25 million TEU	1.89 million TEU
General Cargo Berth Capacity Storage Capacity Gate Capacity	**3.9 million tonnes** 4.8 million tonnes 3.9 million tonnes 4.4 million tonnes	2.57 million tones	3.38 million tones
Dry Bulk Berth Capacity	**10.9 million tonnes** 10.9 million tonnes	9.33 million tonnes	10.1 million tonnes
RoRo Berth Capacity Storage Capacity Gate Capacity	**1.1 million tonnes** 1.1 million tonnes 1.3 million tonnes 3.5 million tonnes	0.75 million tonnes	0.98 million tonnes
Liquid Bulk Berth Capacity	**27.3 million tonnes** 27.3. million tonnes	10.5 million tonnes	12.5 million tonnes
Ferry Berth Capacity Storage Capacity Gate Capacity	**2.4 million tonnes** 3.0. million tonnes 2.4 million tonnes 4.4 million tonnes	0.57 million tonnes	0.75 million tonnes
Cruise Berth Capacity Parking Capacity	**0.55 million Passengers** 0.55 million Passengers 1.53 million Passengers	0.35 million passengers	0.46 million passengers

Source: Compiled by JICA study team based on "Aqaba Ports Master Plan Update (Draft Final Report), 2020"

The gap analysis in "Aqaba Ports Master Plan Update (Draft Final Report), 2020" has shown that the future demand will exceed the current capacity only at the container terminal, while the other facilities have sufficient capacity to handle future demand. The study then examined development options for the container terminal and the cruise terminal, which is subject to the Marsa Zayed development project. The development options are outlined below.

b) Development options for container terminal

Four development options were proposed in the "Aqaba Ports Master Plan Update (Draft Final Report), 2020" and compared against several criteria:

- Option 1: Expansion towards Landside
- Option 2: Expansion Southwards including Land Reclamation
- Option 3: Expansion Southwards without Land Reclamation
- Option 4: Expansion Northwards including Land Reclamation

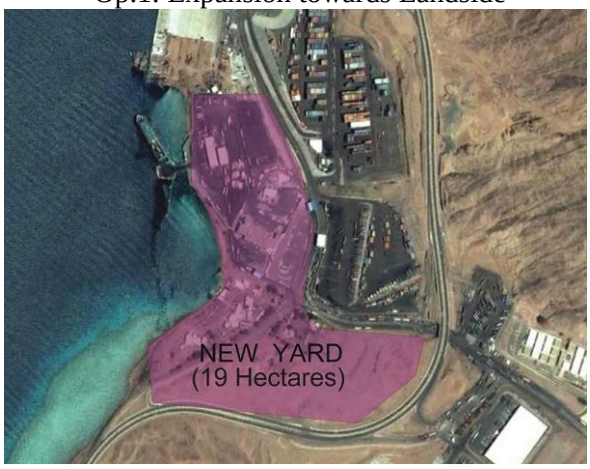
The development image is as shown below:



Op.1: Expansion towards Landside



Op.2: Expansion Southwards w/ land reclamation



Op.3 Expansion Southwards w/o land reclamation



Op.4 Expansion Northwards w/ land reclamation

Source: Aqaba Ports Master Plan Update (Draft Final Report), 2020

Figure 3-94 Development Options for Container Terminal

The result of the assessment of each option in "Aqaba Ports Master Plan Update (Draft Final Report), 2020" is summarized below. It was concluded that Option 4 provides the best results, though it is assumed to be the most expensive to build.

Table 3.72 Assessment of Development Options for Container Terminal

Criteria	Option 1	Option 2	Option 3	Option 4
Construction cost	B 13.5 mil. JOD	C- 17.0 mil JOD	B 5.1 mil. JOD	C- 32.5 mil. JOD
Adequate shape	B	A	C	A+
Impact to Ferry Terminal	A+	C-	C-	A+
Assignment of areas	C	A+	C	A+
Additional Berth possible	C	A	C	A
Ranking	**2**	**2**	**4**	**1**

Legend: A: Good, B: Moderate, C: Not Good

Source: Compiled by JICA study team based on "Aqaba Ports Master Plan Update (Draft Final Report), 2020"

The current development status and the ACT's vision for future development are shown in the figure below. As a plan, ACT is considering rail transport to the planned Madounah Dry Port/Logistics Center near Amman via the access rails at the rear of the container terminal. For this reason, it is considering establishing a new Yard 4 function near the container terminal, where customs procedures, etc., are currently conducted. The future cargo volume handled in 2030 is estimated to be approximately 1.5 million TEUs, considering the fact that Iraq's borders are closed. This is comparable to the estimate of roughly 1.3 million TEUs for 2030 in the "Aqaba Ports Master Plan Update (Draft Final Report), 2020". After that, the container terminal is expected to experience capacity constraints, but it is expected that functional improvements to container yard handling equipment, gates, etc., will increase throughput and transaction capacity. The hydrogen-related facilities in the Future Development Concept figure are shown as a reference, not a concrete plan, as Maersk, the parent company, is considering the development of hydrogen-related facilities in either Jordan, Egypt, or Morocco.



Figure 3-95 Status of Development of the Container Terminal (As-is)



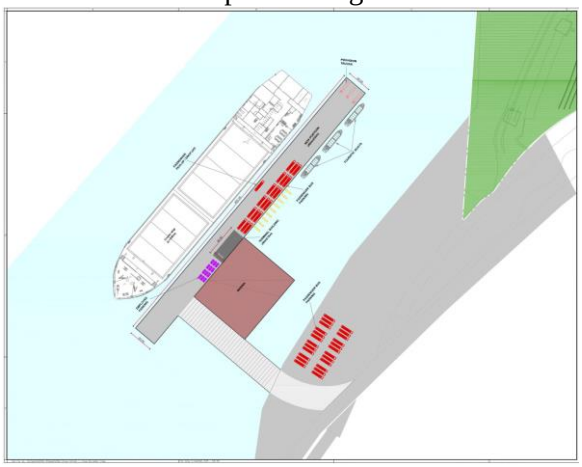
Figure 3-96 Vision for Future Development of the Container Terminal (To-be)

c) Development options for cruise ship facility

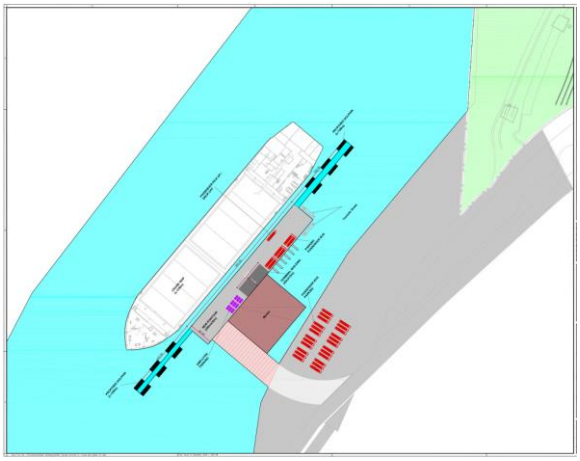
d) Four development options were proposed in the "Aqaba Ports Master Plan Update (Draft Final Report), 2020" and compared against several criteria. Option 1 and 2 follow the approach of integrating with the North Port Area (integration of the Old Port redevelopment (Marsa Zayed development project) and the marina facility), while Option 3 and 4 follows the approach of using the existing infrastructure in the Middle Port Area.

- Option 1: Cruise Terminal + Matal Marina (Large Pontoon)
- Option 2: Cruise Terminal + Matal Marina (Small Pontoon)
- Option 3: Cruise Terminal in Middle Port Area (New Pontoon)
- Option 4: Cruise Terminal in Middle Port Area (Existing Pontoon)

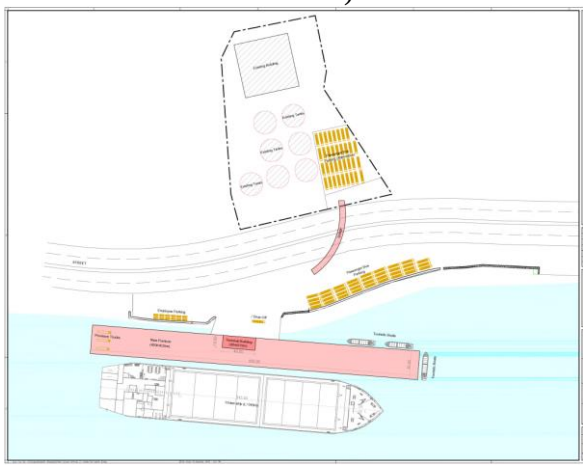
The development image is as shown below:



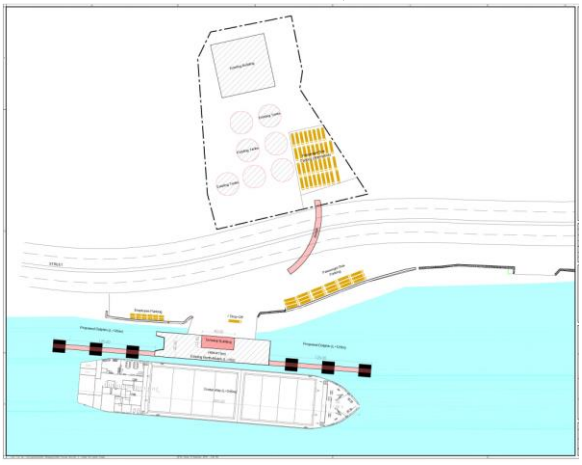
Op.1: Cruise Terminal + Matal Marina (Large Pontoon)



Op.2: Cruise Terminal + Matal Marina (Small Pontoon)



Op.3 Cruise Terminal in Middle Port (New Pontoon)



Op.4 Cruise Terminal in Middle Port (Existing Pontoon)

Source: Aqaba Ports Master Plan Update (Draft Final Report), 2020

Figure 3-97 Development Options for Cruise Terminal

Pros, cons, and costs were compared and reviewed for each option. The report did not come to a specific conclusion, but it was considered that the solutions of Options 1 & 3, although

offering the best operational capability, also require a significantly higher construction cost than the other options and would be riskier in refinancing the construction cost.

A three-berth quay and a cruise terminal building have been developed and are expected to have sufficient capacity to meet cruise demand. Therefore, although it depends on the company's intentions to develop Marsa Zayed, there is no need to adopt the option considered above to develop a new cruise terminal.

Table 3.73 Assessment of Development Options for Cruise Terminal

Criteria	Option 1	Option 2	Option 3	Option 4
Construction cost	48.3 mil. JOD	33.1 mil. JOD	35.5 mil. JOD	19.5 mil. JOD
Pros	・High operational flexibility ・Potential for increased service level ・Potential synergy effects from combination with Matal Marina	・Potential synergy effects from combination with Matal Marina ・Sufficient service level for present utilization	・High operational flexibility ・Potential for increased service level ・Partial utilization of existing infrastructure	・Lowest investment cost ・Utilization of existing infrastructure
Cons	・High investment cost ・Investment only profitable when services are requested by the cruise lines	・No utilization of existing infrastructure ・Only limited-service potential	・Necessary revision of the Middle Port Master Plan ・Investment only profitable when services are requested by the cruise lines ・High investment cost	・Necessary revision of the Middle Port Master Plan ・Only limited-service potential

Source: JICA study team

3) Railway facilities

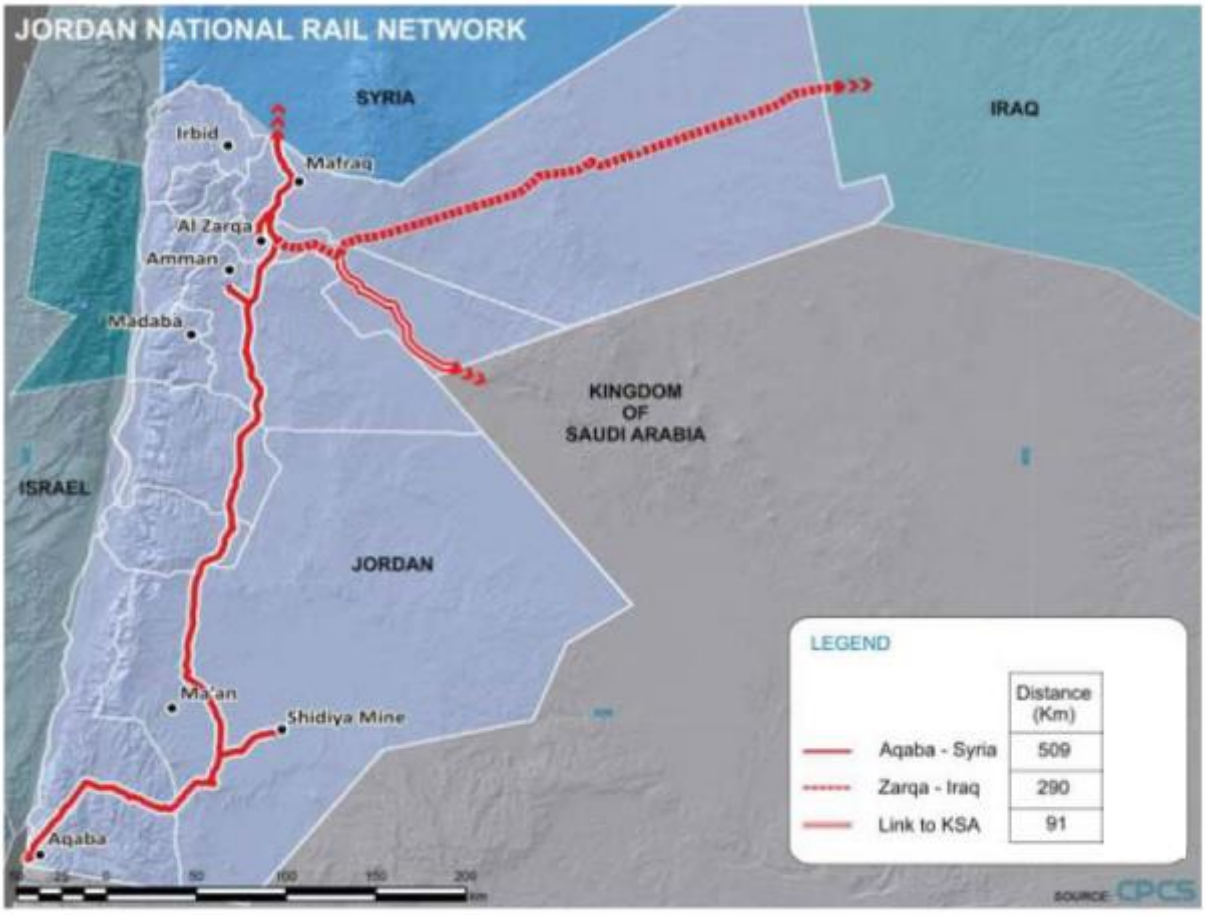
a) JORDAN NATIONAL RAILWAY PROJECT（August 2011）

The "JORDAN NATIONAL RAILWAY PROJECT (August 2011)", published by the Ministry of Transportation in 2011, calls for the construction of a modern and reliable freight rail network with a total length of 897 km, connecting the country's major cities (capital Amman, major industrial cities such as Mafraq, Zarqa, etc.), the sea gateway (Port of Aqaba) and the phosphate mine (Shidiya Mine). The plan also includes connections to Saudi Arabia, Syria, Iraq, and, in the future Turkey and major European cities.

According to the plan, the Jordan Railway Corporation (JRC), a state-owned company, will finance, construct, own, and manage the railway network (infrastructure). In contrast, while the private operators (private companies/consortium) will be engaged in the operation and maintenance of the railways (with operating rights). Selected private operators are expected

to acquire and maintain their rolling stock.

The targets for cargo to be handled are 29 million tons (10,000 tons/km) in 2020, 40 million tons (14,000 tons/km) in 2030, and 55 million tons (20,000 tons/km) in 2040.



Source: JORDAN NATIONAL RAILWAY PROJECT, August 2011

Figure 3-98 Jordan National Railway Network

b) Optimized Jordan National Railway Plan - BANKABILITY STUDY-

The "Optimized Jordan National Railway Plan - BANKABILITY STUDY -" was conducted with the support of AFD to optimize the above-mentioned "JORDAN NATIONAL RAILWAY PROJECT (August 2011)". The main changes compared to the previous plan are as follows.

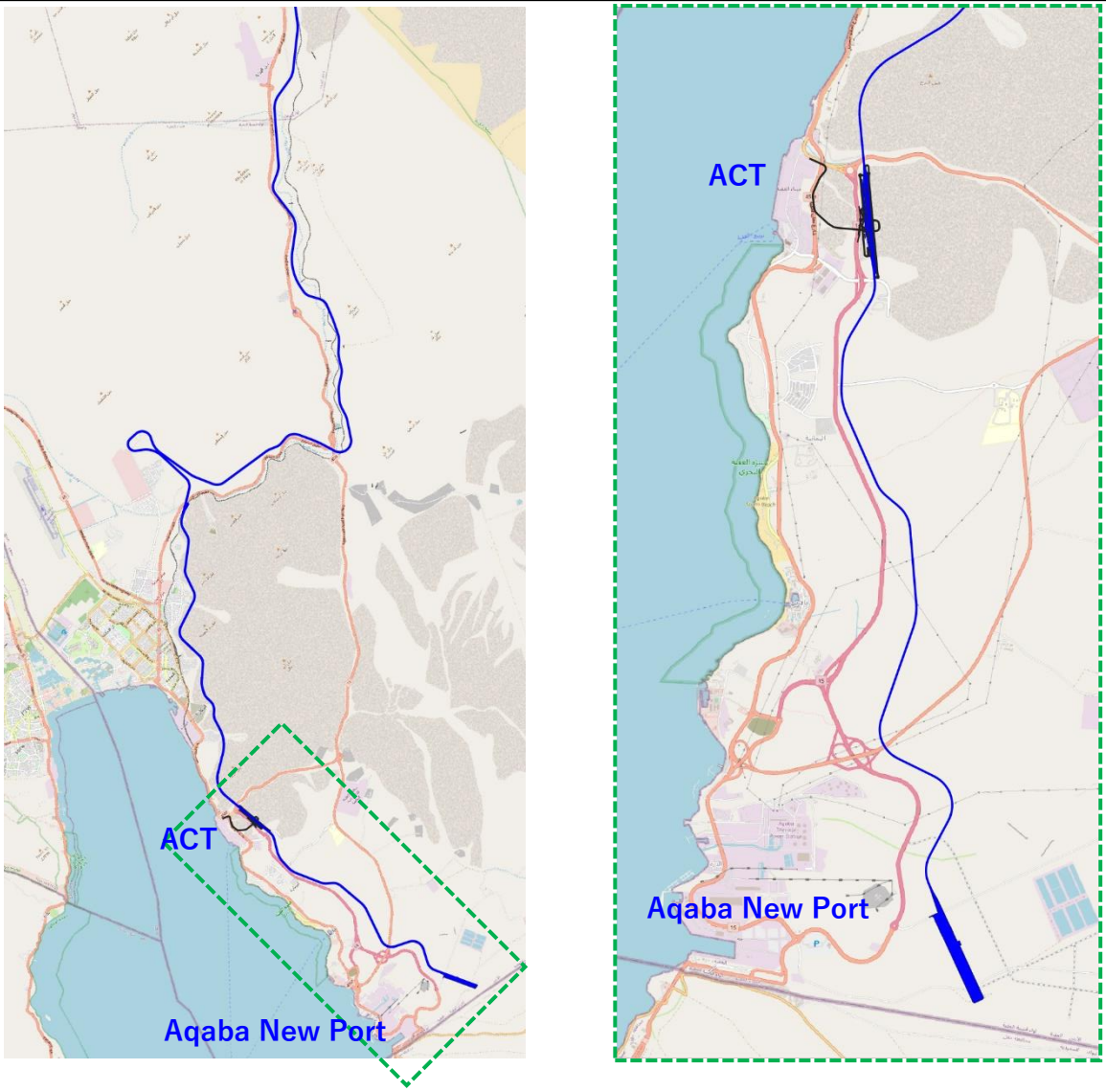
- Transportation of easy-to-handle, reliably profitable cargoes, including those from markets where it is easy to secure business.
  - Such cargoes include, for example, containerized cargo (including potential volume growth) between the container terminal at the Port of Aqaba and the proposed dry port or logistics center at Madounah near Amman and phosphate ore and related products from the Shidiya Mine handled at the New South Port Area.
- Potash transport is planned at the Dead Sea.
- Connection to neighbouring markets through containerized transport using the planned dry port and logistics center in Madounah.

- Projects that can be implemented easily and quickly (in 3-4 years) by extensively using existing infrastructure.

In addition to these plans, several rail development studies have been conducted, as shown in the table below, although they have yet to be implemented to date. However, the feasibility of transporting international sea containers by rail between the container terminal at the Port of Aqaba and the Madounah Dry Port/Logistics Center is being studied. The construction of a freight station in the New South Port area is also being considered for the transportation of phosphate ore, general merchandise, and RoRo cargo. In addition, a freight station, etc., rather than a dry port, is being considered in the Madounah area to transport phosphate ore.

Table 3.74 List of Surveys on Railway Development in Jordan

No.	Title of the Survey	Survey period
1	Strategic Study for the Development of the Railway Network in Jordan, Including Required Property Acquisition (2006 – 2007).	2006-2007
2	Preliminary Design, encompassing Feasibility Study and Financial Model Assessment (Transaction Advisory – Economic and Financial Feasibility), conducted in collaboration with the BNP Group.	2008-2010
3	Environmental Impact Study of the Railway Network in Jordan (2008-2010).	2008-2010
4	JORDAN RAILWAY NETWORK DEVELOPMENT PROJECT	2010
5	JORDAN NATIONAL RAILWAY PROJECT	2011
6	Conceptual Design for the Shidia Link and Wadi Al-Yutum Phosphate Unloading Station (2011).	2011
7	Feasibility Study for the Utilization of the Existing Railway Line (2011).	2011
8	Detailed Design and Tender Documents for the Shidia Link, Wadi Al-Yatamah Phosphate Unloading Station.	2012
9	Jordan National Railway Project / Railway operation Study	2014
10	Preliminary Design and Tender Documents for the Alternative Coastal Route from Al-Rashidiya to the Southern Industrial Zone in Aqaba	2016
11	Optimized Jordan National Railway Plan - BANKABILITY STUDY-	2017
12	Ma'an Dry Port Project/ Engineering Design and Operation Studies	2019-2020
13	Update of Feasibility Study and Detailed Design of National Railway Project Aqaba- Ma'an – Amman	2020
14	Study of Socio-Economic Impact Aqaba - Ma'an Amman	2022

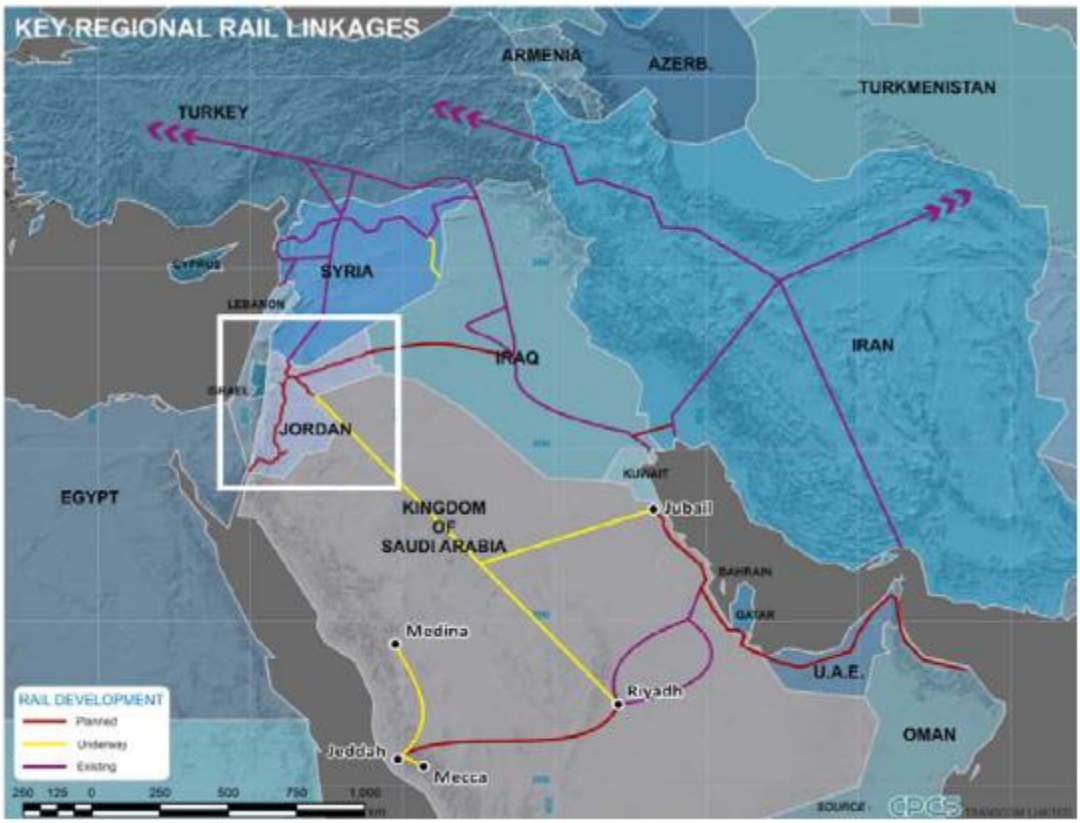


Source：「Study of Socio-Economic Impact Aqaba - Ma'an Amman, 2022」

Figure 3-99 Railway Development Plan

c) Railway network with neighboring countries

The conceptual railway network with Jordan and neighbouring countries is shown in the figure below. There is no direct line planned from the Port of Aqaba to Saudi Arabia.



Source: JORDAN NATIONAL RAILWAY PROJECT, August 2011

Figure 3-100 Railway network with Jordan and Neighboring Countries (conceptual image)

On the other hand, Saudi Arabia is considering the development of a railway network connecting the east-west and north-south sides of its country and is considering extending the rail line to the Halat Ammar Border as a border point near the Port of Aqaba. A road has already been built from Ma'an to this border. It is envisioned that a freight rail line with Saudi Arabia will connect Ma'an to the Halat Ammar Border in the future.

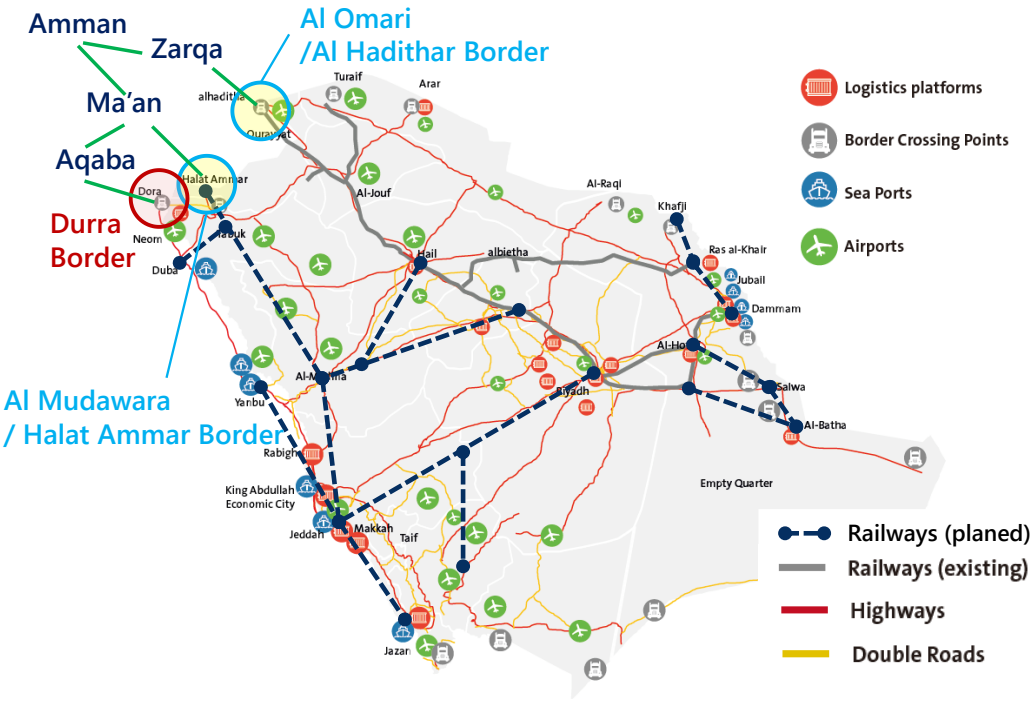


Figure 3-101 Railway Network in Saudi Arabia (conceptual image)

4) Dry port

a) Ma'an dry port

ASEZ and the Saudi-Jordan Investment Fund (SJIF) have signed a Memorandum of Understanding (MOU) for a PPP project to connect a dry port and railroad to be built at the Port of Aqaba and Ma'an in 2019. The project aimed to improve Jordan's logistics environment, develop local communities, and create jobs. The project was expected to start after the completion of a feasibility study. The main components of the project were as follows.

- Transportation of containerized cargo to/from Aqaba and phosphate ore for export from mines in Shidiya
- Construction of a railway line connecting the city of Aqaba with the container terminal and the South Port Area.
- Rehabilitation of the existing railway line between Aqaba and Ma'an
- Acquisition of new rolling stock, freight cars, and other equipment
- Construction of a four million m2 dry port in Ma'an.

This project has now been suspended, and an improvement to the freight station and yard is being considered.

b) Madounah dry port/logistics center

Madounah Dry Port is a dry port (port code: JOAMM)/logistics center located in Amman, approximately 40 km south of Queen Alia International Airport, which is connected to the Port of Aqaba by a major highway.

5) Other logistics facilities

The table below summarizes other existing logistics facilities and their descriptions.

Table 3.75 Other Existing Logistics Facilities

No.	Image	Description
1		**Air Freight Facility** The Aqaba Development Company has signed an agreement with the Kuwait National Aviation Services Company according to a contract (operating, managing, transferring ownership), whereby the Kuwaiti National Company has developed, operated and managed the air cargo facility for joint use at King Hussein International Airport.
2		**Aqaba Logistics Village** The village is a key logistical investment destination in the Aqaba SEZ due to its proximity to the container port. The village offers an integrated package of logistical services in Aqaba, in addition to container and cargo storage services, which in turn serve the trade movement in the Kingdom and the region in general. The first and second phases of the development were completed which includes: infrastructure works, construction of a container handling terminal, external storage yards, a logistics center for cold and dry storage, a split weighing facility (LCL), a service center and external storage and handling yards.
3		**Aqaba Warehouse Complex (National Real Estate Company)** Total area of the project is 1.5 million ㎡. Also known as the Integrated Business Park, the complex has been developed with modern storage warehouses and modular industrial buildings are ready for the establishment of light/medium industries There are also developed and serviced lands for building warehouses, light and medium industrial units, open storage yards, and the company management offices within the administration and services building in the complex.
4		**Aqaba Warehouse Complex (National Real Estate Company)** Granaries silos have been implemented with a storage capacity of 100,000 tons, which is currently being expanded to reach 200,000 tons. The grain handling capacity has been increased by three times Such expansions will enhance the Aqaba Economic Zone with an economic and logistical dimension at the international level and will make the new port of Aqaba a global center for the re-export of grain, especially wheat.

No.	Image	Description
5		**Liquid Storage Centers** The storage centers are in the southern industries area, which specializes in storing crude oil, diesel, gasoline, chemicals, vegetable oils and other oil derivatives with a total capacity of one million m3 and are operated by several agencies: Jordan Petroleum Refinery Company, Jordan Logistics Company for Oil Utilities, Sylvochem Netherlands Company, Aqaba Chemicals Company, Al Sayegh Group, and Electricity generation company.
6		**The customs center of the Aqaba SEZ Authority** A new customs center located at 14 km from the container port. All customs activities have been transferred from the container port, which enhanced the efficiency of handling at the container port and contributed to reducing the dwell time and increasing the control tools for goods through the system of x-ray examination devices for containers and the application of international best practices in the field of container transportation.
7		**Golden Triangle City** The Golden Triangle City offers a heavy equipment yard, a vehicle and general cargo yard, and cross-docking services. Other facilities include warehouses (2 buildings with an area of 5,000 m2), a vehicle weighing facility (2 units), and an administration building.
8		**Track Yard No.1** The yard is maintained to regulate the movement of trucks in and out of the container terminal and has a capacity of 400 vehicles. *ADC is reviewing its logistics plan and taking the necessary measures using the electronic system, including the following two truck yards.
9		**Track Yard No.2** The yard is maintained to regulate the movement of trucks in and out of the southern port and industrial area, with a capacity to accommodate 362 vehicles.
10		**Inland Transportation Yard** The yard is maintained for inland transportation trucks and can accommodate 160 vehicles.
11		**Light/Medium Transportation Yard** The yard is designed for light- and medium-duty trucks and can accommodate 200 vehicles.

Source: ADC Annual Report (2019)



Source: JICA study team (Map data: OpenStreetMap, https://www.openstreetmap.org/)

Figure 3-102 Locations of Other Logistics Facilities

3.6.4 Traffic Management

The following issues and challenges are identified from discussion and site observation from the perspective of transport management.

- High Occupancy of on-street parking

In the downtown city center, the roadsides are highly occupied with cars parked on-street. On-street parking cars limit the road traffic capacity, as well as undermine walkability and the cityscape. Urban planners in ASEZA have also viewed this as an issue and have been tackling this challenge by developing car parks, but the difficulty lies in convincing the residents, shop owners and other car users.

- Roadside safety facility and measures for pedestrians

There are not many pedestrian crossings. The pedestrians are occasionally seen crossing the sections which are not crossing. Also, the driver rarely stops at the pedestrian crossing even when there are people waiting to cross.

- Limited data utilization

Data is limited that is automatically collected or frequently updated but cannot be utilized easily for the traffic management purpose, such as traffic volume, vehicular speed, traffic accidents, and records about traffic congestion. In addition, information or data held by different jurisdictions such as ASEZA, Aqaba Transport Company, and the traffic police are not well aligned.

3.7 Improvement of Infrastructure

3.7.1 Drinking Water Supply System

The existing drinking water supply system is outlined below based on the "WATER MANAGEMENT INITIATIVE (WMI) Aqaba Water and Wastewater Investment Master Plan and Financial Model - Final" and the interview with Aqaba Water Company (AWC).

(1) Overview of the drinking water supply system

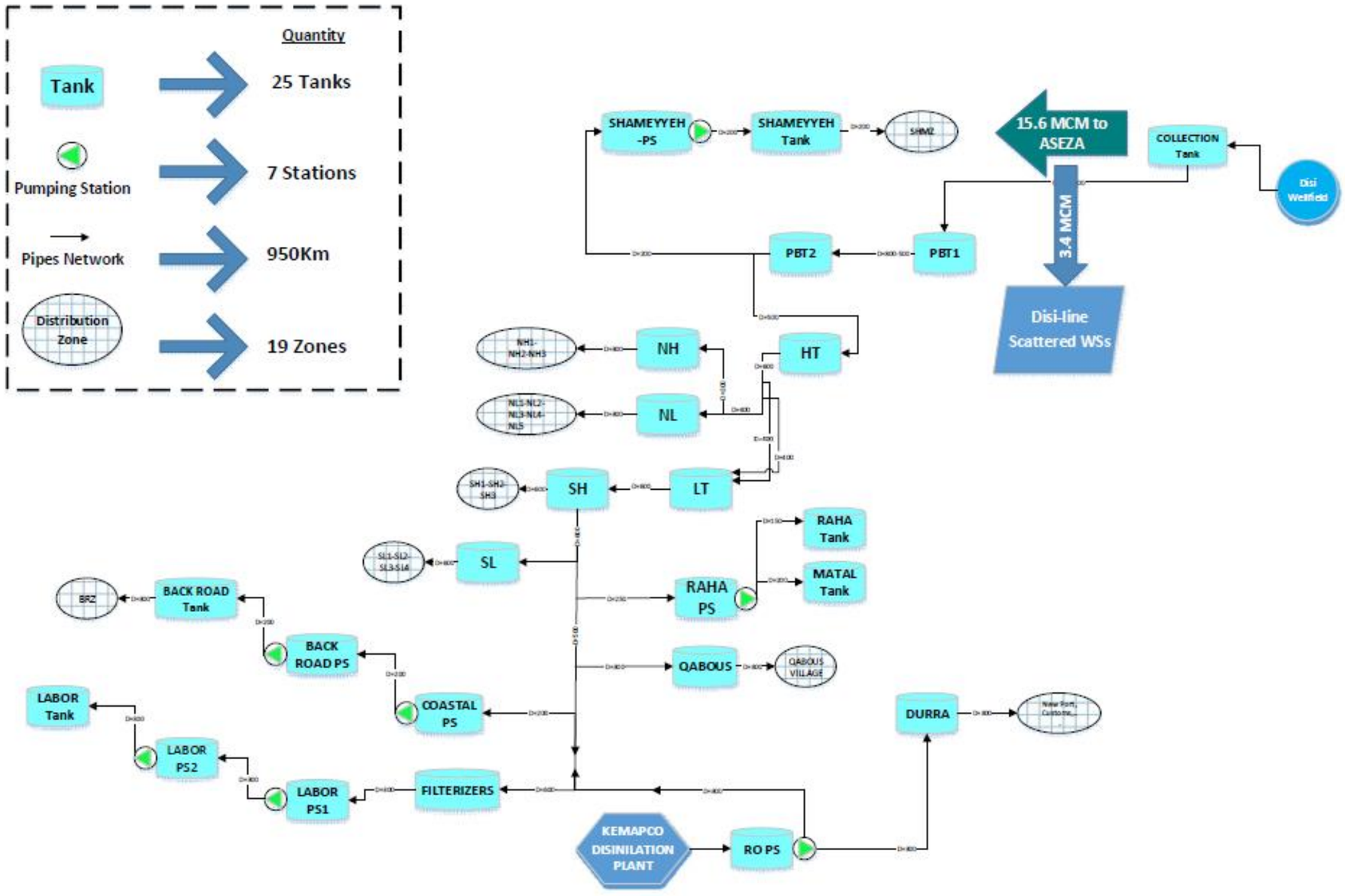
The drinking water supply system in Aqaba consists of four wells in Disi, Rum, and Abu Duba'a, 25 distribution reservoirs, seven relay pumping stations, and 950 km of transmission and distribution pipes, with groundwater from Disi Wellfield as the primary water source (14.5 million m^3/year). The system provides drinking water to 19 distribution zones in the city of Aqaba and the ASEZA zone.

The quality of the above water sources is acceptable for drinking, and no water treatment facilities are in place.

A desalination plant (with a capacity of 5 million m^3/year) constructed in the southern industrial area also supplies water to the system.

Some other areas dotted in the vicinity of the Aqaba governorate and the city of Aqaba (outside the boundaries of ASEZA) are supplied with water from the same supply system. In more remote rural areas, local wells are the source of water supply for both irrigation and drinking.

Figure on the next page shows an overview of the above situation.



Source: WMI P39

Figure 3-103 Current Situation of the Water Supply System

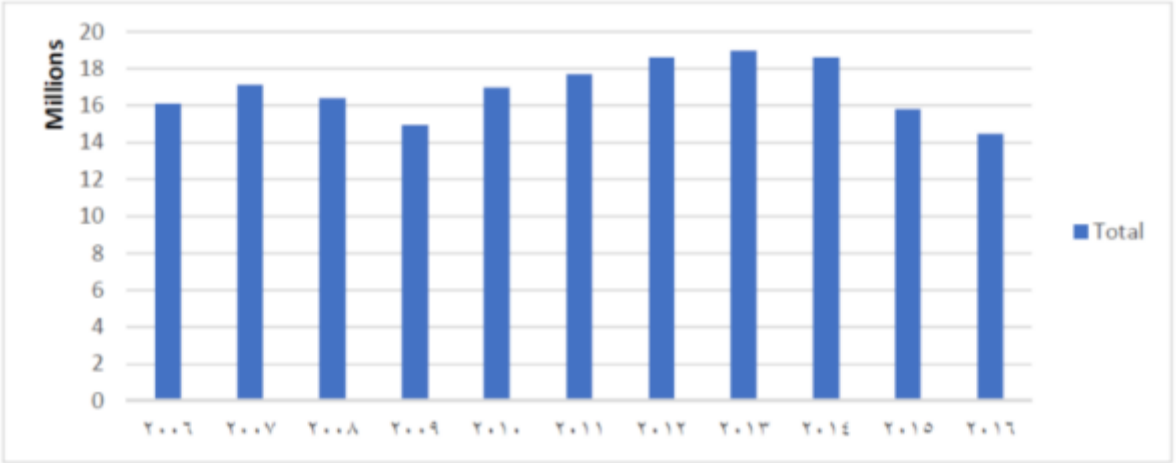
(2) Water sources

As outlined in the following table, the major water sources are 24 wells in Disi, Rum, and Abu Duba'a in Disi Wellfield

Table 3.76 List of Water Sources (Wells)

NO	Name of the well	Status	Location	Elevation
1	AD3 Markazi	In operation	Abu Duba'a	796.8
2	AD4	In operation	Abu Duba'a	796.1
3	AD5	In operation	Abu Duba'a	795.0
4	M 1	In operation	Rum Agricultural Company	799.2
5	M 12	In operation	Rum Agricultural Company	797.1
6	M 13	In operation	Rum Agricultural Company	796.9
7	M 9	In operation	Rum Agricultural Company	799.1
8	QA 1	In operation	Qa'a Disi	795.1
9	QA 10	In operation	Qa'a Disi	798.6
10	QA 12	In operation	Qa'a Disi	797.8
11	QA 13	In operation	Qa'a Disi	797.8
12	QA 14-A	In operation	Qa'a Disi	
13	QA 2	In operation	Qa'a Disi	795.8
14	QA 3	In operation	Qa'a Disi	797.7
15	QA 4	In operation	Qa'a Disi	795.8
16	QA 5	In operation	Qa'a Disi	800.0
17	QA 6	In operation	Qa'a Disi	798.5
18	QA 7	In operation	Qa'a Disi	797.9
19	QA 9	In operation	Qa'a Disi	798.7
20	AD7	Not in operation	Qa'a Disi	795.3
21	M 2	Not in operation	Rum Agricultural Company	806.3
22	QA 14	Not in operation	Qa'a Disi	797.7
23	QA 15	Not in operation	Qa'a Disi	798.7
24	QA 8	Not in operation	Qa'a Disi	798.9

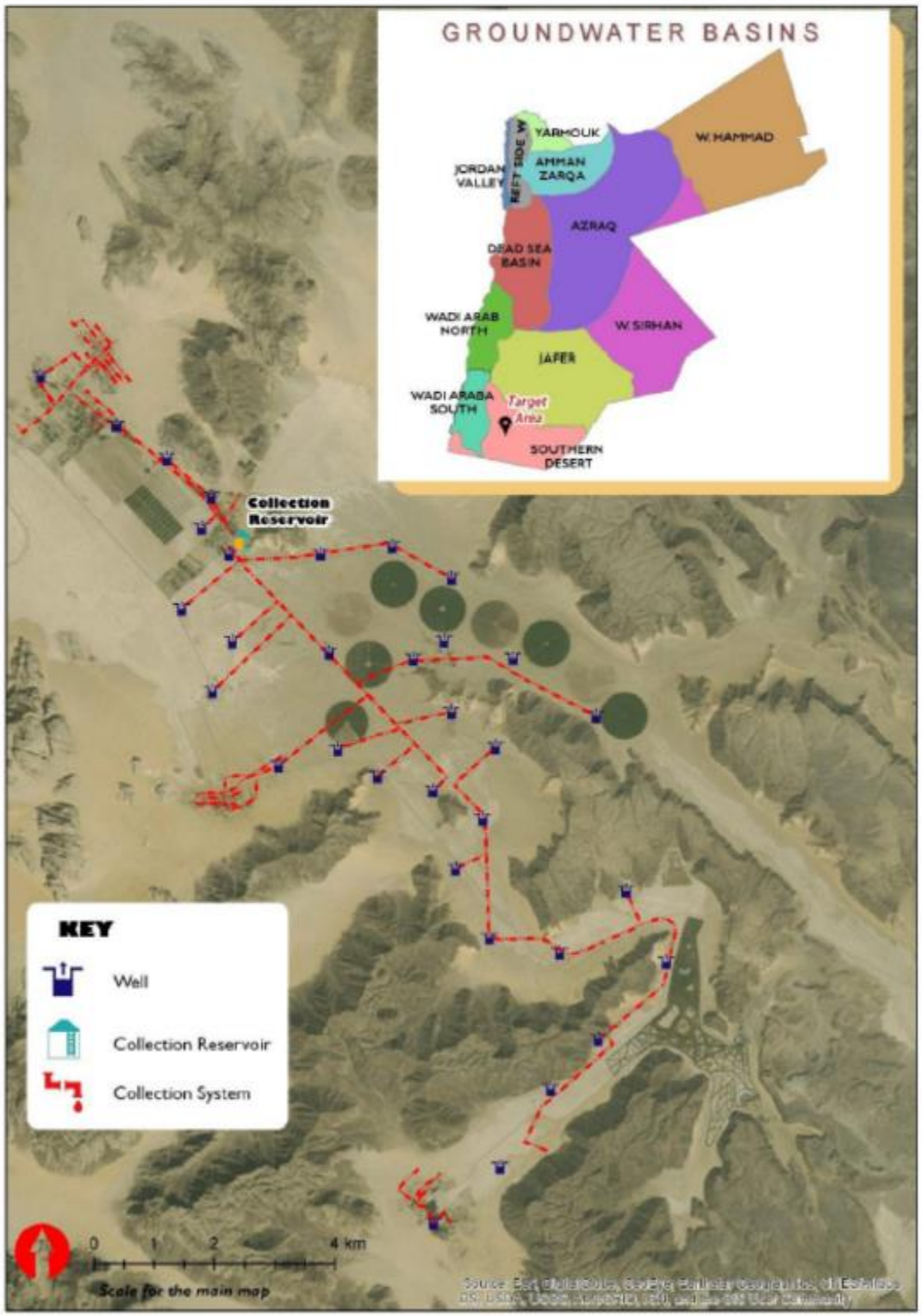
Source: WMI page38



Source: WMI P41

Figure 3-104 Annual Water Intake

The figure below shows the locations of wells.

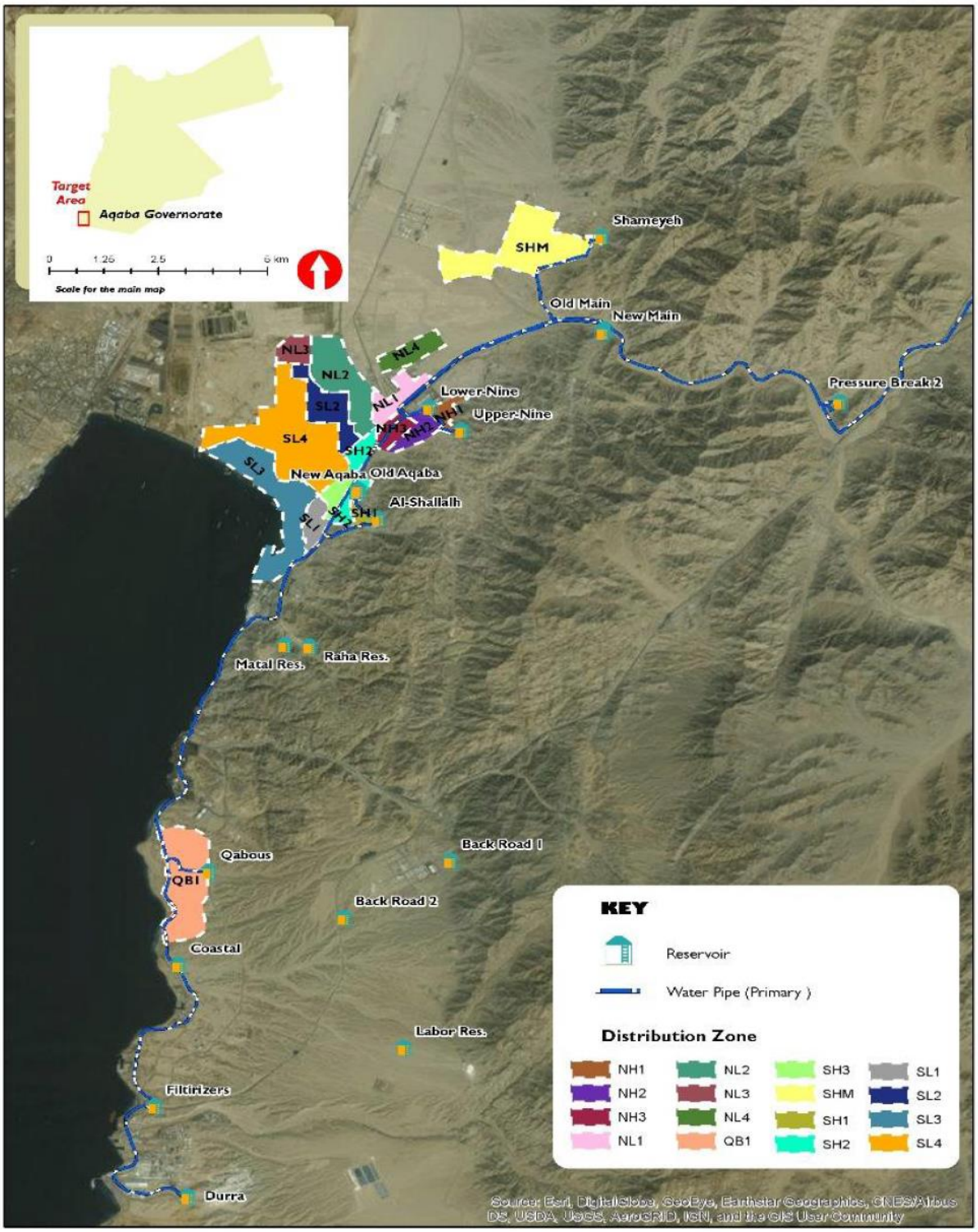


Source: WMI Page 40

Figure 3-105 Map of Wells and Subsurface Basins in Disi Wellfield

(3) Target water distribution zones and amounts

The figure below shows the target water distribution zones of the Aqaba water supply system. It supplies water to the 19 zones in ASEZ.



Source: WMI Page 54

Figure 3-106 Target Water Distribution Zones

The target amount of water distribution was calculated according to each zone's current land

use and building conditions. The purpose of property use was divided into five categories: commercial, residential, industrial, governmental, and tourism. The following table outlines target amounts and the actual distribution of water in 2021 for each zone.

Table 3.77 Target Amount of Water Distribution by Distribution Zone

NO	Zone	District	Distribution Reservoir	Unit of measurement for design water supply calculation						Actual water supply (m3/year)	Note
				Commercial (m3/day)	Residential (m3/day)	Industrial (m3/day)	Govcenment (m3/day)	Tourism (m3/day)	Total (m3/day)		
1	NH1	Nine High (Residential Area 9. Warehouses Logistics Center)	High Nine	19.2	218.3	2.6	108.7	0	349	127,306	
2	NH2	Nine High (Residential Area 9)	High Nine	6	68.7	0	34.2	0	109	39,776	
3	NH3	Nine High (Residential Area 9)	High Nine	17.7	201.1	0	100.2	0	319	116,445	
4	NH4	Nine High (Residential Area 9)	High Nine	10.1	114.7	0	57.1	0	182	66,381	
5	NH5	Nine High (Residential Area 9)	High Nine	7.5	84.7	0	42.2	0	134	49,047	
6	NH6	Nine High (Residential Area 9)	High Nine	3.2	36.8	0	18.4	0	58	21,329	
7	NH7	Nine High (Residential Area 9)	High Nine	10.8	123	0	61.3	0	195	71,218	
8	NL1	Light Industrial (Hirafyah) and 7th residential (Hay an Rabwa Hay al Batraa Hay az Zahra)	Low Nine	24.3	269	0	0	0	293	107,077	
9	NL2	3th, 8th and 10th residential neighborhoods (Town Park Hay al Batraa Hay az Zahra)	Low Nine	104.3	1286.5	0	65.7	0	1,456	531,620	
10	NL3	3th 8th 10th and Fayha'a neighborhoods (Town Park Ayla Oasis)	Low Nine	31.6	1053.7	0	11.6	0	1,097	400,392	
11	NL4	Kramah and Marared (Hay al Fayha Hay al Batraa Hay az Zahra)	Low Nine	59.3	1075.6	0	24.9	0	1,160	423,362	
12	NL5	Aqaba North & Airport	Low Nine	33.3	1107.8	0	122	0	1,153	420,968	
13	NL6	light Industrial Area Exhibitions Area NEW BUSINESS DESTRICT Tal al Ghozlan Abdaliyyeh and Railway Station	Low Nine	1165.5	22.4	55.7	5.8	0	1,249	456,043	
14	NL7	Hay al Karama Abdaliyy eh Hay al Batraa Residential Area 8 NEW BUSNESS DESTRICT and Albaqa Applied	Low Nine	179.6	654.7	0	48.1	0	882	322,073	
15	NL8	Hay al Karama and Tal al Ghozlan	Low Nine	41.3	760.2	0	26.2	0	828	302,083	
16	QB1	Qabous	Qabous	316.2	154.3	2.2	145.5	1052.8	1,671	609,930	
17	SH1	Khazan and Ash Shallala Area	Shallalah	64.5	527.6	0	20.9	0	613	223,735	
18	SH2	Old Town Area Hay al Manara Hay ar Rabwa Khazan, Shalalah and 5th residential neighborhoods	Shallalah	100.5	500.7	0	12.3	0	614	223,940	
19	SH3	5th residential (Hay or Rabwa Hay al Manara)	Shallalah	76	324.4	0	20.2	0	421	153,511	
20	SH4	5th residential (Hay al Fayha, Hay al Manara)	Shallalah	25.7	167.8	0	10.3	0	204	74,405	
21	SH5	5th residential (Hay al Fayha Hay an Rabwa Hay al Batraa)	Shallalah	23.8	137.5	0	8.4	0	170	61,961	
22	SL1	Old Town Hay Salah ad Din Hay al Madina al Janubi Middle Coast Area and Mnarah	New And Old Aqaba	701.2	1679.3	0	43.5	0	2,424	884,767	
23	SL2	Old Town Area and Hay Salah ad Din	New And Old Aqaba	63.2	145.5	0	13.6	0	222	81,140	
24	SL3	Old Town Area and Hay Salah ad Din	New And Old Aqaba	33.9	71.4	0	7.5	0	113	41,181	
25	SL4	Old Town Area Hay Salah ad Din. Middle Coast Area Hay al Madina al Janubi House of Sharif Hussien and	New And Old Aqaba	282	640.2	0	101.9	26.1	1,050	383,365	
26	SL5	Hay al Madina al Awsat Hay al Manara Hay al Madina ash Shamali, Hay an Ridwan Hay as Safa Circular Area	New And Old Aqaba	1292.5	10	0	99.8	1779.7	3,182	1,161,436	
27	SL6	Al Hay al Akhdar Hay al Manara, Hay al Fayha Hay al Madina ash Shamali Hay an Rabwa Hay ad Dawha Hay	New And Old Aqaba	290.9	47.6	0	6.3	3.6	348	127,163	
28	SL7	Al Hay al Akhdar, Hay ar Ridwan Hay as Safa. Circular Area Hay at Talla alHamra Hay an Ridwan and Saraya	New And Old Aqaba	40.4	1024.8	0	28.3	27.5	1,121	409,136	
29	SL9	Residential Area 6. Al Hay al Akhdar Hay al ayha Hay ad Dawha Hay at Talla alHamra and Hay an Nasir	New And Old Aqaba	127.7	1140	0	51.2	0.5	1,319	481,570	
30	SL10	Hay an Nakhil Al Hay al Akhdar Circular Area Hay an Nasir and Aqaba International School	New And Old Aqaba	520.9	262.8	0	595.3	57.9	1,437	524,428	
31	SL11	Circular Area Ayla Oasis and Saraya Project	New And Old Aqaba	0	25.6	0	0.6	4	30	11,015	
32	SL12	Hay an Rawda al Awsat wl Janubi, Al Hay al Akhdar Town Park Hay an Nakhil Circular Area Hay an Nasir and Sport	New And Old Aqaba	269.1	1795	0	62.4	20.1	2,147	783,495	
33	SL13	Residential Area 6 8. Hay al Fayha and Hay az Zahra	New And Old Aqaba	141.3	662.7	0	19.5	0	823	300,573	
34	SL14	Hay an Rimal Hay an Rawda ash shamali & Al Awsat, Town Park Residential Area and Ayla Oasis	New And Old Aqaba	124.7	1168.8	0	29	0	1,323	482,724	
35	SL15	Residential Area 10. Hay ar Rimal and Town Park	New And Old Aqaba	58.6	414.8	0	32.7	0	506	184,724	
36	SL16	Residential Area 10. Hay an Rimal and Ayla Oasis	New And Old Aqaba	53.7	434	0	33.2	0	521	190,137	
37	SL17	Residential Area 6 8, Hay al Fayha, Hay ad Dawha Town Park and Hay an Nasir	New And Old Aqaba	90.8	592.3	0	49.2	0	732	267,307	
38	SL18	Hay an Ridwan, Hay as Safa Hay at Talla alHamra and Cinema	New And Old Aqaba	53.5	10.5	0	1.2	3.4	69	25,074	
39	BRZ	Light industry	Back Road	4885	156.7	16.4	0	0	5,058	1,846,210	
40	SHM 1	Toob New Shameiah and Mulgan	Shameyyeh	0.2	42.9	1420	0.1	0	1,463	534,063	
41	SHM 2	Shamyeh (Toob, Toob Expanding Mulgan)	Shameyyeh	0	8.5	664.5	0	0	673	245,649	
42	SHM 4	Shamyeh, Toob North Res. Vilage and Labor Housing	Shameyyeh	142.8	12.8	3.7	15.3	0	175	63,708	
43	SHM 5	Shamyeh and North Res. Village	Shameyyeh	144.1	4.9	0	15.4	0	164	59,999	
44	N1	Qualified industrial Area(QIZ) Mulgan and Engineers Morjan Project	New Main Res	0	20.2	6.9	0	0	27	9,881	
45	N2	Medical City, Private School Public School and Engineers Morian Project	New Main Res	1.1	134.5	0	0	0	136	49,505	
46	N4	NEW BUSNESS DESTRICT Green Res.Area Qasabet Nahhas, Albaqa Applied University Airport	Low Nine	941.7	58.6	0	0.7	0	1,001	365,337	
47	N5	Residential Area 10, Abdaliyyeh NEW BUSNESS DESTRICT Residential Area 8. Airport and Albaqa Applied	Low Nine	984.1	180.1	0	74	0	1,238	451,966	
48	N6	Qualified industrial Area(QIZ) Mulgan, Saraya Sport City Cereals Stores Armed Forces King Hussein International	Low Nine	266.2	333.5	3769.1	420.7	0	4,790	1,748,175	
49	N8	Toob, New Shamejah and Mulgan	New Main Res	60.1	587.2	24.6	21.3	0	693	253,047	
50	SOC 1	NewPort	DURRA	742.3	0	0	0	0	742	270,950	
Total				14,633	20.555	5,966	2,557	2,976	46,686	17,040,326	
				31.30%	44.00%	12.80%	5.50%	6.40%	100.00%		

Source: JICA study team

In 2021, the daily water supply volume was approximately 47,000 m3 (17 million m3 per year), of which more than 40% will be for residential areas, more than 30% for commercial facilities, and 20% for industrial and tourist facilities.

The above planned water supply volume was calculated based on the water supply volume per unit of production shown in the table below.

Table 3.78 Levels for the Target Water Distribution Amount

Land use	Category	Unit	Authorized Billed Consumption Unit Rate	Demand Rate (Allocated Water Consumption)	Supply Rate	Note
			L/Unit	L/Unit	L/Unit	
Commercial	Commercial	m2	5.25	6.93	8.61	Per floor area
Educational Facilities	Commercial	Student	15.00	19.80	24.59	Per student
Government/Community Services/Institutional	Governmental	m2	0.15	0.20	0.25	Per floor area
Health Facilities	Commercial	Bed	80.00	105.57	131.15	Per bed
Hotel or Tourism	Touristic	Guest	117.00	154.40	191.83	Per guest
Light Industrial	Industrial	ha	8.00	10.56	13.11	Per site area
Logistic	Industrial	m2	0.23	0.30	0.38	Per floor area
Military and security Facilities	Governmental	m2	0.10	0.13	0.16	Per floor area
Mixed Use	Commercial	m2	3.05	4.03	5.00	Per floor area
Mosque	Governmental	m2	4.00	5.28	6.56	Per floor area
International Industrial Estate	Industrial	m2	10.00	13.20	16.39	Per floor area
Public Services	Governmental	m2	4.95	6.53	8.11	Per floor area
Residential/Commercial	Commercial	m2	4.05	5.34	6.64	Per floor area
Residential	Residential	Capita	87.00	114.81	142.62	Per capita
Social Facilities	Commercial	m2	3.00	3.96	4.92	Per floor area
Note 1. Authorized Billed Consumption Unit Rate: calculated from billing data for each category.						
Note 2. Demand rate: Actual consumption plus 50% of non-revenue water (management loss (losses from ineffective management) and water leakage)						
Note 3. Supply rate: Actual consumption plus non-revenue water (management losses and water leakage)						
Note 4. Management loss: unbilled and unapproved consumption, meter defects, data errors, etc.						

Source: WMI Page 90

(4) Distribution reservoirs and relay pumping stations

As shown in the following figure, Aqaba has 25 distribution reservoirs with a total capacity of approximately 58,000 m^3.



Source: WMI Page 42

Figure 3-107 Locations of Distribution Reservoir and Relay Pumping Stations

The table below shows a description of each distribution reservoir.

Looking at the relationship between water distribution performance and reservoir capacity, many reservoirs have sufficient capacity, but there is a tendency for reservoirs (BACK ROAD and SHAMEYYEH) to have insufficient capacity in relation to the amount of water supplied.

Table 3.79 Summary Description of Distribution Reservoirs

NO	Name	Volume	Altitude	Water Supply Zone	Amount Distributed(2021)	
		(m3)	(m)		m3/Year	rotation/day
1	COLLECTION Tank					
2	PBT1					
3	RBT2	500	461.0			
4	HT	3,600	262.9			
5	LT	7,500	251.9			
6	NH	1,000	238.2	NH1,NH2,NH3	491,503	1.35
7	NL	4,500	145.5	NL1,NL2,NL3,NL4,NL5	2,963,618	1.80
8	SHAMEYYEH-PS	300	250.9			
9	SHAMEYYEH	1,000	328.7	SHM	903,418	2.48
10	SH	3,600	163.9	SH1,SH2,SH3	737,551	0.56
11	SL	13,300	90.0	SL1,SL2,SL3,SL4	6,339,234	1.31
12	RAHA PS	500	50.8			
13	RAHA	1,000	120.3	Marsa Zayed Project		
14	MATAL	2,000	209.6	Marsa Zayed Project		
15	QABOUS	2,000	101.7	QB1	609,930	0.84
16	COASTAL PS	600	11.6			
17	FILTERRIZERS	4,500	65.0	Industrial Complex		
18	BACK ROAD PS	400	264.0			
19	BACK ROAD	1,000	480.0	BRZ	1,846,210	5.06
20	RO PS	1,500	163.9	From dissimilation plant		
21	LABOR PS1	1,000	41.0			
22	LABOR PS2	1,000	224.0			
23	LABOR	2,000	368.0	Labor Village　Not in operation		
24	DURRA	2,500	65.0	To New Port, Customs　ETC	270,950	0.30
	Unkown				2,877,911	
Total		55,300			17,040,326	

Source: WMI P43-51
Note: Data is being requested for the blanks in the table.

(5) Main transmission and distribution pipes

The main distribution pipe network consists of the following three parts.

・Primary: Transmission pipes from a distribution reservoir or relay pumping station to a distribution reservoir. The diameter is 150 to 800 mm, and the total length is approximately 130 km.

・Secondary: Main distribution pipes from a distribution reservoir of 150 to 600 mm in diameter, and approximately 40 km in total length.

・Tertiary: Distribution pipes to bring water to each household that are 25 to 400 mm in diameter and approximately 420 km in total length.

Most of the pipes are high-density polyethylene (HDPE) pipes, with some made of steel, galvanized iron, and ductile cast iron.

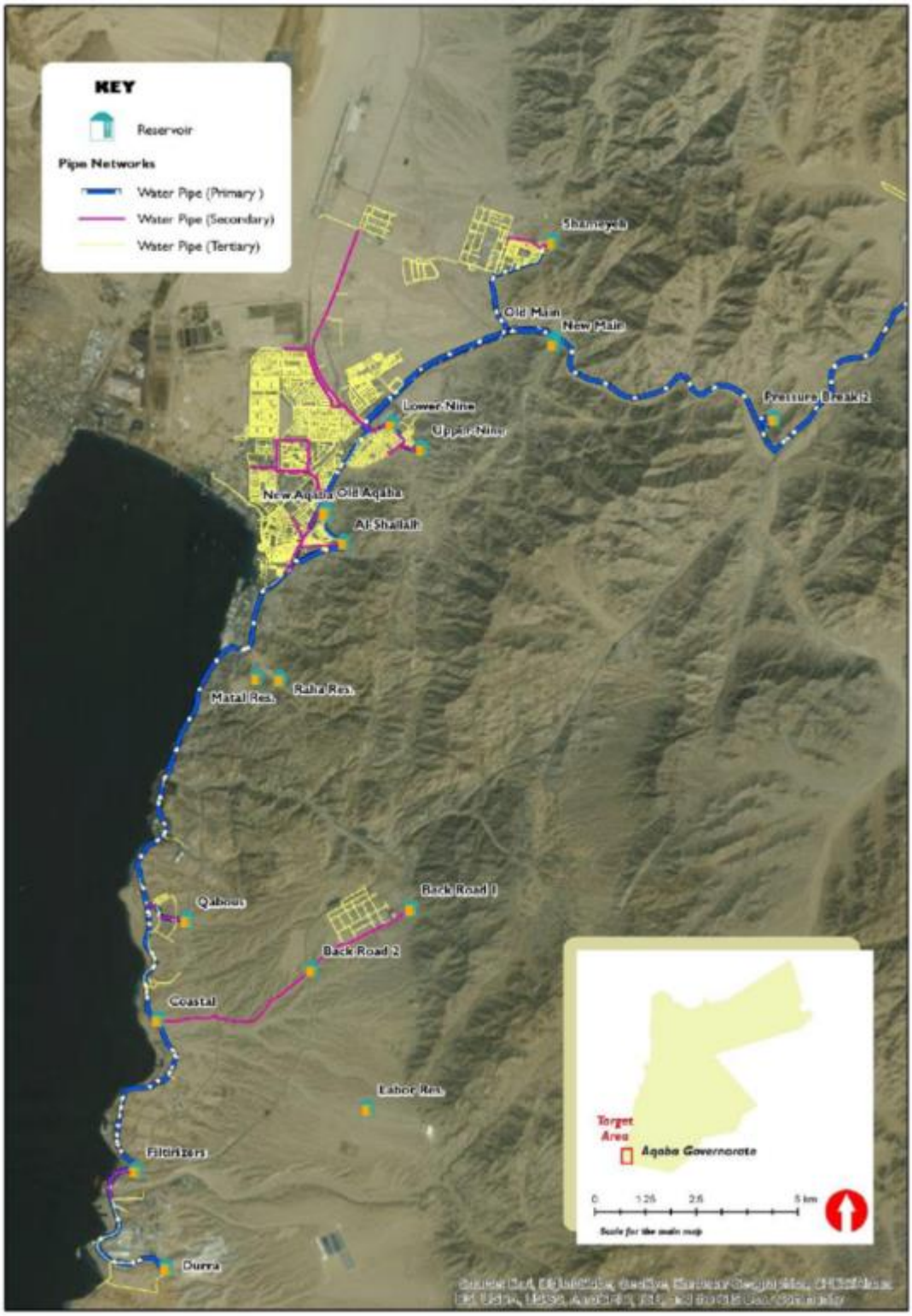
Table 3.80 outlines the primary pipe network.

Figure 3-108 shows the existing water pipe network.

Table 3.80 Primary Pipe Network

No	Pipe Start-End	Length (m)	Diameter (mm)
1	Collection-PBT1	41,500	800-700-600-500
2	PBT1-PBT2	15,300	800-600-500
3	PBT2-HT	7,400	500
4	Pipe3-Shamyeh PS Tank	50	200
5	HT-LT	150	600-400
6	HT-NL	6,600	400
7	Pipe6-NH	1,300	300
8	Shamyeh PS-Shamyeh Tank	4,800	200
9	LT-SH	11,300	600
10	SH-SL	1,100	600
11	SH-Qabous Connection (South Coast Pipeline)	12,000	600-500
12	Qabous Connection-Fertilizer Res. (South Coast Pipeline)	8,200	600-500
13	Pipe12-Costal PS	300	200
14	Costal PS-Back Road PS Tank	4,500	200
15	Back Road PS-Back Road Res.	3,000	200
16	Fertilizer Res.-Labor PS1 Tank	75	300
17	Labor PS1-Labor PS2 Tank	3,100	300
18	Labor PS2-Labor Res.	3,900	300
19	RO PS-Durrah Res.	1,100	200-250-300
20	RO PS- Fertilizer Res.	3,900	250
Total		**129,575**	

Source: WMI Page 53



Source: WMI Page 52

Figure 3-108 Existing Network of Transmission and Distribution Pipes

(6) Large-scale freshwater generation project (Aqaba-Amman desalination and water supply project)

Based on "Economic Resilience Initiative - Infrastructure Technical Assistance TA2017141 R0 ERI," the outline of the large-scale seawater desalination project is summarized as follows:

This project is the largest seawater desalination plant in Jordan's history, led by the Ministry of Water and Irrigation (MWI). It aims to desalinate Red Sea seawater through a seawater reverse osmosis plant to provide safe and reliable freshwater supply to Amman, other administrative regions in Jordan, and areas along the pipeline route.

The planned annual supply volume for this project is 300 million cubic meters (m3).

The outline of the facilities to be developed in this project can be summarized as follows:

Table 3.81 Outline of Facility Improvement by the Project

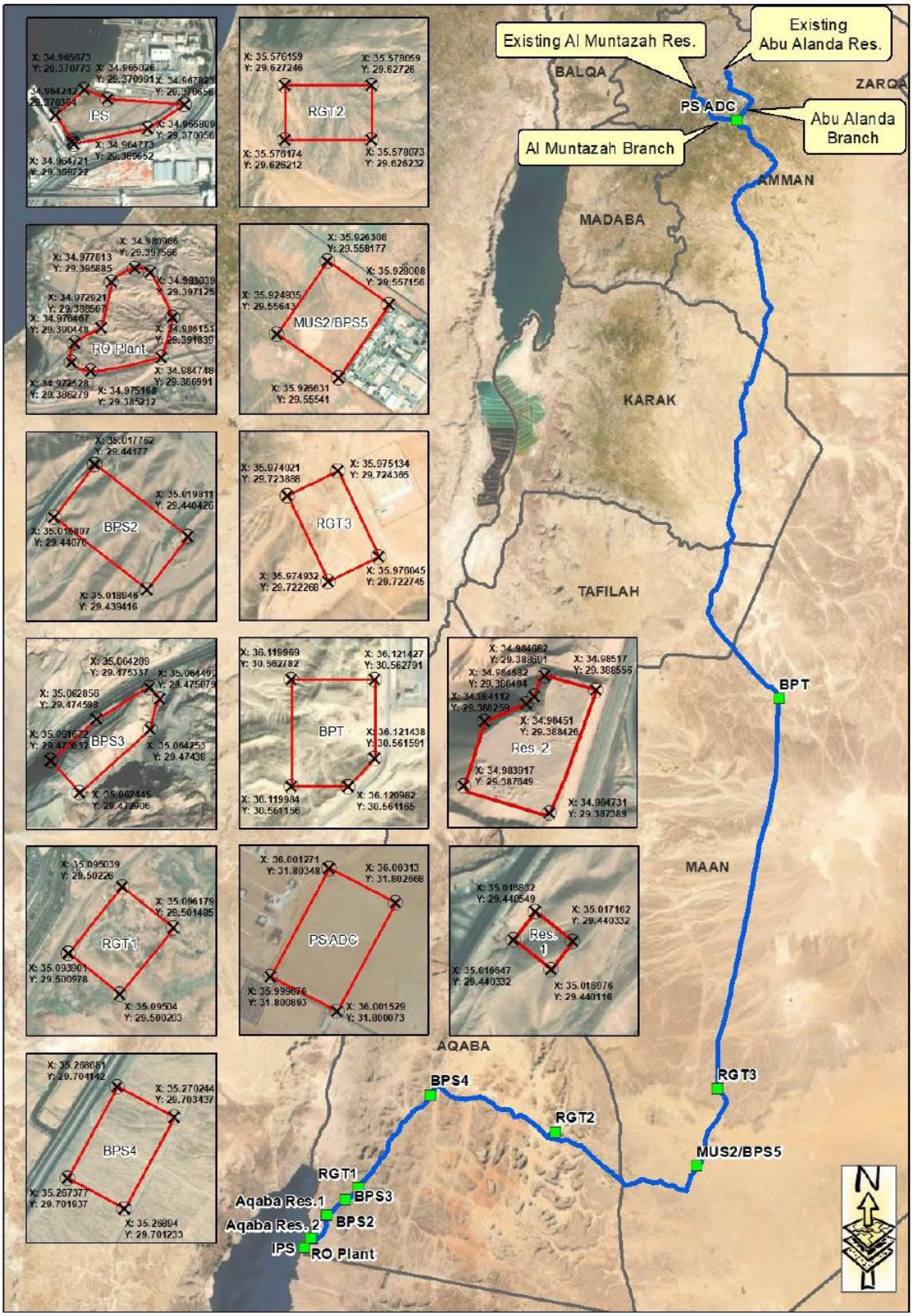
No	Type of Facility	Details
1	Seawater intake facilities and intake pump station.	The freshwater production capacity is 300 million cubic meters per year (with 97% availability). The overall recovery rate of the plant is between 42% and 45%.
2	Seawater intake pump station.	
3	Seawater intake pipeline from the seawater intake pump station to the desalination plant.	
4	Desalination plant.	
5	Brine discharge pipe.	The size of the discharge for generated salt
6	Water supply pipeline from the desalination plant to Amman pumping station.	250 million cubic meters per year
7	Intermediate pumping station to be installed along the water supply pipeline from the desalination plant to Amman. 1. BPS 1 to 4 2. Mudawarra PS 3. PS ADC	BPS1 produces 300 million cubic meters per year. Other pump stations produce 250 million cubic meters per year.
8a	Water supply pipeline from ADC pumping station to AbuAlanda reservoir.	180 million cubic meters per year
8b	Water supply pipeline from ADC pumping station to AlMuntazah reservoir.	70 million cubic meters per year
9	Adjustment tank for the water supply pipeline.	For tanks that are part of the water supply system, the production is 250 million cubic meters per year.

Source: JICA study team

The project is planned to be implemented under the BOT scheme, with the BOT operator responsible for operation for a period of 25-35 years, after which it will be transferred to the Jordanian government.

The construction schedule is set to commence in the second quarter of 2023, with operation starting in the second quarter of 2027.

The overview of the project is shown in the following diagram.



Source: WMI

Figure 3-109 Aqaba-Amman Desalination and Water Conveyance Project Overview

(7) Issues of the water supply system

1) Measures against water shortages

- Identifying causes of gradual decreases in the water intake from the wells that serve as sources of water, and measures to address the issues.
- Installing seawater desalination equipment effectively.
- Improving the non-revenue water ratio.

-Identifying impacts caused by ineffective management and measures for improvement.

-Preventing water leakage (due to aging primary pipes).

2) Improvement in the water distribution systems

- Verifying the target amounts of water distribution.
- Appropriate placement of distribution reservoirs.
- Appropriate placement of relay pumping stations.
- Policies to respond to new large-scale development.
- Layout of water supply facilities and intelligent water supply systems in accordance with urban planning.

3) Measures against aging equipment/infrastructure

- Formulation of maintenance and replacement plans in consideration of life-cycle costs.

3.7.2 Wastewater System

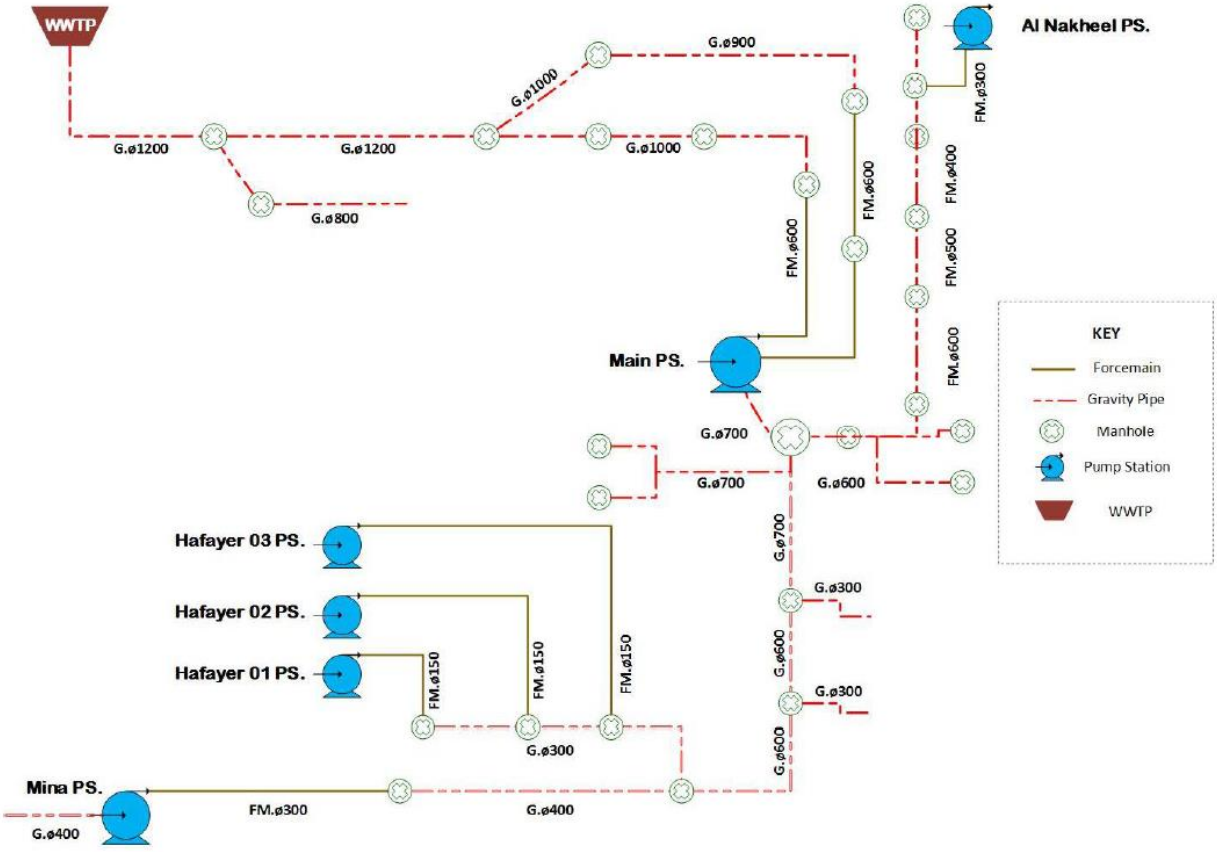
The existing sewer system is outlined below based on the "WATER MANAGEMENT INITIATIVE (WMI) Aqaba Water and Wastewater Investment Master Plan and Financial Model - Final" and the interview with Aqaba Water Company (AWC) as with the water supply system.

(1) Overview of the sewer system

Aqaba's wastewater treatment zones cover the northern part of Aqaba and are supplied with water by the wastewater treatment plant and several relay pumping stations.

As shown in Figure 3-110 on the system schematic design, gravity pipes and pumping pipes collect and discharge the wastewater to a wastewater treatment plant.

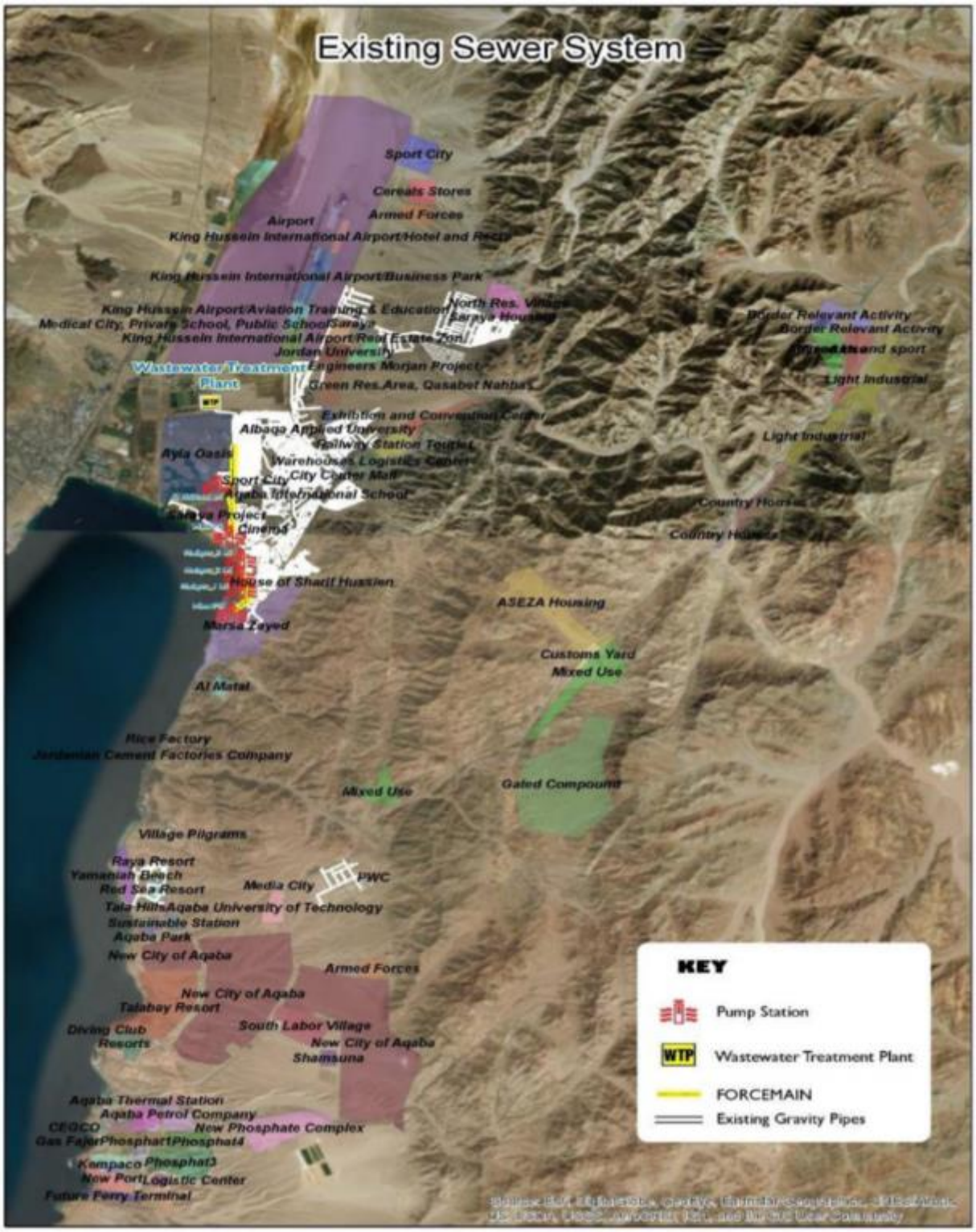
Of the wastewater collected at the treatment plant, a small amount of wastewater is collected by gravity, and the amount of wastewater pumped by the six relay pumping stations accounts for almost two-thirds of the total amount of wastewater.



Source: WMI Page 56

Figure 3-110 The Sewer System

The sewage pipes of the southern area of Aqaba do not connect to the public sewage system and wastewater is discharged to private treatment plants, such as the one in Tala Bay, and to septic tanks in Qabous and other areas. The wastewater from the septic tanks is transported by tankers to the treatment plant in the northern area.



Source: WMI Page 59

Figure 3-111 Overview of the Existing Sewer System

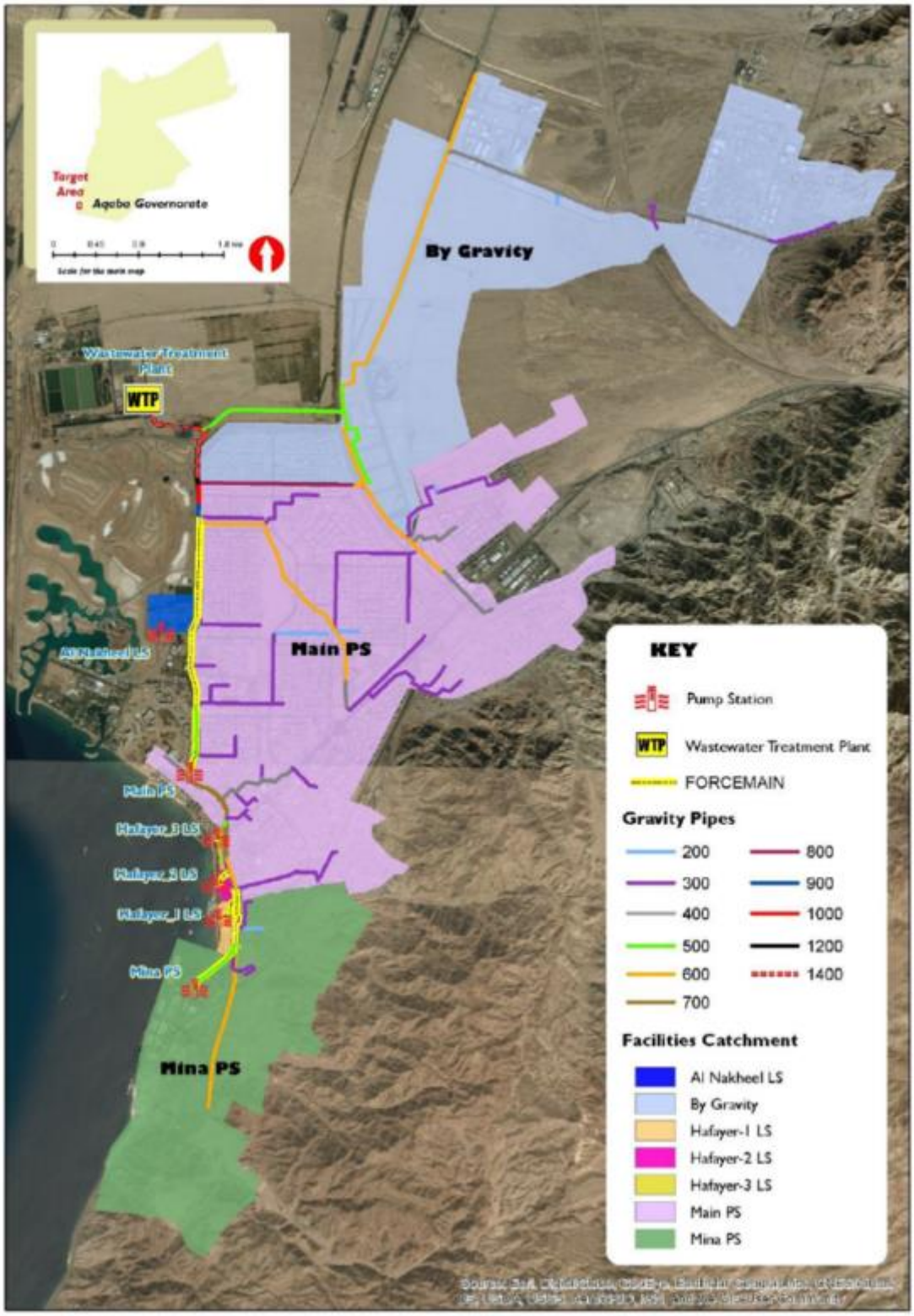


Source: WMI Page 58

Figure 3-112 Overview of the Sewage System in the Northern Area

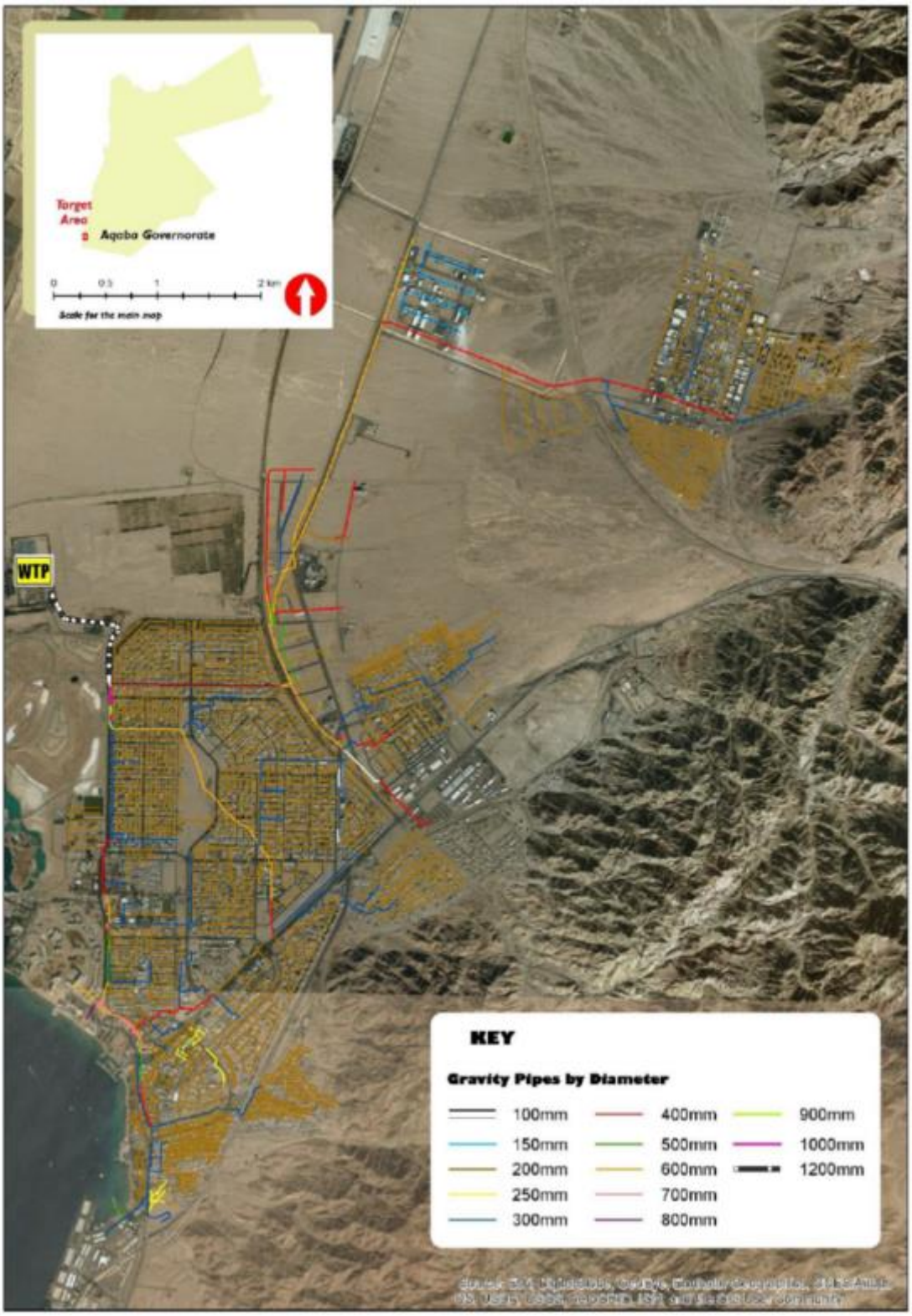
(2) Target wastewater treatment zones and target amounts of wastewater treated

Figure 3-113 shows the existing wastewater treatment zones.



Source: WMI Page 66

Figure 3-113 Wastewater Treatment Zones



Source: WMI Page 65

Figure 3-114 Alignment of Gravity Pipes

(3) Wastewater Treatment Plant

The existing wastewater treatment plant was constructed in the north-western part of Aqaba and has been in operation since 1986.

The plant currently has a total treatment capacity of 21,000 m^3/day, consisting of a mechanical treatment unit (12,000 m^3/day) and a natural treatment unit (9,000 m^3/day).

The natural treatment unit will be decommissioned, and the mechanical treatment unit is planned to be expanded in the place of the natural treatment unit, increasing the capacity of the mechanical treatment unit to 40,000 m^3/day.



Source: WMI Page 62

Figure 3-115 Existing Layout of Wastewater Treatment Plant

The volume of wastewater discharged to the terminal treatment plant is summarized in Tables 3-82 and 3-83. On average over the past few years, 7-8 million m3 of sewage has been treated annually, meaning that just under half of the water supply (17 million m3 in 2021) is sent to the treatment plant.

The average daily sewage volume is approximately 20,000 m3, and the maximum daily sewage volume is approximately 30,000 m3. At the daily maximum, sewage inflow exceeds 30,000 m3 (43,000 m3 in 2015).

The daily coefficient of variation (daily maximum/ daily average) ranges from 1.1 to 2.6.

Table 3.82 Inflow to the Wastewater Treatment Plant

Year	Treatment Capacity (m^3/day)		Diurnal Variation Coefficient
	Average	Maximum	
2015	16,988.2	43,904.5	2.6
2016	19,746.3	32,976.3	1.7
2017	19,838.5	26,662.8	1.3
2018	19,955.3	25,447.6	1.3
2019	19,103.8	27,503.8	1.4
2020	19,834.1	27,336.9	1.4
2021	21,770.6	32,602.5	1.5
2022	22,510.9	25,657.9	1.1
Average	19,968.5	30,260.3	1.5

Source: WMI Page 68
Note: Data request is pending for the blank cells in the table.

Table 3.83 below shows the monthly inflows. Although the amount of wastewater is relatively constant throughout the year, it tends to increase slightly during the summer months.

Table 3.83 Monthly Wastewater Amount (thousand m^3/month)

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total	Avg.
2015	547.0	502.6	503.7	245.2	407.0	580.5	568.8	583.8	586.2	582.5	519.2	556.3	6,200.8	516.7
2016	550.2	524.2	571.9	609.1	639.1	567.4	618.1	639.1	621.1	652.7	608.4	624.9	7,226.2	602.2
2017	557.0	509.6	611.4	593.0	640.1	611.3	600.0	612.6	624.4	626.3	636.6	620.8	7,243.1	603.6
2018	627.1	657.6	732.4	615.7	647.3	591.4	660.8	593.7	614.3	540.3	507.2	487.7	7,275.3	606.3
2019	481.2	455.0	595.8	570.8	570.6	547.7	588.9	619.2	641.4	672.0	623.8	612.1	6,978.4	581.5
2020	573.5	565.4	647.1	559.6	606.4	600.7	624.9	625.3	620.3	657.1	580.5	599.9	7,260.6	605.0
2021	582.8	543.3	575.1	600.1	677.5	633.4	722.4	827.8	651.6	787.6	710.4	643.0	7,953.9	662.8
2022	600.8	557.5	622.1	688.1	721.8	701.4	741.1	763.0	735.0	751.5	675.6	663.0	8,221.0	685.1
Ave.	565.0	539.4	607.4	560.2	613.7	604.2	642.9	658.1	636.8	658.7	607.7	600.8	7,294.9	607.9
Monthly variation	0.9	0.9	1.0	0.9	1.0	1.0	1.1	1.1	1.0	1.1	1.0	1.0	-	1.0

Source: WMI Page 69
Note: Data request is pending for the blank cells in the table.

(4) Challenges of wastewater systems

1) Capacity of the wastewater treatment plant

- The target (total) amount of wastewater to be treated and the policy to expand the facility according to the future land use plan.
- The construction of a new wastewater treatment plant at an appropriate location according to the demand for wastewater treatment.
- Policies to determine the wastewater treatment method for large-scale development (establishment of a single treatment area).
- Improvement in wastewater treatment systems (natural or mechanical treatment).

2) Improvement in the sewer systems

- How to deal with the sewage discharges from southern areas (improvements in wastewater discharged to the treatment plant by ship transport).
- The gravity and pumping pipe sections for wastewater transport.
- Locations of relay pumping stations.
- Combination of the use of sewage systems (wastewater treatment plants) and individual septic tanks/household septic tanks by zone.
- Measures against illegal discharges.

3) Measures against aging equipment/infrastructure

- Formulation of plans on equipment/infrastructure maintenance and replacement in consideration of life-cycle costs.

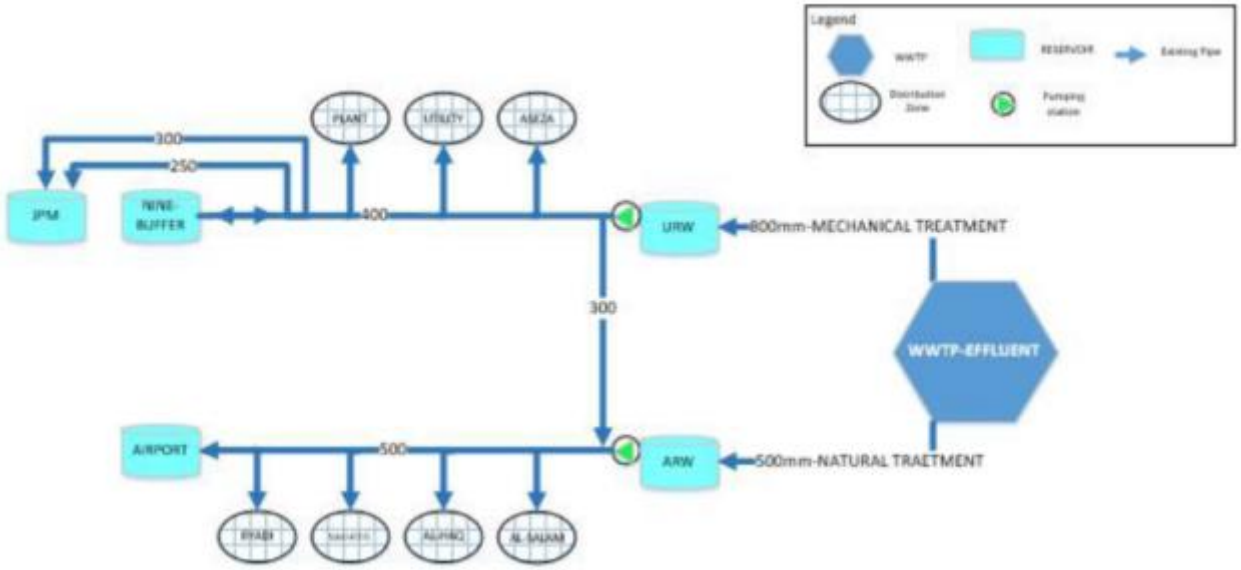
3.7.3 Wastewater Reclamation

(1) Overview of the wastewater reclamation system

The status of wastewater reclamation systems is summarized below, using the same materials and information on sewer systems.

Water treated and cleaned in the sewer system's wastewater treatment plant is reused for industrial, agricultural, and irrigation purposes. (According to WMI, out of the daily average of 17,000 m^3 inflow to the wastewater treatment plants, approximately 13,000 m^3/day (76.5%) is reused as reclaimed water)

Figure 3-116 below outlines the wastewater reclamation system. Urban Reclaimed Water (URW) treated by the mechanical treatment unit of a wastewater treatment plant, and Agricultural Reclaimed Water (ARW) treated by a natural treatment unit are delivered to the demand area through a distribution reservoir (pumping station) in each system.



Source: WMI P72

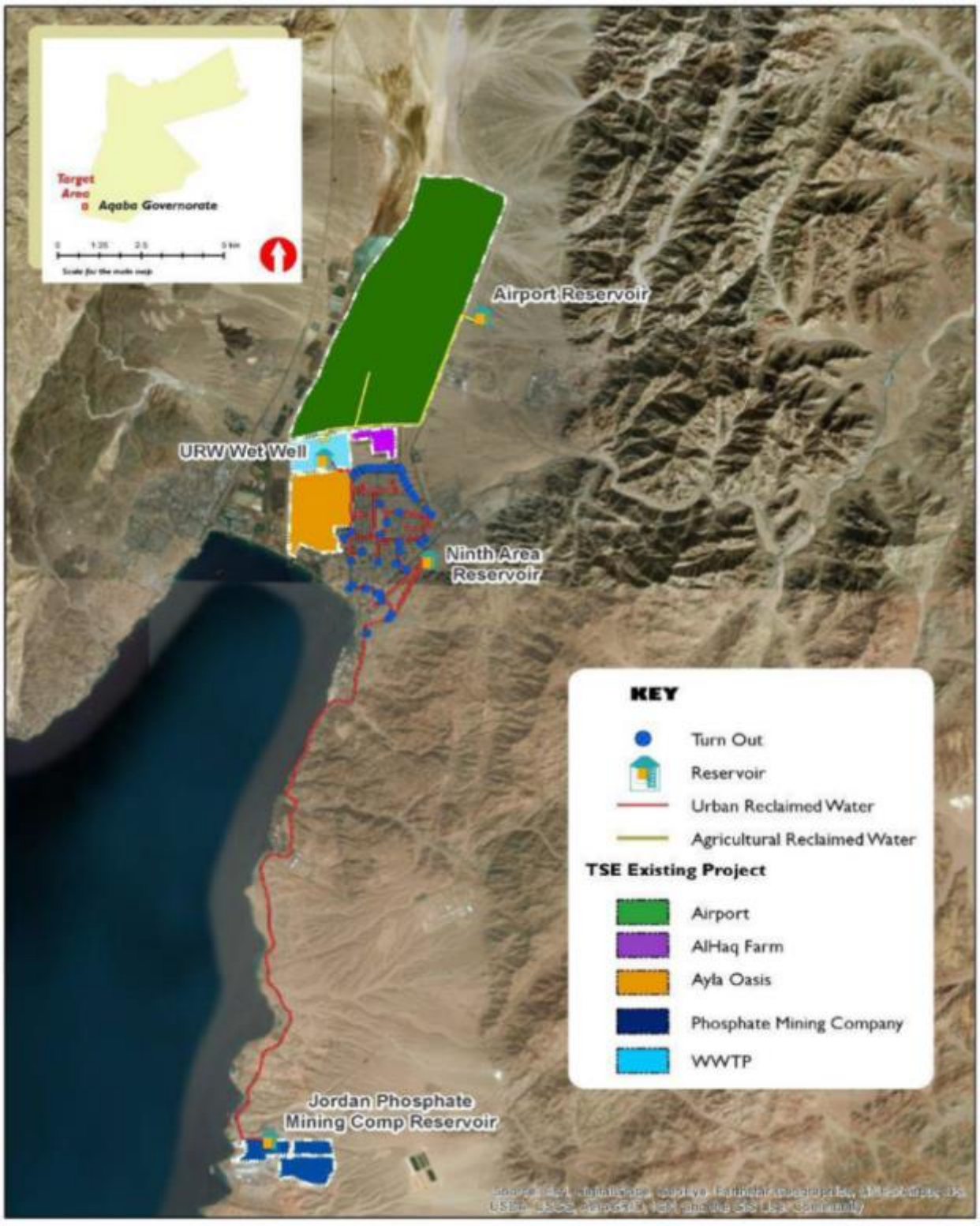
Figure 3-116 Schematic Diagram of the Wastewater Reclamation System

As shown in the next figure (Source: WMI Page 73

Figure 3-117), the ARW system provides reclaimed water to the farms surrounding the wastewater treatment plant and farmland adjacent to the airport. On the other hand, the URW system provides reclaimed water for firefighting in the existing residential areas (turn out) and a phosphate mining company in the southern industrial area.

The ARW system, which pumps water to a 1,500 m^3 evaporation pond near the industrial park to the east part of ASEZA, also helps to adjust demand by delivering excess treated water to the evaporation pond during low demand periods.

In addition, the ARW system connects to the URW system by a bypass pipe that allows excess water from the URW system to be pumped into the ARW system.



Source: WMI Page 73

Figure 3-117 Overview of the Existing Wastewater Reclamation System

(2) Demand for reclaimed water

The table below shows the demand for reclaimed water in 2017, separately for urban reclaimed water (URW) and agricultural reclaimed water (ARW); in 2021, about 3/4 of the annual sewage treatment volume (about 8 million m3/year) was reclaimed.

While the overall demand for reclaimed water remains almost flat, the demand for agricultural reclaimed water tends to decrease, while the demand for urban reclaimed water tends to increase.

Table 3.84 Demand for Reclaimed Water

Demand for Reclaimed water		Demand (m3)				
		2017	2018	2019	2020	2021
ARW	Al_Hap Farm					
	Airport	44,043	41,257	47,198	63,273	67,818
	Nakheel farm	1,808,723	1,086,877	911,988	1,195,440	1,115,422
	Riyadi farm	0	0	0	0	0
	Plant	0	0	0	0	0
	Total	1,852,766	1,128,134	959,186	1,258,713	1,183,240
	Trend since 2017	1.00	0.61	0.52	0.68	0.64
URW	Phosphate Mining Company	1,888,600	1,986,857	1,782,478	1,928,356	2,040,127
	Ayla Oasis	221,959	553,395	606,349	565,151	574,309
	WWTP Utilities	395,793	484,098	368,369	364,770	329,511
	WWTP Plant	92,357	73,217	37,972	54,750	43,980
	ASEZA	92,537	1,161,825	1,523,718	1,793,834	1,835,729
	Total	2,691,246	4,259,392	4,318,886	4,706,861	4,823,656
	Trend since 2017	1.00	1.07	1.09	1.19	1.21
Total	Demand Amount	5,824,603	5,386,526	5,278,027	5,965,574	6,006,896
	Trend since 2017	1.00	0.92	0.91	1.02	1.03

Source: WMI Page 70 and 71

(3) Distribution reservoir

A total of five distribution reservoirs have been constructed to supply reclaimed water. Their capacities are summarized below.

Table 3.85 Distribution Reservoirs for Reclaimed Water

Name of Reservoir	Capacity (m3)
URW	Pump station (1,100m3/hr)
AlNINE BUFFER	6,000
JPM	6,000
ARW	Pump station (1,100m3/hr)
AIRPORT	55,000
Total	67,000

Source: WMI P25

(4) Pipes for reclaimed water

The total length of reclaimed water pipes is approximately 74 km.

Table 3.86 shows the diameter and material for each length of pipe.

Table 3.86 Pipes for URW

Diameter (mm)	Material	Length (m)
100	PVC	11822.8
150	PVC	7647.5
200	PVC	4634.5
250	HDPE	16654.0
300	PVC/HDPE	22940.1
400	DI	9253.7
500	DI	872.2
Total		73824.88

Source: WMI Page 70

(5) Issues of the wastewater reclamation system

1) Expansion of the use of recycled water

- Possibility of using more reclaimed water instead of drinking water
- Study of demand and use of reclaimed water

2) Improvement in the wastewater reclamation system

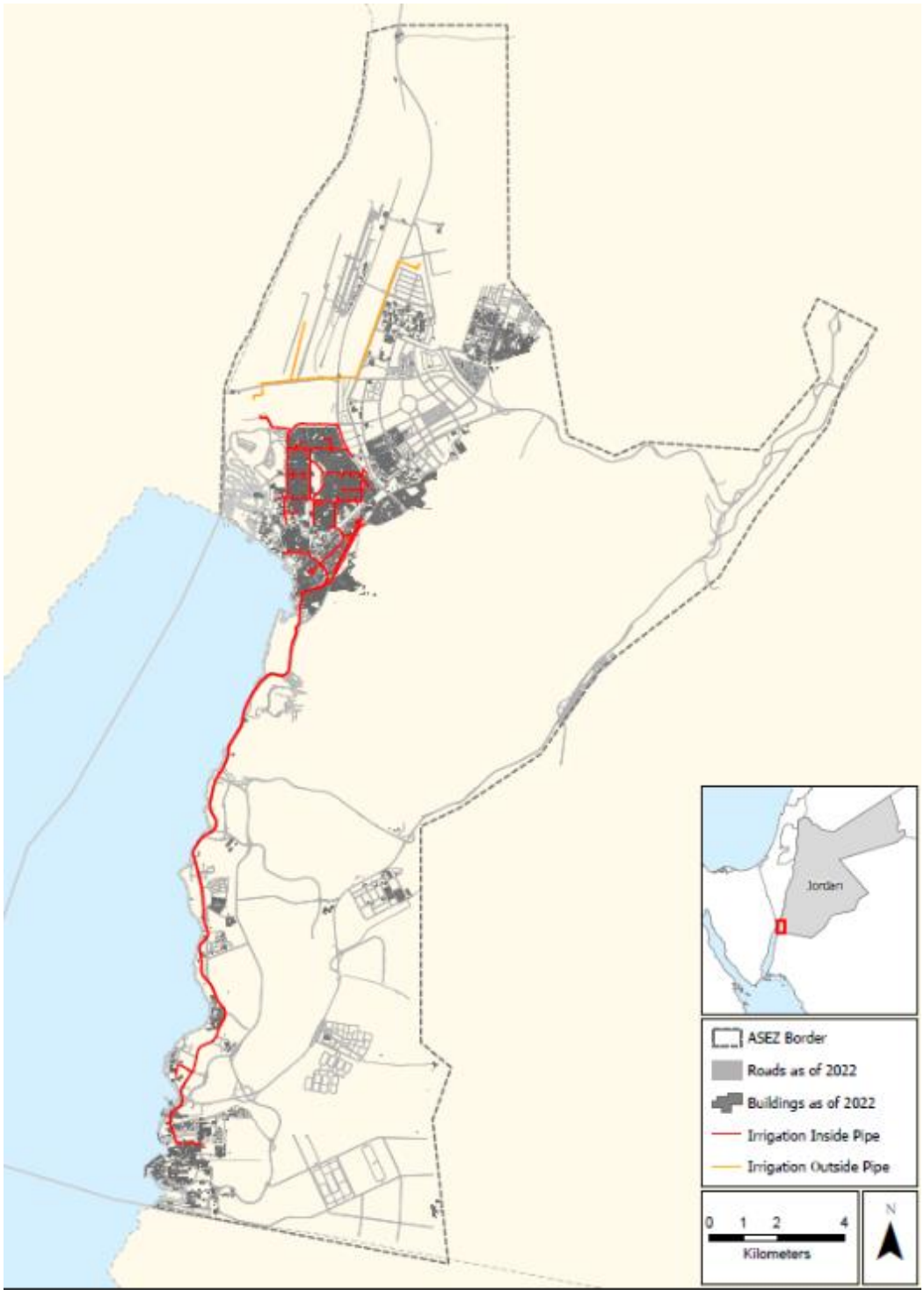
- Reclaimed water network expansion
- Appropriate placement of reservoirs and improvement of reclaimed water distribution pipe network

3) Measures against aging of equipment/infrastructure

- Development of appropriate maintenance and renewal plans based on lifecycle costs.

3.7.4 Irrigation

Within the ASEZ, an irrigation network, including pipelines, has been established, which is utilized for supplying water to open spaces. Additionally, treated wastewater (reclaimed water) is supplied to agricultural lands adjacent to the final treatment site and farms near the airport as part of the Agricultural Reuse System (ARW).



Source: Made by JICA study team from GIS data provided by ASEZA

Figure 3-118 Location map of irrigation pipelines

3.7.5 Rainwater Drainage

(1) Regulatory authorities and contractors related to rainwater drainage

Rainwater drainage facilities are managed by the Ministry of Public Works and Housing (MPWH) and ASEZA.

MPWH owns and manages intercity highways under the jurisdiction of the national government, and rainwater drainage facilities along the highways are developed as part of highway construction projects with funding from the government provided to MPWH.

Rainwater drainage facilities along municipal roads are owned and managed by ASEZA, and ASEZA's Public Works Directorate is responsible for construction, operation, and maintenance. To maintain the efficiency of the drainage system, cleaning and maintenance of grids and manholes on roads are conducted annually before the winter season begins.

(2) Current Status of Rainwater Drainage

The following is an overview of the main rainwater drainage facilities within ASEZ:

- Wadi: Natural watercourses formed by the runoff of rainwater, which function as the main rainwater network to control the flow of rainwater and facilitate discharge into the sea. Closed-type concrete pipelines (culverts, etc.) are established in urban areas undergoing development to avoid hindering the flow of major wadis.
- Rainwater channels: Waterways constructed to drain floodwater, designed to control the flow of rainwater and direct it to the desired destination (such as the sea or reservoirs).
- Box culverts and rainwater pipelines: Rainwater pipeline network consisting of concrete closed-type pipelines. This includes gratings and manholes that drain rainwater from road surfaces and discharge it into the rainwater network.

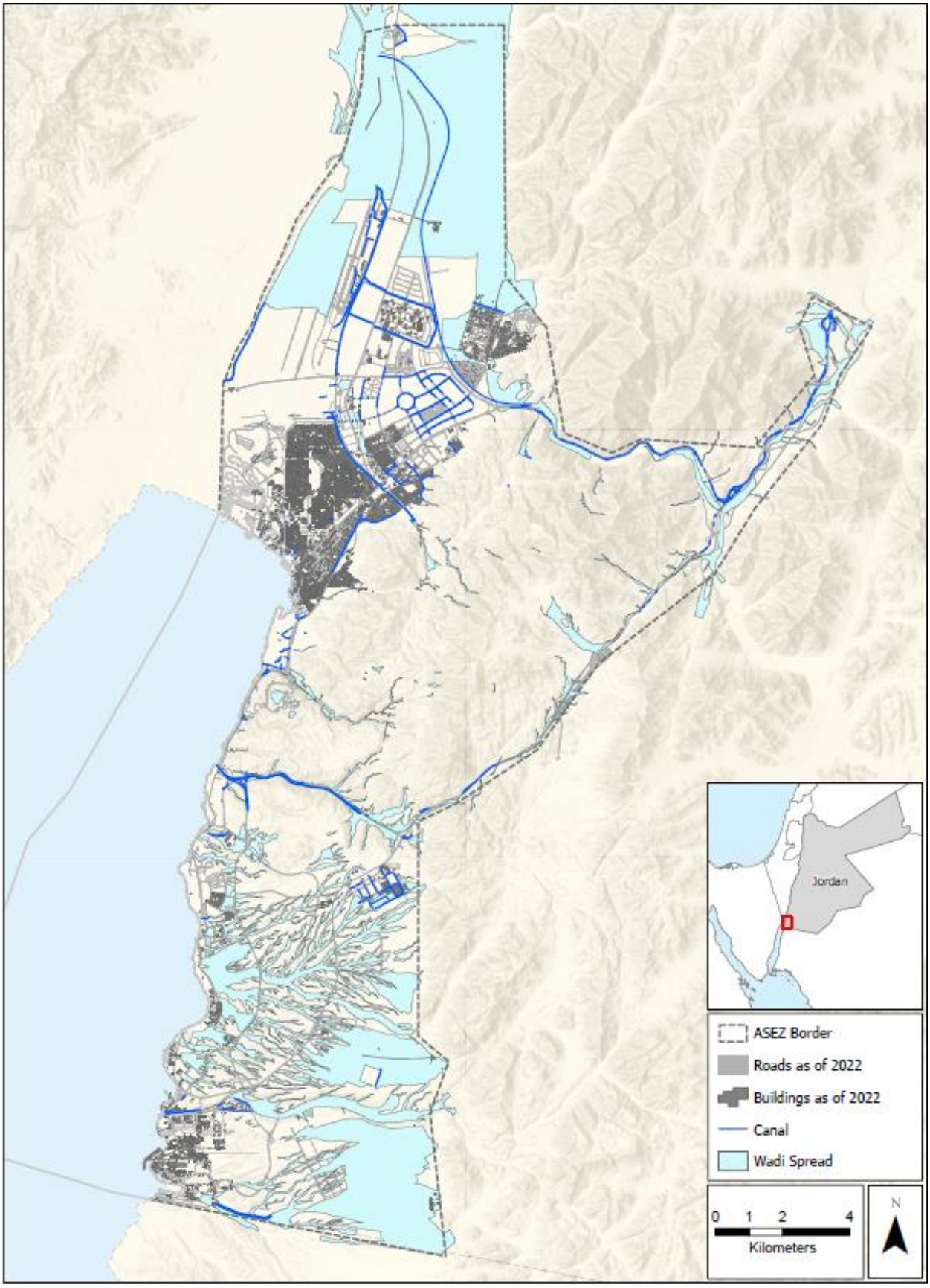
In response to the significant damage caused to infrastructure (such as power supply, water supply, and wastewater treatment facilities) by flash floods that occurred in Wadi Yutum in 2006, ASEZA implemented the "Improved Drainage and Flood Control in ASEZA" project in 2009 with assistance from USAID. The project aimed to identify and prioritize flood risks, develop flood management plans, identifying risks of watercourse erosion, preserve critical infrastructure, and design flood warning systems to protect urban assets from floods. Based on these proposals, ASEZA constructed rainwater channels that diverted floodwaters to the north of the airport, among other measures (for detailed analysis results on flood risks, refer to section 3.7 Disaster Risk Management).

(3) Rainwater Drainage Issues

- Within ASEZ, there are multiple locations where flooding occurs during rainfall due to poor drainage, which affects citizens' lives and transportation. This is presumed to be caused by increased impermeable surfaces resulting from ongoing development, and efforts to increase permeability are necessary.
- The rainwater drainage network that has been individually developed by MPWH and ASEZA is not functioning as an integrated system, and effective and efficient measures are not being implemented. Additionally, there is no aggregation or updating of GIS data related to rainwater pipelines and culverts.
- Rainwater infrastructure has lower priority compared to other infrastructures such as

water supply, electricity, and communication, and limited financial resources hinder the necessary maintenance and development of waterways and dams.

- Pollution and environmental impacts are occurring due to illegal dumping of waste into rainwater infrastructure, which flows directly into the sea. The discharge of contaminated water from industrial areas and public markets is also a concern, and proper management is necessary.



Source: Made by JICA study team from GIS data provided by ASEZA

Figure 3-119 Location map of wadi and rainwater channels

3.7.6 Electricity

Electricity in Aqaba is supplied by three types of companies: a power generation company, a transmission company, and a distribution company.

(1) Power generation company (CEGCO)

- The power generation system is thermal power generation using heavy oil.
- An electricity exchange agreement is in place between Egypt and Jordan to match services to electricity demand based on the differing electricity usage periods.
- Electricity is sold by the power generation company (CEGCO) to the transmission company (NEPCO). Meters are installed between the companies.

(2) Transmission company (NEPCO)

- The transmission company (NEPCO) supplies 33kV and 11kV power to the distribution company (EDCO).
- There are two types of electrical cables: medium-voltage cables are used underground, and low-voltage cables are used both underground and overhead.

(3) Distribution company (EDCO)

- The distribution company (EDCO) converts 33kV and 11kV power received from the transmission company (NEPCO) to 0.4kV and distributes it to the customers.
- Aqaba's maximum demand is 150 MW (usually in summer), and the winter demand is approximately 120 MW. (Power shortages tend to occur when residential areas are converted to commercial areas).
- EDCO is supposed to build a substation if NEPCO does not.
- Aqaba has 1,339 substations, with a total capacity of 736.9 MVA, and during the peak hours, 95% of the substation are operating at 80% to 95% or more of their capacity.
- Prices are the same throughout Aqaba, but vary for residential, commercial, and industrial use.
- Capacity and demand are assessed before solar panels are installed, to ensure that the amount of electricity produced does not exceed the amount of electricity consumed, i.e. the electricity produced by the solar panels cannot be sold.

Table 3.87 List of Substation

Voltage	Within ASEZ	Outside ASEZ	Total
132/33 KV	3	2	5
33KV	385	528	913
33/11 KV	19	1	20
11 KV	401	0	401
Total	808	531	1339

Source: Made by JICA study team from data provided by EDCO, ASEZA and ADC

The table below shows the extension of transmission lines by overhead and underground.

Table 3.88 List of power line extensions

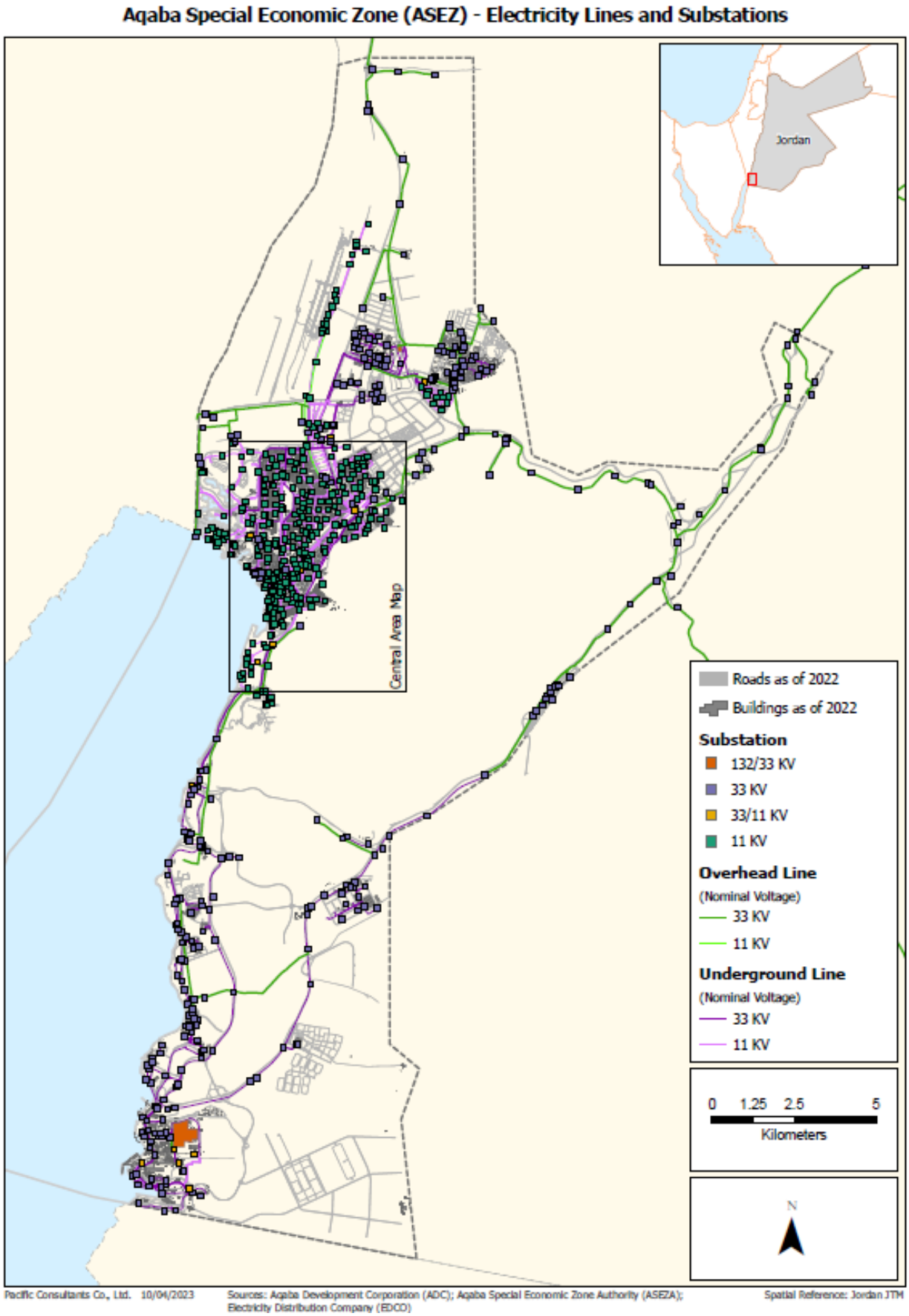
	Voltage	Within ASEZ	Outside ASEZ	Total
Overhead Cable	11 KV	5.76 km	1.90 m	7.66 km
	33 KV	99.69 km	662.79 km	762.48 km
	Total	105.45 km	664.69 km	770.14 km
Underground Cable	11 KV	264.60 km	0.10 km	264.70 km
	33 KV	242.03 km	15.49 km	257.42 km
	Total	506.63 km	15.49 km	522.12 km
Total	11 KV	270.36 km	2.00 km	272.36 km
	33 KV	341.71 km	678.18 km	1,019.89 km
	Total	612.08 km	680.18 km	1,292.25 km

Source: Made by JICA study team from data provided by EDCO, ASEZA and ADC

(4) Issues related to the power supply

- In the 10th neighborhood, ASEZA has not given permission to build a substation even after consumption increased from 4-5 MW to 18 MW. (Contact person: Khaled)
- ASEZA has refused to cooperate despite repeated requests to install a power plant. As there is not enough space to install a new substation, power distribution to some commercial areas is inadequate, such as to Commercial District No. 4. (Area required for construction: 40x60 m^2 for a power plant, 7x5 m^2 for a substation).
- Each house has a meter, but due to problems such as electricity theft, accurate data is not available.
- Problems related to voltage loss

  - Technical problem: Loss of power from cables and transformers
  - Non-technical problem: Electricity theft from meters and cables



Source: Made by JICA study team from GIS data provided by ASEZA

Figure 3-120 Location Map of Electricity Lines and Substation (Entire ASEZ)



Source: Made by JICA study team from GIS data provided by ASEZA

Figure 3-121 Location Map of Electricity Lines and Substation (Central Area)

3.7.7 Telecommunication

(1) Regulatory authorities and contractors related to telecommunication

In Jordan, the field of telecommunications and information technology is regulated by the Telecommunications Regulatory Commission (TRC), which operates under the Ministry of Digital Economy and Entrepreneurship (MoDEE). The TRC is responsible for establishing policy frameworks to ensure the provision of high-quality telecommunications and information technology services and regulating service providers in this field. Telecommunication services in Jordan, including fixed-line phone services, mobile phone services, DSL, and wireless internet, are provided by multiple private companies.

In Jordan, Orange is a major provider of fixed-line phone and DSL services. For mobile phone services, there are four main providers, namely Zain, Orange, Umniah, and Express, who collectively share a subscriber base of over 6 million people in Jordan. Available mobile phone services include WAP (Wireless Application Protocol), GSM (Global System for Mobile Communications) services, wireless data links, and GPRS (General Packet Radio Service), among others.

(2) Current Status of telecommunication

The configuration of the communication system within ASEZ is as follows:

1. Telephone service: Provided through a copper wire network owned, operated, and managed by Orange.
2. Mobile phone service: Provided through a fiber network and towers, maintaining connectivity throughout ASEZ.
3. Internet: The current infrastructure for DSL service is owned by Orange. However, other service providers can utilize Orange's network infrastructure to offer DSL service to their customers. Wireless internet is also provided by multiple providers, with mobile phone service providers in particular offering wireless internet service through network towers.

Since 2005, ASEZA had prohibited the construction of communication towers in urban areas. However, starting from 2007, ASEZA began granting approvals for specific types of towers (tri-pole) to maintain and improve service coverage and connectivity in Aqaba. ASEZA has also allocated land for the construction of communication towers, which is located near the city's northern sewage treatment plant.

(3) Telecommunication issues

- There are multiple towers built within the existing urban areas as each service provider has set up their own towers. However, it is possible to maintain coverage and service quality with a single tower, which could help improve the aesthetics by reducing the number of towers installed on building rooftops.
- There is a need to collaborate with communication service providers to update and rebuild the GIS database as it is not currently comprehensive in terms of communication-related data.

3.7.8 Waste Management

(1) Waste Generation Amount

In Jordan, with the recent progress of industrialization and population growth, the amount of waste generation has been increasing. The total amount of waste collected by municipalities throughout Jordan was 3.56 million tons annually in 2020, with an approximate per capita waste generation rate of 0.9 kg/day.

Table 3.89 Waste Collection in Jordan by Region (ton/year)

Year	Middle	North	South	Total
2018	2,157,446	1,003,845	304,714	3,466,005
2019	2,378,503	795,995	262,592	3,437,090
2020	2,337,825	986,230	237,585	3.561,640

Source: Made by JICA study team based on https://jorinfo.dos.gov.jo/Databank/pxweb/en/

Table 3.90 Daily per capita waste generation in Jordan by region

Year	Middle	North	South	Total
2018	0.9	0.9	1.0	0.9
2019	1.0	0.7	0.9	0.9
2020	0.9	0.9	0.8	0.9

Source: Made by JICA study team based on https://jorinfo.dos.gov.jo/Databank/pxweb/en/

Table 3.91 Waste Generated and Destination by Prefecture

Unit: ton/year

	2018					2019					2020				
	Dump	Sanitary landfill	Open Areas	Others	TOTAL	Dump	Sanitary landfill	Open Areas	Others	TOTAL	Dump	Sanitary landfill	Open Areas	Others	TOTAL
Middle	**0**	**2,157,446**	**0**	**0**	**2,157,446**	**0**	**2,378,503**	**0**	**0**	**2,378,503**	**0**	**2,337,825**	**0**	**0**	**2,337,825**
Amman	*0*	*1,334,013*	*0*	*0*	*1,334,013*	*0*	*1,867,609*	*0*	*0*	*1,867,609*	*0*	*1,653,815*	*0*	*0*	*1,653,815*
Balqa	*0*	*375,547*	*0*	*0*	*375,547*	*0*	*200,784*	*0*	*0*	*200,784*	*0*	*261,705*	*0*	*0*	*261,705*
Zarqa	*0*	*361,408*	*0*	*0*	*361,408*	*0*	*301,248*	*0*	*0*	*301,248*	*0*	*329,960*	*0*	*0*	*329,960*
Madaba	*0*	*86,478*	*0*	*0*	*86,478*	*0*	*8,862*	*0*	*0*	*8,862*	*0*	*92,345*	*0*	*0*	*92,345*
North	**0**	**1,003,845**	**0**	**0**	**1,003,845**	**0**	**795,995**	**0**	**0**	**795,995**	**0**	**986,230**	**0**	**0**	**986,230**
Irbid	*0*	*560,390*	*0*	*0*	*560,390*	*0*	*313,319*	*0*	*0*	*313,319*	*0*	*544,580*	*0*	*0*	*544,580*
Mafraq	*0*	*255,855*	*0*	*0*	*255,855*	*0*	*291,474*	*0*	*0*	*291,474*	*0*	*249,295*	*0*	*0*	*249,295*
Jarash	*0*	*98,175*	*0*	*0*	*98,175*	*0*	*87,396*	*0*	*0*	*87,396*	*0*	*105,120*	*0*	*0*	*105,120*
Ajlun	*0*	*89,425*	*0*	*0*	*89,425*	*0*	*103,806*	*0*	*0*	*103,806*	*0*	*87,235*	*0*	*0*	*87,235*
South	**304,714**	**0**	**0**	**0**	**304,714**	**262,592**	**0**	**0**	**0**	**262,592**	**237,585**	**0**	**0**	**0**	**237,585**
Karak	*113,470*	*0*	*0*	*0*	*113,470*	*109,232*	*0*	*0*	*0*	*109,232*	*87,965*	*0*	*0*	*0*	*87,965*
Tafiela	*84,210*	*0*	*0*	*0*	*84,210*	*75,193*	*0*	*0*	*0*	*75,193*	*77,745*	*0*	*0*	*0*	*77,745*
Maan	*51,370*	*0*	*0*	*0*	*51,370*	*57,546*	*0*	*0*	*0*	*57,546*	*52,195*	*0*	*0*	*0*	*52,195*
Aqaba	*55,664*	*0*	*0*	*0*	*55,664*	*20,621*	*0*	*0*	*0*	*20,621*	*19,680*	*0*	*0*	*0*	*19,680*
TOTAL	**304,714**	**3,161,291**	**0**	**0**	**3,466,005**	**262,592**	**3,174,498**	**0**	**0**	**3,437,090**	**237,585**	**3,324,055**	**0**	**0**	**3,561,640**

According to the data on waste disposal site and the amount of waste accepted, the annual amount of waste accepted at Al Aqaba in Jordan is 55,000 tons.

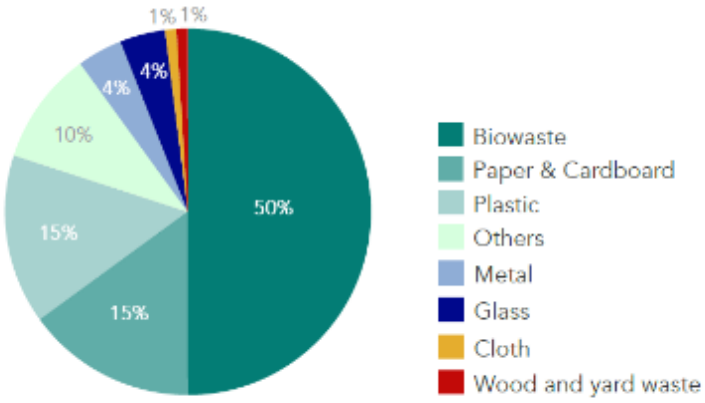
Table 3.92 Waste Landfill Volume by Landfill Site

Unit: ton/year

	2018	2019	2020	2021
Al Ekaider	469,800	465,000	474,500	749,631
Al Hussainyyat	72,794	78,930	91,250	81,829
Al Badiah Al Shamaliyah	38,000	41,800	45,980	20,000
Al Safawi	2,520	2,520	2,520	3,049
New Ruwashed	16,450	17,272	18,000	20,899
Al Aghwar Al Shamaliyah	43,800	...	...	...
*Iskayeen / Rabyet Al Kourah	...	...	...	...
Al Ghabawi	1,255,109	...	...	...
Madaba	115,000	126,500	139,150	153,065
Al Duleil	130,176	117,500	129,250	130,000
Al Homra	162,000	485,000	533,500	586,850
New Dair Alla (Agwar Wosta)	72,000	63,360	69,696	605,436
Al Azraq	12,775	14,053	15,458	17,004
Al Russeifeh	...	...	...	...
Ma'an	28,800	31,680	34,848	38,333
Ayl	19,500	21,450	23,595	25,955
Al Lajoun	72,000	64,000	70,400	54,000
Aqwar Al Mazrah / Al Briykhah	6,700	7,571	8,328	9,161
Southern Agwar / Al Samar	7,100	8,023	8,825	9,708
Joarf Al Daraweash	43,200	48,180	53,000	73,000
Al Aqaba	**42,000**	**46,200**	**50,820**	**55,000**
Al Qawiera	9,000	9,900	10,890	15,000
AL Modawara	12,000	14,000	15,400	1,560
Alswaga	....	..	..	..
TOTAL	**2,630,724**	**1,662,939**	**1,795,410**	**2,649,479**

Source: Made by JICA study team based on https://jorinfo.dos.gov.jo/Databank/pxweb/en/

According to the EDAMA report from 2018, the main types of waste generated in Jordan include organic waste, paper, plastic, and metal, among others.



Composition of waste in Aqaba. Source: Ministry of Local Administration

Source: Made by JICA study team based on https://jorinfo.dos.gov.jo/Databank/pxweb/en/

Figure 3-122 Composition of waste in Aqaba

(2) Regulatory authorities and contractors related to waste disposal

Regarding waste collection, ASEZA collaborates with the private sector, with Urbaser and MAB operating as a joint venture to manage waste disposal, while ASEZA serves as the contracting authority. Waste sorting is not conducted during collection and processing, and all waste is treated using the same method. Currently, the majority of waste is transported to a landfill site in the southern part of ASEZA, with only an estimated 7% of waste being informally recycled within the city (UNDP, 2015).

In Aqaba, there are regulatory measures in place regarding plastic, particularly plastic bags. ASEZA has developed a proactive waste and plastic bag management plan for the city, called "Aqaba Proactive Waste Management (APreWaM)", which outlines appropriate actions to reduce overall plastic bag consumption.

Furthermore, since the existing dumping site is nearing the limit of its capacity, a study on the expansion or new development of dumping sites will be conducted with the support of the EBRD.



Source: Made by JICA study team using Open Street Map

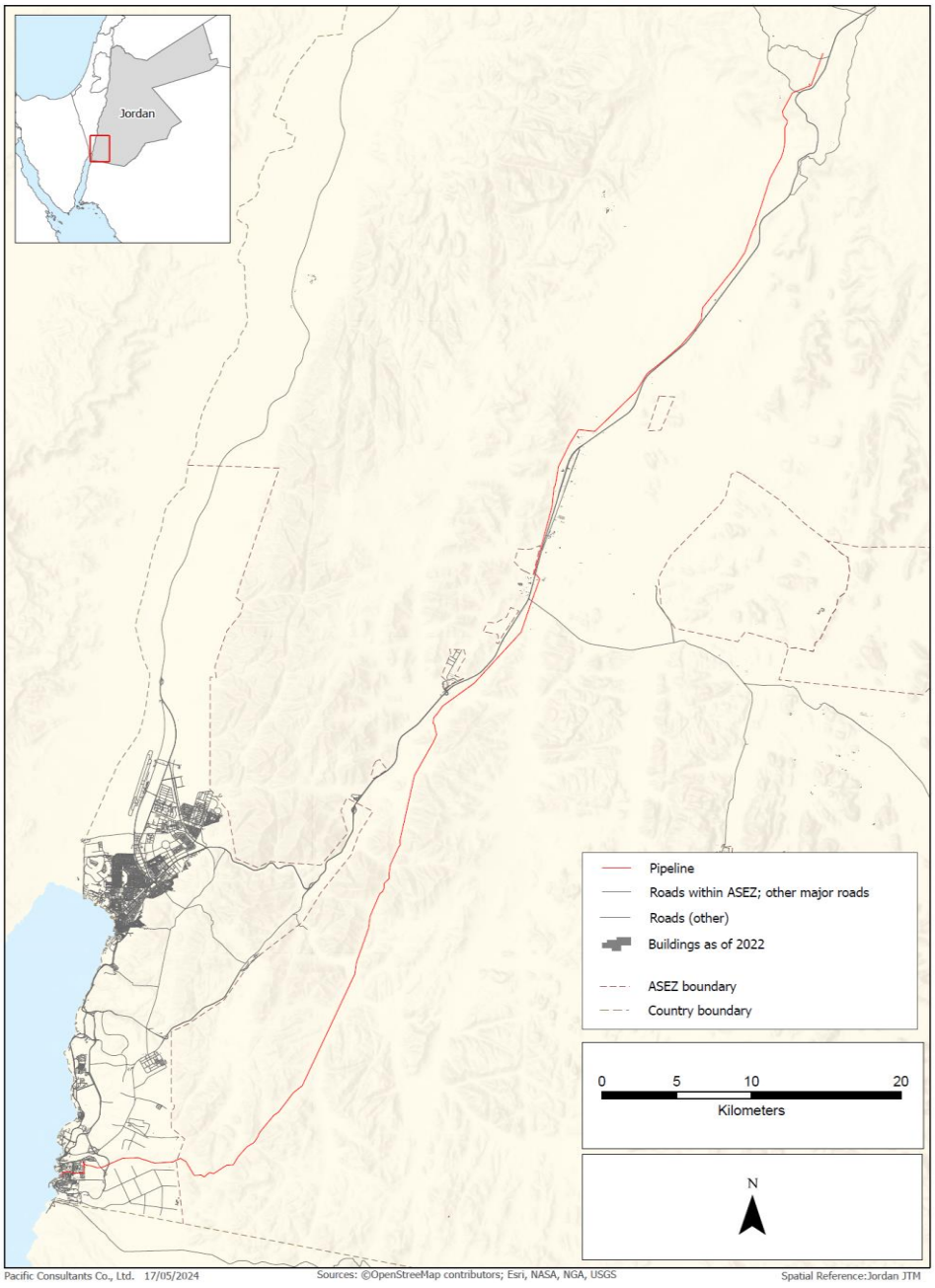
Figure 3-123 Location of Landfill site

(3) Waste treatment issue

- About 50% of the waste in Aqaba consists of food waste, while packaging waste makes 35% of the total. If waste separation and resource recovery measures are implemented, there is potential for recycling.
- Furthermore, the current landfill is an open dump, which increases the risk of waste being washed into the sea during floods and other events. Therefore, it is desirable to establish a well-managed landfill facilities to mitigate this risk.

3.7.9 Gas

The license of gas supply business is under the jurisdiction of Ministry of Energy. In Aqaba, Egyptian Fajr Natural Gas Company is operating a gas provision business of natural gas to some industrial sites, which are a thermal power plant and some factories in the South Industrial Zone as of 2024. In addition, the company will start to provide the natural gas to Al-Quwaira industrial estate from 2025. The following picture shows the gas pipeline network of the Egyptian Fajr Natural Gas Company. The company will be able to start the provision of LP gas to households in Aqaba, when the LP gas plant is constructed in the future, according to the company.



Source: Made by JICA study team from Gas network data provided by Egyptian Fajr Natural Gas Company, 2024

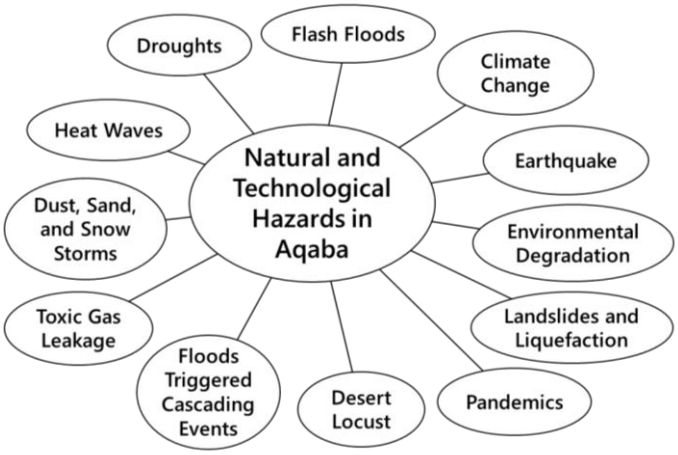
Figure 3-124 Location Map of Gas Network

3.8 Disaster Risk Management

3.8.1 Overview of Disaster Risk in ASEZ

(1) Summary of disaster risk management in ASEZ

City Smartification should make it resilient to all hazards and risks to attract investments and secured developments. There is a mutual linkage between smart urban development, including the transportation sector, and resilience against natural and technological hazards through proactive, innovative mitigation measures. Aqaba was hit by several natural and technological disasters resulting in people, economic and property losses. The following figure classifies the significant natural hazards resulting from the adverse interaction between the natural process and human society, i.e., earthquakes, flash floods, droughts, storms, landslides, and environmental degradation. While the technological accident due to human system failure as earthquake/flood triggered cascading events and ammonia gas leaks in the southern industrial zone. In Aqaba, both **Na**tural and **Tech**nological (**NaTech**) events may occur as a dual disaster resulting in significant losses owing to amplifying effects between the two types of hazards, for instance, gas leaks triggered by a severe flood of the high return periods. Therefore, integrated strategies for disaster prevention, preparedness, and response must be implemented to mitigate consequences.



Source: Compiled by the JICA study team based on National Center for Security and Crisis Management (NCSCM), UNDP, and UNDRR published reports, 2019 and 2023.

Figure 3-125 Classifications of significant hazards and risks in Aqaba Governorate

Among all-natural hazards, climate risks such as flash floods, droughts, and storms are projected to increase due to climate change impacts, resulting in socio-eco-environmental damages. Therefore, one of the critical challenges for disaster risk management in ASEZ is an insufficient database and post-disaster surveys for the occurred hazards characteristics, damages, losses, and impacts. For instance, the flash floods inventory maps, flood extent of the affected areas, and inundation depth should be collected regularly. Therefore, an integrated disaster information database/platform is essential for smart cities and decision-makers.

The ASEZ Masterplan 2001-2020 neglected the disaster prevention and climate risks on urban development. Moreover, the master plan bypassed the social aspects and the needs of the local communities in Aqaba. Therefore, it is crucial to enhance the awareness of

Aqabawii (promoting public awareness plan) regarding disaster risk management and involve the local people in the action plans for disaster risk reduction.

(2) Related Major Studies and Reports for Disaster Risk Assessment

The disaster risk assessment of earthquake and flash flood hazards has been the central focus of various studies:

1. UNDP, July 2011, Disaster Risk Assessment for Aqaba (https://www.undp.org/jordan/publications/disaster-risk-assessment-aqaba)
2. Flash Flood Hazard and Risk Map for Wadi Yutum, Report, UNESCO flash flood project, 2015 (Provided report through ADC)
3. Disaster risk management profile for Aqaba Special Economic Zone, Swiss Agency for Development and Cooperation SDC, and UNDP, 2010 (https://www.preventionweb.net/publication/disaster-risk-management-profile-aqaba-special-economic-zone)
4. Aqaba: A Resilient City Through Its Neighborhoods, The Regional Energy and Climate Project in the Middle East and North Africa (MENA) of Friedrich-Ebert-Stiftung has Funded, commissioned, edited, and reviewed this study. (https://library.fes.de/pdf-files/bueros/amman/18747.pdf)

The flash flood hazards, hydrological studies, flood mitigation measures, and flash floods master plans for the Aqaba catchment Wadis area have been the central focus of enormous studies from 1987 to 2019:

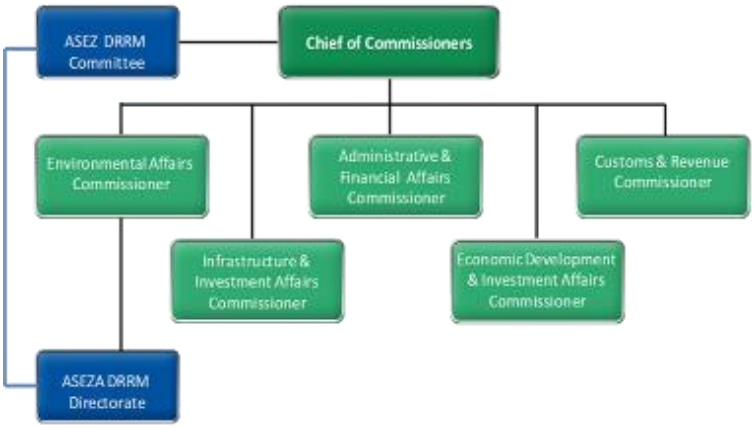
1. Engineering Science INC and Jouzy (1987), AQABA Basin – Wadi, Flood Control Study, AQABA Region Authority (received from ADC flash flood EWS unit)
2. MWH (2007) Draft Aqaba stormwater master plan report review. By: MWH Americas, Inc. in association with MWH Arabtech Jardeneh. For: Water Authority of Jordan and Aqaba Special Economic Zone Authority. Project funded by USAID. (received from ADC flash flood EWS unit)
3. CDM (2011), Final Flood Protection Master Plan for Wadi Yutum and Adjacent Coastal Wadis, Aqaba Special Economic Zone Authority (ASEZA). (received from ADC flash flood EWS unit)
4. DORNIER (2019), Hydrological study for the design of Aqaba flood early warning and monitoring system (ADC) (received from ADC flash flood EWS unit)
5. Redevelopment Plan of Port Area (MARSA ZAYED MASTER PLAN), AD Port Group, 2022
6. Farhan Yahya, and Ali Hasan Dawod Anbar (2014), Fragile Landscape: Impact and Consequences of May 2014 Flash-flood Disaster in the Aqaba Area, Southern Jordan, Research Journal of Environmental and Earth Sciences 6(9): 451-465
7. Farhan Yahya, Omar Anaba, Ali Salim (2016), Flash flood risk estimation of Wadi Yutum (Southern Jordan) watershed using GIS based morphometric analysis and remote sensing techniques. Open Journal of Modern Hydrology, 06(02|2), 79–100.

https://doi.org/10.4236/ojmh.2016.62008

8. Farhan, Yahya, and Atef Ayed (2017). Assessment of flash-flood hazard in arid watersheds of Jordan/wadi rajil. Journal of Geographic Information System, 9, 717–751. https://doi.org/10.4236/jgis.2017.96045
9. Lubna AlMahasneh, Doaa Abuhamoor, Khaldoun Al Sane, N. Haddad, (2021). Assessment and mapping of flash flood hazard severity in Jordan, International Journal of River Basin Management, DOI:10.1080/15715124.2021.1981354

(3) ASEZA disaster risk reduction DRR practices

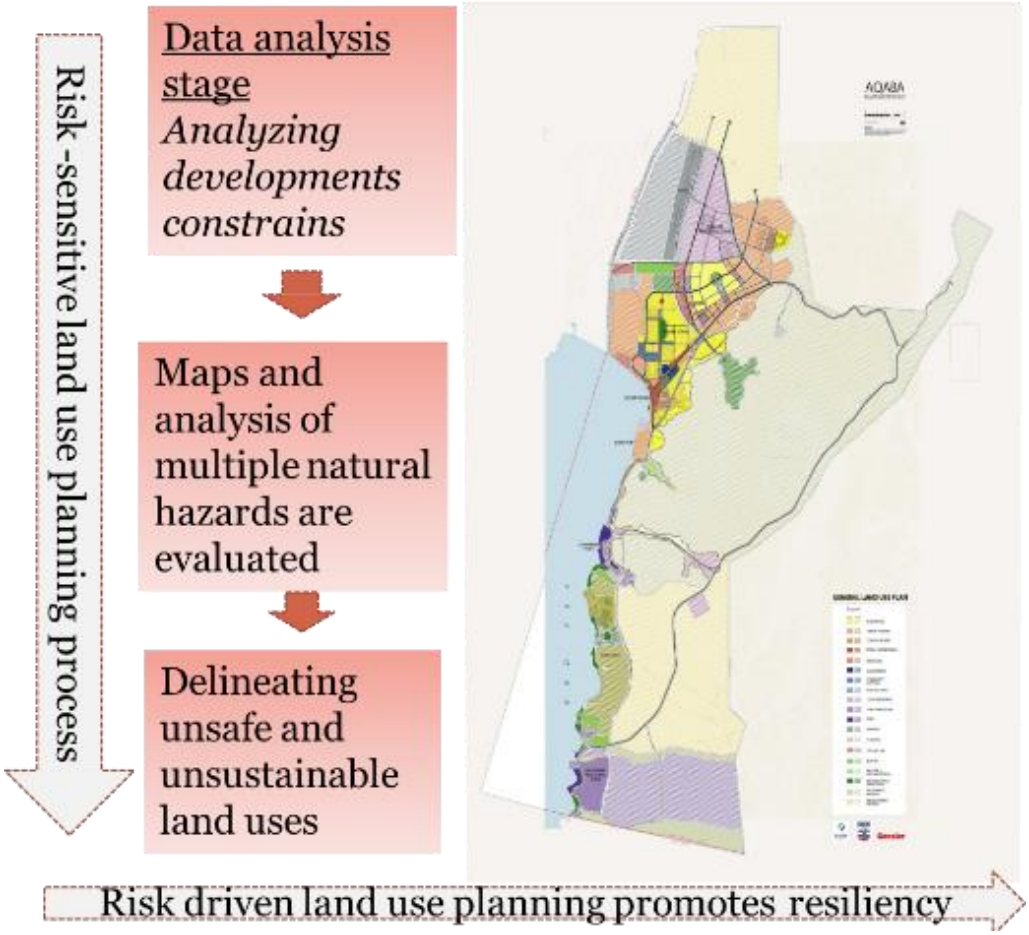
JICA study team reviewed most of the published reports/documents by UNDRR, UNDP, Swiss Agency for Development and Cooperation (SDC), Cleaner Energy Saving Mediterranean Cities (CES-MED), Arab conferences/platforms for DRR, Capacity for Disaster Reduction Initiative (CADRI), and initiatives by the world bank. We can confidently conclude that ASEZA has established a clear understanding of priorities and strategies for disaster risk reduction in Aqaba in the past through the DRR and climate change unit (established in 2010). Furthermore, ASEZA has active participation/involvement in most of the events and discussions to assess and improve its tasks to combat disasters and their devastating effects. ASEZA was involved in the UNDP project "enhancing institutional capacities to reduce disaster risk and to integrate climate change" between 2011 and 2014. The project's main objective is to improve governance and strengthen Jordanian institutional coping mechanisms to address disaster risk reduction (DRR) for natural hazards and climate change adaptation regarding prevention, mitigation, and preparedness for flash flooding. Both ASEZA and PDTRA received support to strengthen the institutional capacity to deal with all aspects of DRR. Based on the published proceeding materials during the first Arab DRR conference held in Aqaba on March 2013, ASEZA confirmed the creation of multi-stakeholders' platforms to promote DRR in Aqaba city. The main goal was to integrate DRR principles into ASEZA'S existing business processes and fill the gaps to make the City of Aqaba a resilient city. The proposed structure for the ASEZ DRRM committee is shown below.



Source: Presentation material by Eng. Khalid Abuaisheh, Implementing Disaster Risk Reduction at the Local Level "Words into Action," The First Arab Conference for Disaster Risk Reduction, 19-21 March in Aqaba, Jordan.

Figure 3-126 DRR practice, ASEZA's organization structure

ASEZA proposed a unique approach depicted in the following figure based on risk-driven land use planning to promote resilience in Aqaba city. An integrated tool to assess and define secured future development areas suitable for growth in the desirable land use pattern that supports the socio-economic and infrastructure development. ASEZA contributed to developing the handbook Making cities Resilient under UNDRR by providing an example of Aqaba as a role model city for localizing DRR. The figure below summarizes the ten essentials of Aqaba city for monitoring the implementation progress of DRR at local levels. It was reported by UNDRR that, utilizing all the risk information and building on the risk assessment studies conducted, Aqaba can now produce risk and hazard maps for flood and earthquake-prone areas.



Source: Presentation material by Eng. Khalid Abuaisheh, Implementing Disaster Risk Reduction at the Local Level "Words into Action," The First Arab Conference for Disaster Risk Reduction, 19-21 March in Aqaba, Jordan.

Figure 3-127 DRR practice, the proposed physical processes for the Aqaba city land use plan

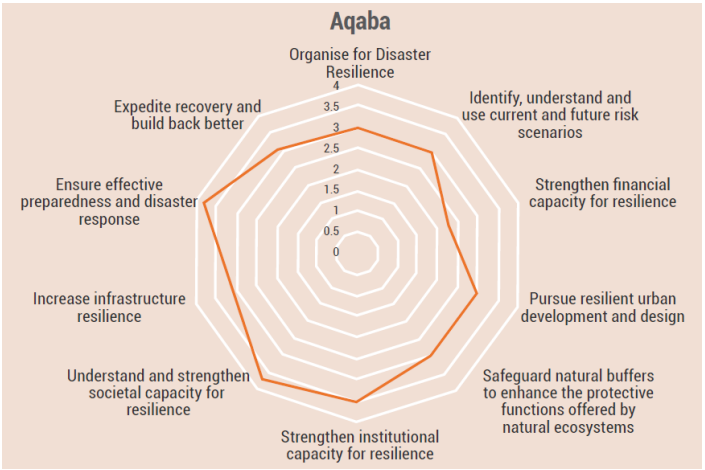
The importance of DRR in Arab cities has been recognized through the comprehensive Aqaba declaration on 21 March 2013, during the last day of the first Arab conference for DRR. The 16 declared items are an excellent document and guidance for establishing a resilient city, which is an essential item of the smart city. Furthermore, the updated 2023-2030 Jordan national DRR strategy prepared by the National Center for Security and Crisis Management (NCSCM) and in collaboration with the United Nations Development Program (UNDP) is a unique roadmap for combating disasters and setting action plans. The following figure, published by UNDRR within the assessment report on disaster risk reduction in the Arab region 2021, shows that Aqaba is in an excellent position to understand and strengthen

the societal capacity for resilience and low financial capability. The UNDRR report summarized the following statements "Aqaba Risk Reduction and Resilience Action Plan 2016 assessed seismic and other hazards affecting the city, including floods and flash floods, drought, and extreme heatwaves. The plan recommends that the city development plan be more risk-informed by integrating the risk reduction plan within the local development plan. It also provides legislative recommendations to allow the Aqaba Special Economic Zone Authority (ASEZA) to participate more effectively in DRR. In addition, the plan recognizes the impact of economic growth on the existing marine ecosystem and advises integrating ecosystem services into urban land-use planning."



Source: Presentation material by ASEZA, Implementing Disaster Risk Reduction at the Local Level "Words into Action," The First Arab Conference for Disaster Risk Reduction, 19-21 March in Aqaba, Jordan.

Figure 3-128 The ten essentials of Aqaba city: ASEZA tools to monitor progress in DRR at the local level



Source: Aqaba Special Economic Zone Authority (ASEZA) and UNDRR, 2016, published at Regional Assessment Report on disaster risk reduction in the Arab region 2021, UNDRR Regional Office for Arab States. Source: https://www.undrr.org/organization/aqaba-special-economic-zone-authority

Figure 3-129 Spider chart for the assessment of ASEZA for the ten essential components

3.8.2 Climate Change and Flood Risk Management

(1) Summary and recommendation for flood risk management in Aqaba

Aqaba typically has a hyper-arid climate with hot, dry summer with rare intermittent rainfall and a warm winter with occasional storms. The average annual rainfall in Aqaba has been less than 50 mm in the last 20 years. According to the IPCC projection from 2022 to 2100 over Aqaba, there is a decreasing trend in the average rainfall, thus reducing water availability during severe drought periods. In contrast, the frequency and magnitude of extreme hydroclimatic events will likely increase, with more water-related disasters such as flash floods. The generated rainfall runoff during such flash floods erodes and transports large sediment volumes and debris flow.

The increased urbanization and the impervious granite ground in the watershed resulted in increasing stormwater and reduced infiltration. According to the ASEZA report, February 2006 flash flood left six dead people and triggered widespread destruction to infrastructures in Aqaba city. In addition, the flood started cascading effects on power and water supplies, damaged the wastewater treatment plant, and caused environmental degradation disasters. After the 2006 flash flood, ASEZA adopted a new flood protection master plan with assistance from USAID, which updated the 1987 master plan for flood protection, known as the Jouzy study. The USAID master plan evaluated five alternative mitigation measures to protect the existing urban areas. Among the mitigation measures that the master plan examined was using 13 cascading dams in the Yutum and Tittin watersheds. It was reported that despite the low cost of the dam series option, there is a significant drawback due to the risk of structural failure. Furthermore, due to limited rainfall data, the master plan did not study the detailed precipitation and runoff relationship to calibrate and verify the HEC-HMS model. However, the master plan proposed an advanced flood warning system design that has not been implemented or utilized while building the ADC flash floods Early Warning System. In addition, the master plan did not recognize the impacts of climate change and floodwater harvesting and had implications of diverted floods on the marine environment. Therefore, there is a need to evaluate the existing mitigation measures under climate change scenarios. Furthermore, there is a need to maintain the natural flow, sediment transport, and infiltration processes based on green infrastructure and water harvesting for future development target areas.

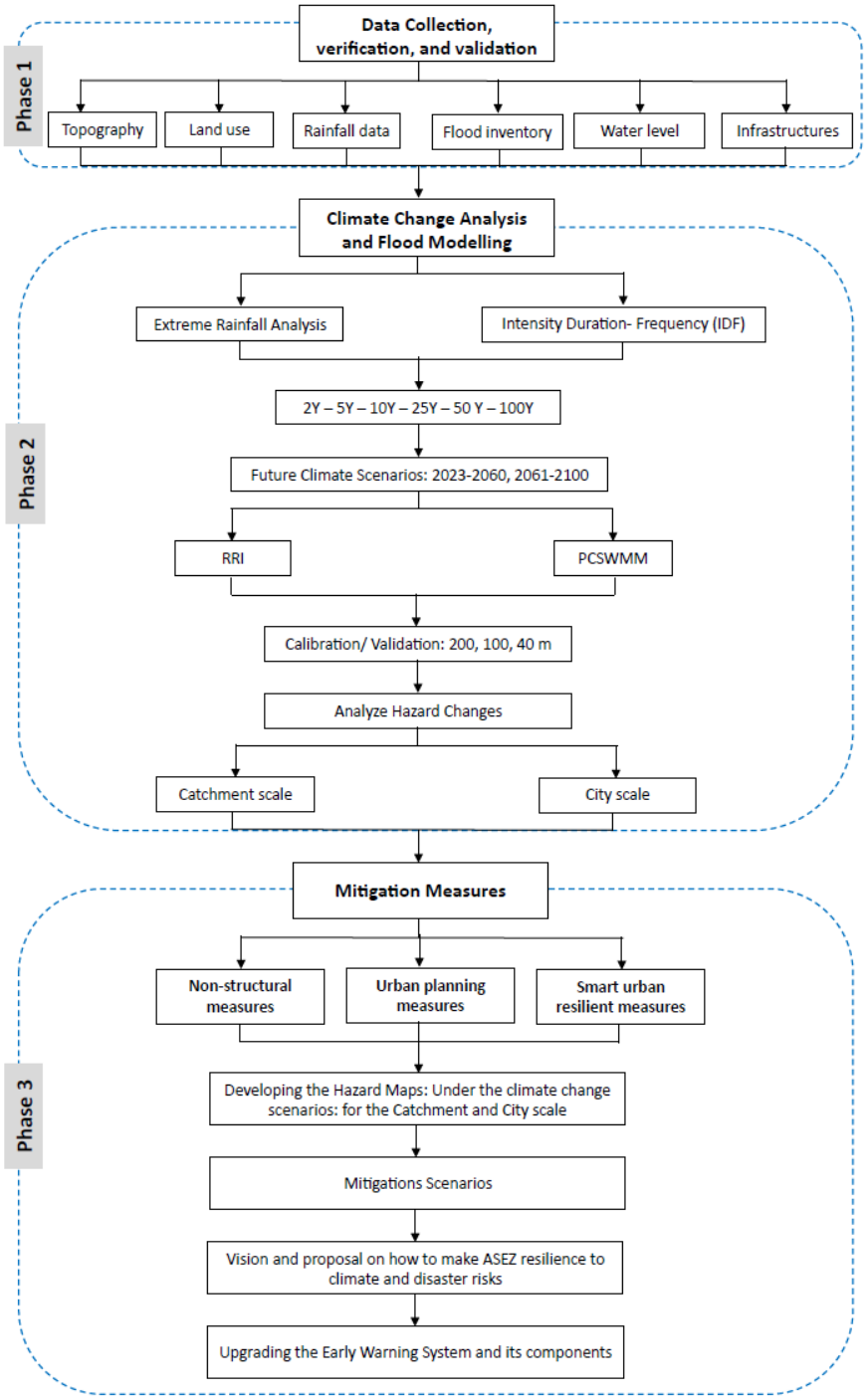
ASEZA and ADC have undertaken substantial efforts to enhance flash flood mitigation structures by constructing 32 dams and setting up an early warning system that includes 14 rainfall stations, 11 water level stations, three weather stations, and seven monitoring cameras. Three-alarm levels (yellow is 6mm/15 minutes, orange is 15mm/15 minutes, and red is 20mm/15 minutes) have been defined based on the rainfall intensity measured by the rainfall gauges. The first warning is based on the rainfall by Arabia Weather forecasting. Based on long-term rainfall analysis, the proposed three-alarm limits must be reviewed. The proposed limits may generate high runoff and inundation depths in the city before issuing the warning. The installed EWS is very crucial for ASEZ. However, EWS components need to be integrated and more utilized and interpreted by the hydrologist at ADC. There is a need to update the EWS to include Rainfall- Runoff-Inundation forecasting for three days before the storm is recommended. The proposed flood warning system was designed on July 2009 as part of the USAID master plan, and it is an excellent proposal to be considered for updating the existing EWS.

Based on the received emergency plans and data from the director of the Public works directorate and city services manager at ASEZA, the natural disaster management in Aqaba is a collective responsibility of Aqaba Governorate, represented by the governor and the civil defense of the public security directorate along with various authorities of ASEZA as the City Services Directorate, Public Works Directorate, and Aqaba Development Company in coordination and collaboration with the ministry of the public wors and housing, National Center for Security and Crises Management and Aqaba Governorate Police Directorate. The Aqaba Governorate Operations Room shall be the main room for managing operations and receiving and passing information and an experienced employee from the Authority's City Services Directorate shall be called its liaison officer. The ASEZA operations room in the City Commission building is the auxiliary room to the main operations room, through which all data and information are received from the field team and passed to the main governorate room., the operations room is managed by the director of the City Services Directorate or the Deputy Director of the City Services Directorate. After the head of the Emergency Plan Committee declares the emergency, the head will request data related to the rainfall intensity and the weather conditions. If a flash flood occurs, then increase the level of emergency to the maximum and coordinate with the relevant authorities and the main operation rooms. After reviewing the existing emergency plan, there is a severe gap in the existing disaster management plan as follows:

1. There is no hazard map analysis based on the predicted rainfall storm to determine the hotspot areas and critical points in the city or catchment areas. The available hazard maps are the first step in the emergency response plans and the critical step for decision-making processes and planning.
2. The leading time of rainfall forecasting is very short as the existing early warning system relies only on available satellite data.
3. The public participation and citizens and affected people are not involved directly in the management plan.
4. Further challenges and information related to ASEZA disaster risk reduction practices and early warning systems are reported in Section 3.8.2.

It is recommended to restructure the robust Disaster Risk Management Department for resilience city. Furthermore, it is crucial to consider the impact of climate change impacts and flash flood disasters to design and maintain road development in Aqaba. Therefore, it is recommended that ASEZA establish guidelines for climate-resilient road networks and drainage systems that consider the associated risks with climate change.

The framework shown in Figure 3-130was established to summarize the overall climate change and flood management study to be reflected in the master plan. The framework relies upon three phases: data collection and hydrological analysis, climate change and hazard mapping, and mitigation measure scenarios.



Source: Created by the JICA Study Team

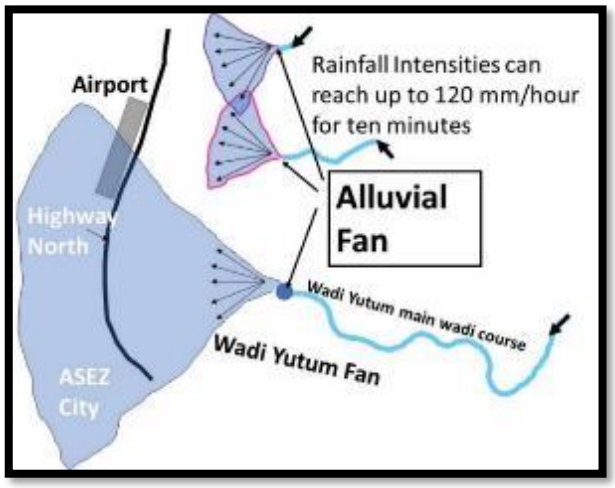
Figure 3-130 Framework and scope of climate change and flood management in Aqaba

(2) Data Collection, Verification and Validation

1) Related Major Studies for Flash Floods

a) Flash Flood Risk Assessment in Aqaba

The UNDP and SDC studies highlighted the damages from the 2006 flash flood and the associated flood-prone areas in Aqaba. The urban development of ASEZ is taking place on the alluvial fans of Wadi Yutum (the following figure), so the site will inevitably be hit by disasters when floods happen. It was reported that the 2006 flood hit the alluvial fans of Wadi Yutum, which caused five human casualties, damages to the Disi water supply pipeline, the airport, road inundations, and the wastewater treatment plant. According to Farhan and Anbar (2014), the 2006 flood was associated with large sediment debris and slumping. The rainfall intensity within 10 minutes reached 120 mm. The JICA study expert team could find flash flood inventory maps, flood extent of the affected areas, and inundation depths of all historical flood events that hit Aqaba and its associated watershed. Furthermore, there needs to be a detailed study for climate change impact assessment for the past, present, and future in Aqaba.

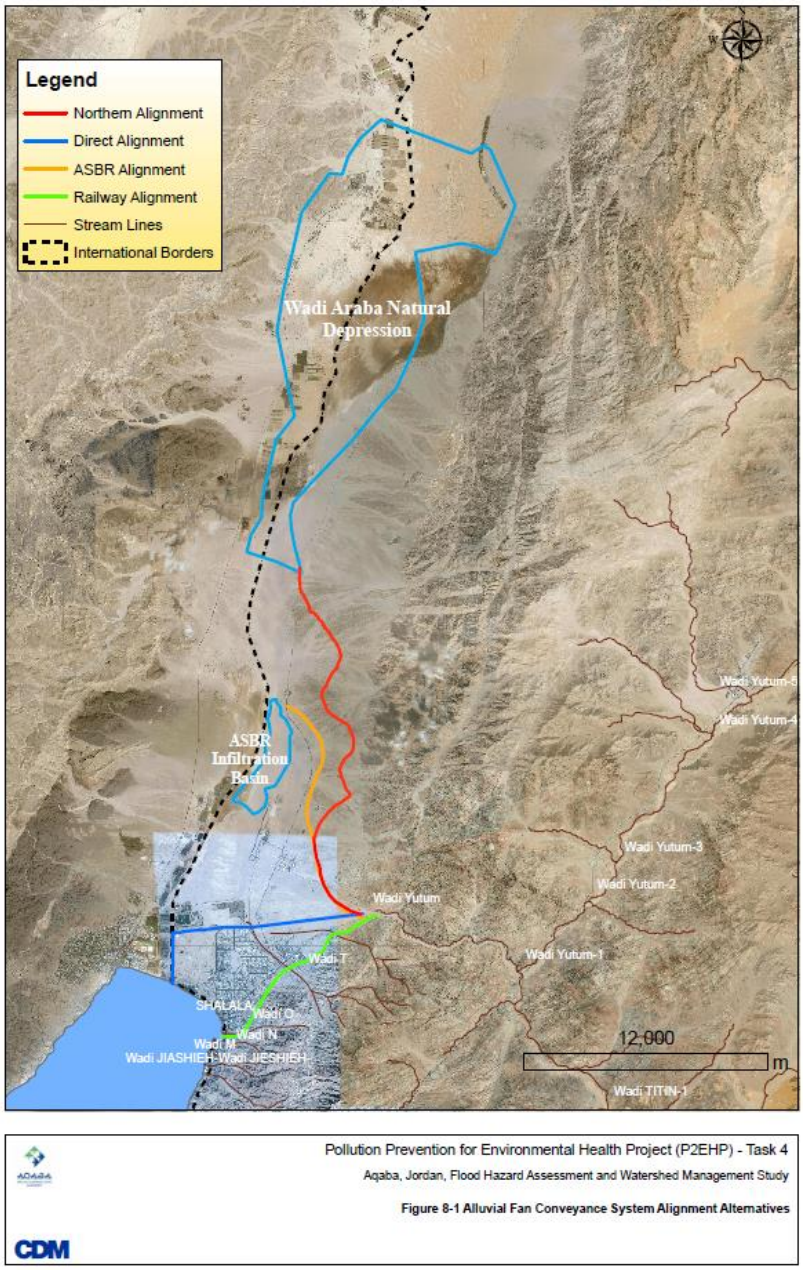


Source: Compiled by the JICA study team based on Google Maps and UNDP and SDC studies

Figure 3-131 Wadi alluvial fans brought the flash flood in urban and non-urbanized areas.

b) Flash Floods Protection in Aqaba

The USAID flood protection master plan (FPM/P) reported that the development of the alluvial fans poses a high flood risk, and the safe diversion of flood water will require a significant investment by ASEZA. ASEZA had previously prepared a channel design that would convey flow from the mouth of Wadi Yutum via an open channel along an alignment that parallels the Al Safi Back Road (ASBR). Furthermore, the master plan evaluated five alternatives, as depicted in the following figure.



Source: Final Flood Protection Master Plan for Wadi Yutum and Adjacent Coastal Wadis, Volume 1, USAID

Figure 3-132 Alluvial fan conveyance system alternative

These five proposed alternatives include:

1) Basin at the entrance of Wadi Yutum to capture sediment and debris.

2) High and low gradient channels to convey the flow down the fan.

3) Flood water harvesting and groundwater recharge at Wadi Araba basin. The capacity of the northern natural depression in Wadi Araba is estimated to be more than one billion cubic meters.

4) Wadi T basin does not have adequate storage for a 100-year flood volume and needs to be enlarged or diverted.

5) Finally, the FPM/P proposed flood mitigation implementation plan in Section 9 find as follows:

"Section 9.6 Flood Mitigation Implementation Plan"

The implementation of the recommended flood mitigation measures includes a variety of elements, such as engineering analysis, design, construction, and programmatic elements. The following recommendations are provided for implementation:

1. In general, all drainage and flood control improvements be constructed from downstream to upstream, beginning, ideally at a Gulf outfall. This approach ensures that adequate conveyance capacity is available as improvements are constructed, and avoids adverse impacts during interim conditions, before the entire system of improvements is constructed. However, the sequence of construction for a system to mitigate flood hazards on the Yutum alluvial fan is more complex and discussed further in Item number 2.
2. The following implementation recommendations are provided for the Wadi Yutum complex.

   a. If selected as a viable option, construction of the detention/retention dams in upper Wadis Yutum and Titin.

   b. Construction of the sedimentation/debris capture basin at the mouth of Wadi Yutum.

   c. Construction of downstream infiltration basins if the ASBR or northern alignment channels are chosen.

   d. Construction of the selected flood conveyance channel, beginning downstream and progressing upstream to the Wadi Yutum sedimentation/debris capture basin.
3. Existing development that is located in active flow paths or that is subject to alluvial fan flooding should be protected as soon as possible with the completion of design and construction of diversion berms and channels around developments in active flow paths. One example of such as development is the Hiddab development in Wadi 11.
4. In the coastal wadis, partially constructed drainage and flood control improvements should be completed regardless of their location in the system. Completion of partially constructed facilities should include downstream components, if necessary to eliminate a flood hazard, and prevent adverse downstream flood impacts.
5. Redesign and reconstruction of damaged flood control infrastructure (embankment reconstruction and armoring, drop structure and channel repair, etc.) should also be completed as soon as possible, and are not dependent on downstream improvements.
6. ASEZA should establish a Flood and Drainage Management Department responsible for to implementing both structural and non-structural (i.e., institutional) controls and oversee operation and maintenance of the system. As discussed in Section 9.5, to implement these types of controls, ASEZA needs to dedicate the necessary staff and resources. At a minimum staffing should include:

   a. Senior Engineering Manager – Responsible for overall department management and this individual should be an expert in drainage controls and hydraulic engineering.

   b. Hydraulic Engineer - This individual will be responsible for future hydrologic, hydraulic and sediment transport studies and future drainage and flood management master planning.

c. Civil Engineer – This individual will be responsible for overseeing the capital improvements, operation and maintenance of the system and ensure system is functioning properly.

d. Field Engineer - This individual will be responsible for field oversight of capital and maintenance contractors through a staff of inspectors.

e. Development Engineer – This individual will review drainage and flood management improvements for new development and redevelopment, manage design criteria and interact with developers.

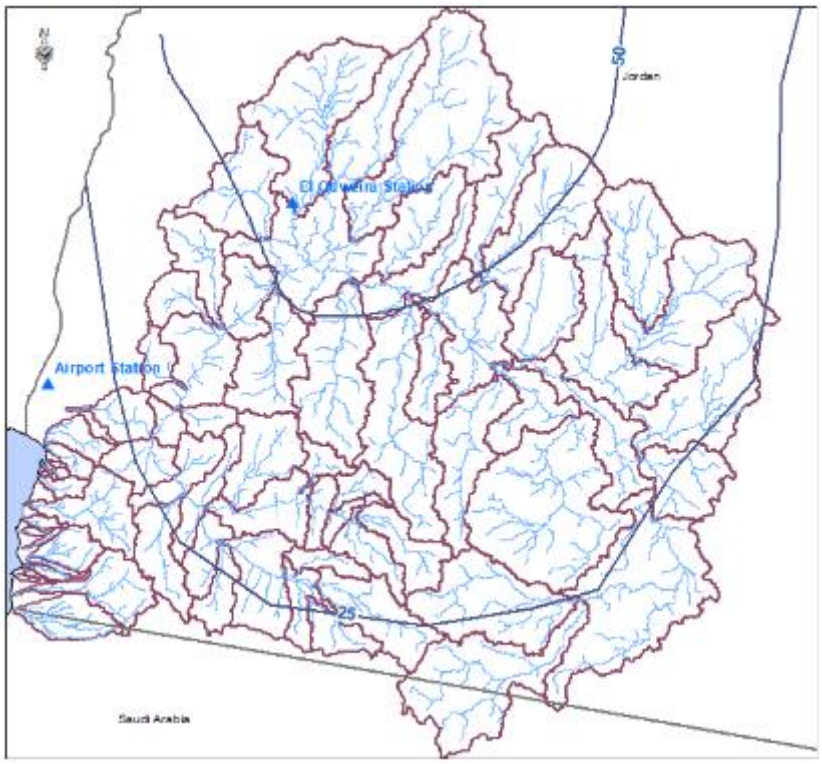
f. Flood Warning Engineer – This individual will be responsible for developing an effective flood warning system, interaction with emergency response agencies and for acquiring flow and precipitation data through implementation of gauge stations. This staff will interact internally to provide technical and administrative support for drainage and flood management programs and externally with government agencies, the general public and developers."

c) Flash Flood Early Warning Systems (EWS) in Aqaba

A recent report by Dornier consulting International 2019 studied the hydrological parameters for designing a flood Early Warning System (EWS). The report included four main sections:

1) Hydrological analysis for the entire watershed, including dams and rainfall characteristics.
2) Hydrological modelling using HEC-HMS under various return periods to calculate the hydrographs at the monitoring flow stations of the EWS.
3) Estimating EWS parameters and threshold values for rainfall and flow stations as a warning system of flash floods.
4) Recommendation for the institutional needs and working protocols for the entire EWS

The rainfall analysis and the hydrological modelling were based on two stations of El Quwaira and Aqaba Airport, as shown in the following figure. The Dornier study utilized the Intensity-Duration-Frequency (IDF) curve developed by (WAJ 1986) to predict quantities of rainfall intensities.



Source: Final report of Flood Warning and Monitoring System Project, Hydrological Study for the Design of Aqaba Flood Early Warning and Monitoring System Aqaba Wadies - Jordan (Dornier consulting International 2019

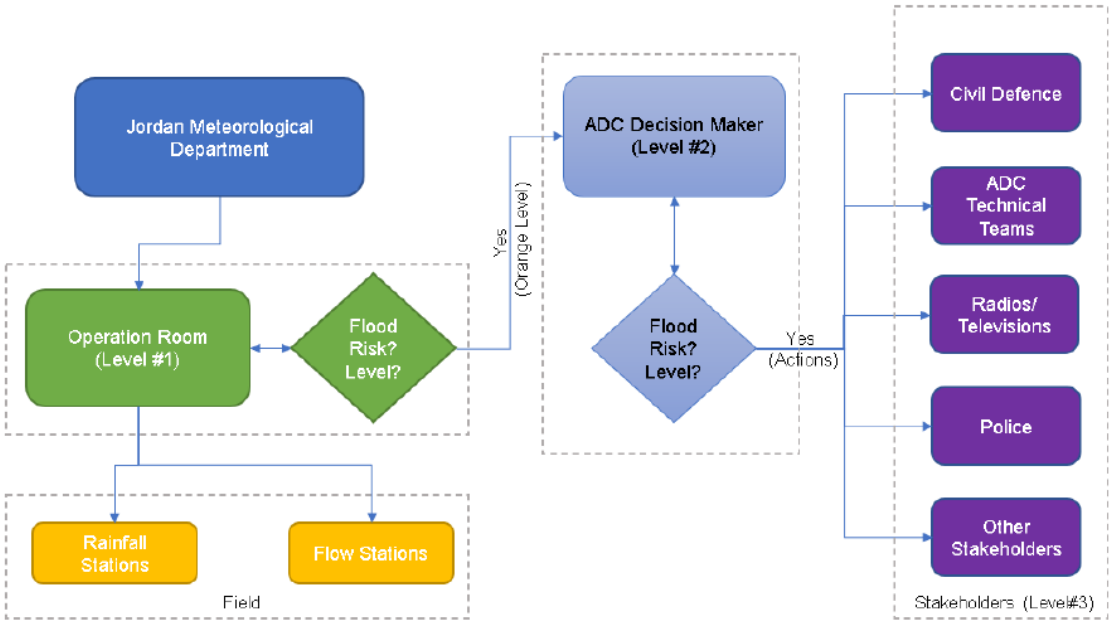
Figure 3-133 Location map of the two representative rainfall stations

The proposed EWS components are 14 rainfall stations distributed in Yutum, Titin, and coastal wadis and 11 water level stations to monitor the flow discharges at five cross sections. The study proposed three levels of responsibility on the institutional levels to establish the EWS, as shown in the following figure. Tin addition, the study proposed three warning levels according to the rainfall intensity as followings:

a *If the measured rainfall at any station >= 20 mm/15 minutes (Red level), indicating high flood risk.*

b *If the measured rainfall at any station >= 15 mm/15 minutes (Orange level), indicating moderate flood risk.*

c *If the measured rainfall at any station >= 6 mm/15 minutes (Yellow level), indicating low flood risk.*



Source: Final report of Flood Warning and Monitoring System Project, Hydrological Study for the Design of Aqaba Flood Early Warning and Monitoring System Aqaba Wadies - Jordan (Dornier consulting International 2019

Figure 3-134 Schematic Diagram of the FEWS data flow

The study must explain why such rainfall thresholds have been designed or selected. Additionally, the installed rainfall stations measure a cumulative rainfall every 15 minutes and start from zero rainfall intensity on the 2nd day. It means the rainfall threshold should be given as depth, not intensity. The study does not propose an integrated EWS as there is no proposed linkage between the water level stations, rainfall, and weather stations in the proposed warning procedure. The JICA study team suggests reviewing the designed EWS and being updated comprehensively.

2) Data Collection

ASEZA and ADC provided JICA study Team with relevant data on elevation contour with different resolutions, EWS rainfall stations, drainage channels, several geodatabases, raster, and shape files for infrastructures, utilities...etc. Data related to the summary of each significant flash flood event that occurred recently in Aqaba has been gathered by the JICA study team from reports, published papers, newspapers, and internet-based information. ASEZA has no historical flood maps based on observations or satellite images. The post-flood surveys enable ASEZA to collect information about damages and inundation depths from the field markings. The assessment after each disaster is essential for developing a calibrated model for different hazards, and the degree of damage can be determined (e.g., water depth or flow velocity).

a) Inventory of Extreme Flash Floods in Aqaba

Table 3.93 summarizes each significant flash flood event in Aqaba and some related pictures. In addition, the table indicates the date, causalities, damages caused by each event, and the maximum water depth recorded during the event.

Table 3.93 Record of some flash flood events in Aqaba

Date	Casualties	Damages	Water Depth
Feb 2006	6 people	Houses in Al-Shamiyah & Quwerah were damaged, Vehicles at the south beach were damaged	
2010	3 died, 2 missing and 4 injured		
Oct 2012	2 people	Roads and Properties	1- 2 m
Nov 2012	1 person	Properties	1.3 m
Jan 2013	None	Wadi Al-Yutum	
Feb 2013	None	King Hussein Airport	
May 2014	None	Erosion of roads in Wadi Al-Yutum	
October 2016	None	Properties, houses, vehicles, drainage system and electricity cables were all damaged	
March 2020	None	Facilities were damaged	
May 2020	None	damages to public and private properties	
December 2020	None	Damaged properties & facilities	

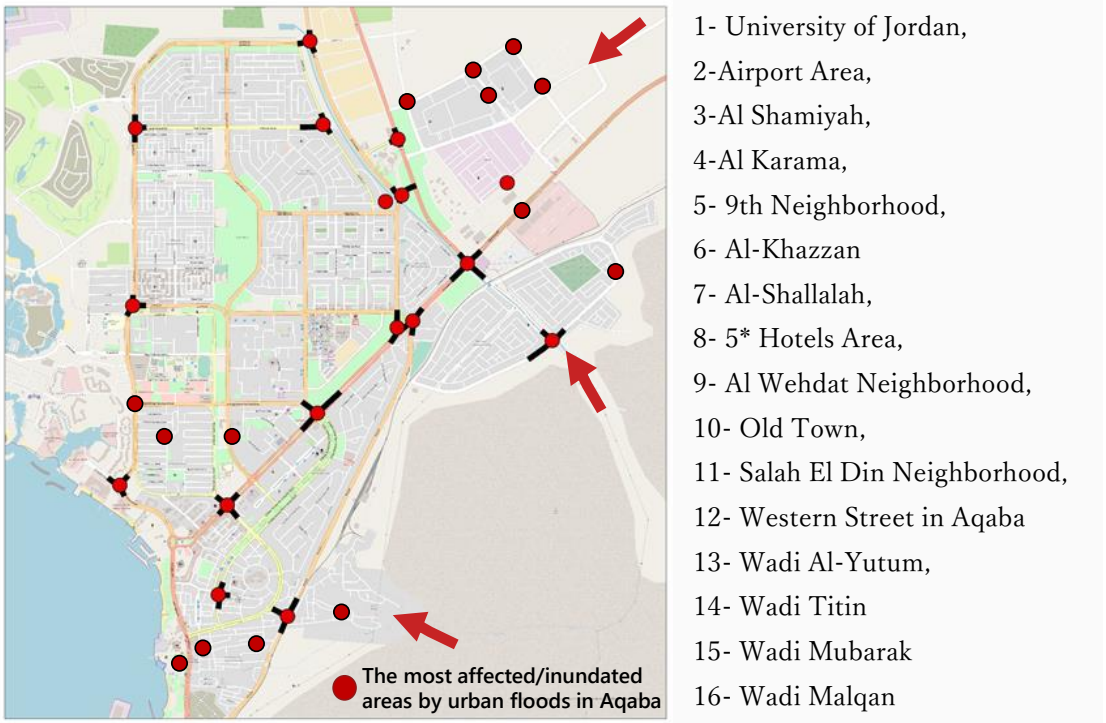


Source: collected information by JICA study Team)

Source of Pictures: https://alghawasnews.com/, https://www.khaberni.com/news/85617

b) Urban Flood Mapping of ASEZ

JICA study expert team mapped the flood-prone areas in ASEZ based on newspaper reports, published papers, and local residence information. The following figure depicts the most inundated areas in the recent 15 years to understand the flood processes and the hotspot areas. The following figure qualitatively analyses the influence of urbanization and street alignments and forms on stormwater runoff. A steeper road slope may cause a higher flow velocity and retention at junctions with flat areas. The land use, road slope, building coverage ratios, arrangement, and distributions may affect flood inundation and stored water over the main street, as the case occurred in Aqaba. Therefore, for flood resilient sustainable city various consideration for urban planning and road design guidelines for pluvial floods.

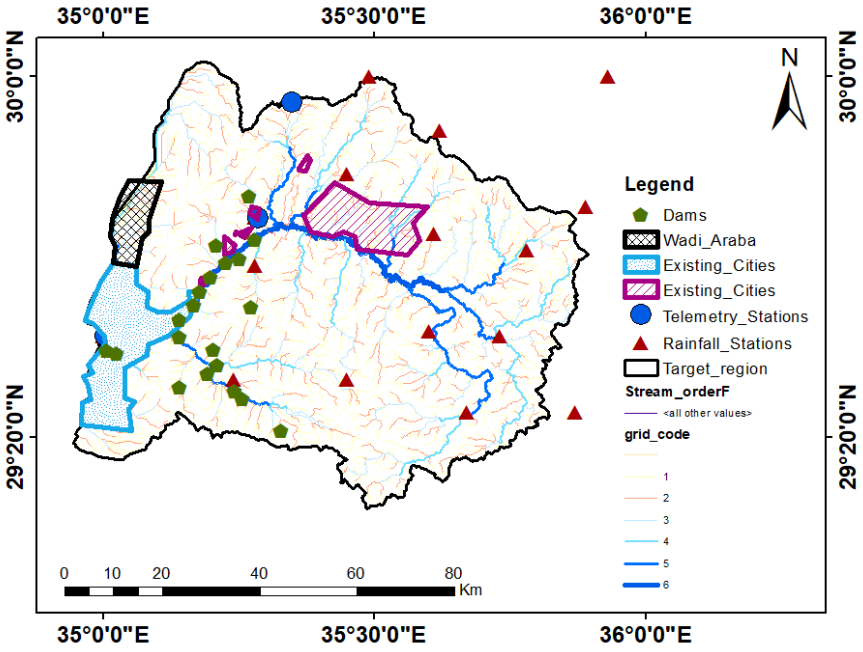


Source: Compiled by the JICA study team based on newspaper reports, published papers, and local residence

Figure 3-135 Flood prone areas in Aqaba

c) Rainfall and water level data

JICA study expert team collected historical hydrological data (1968 to 2022) from the Ministry of Water and Irrigation (MWI). Forty-four rainfall stations in the Aqaba governorate and surrounding areas are operated by the Water Authority of Jordan (WAJ). Most of the received rainfall data are annual rainfall, and few stations measure daily. Therefore, 17 rainfall stations were selected among the 44 for rainfall analysis. The following figure shows the location of the selected stations on the catchment map. Furthermore, the figure shows the location of constructed dams in Aqaba by ADC, and study area of ASEZ, and the new development area. Moreover, we received another 14 rainfall stations operated by ADC for the EWS. Also, the JICA study expert team downloaded different remote sensing data (reanalysis and satellite data) available for the entire Aqaba catchment areas, as summarized in the table. The reanalysis and satellite data are helpful for future climate change analysis. Various datasets are needed to develop a hydrological model: rainfall, topography with high resolutions, land use, and other hydro-meteorological data. Regarding the water level stations, there are 11 stations operated by the flash flood unit at ADC. The data time interval is every minute. Therefore, we could not receive such data as the FEWS engineer could not download and deal with such data directly.



Source: Compiled by the JICA study team based on information from the Ministry of Water and Irrigation

Figure 3-136 Location map of the received monitoring rainfall station, dams, and target study area of ASEZ and new development areas

Table 3.94 Information on the collected remote sensing datasets

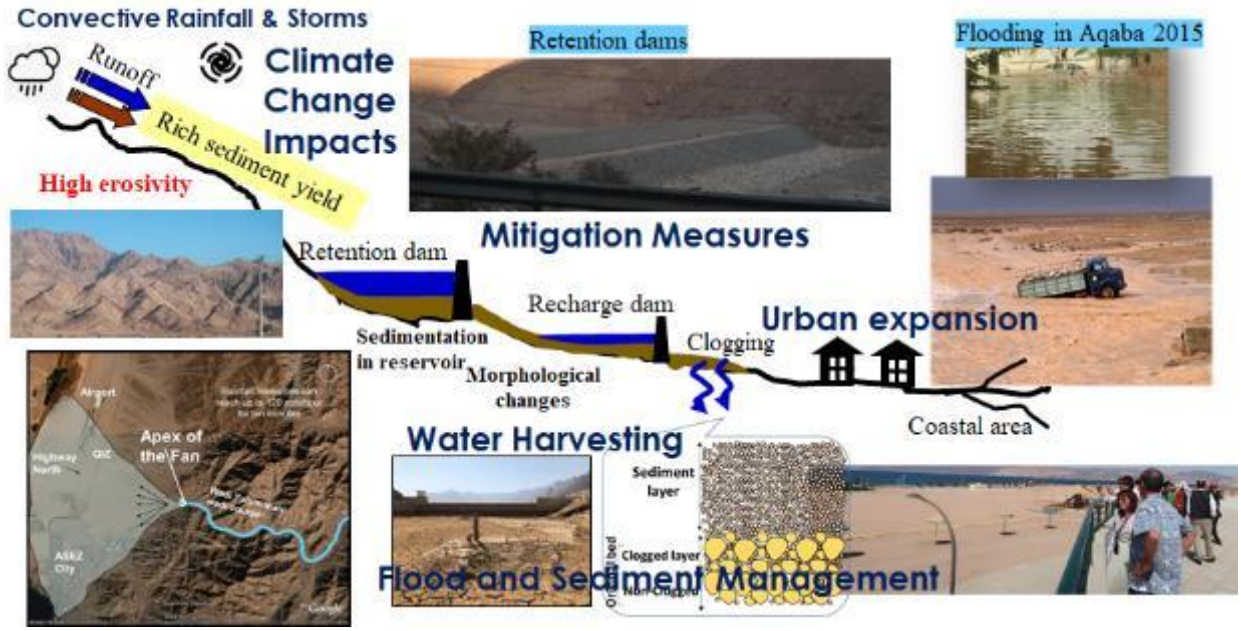
Reanalysis data	Resolution	Date_ From	Date_ End	Cont. Stat. indices	Categ. Stat. indices
ERA5	0.25	1979	till now	√	
JRA55	1.25	1958	till now	√	
NCEP	1.875	1948	till now	√	
GPCC	1	1982	till now	√	
Merra2	0.5 ° x 0.625 °	1980	till now	√	
Satellite data					
CHIRPS	0.25	1981	till now	√	
CMORPH	0.5	1998	till now	√	
PERSIANN	0.25	2000	till now	√	
PERSIANN_CDR	0.25	1983	till now	√	
PERSIANN_PDIR	0.25	2000	till now	√	
IMERG	0.5 or 0.2	2000	till now		
GSMap_Gauge	0.1	2000	till now	√	

Source: collected information by JICA Study Expert Team

3) Current situation and site investigations

This section explains the current situation of Aqaba's catchment, including dams, infrastructure crossing Wadis, and geomorphological. The following figure depicts the infrequent extreme rainfall events that erode the soil in the Wadi Yutum watershed and bring flash floods into the alluvial fan's urban area. Local erosion and sediment transport processes along the wadi channel occur according to the generated rainfall runoff. Therefore, the constructed dam series along the Wadi channel has a retention and detention function before discharging its water and transporting sediment to the Gulf of Aqaba. Various factors

should be considered for the "Smartifications" of Aqaba city: climate change, urban expansion, dam safety, sediment management, water harvesting, and smart mitigation measures.



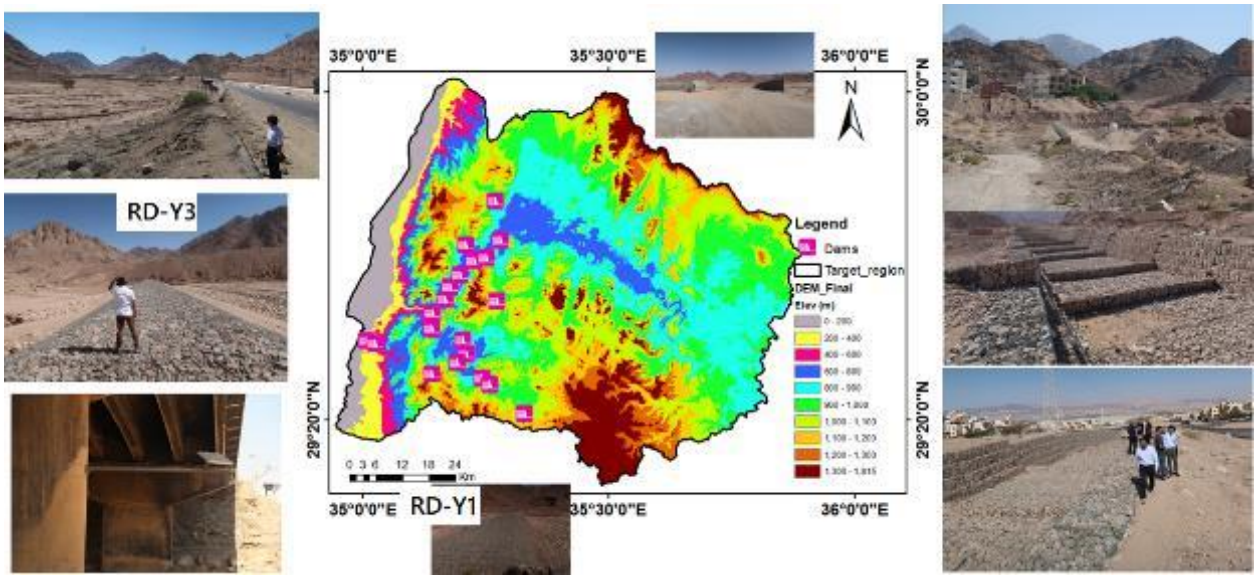
Source: Compiled by the JICA study team based on the Wadis system in Aqaba

Figure 3-137 Conceptual diagrams for the Wadi Yutum basin and mitigation along the alluvial fan

During the first mission, the JICA study expert team visited two constructed dam sites (RD-Y1 and RD-Y3). Based on the received dams drawing from ADC, both are rockfill dams with upstream sediment basins. The height of the RD-Y1 dam is 5 m, with a reservoir capacity of 280,000 m^3 and a dam length of 301.9 m. The size of the RD-Y3 dam is 9 m, with a reservoir capacity of 415,000 m^3 and a dam length of 289.9 m.

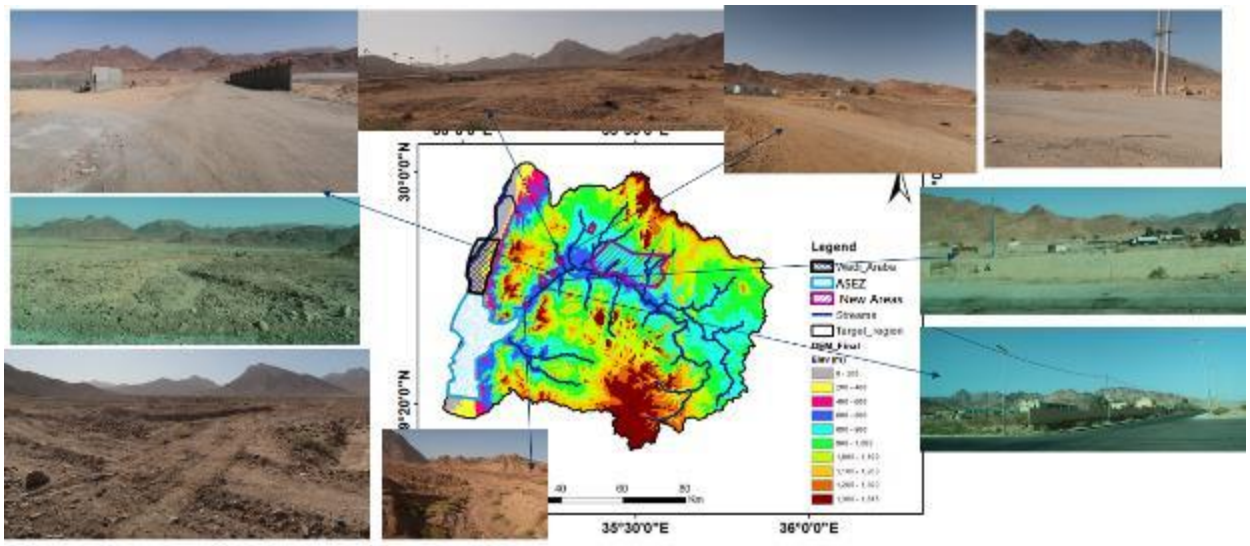
Based on visual inspection at RD-Y3, it was noticed that a small part of the downstream gabion was damaged and moved boulders due to overtopping. Furthermore, the reservoir sedimentation is high, and dry excavation is needed to keep the reservoir volume as the original design. Monitoring the sediment before and after each event with a detailed inspection routine is necessary to look for needed repairs or interventions for reservoir siltation. It was noticed that erosion and sediment debris are high in both Wadi Yutum and Titin (Figure 3-138). Therefore, it is vital to consider sediment and debris management in conjunction with the new development areas and its drainage system to reduce sediment accumulation in the main channel, box culverts, and storm drains. Furthermore, based on a visual inspection at the junction of both Yutum and Titin wadis, it was noticed that three water level sensors had been installed to record the flow discharge for EWS purposes. The erosion rate in this junction cross section near the bridge piers is high, which may affect the water level values. The water flood marks were also higher than the installed sensor elevation (See Figure 3-138). That means these sensors are submerged in water during a flood, which may result in erroneous measurements by these sensors. Therefore, shifting the sensor location to the downstream side of the bridge above a fixed concrete weir with a selected cross-section is recommended. Figure 3-139 shows the sites of the newly developing target areas. It was noticed that some of these areas are under rapid construction

of drainage channels, roads, and some mitigation measures.



Source: Compiled by the JICA study team based on a site visit during the first mission in September 2022.

Figure 3-138 Site visit for two constructed dams and drainage channels in the urbanized area



Source: Compiled by the JICA study team based on a site visit during the first mission in September 2022.

Figure 3-139 Site inspection for four of the six newly developing target areas

Based on the visual inspection of drainage channels and structures in place nearby PBI (the following figure), the existing drains and box culverts appear to provide a 100-year capacity, including a freeboard. However, some maintenance issues need to be addressed, as sediment deposition and plastic debris are deposited in the culvert in some parts of the channel. Furthermore, it was noticed a concrete abrasion in the bed of the box culvert that will require regular monitoring and maintenance. Past floods have damaged the downstream portion of the lined channel in the downstream side; inspection should be completed to identify needed repairs to the existing lining channel. Harvesting the floodwater at upstream parts or suitable locations along the canal is possible.

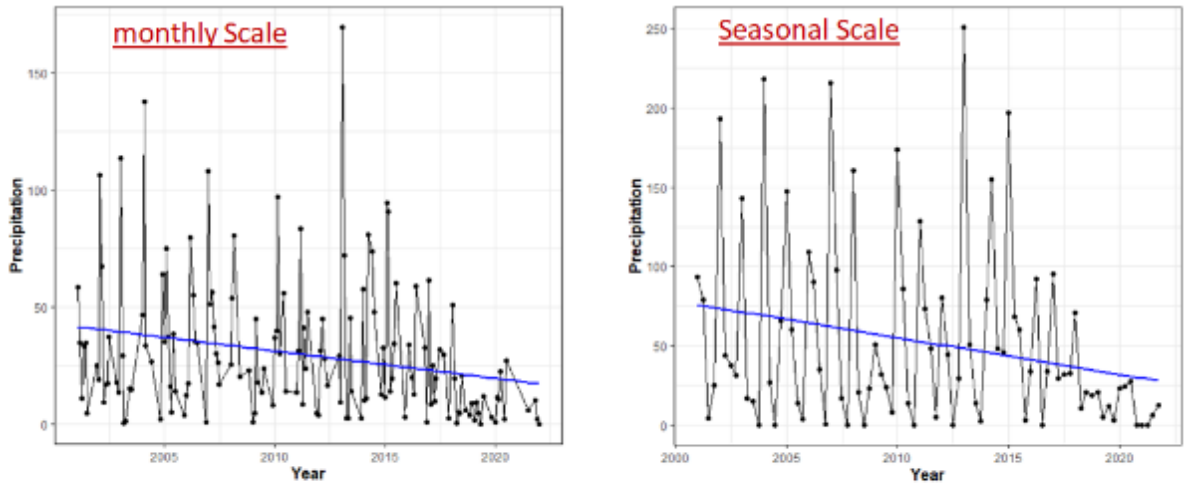


Source: Compiled by the JICA study team based on the Wadis system in Aqaba

Figure 3-140 Site inspections for the crossing Wadi structures as culvert and the drainage channels

4) Preliminary analysis and discussions

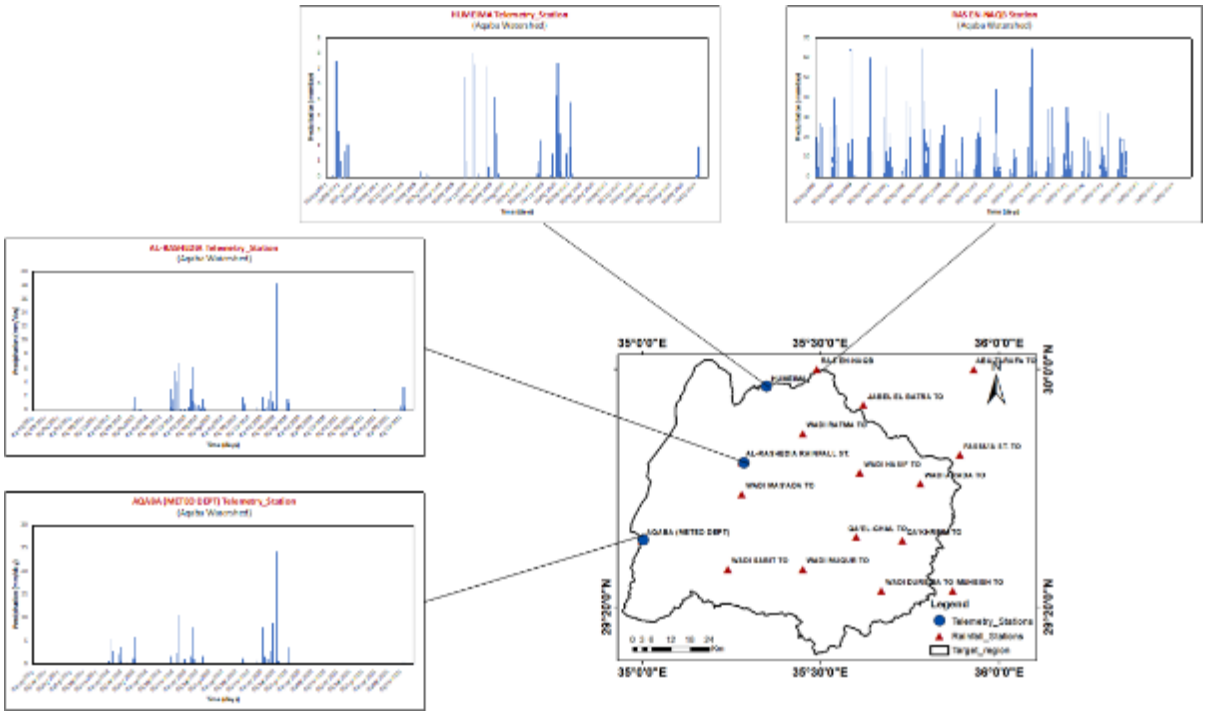
MWI provided the observed data from the rain gauge on a daily timestep for 20 years. The data is provided from 2001 to 2022 daily with many discontinuities. However, the data was still valuable since it detected some events and helped compare the satellite products and the bias correction stage. Moreover, the JICA study Expert team depicted the Aqaba catchment's daily, monthly, and seasonal trends. Figure 3-141 shows a decreasing rainfall trend over Aqaba on monthly and seasonal scales. However, there is an increasing frequency of extreme flood events. The widely used Mann-Kendall Test was used for the trend analysis in this analysis to estimate the trend in the monthly and seasonal rainfall and the number of possibilities. There is expected to be an increase in the intensification of extreme rain and flash floods over Aqaba. However, this requires further analysis under different climate scenarios. The decreasing rainfall tendency will likely increase the drought events and shrink the water supply. Therefore, it is a challenge to simultaneously satisfy the needs of new development areas for water supplies, energy production, agricultural activities, and industry. Figure 3-142 shows the hydrographs at different stations over the Aqaba region. JICA Study Expert Team also collected various satellite data from 2001 until 2022.



	Kendall's tau	Zs (MK test)	p-value	Sen's Slope	Trend
Monthly	-2.076105e-01	-3.714	0.000204	-0.1364493	Downward trend
Seasonal	-0.1759397	-2.351	0.01872	-0.3640833	Downward trend

Source: Compiled by the JICA study team based on received rainfall datasets

Figure 3-141 Monthly and seasonal rainfall trend analysis for collecting data over the last 20 years from rain gauges

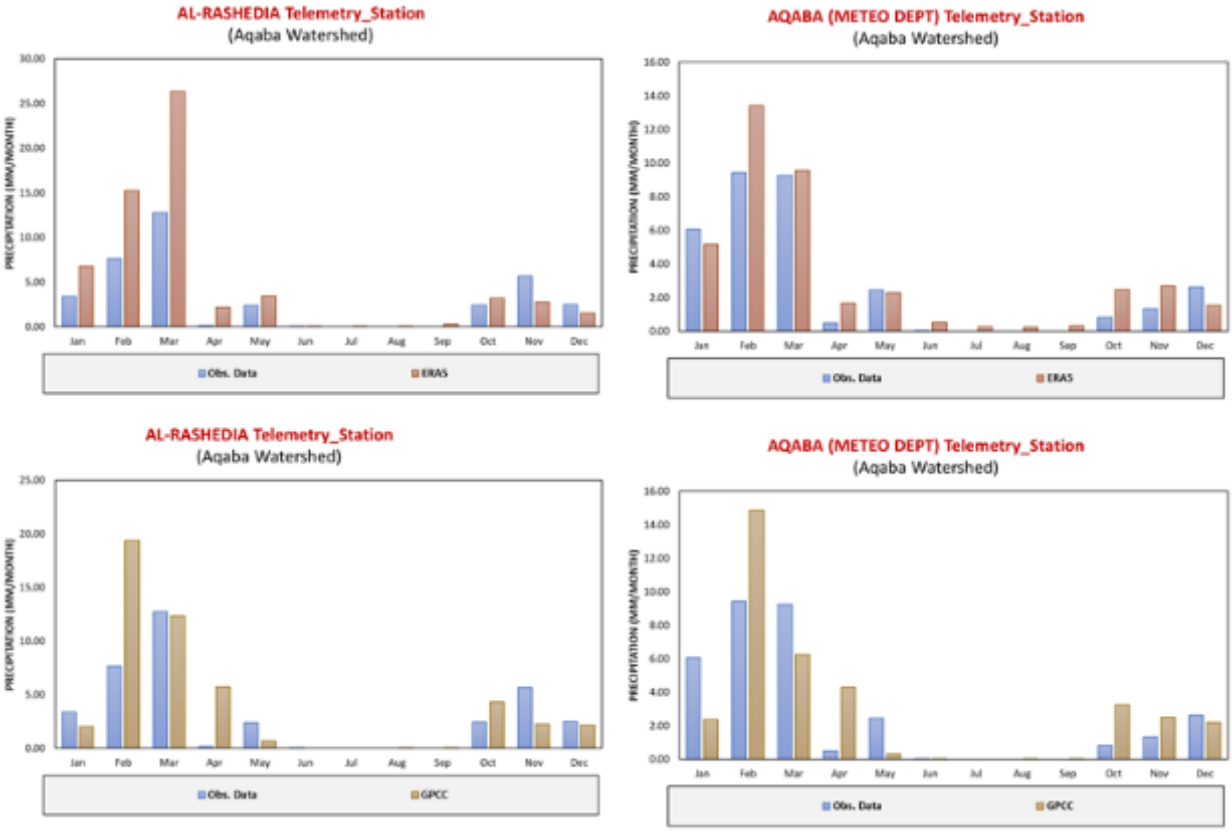


Source: Compiled by the JICA study team based on received rainfall datasets

Figure 3-142 Rainfall photographs for telemetry stations of Aqaba airport, Al-Rashedia, Humeima, and Ras En-Naqab stations.

The goal is to identify the data with a relatively good performance in detecting the events in Aqaba (see Inventory in Table 3.93). There were about 45 events that were reported and detected during that period. The idea is to test each data set and confirm if each data could see the events compared to the measured data (the following figure). Consequently, the data that could detect the highest number of events can be referred to as the best-performing data in the city. Later, that data will go through a bias correction process to reduce the error and

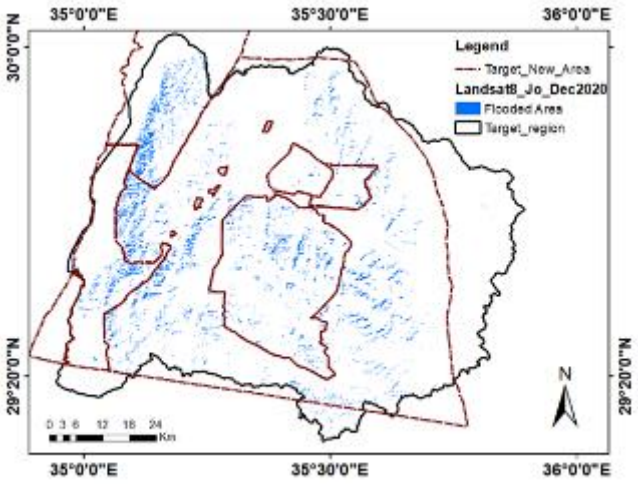
use it for further analysis in urban flood modelling. The figure shows that the GPCC and ERS5 products detected the rainfall event with acceptable performance and precipitation intensity.



Source: Compiled by the JICA study team based on received rainfall stations and satellite datasets

Figure 3-143 Comparison between gauging stations and satellite data for the average monthly rainfall for the period (2001-2021)

Additional analysis to develop flood extent maps during selected flood events in 2020 based on two satellite images (Sentinel-2 and Landsat-8) to predict the extreme flood inundation event, as shown in Table 3.93. The satellite observations are retrieved and processed through the Google Earth Engine (GEE) platform (https://earthengine.google.org/). The GEE is a cloud computing platform that provides a free geospatial dataset from several agencies with a high-performance computing capability. The flood inundation extents are estimated by classifying satellite images using the normalized difference water index (NDWI). Such classification of satellite images was driven based on the normalized difference water index (NDWI) through the difference between the green and near-infrared wavelength values. The following figure shows that larger extended areas have received floodwater during the 2020 flood events. The hazard must first be identified and comprehended in the next step to identify the urban areas affected by floods. As a result, it is necessary to identify the causes of floods and their likelihood in terms of velocity, inundation depth, flood extent, and flood duration. Such understanding is required to design and suggest potential mitigation methods for limiting and minimizing the impact of floods.



Source: Compiled by the JICA study team based on Sentinel-2 and Landsat-8 datasets

Figure 3-144 Developed maps for flood-prone areas based on Google Earth Engine (GEE) to identify the flood extent in Aqaba

(3) Climate Change Analysis and Flood Modeling

1) Climate Change Analysis

a) Analysis of Climate Risks in Aqaba

Urbanized coastal Wadis in Aqaba are where the most significant population, tourism, industrial development, high levels of investment in built infrastructures, and environmental resources are at risk from climate change impacts. There are various recognized impacts of climate risk in coastal wadis, such as increasing rare rainfall storms that rapidly increase in frequency and intensity, frequent droughts and flash floods, storm surge flooding, sea level rise, saltwater intrusion, coastal erosion, ecosystem degradation, water and air pollution, heatwaves and dust. The recent comprehensive report of Jordan's Fourth National Communication Report on Climate Change (4th NC), submitted to UNFCCC and prepared by the Ministry for Environment (MoEnv) in Jordan is a crucial document for guiding the mainstreaming of climate change in all sectors policies, and strategies (**Table** 3.95).

The coastal zones at the Gulf of Aqaba were selected to assess the climate change impacts. The 4th NC report analyzed long historical local climate data of daily precipitation, min/max temperature, mean wind speed, and relative humidity provided by the Jordan Meteorological Department (JMD) and Ministry of Water and Irrigation (MWI). Furthermore, the flood risk in the Aqaba coastal zone was assessed based on SWAT and HEC-RAS models. In addition, the future climate projections were analyzed based on RCP4.5 and RCP8.5 scenarios. According to the 4th NC report, Jordan will witness a significantly drier climate. By the end of the 21st century, the precipitation tends to decrease by 15.8%, according to RCP 4.5, and by 47%, according to RCP 8.5. Some areas are expected to receive more precipitation, with a maximum increase of 19%, according to RCP4.5. It is said that future heavy rain days are rare. report summarizes the expected impacts of climate change on Jordan and the Aqaba coastal zone.

Table 3.95 Summarized climate change impacts from the 4th NC report

Trend	Details
A warmer climate	For the 2070-2100 period, the minimum air temperature will likely increase by +1.2 °C and 2.7 °C.
A drier Climate	The country will likely become drier for 2070-2100 as the precipitation tends to decrease by 15.8% and 47.0%. Some zones are subjected to receiving more precipitation with a maximum increase of 19%, according to RCP4.5.
Insignificant wind changes	Wind speed forecasts didn't indicate significant changes.
Mild decrease in relative humidity	For the 2070-2100 period, the relative humidity will likely decrease by 3%, according to RCP 4.5, and by 7.2%, according to RCP 8.5.
More drought, a contrasted water balance	The drought SPI indicator reveals an increasing drought trend in the northern part of the country. In contrast, the drought duration is ***likely*** to become longer, with more than 3 consecutive years and more than five years.
Intense precipitation and potential floods	There are no signs of heavy rain days (more than 20 mm); however, future trends indicate the probability of potential intense precipitation that decreases with time.
More intense heatwaves	Future predicted heatwave events are more severe in duration and magnitude, especially in the highland's regions of Madaba, Shoubak, and Q.A.I. Airport during March, April, and May months.

Source: Compiled by the JICA Expert Team based on the 4th NC report (2023) (key message climate projections)

b) Comprehensive evaluation of precipitation products over Aqaba

The JICA expert teams comprehensively evaluated historical and future climate models regarding spatial distribution, annual cycles, and frequency distributions of precipitation over Aqaba based on different statistical indices. Additionally, the autocorrelated time series data were subjected to the Mann-Kendall (MK) and Sen's slope estimator tests to identify trends. Various remote sensing data from satellite and reanalysis products, such as CHIRPS, PERSIAN, GSMAP, ERA5, GPCC, and JRA55, are employed to compare observed and remote sensing data to estimate the impact of climate change on extreme precipitation events over Aqaba.

Figure 3-145 summarizes the historical climate change analysis data over Aqaba. We utilized long-term daily rainfall data from the Global Precipitation Climatology Centre (GPCC) from 1982-2019 to analyze extreme events and related statistical trends.

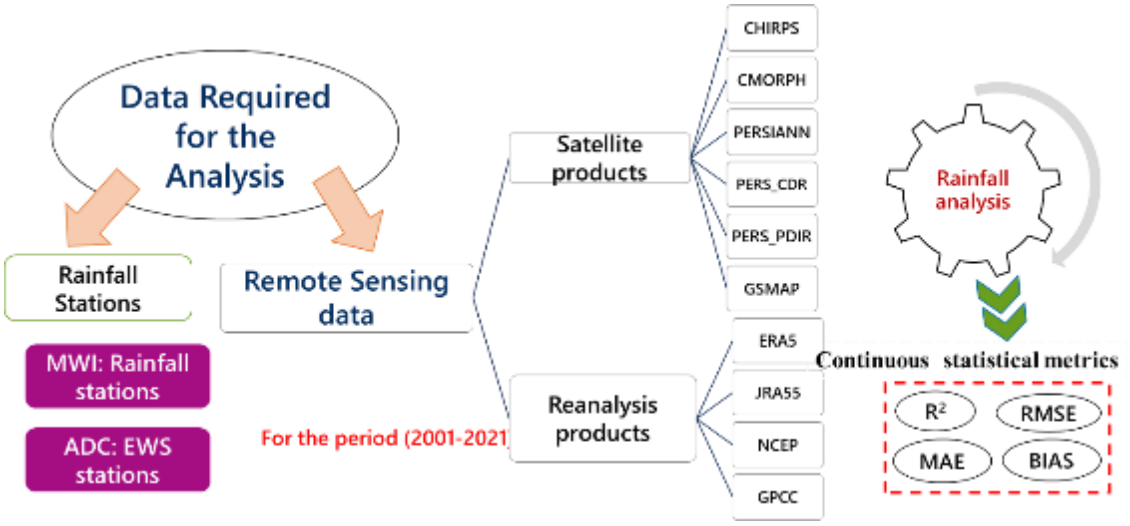


Figure 3-145 Collected observed and remote sensing data for historical climate analysis

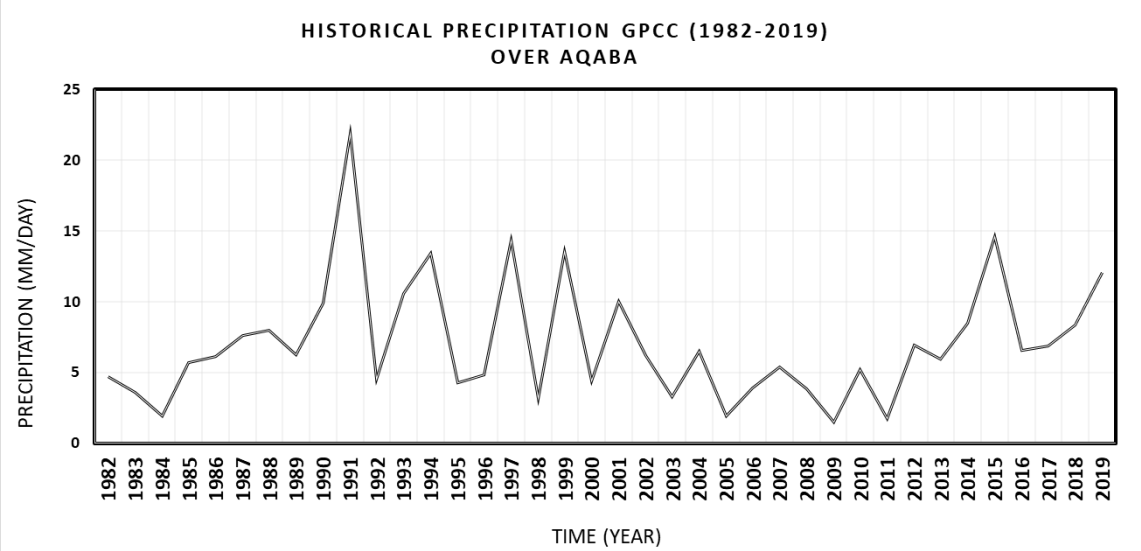


Figure 3-146 Time series (1982 – 2019) of GPCC data of the mean daily rainfall over Aqaba

Figure 3-146 shows the long-term rainfall variability over 37 years in Aqaba with high intra-annual and intra-seasonal variabilities. The long-term annual trend shows a decreasing tendency in rainfall over Aqaba. The GPCC dataset showed that the ranges of rainfall anomalies in Aqaba increased from 5 mm before 1989 to 23 mm after that year. The frequency of extreme flash flood events increased from two times per decade before 1989 to five times per decade.

c) Climate Change Analysis over Aqaba using d4PDF (Database for Policy Decision making Future climate change) datasets

Significant global warming has occurred in the last five decades (Jarraud and Steiner, 2012; Mancosu et al., 2015). If current greenhouse gas (GHG) emissions rates are maintained, the global average temperature will likely increase by nearly 5°C or more by the end of the 21st century (Krishnan et al., 2020). Given the significance of global warming effects, there is an

increase in future extreme weather events. Therefore, the JICA study team investigated long-term high spatial-resolution gridded data of past, present, and future periods over Aqaba based on different warming scenarios from a large ensemble high-resolution database, d4PDF (Database for Policy Decision-making for Future Climate Change). Two future scenarios (+2 K, and +4 K) of the d4PDF datasets will be used to analyze future climate risk under the influence of the increase in global mean temperature by 2°C to 4°C by the year 2100 (Figure 5.9-4). These scenarios correspond to a Representative Concentration Pathway (RCPs), RCP2.6, and RCP8.5, scenarios of the rising radiative forcing pathway leading to 2.6 and 8.5 W/m2 in 2100, respectively, as shown in **Figure** 3-147.

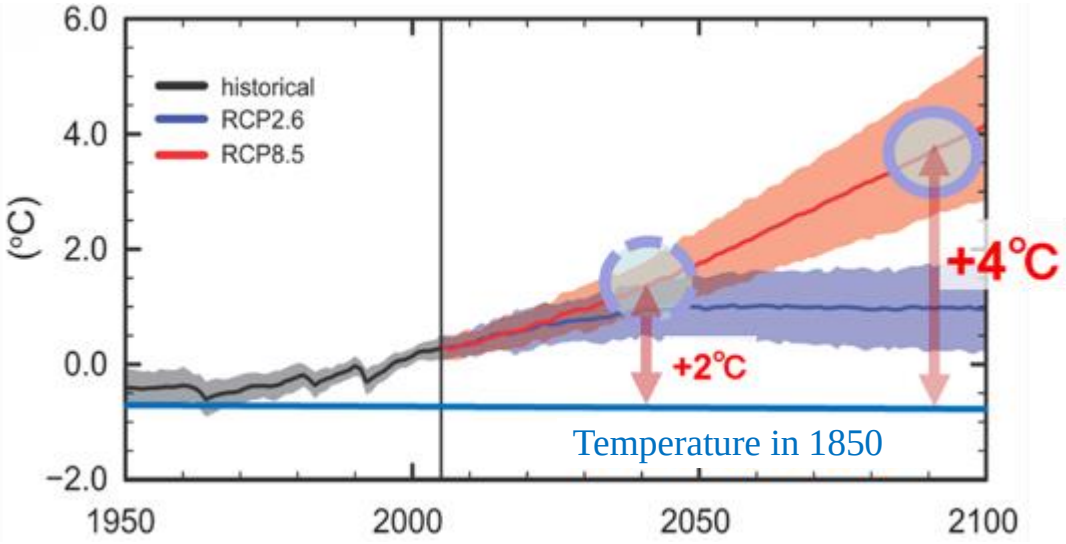


Figure 3-147 RCP scenarios presented in the d4PDF database (Source: https://www.miroc-gcm.jp/d4PDF/design_en.html)

This d4PDF database was developed through the joint project of the Meteorological Research Institute (MRI) of the Japan Meteorological Agency (JMA), Atmosphere and Ocean Research Institute of the University of Tokyo, Disaster Prevention Research Institute (DPRI) of Kyoto University, National Institute of Environmental Study (NIES), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), and University of Tsukuba (https://www.miroc-gcm.jp/d4PDF/index_en.html) to predict the future climates under different global warming levels (+1.5 K, +2 K, and +4 K degree increase in global mean temperature) by running numerous climate simulations using a high-resolution global atmospheric model AGCM-3.2 at a 60-km resolution (Mizuta et al., 2017). This database was created mainly to contribute towards disaster risk reduction through precise climate change analysis (Kawasaki et al., 2017; Nies, 2015), and it consists of outputs from multiple global warming simulations by a global atmospheric model with a horizontal grid spacing of 60 km.

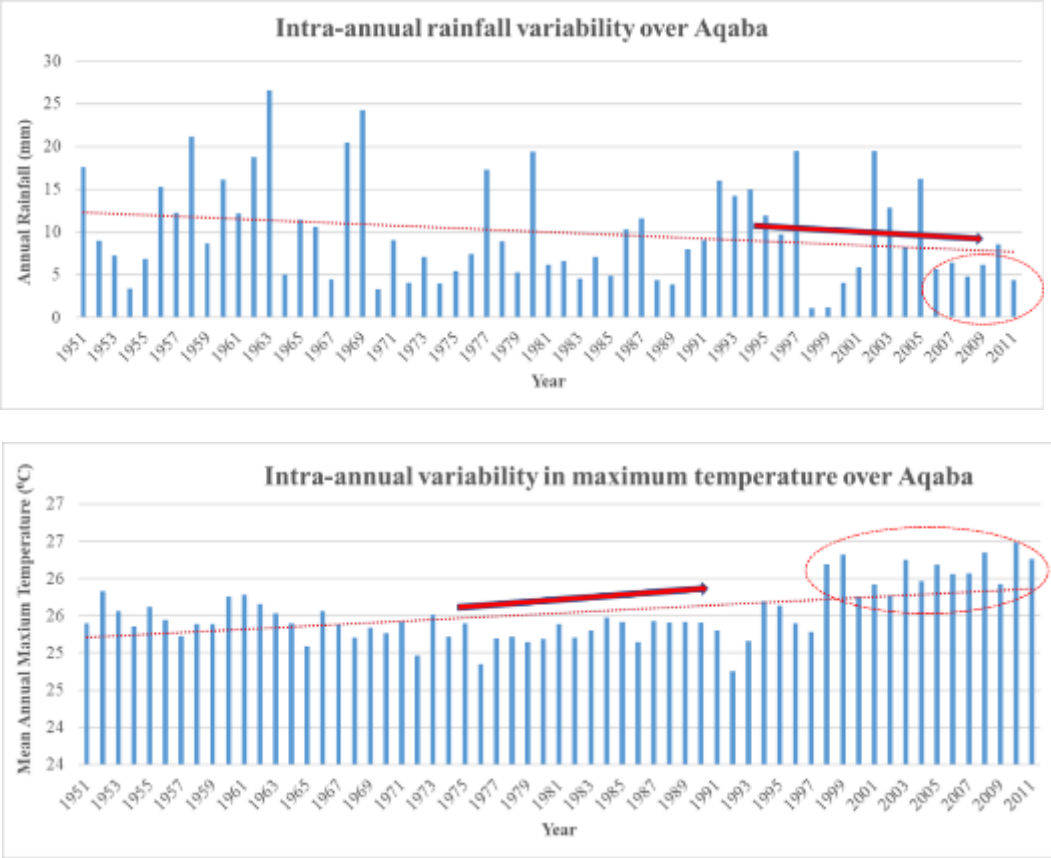


Figure 3-148 Intra-annual variability of rainfall and maximum temperature over Aqaba during 1951-2011

We selected d4PDF differently from the data used in the 4th NC (2023) to estimate the future potential risk due to its strengths (reducing the uncertainty in prediction) and advances (with the inclusion of the large number of ensemble members varying with different initial boundary conditions such as sea surface temperature, sea ice, the concentration of greenhouse gases, sulfuric acid aerosol, ozone, and volcanic aerosol and external forces). It is a large ensemble dataset (each set of experiments has 54 to 90 ensemble members each for future 4°C warming (+4K), and 2°C warming (+2K), respectively), for which initial conditions and lower boundary conditions are set differently, with varied external forces. The lower boundary conditions are set differently with varying external forces to cover internal climate variability and reduce uncertainty in extreme climate prediction. Hence, this database is used for impact assessment studies because, it decreases prediction uncertainty and has been widely used in impact assessments and adaptation plans related to global warming (Ishii and Mori, 2020). These data were created mainly for impact assessment studies and adaptation planning for global warming and are available over specific periods, such as (+2K -warming scenarios available from 2031-2091, and +4K warming scenarios available from 2051 onwards).

The adequate length of daily rainfall values and temperature data were used to aggregate annually to analyze variability and change detection. The results are illustrated in a time-series graphical format for temporal variation in **Figure** 3-148. Relative statistics were performed to investigate the variability and magnitude of change in climate variables and

extreme weather events over historical and future periods. The analysis indicated some promising vital results. Temporally, the intra-annual rainfall has decreased over the past six decadal periods from 1951 to 2011 over Aqaba, with a higher fluctuation rate in minimum and maximum annual rainfall. On the other hand, a significantly increased trend has been observed for the intra-annual variability of maximum temperature over Aqaba. A consistent increase in temperature increases warming over the period in Aqaba, and there will be a higher probability of increasing extreme weather events in the future, such as prolonged dry spells leading to droughts and intensifying convective rainfall in short periods, leading to frequent flash floods. The synergy between prolonged droughts and too much rainfall in short periods generates extreme flash floods.

d) Other data for possible future climate scenarios

We examined the impacts of climate change on rainfall in the latest Coupled Model Intercomparison Project Phase 6 (CMIP6) over Aqaba under medium-emission (SSP2-4.5) and high-emission (SSP5-8.5) scenarios. **Figure** 3-149 displays a larger rainfall increase of more than 40 mm in some specific years. Climate models are constantly updated, as different modeling groups worldwide incorporate higher spatial resolution, new physical processes, and biogeochemical cycles. These modeling groups coordinate updates around the Intergovernmental Panel on Climate Change (IPCC) assessment report schedule. The new featured version released recently is the Coupled Model Intercomparison Project (CMIP6). CanESM5, MIROC5, and MIROC6 datasets from CIMP6 were downscaled to give the future precipitation under the SSP5 scenario. In (CIMP5-AR5), four Representative Concentration Pathways (RCPs) examined possible future greenhouse gas emissions. These scenarios are RCP2.6, RCP4.5, RCP6.0, and RCP8.5. The updated scenarios in (CIMP6) are SSP1-2.6, SSP2-4.5, SSP4-6.0, and SSP5-8.5, each resulting in similar 2100 radiative forcing levels as their predecessor in AR5. The provided (CanESM5, MICRO5, and MICRO6) daily data were downloaded and disaggregated hourly using the IMD empirical reduction formula.

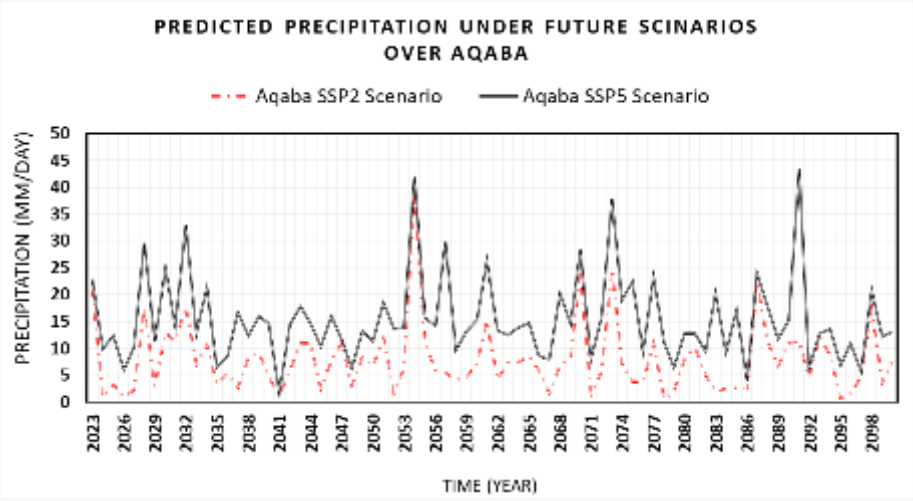


Figure 3-149 Future precipitation (2023 –2089) of CMIP6 data for medium and high-emissions over Aqaba

The ratio of change in precipitation for the 100 return periods for the historical and future scenarios over the period (2060-2100) is presented in **Figure** 3-150. Thus far, depth-duration-frequency analysis (IDF) has been computed. The change ratio has been calculated between the historical and future periods (2060-2100). For T=100-year, there will be an increase of almost three times compared to the current situation. The expected change extended to a broader area of Aqaba. Based on the future climate scenarios, there are various discrepancies in rainfall occurrence in spatial and temporal distributions over Aqaba. Therefore, within the JICA study, we will consider the climate change scenarios as if rainfall will increase by 1.20, 1.40, 1.60, 1.80, two and three times compared to the current situation. However, our climate is changing, and the constructed structures, such as dams in Aqaba, are static. Not only static but also reservoir capacity is losing its volume due to reservoir sedimentation, one of the leading causes that aggravated the disaster. All cascade dams constructed in Aqaba lack spillways, reducing overtopping risks. Therefore, the overtopping risks of the earth-rockfill dam must be analyzed by ASEZA to ensure cascading dam safety under climate scenarios.

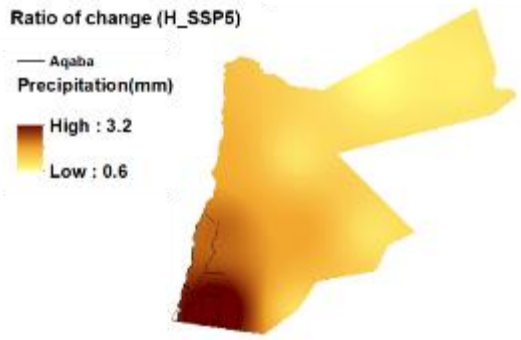


Figure 3-150 The change ratio for the extreme precipitation of a 100-year return period between historical and SSP5 (H_SSP5: 2060-2100) over Jordan.

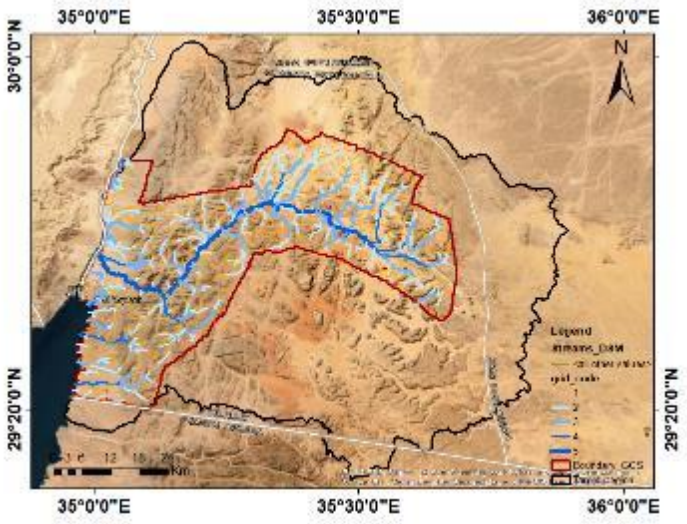
e) Intensity-Duration-Frequency curve (IDF curve)

An intensity-duration-frequency curve (IDF curve) is a mathematical relationship that relates the rainfall intensity with its duration and frequency of occurrence. There are two main steps in IDF curve development: (1) extraction of annual maximum precipitation intensities for a specific duration. (2) Fitting the probability distribution to the annual maximum to estimate the precipitation intensity of different return periods. This study used the IDF curves developed by WAJ 1986 and USAID (CDM, 2011). A detailed study is recommended to update the developed IDF curves over Aqaba to consider the impact of climate change on the IDF curves for water management infrastructures. Minimal studies are related to the development of IDF curves under future climate scenarios over Aqaba. Most of the previous works were for the historical period.

2) Flood Modelling Applications

Two software programs, Rainfall-Runoff-Inundation (RRI) and Personalized Computer Stormwater Management Model (PCSWMM), were used to assess the flood-prone areas in the Aqaba catchment. The primary purposes are to develop flood hazard maps for different return periods of 2, 10, 50, and 100 years and climate scenarios of 1.20, 1.4, 1.6, 1.8, 2.0, and 3 times the current conditions. The 100-year return periods were selected to study flood inundation in city-scale scenarios by using PCSWMM. Both software programs were calibrated and validated based on the data collected from ADC stations.

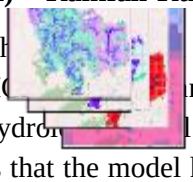
The study area is part of the Wadi Yutum catchment, as shown in the **Figure** 3-151. The catchment is characterized by dendritic wadi networks that drain its flood discharge to the red sea in Aqaba. The mountainous catchment geology consists mainly of igneous granite rocks that keep the high surface flow to the downstream areas.



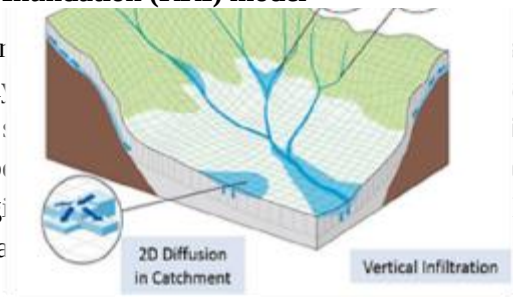
Source：JICA Study Team

Figure 3-151 The boundary of the study area is in the red boundary line, which is a part of the. Wadi Yutum catchment

a) Rainfall-Runoff Inundation (RRI) model



Th Centr ard and Ris ment (I n (Say o-dimensional distributed hydro l that on. One of its advantages is that the model has b d inund arid and semi-arid reg Petra in simulates the latera flow,



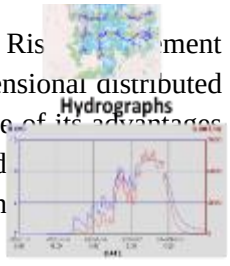


Figure 3-152. The lateral subsurface flow is treated in terms of the discharge-hydraulic gradient relationship, which considers the saturated surface and subsurface. One of its advantages is that it can address slopes and river channels separately. This adds to its successful performance in simulating flood inundation and conducting hazard mapping and real-time inundation prediction in different regions worldwide (Try et al., 2020). It is also

used to elucidate flooding characteristics and assess flood risk at the river basin scale. Two-dimensional wave-diffusion models compute the flow on the slope grid cells. In contrast, one-dimensional wave-diffusion models are used to determine the flow in the river channel. In addition, the RRI model simulates surface flow, vertical infiltration flow, and lateral subsurface flow for better representations of rainfall-runoff-inundation processes. The governing equations of the model are derived based on the following mass balance equation (1) and momentum equation for gradually varied unsteady flow.

$$\frac{\partial h}{\partial t} + \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y} = r - f \qquad (1)$$

where *h* is the height of the water from the local surface, *qx* and *qy* are the unit width discharges in the x and y directions, r is the rainfall intensity, f is the infiltration rate, and H is the height of water from the datum.

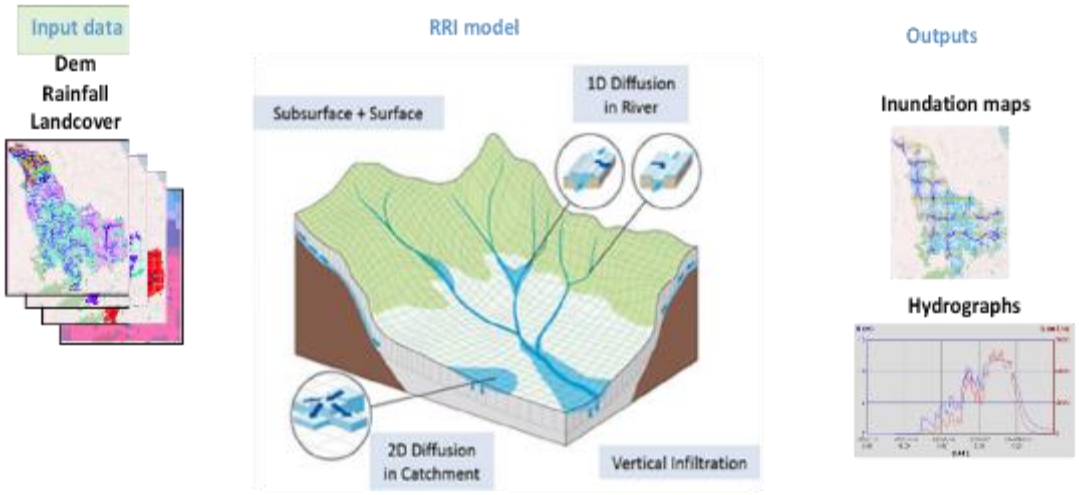


Figure 3-152 Schematic diagram of required data, concept, and expected outputs of the RRI model (Sayama et al., 2012).

Model Simulation

Several inputs, such as topographic data, rainfall data, soil type, and land use, are needed. The topographical data inputs for the RRI simulation include the digital elevation model (DEM), the flow direction (DIR), and the flow accumulated (ACC) models. This study employed a high-resolution digital surface model (DSM) with a resolution of 2.5 m, and the DIR and the ACC were generated using ArcGIS software. The DSM was selected for its ability to capture the environment's natural and built/artificial features, and it is recommended for hydrologic simulation and flood inundation studies. These topographic data were resampled from 2.5 m to 100 m and 200 m to reduce the simulation period. The Ministry of Water and Irrigation (MWI) obtained the land use data. The land use was reclassified into two groups to simplify the calculation. The upper part of the catchment, which is located in the mountainous areas, was assumed to be type A (surface flow model), and the lower part of the catchment, which is located in the coastal wadi and the existing ASEZ city, was considered type C (lateral subsurface flow model). We assumed this

assumption to eliminate the loss due to infiltration. This adds to compensate for the excluding part from the entire basin. For the precipitation data, 14 stations were collected from the early warning system (EWS) from 2020 to 2023 for each 15 minutes. Additionally, the model requires information on the cross-sectional geometry and river channel locations. The cross-section of the river in the RRI model was assumed to be rectangular with a width of W, a depth of D, and an embankment height of He. The width and depth parameters (Cw, Cd) were found through the upstream contributing area, A (km2), of Equations (2) and (3).

$$W = C_w A^{sw} \quad (2)$$

$$D = C_d A^{sa} \quad (3)$$

The simulation results of the RRI are sensitive to the cross-sectional parameters of a river [3]. These parameters were adopted based on the observed cross-section data at the SG01 station. The model was calibrated by adjusting the input parameters to obtain realistic results for 13-14 March 2020 and then validated for 29 May 2023 for 200 m and 100 m resolutions. The RRI simulation procedure is depicted in **Figure** 3-153. To improve the model performance, we checked the reliability of the observed data from the ADC and ASEZA. Based on our analysis and the preliminary simulation of the received DEM data, we decided not to use the DEM provided by the ADC. JICA purchased high resolutions of 2.5 meters and calibrated and validated the digital surface model (DSM) for 1,910 km^2. Furthermore, several sensitivity analyses for the model were conducted to check the effects of gride mesh sizes of 200 m, 100 m, and 40 m. The flash flood event in March 2020 was chosen to calibrate the model, and March and May 2023 were chosen for validation. A set of optimum parameters indicated the best-calibrated simulations and good calibration results.

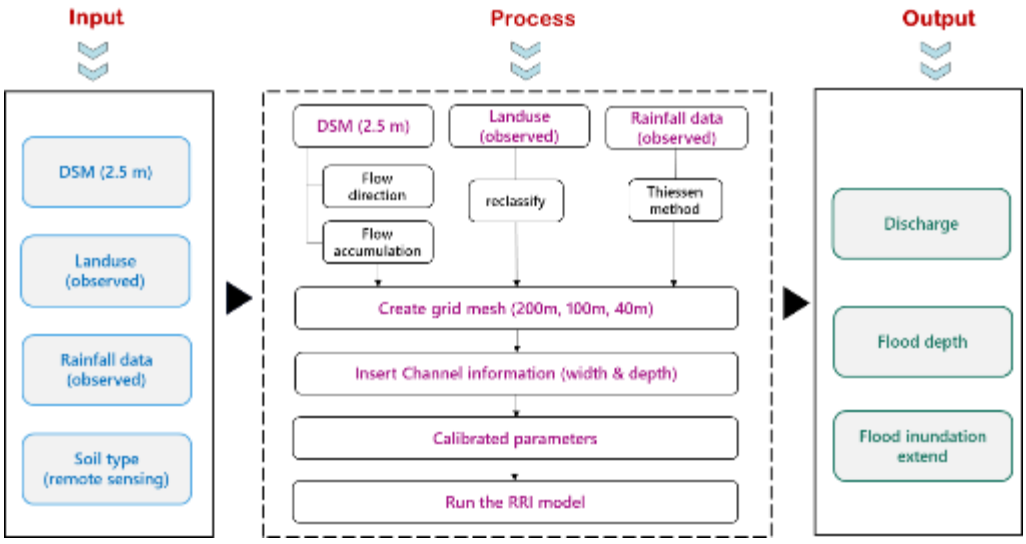


Figure 3-153 Schematic diagram of flood modeling procedure for RRI software.

Model Calibration

Figure 3-154 shows the spatial variation maps during the March 2020 flood event. The maximum rainfall occurred on March 13, with intensities varying from 0.6 mm /hr to 14.59 mm/hr. The maximum rainfall appears in the western part up to 50 mm and decreases gradually in the eastern part. **Figure** 3-154 and **Figure** 3-155 represent the input

precipitation data for the 13-14 March 2020 event. The cumulative rainfall, represented in **Figure** 3-154 for the simulation period from 12-17 March 2020, reaches 30 mm over the whole basin. The maximum rainfall intensity was recorded at approximately 6 mm/h over the whole basin at 13-03-2020 22:00. **Figure** 3-155 shows the variation in the total precipitation for the simulation period over the whole basin based on the Thiessen rainfall method. The maximum rainfall appears up to 50/storm in the western part and decreases gradually in the eastern part.

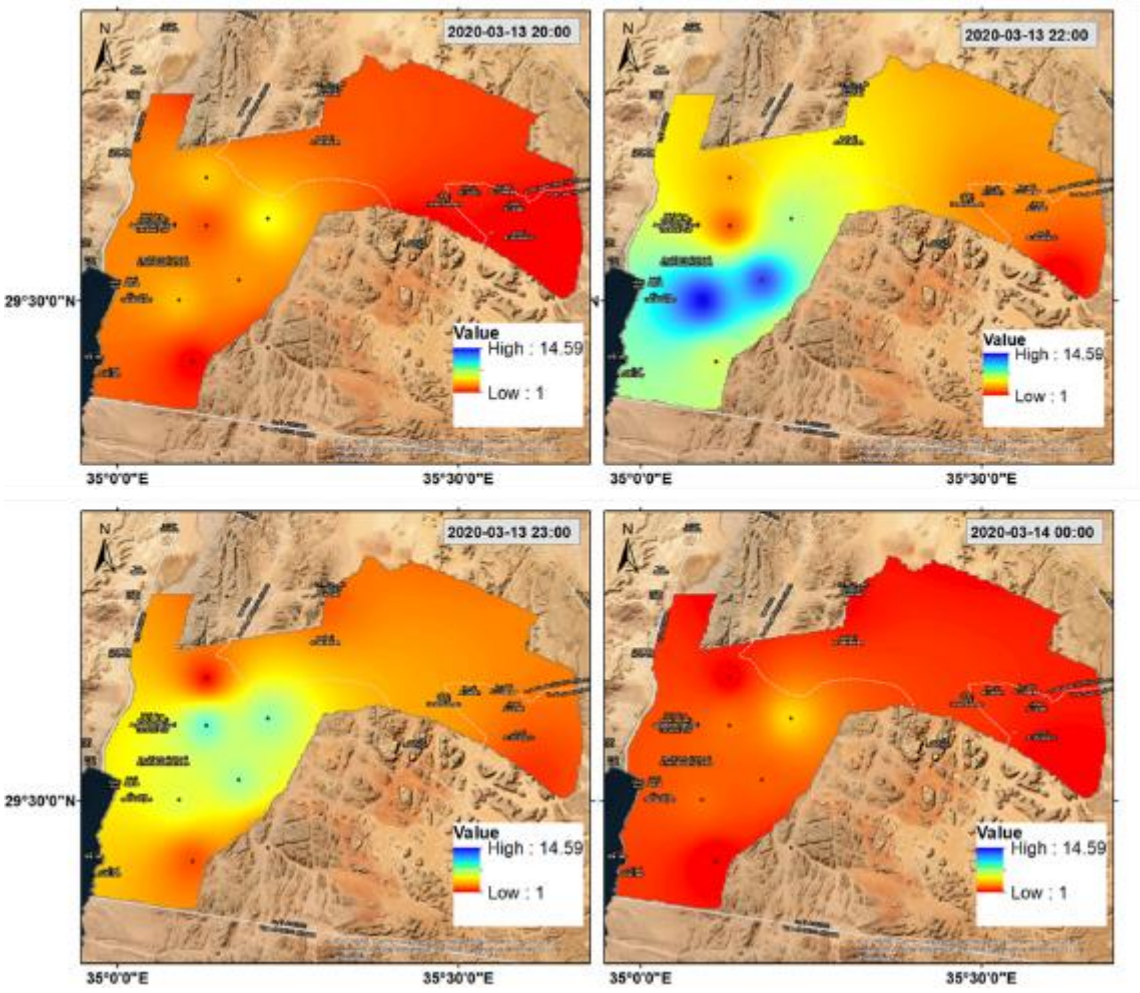


Figure 3-154 Spatial rainfall variation during the storm on 13-14 March 2020.

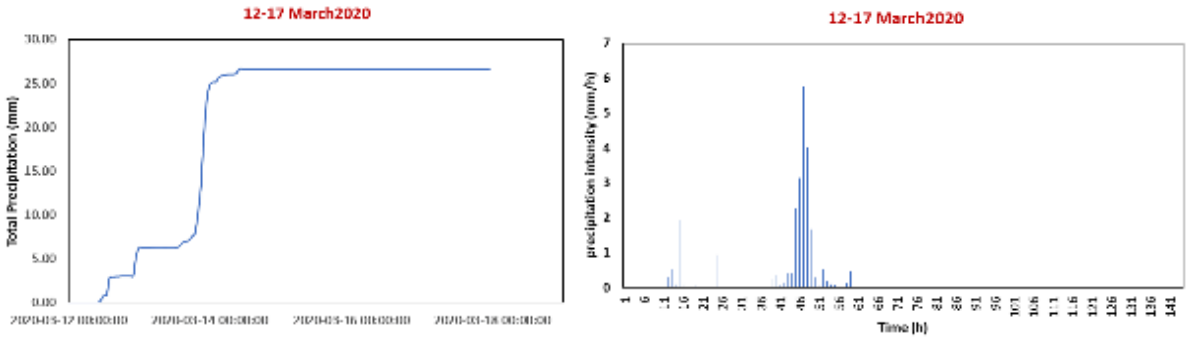


Figure 3-155 The cumulative rainfall for the 13-14 March 2020 event and hourly rainfall distribution for the 13-14 March 2020 event

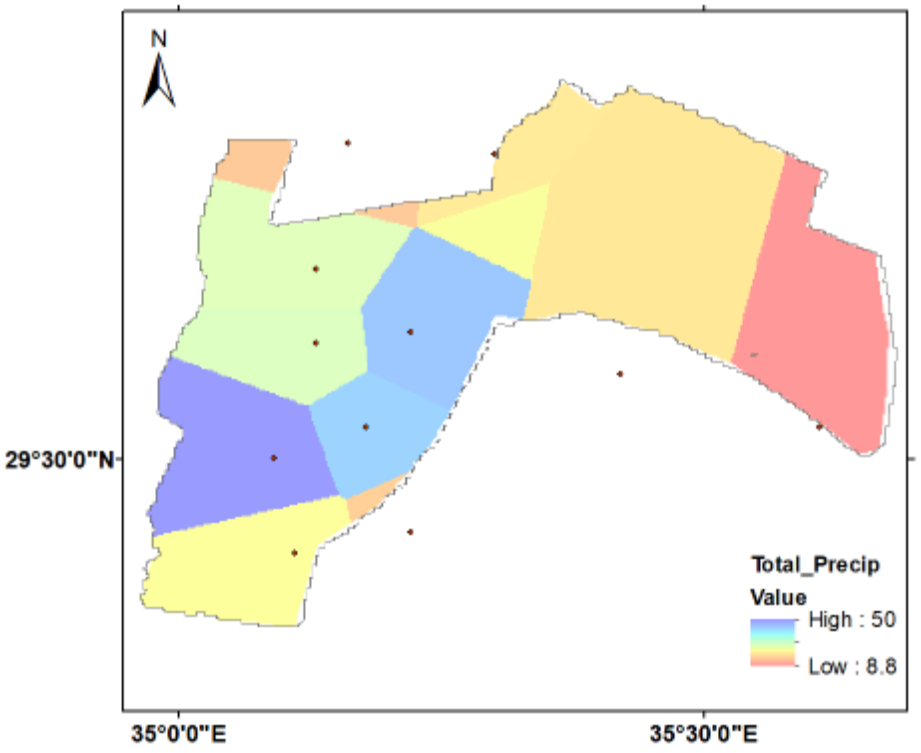


Figure 3-156 The spatial map represents the spatial distribution of rainfall over the simulated area.

The performance of the RRI is acceptable for predicting flow discharge, and inundation depths in the Aqaba catchment area. Therefore, we will use this model for developing flood hazard maps at different return periods under different climate scenarios. The model successfully simulated the discharge, flood inundation extent, and depth at both spatial resolutions, as shown in **Figure** 3-157. Both spatial resolutions of 200 m and 100 m mesh sizes reveal the same hydrograph value with an insignificant difference, which is approximately 450 m^3/sec; however, the 100 m resolution appears to have more detailed in flood inundation depth for constructing the flood hazard maps and the flood-prone areas. **Figure** 3-157 shows the March 2020 flood event simulation results at SG01. The simulated maximum flood depth at SG01 reproduced the observed flood depth well, reflected in the correlation value (0.9638). The simulated maximum flood peak was approximately 450 m^3/s. The simulated flood inundation extent was compared against the remote sensing data owing to the limited observed information on flooded areas. Sentinel 2 was chosen due to its good performance in predicting flood extent based on the literature, as explained in 3.8-18. The satellite observations are retrieved and processed through the Google Earth Engine (GEE) platform (https://earthengine.google.org/). The simulated flood maps reproduced well against the satellite image data at both spatial resolutions, as displayed in **Figure** 3-157. For instance, Sentinel-2 and the simulated result for 100 m estimated that Al-Hussein bin Aly Street and Al-Farouk Street were affected by the March 2020 event.

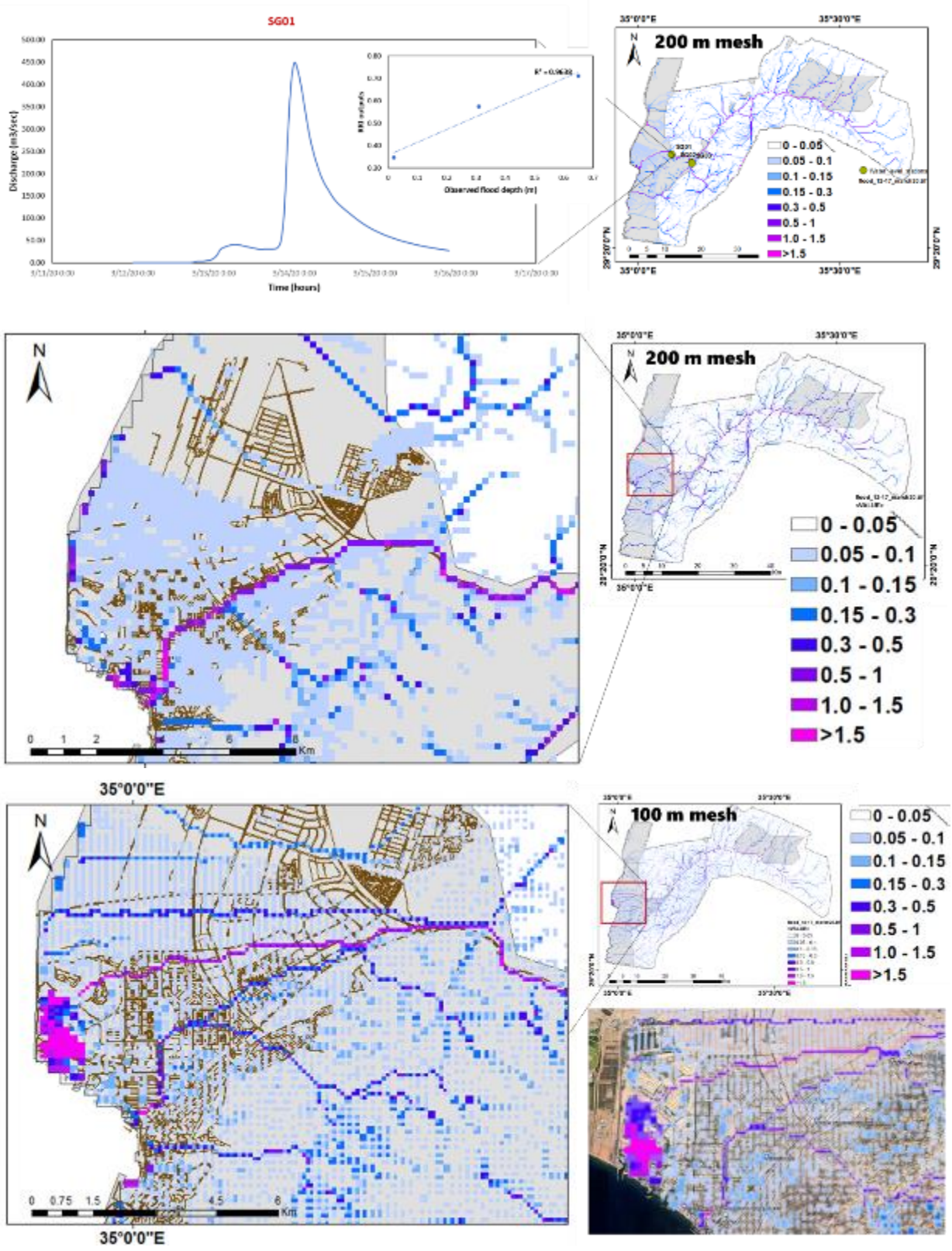


Figure 3-157 Results of RRI model calibration and sensitivity analysis of mesh sizes during March 2020

Validation of the model

The recent flood event of 29 May 2023 was employed to validate the RRI model. **Figure** 3-158 shows the variation in rainfall over the simulated catchment of Aqaba. The maximum rainfall intensity reaches 60.4 mm/storm over the northwestern part of Aqaba. This significant rainfall was reflected in the discharge with a 580 m^3/sec peak, as shown in Figure 3-159. The Sentinel-2 results, and simulated results matched in estimating the flood extent. For example, both estimated significant damage that affected the Al-shamya region, as shown in **Figure** 3-160 and **Figure** 3-161. Furthermore, we used the calibrated parameter values to validate the results in another two events during March 2023, as shown in **Figure** 3-160. The simulated peak discharges reached 270 m^3/sec on 13-15 March 2023 at SG01. The storm on the 24th and 25th of March with a maximum total rainfall of 16.6 mm within the southwestern part of Aqaba (coastal Wadi). The results of the flood inundation map were validated for the storm on the 29th of May 2023, as shown in **Figure** 3-161.

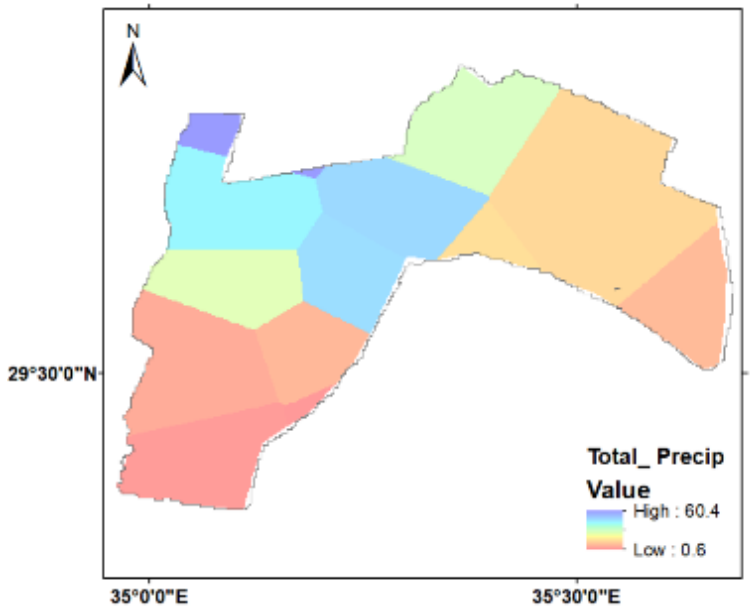
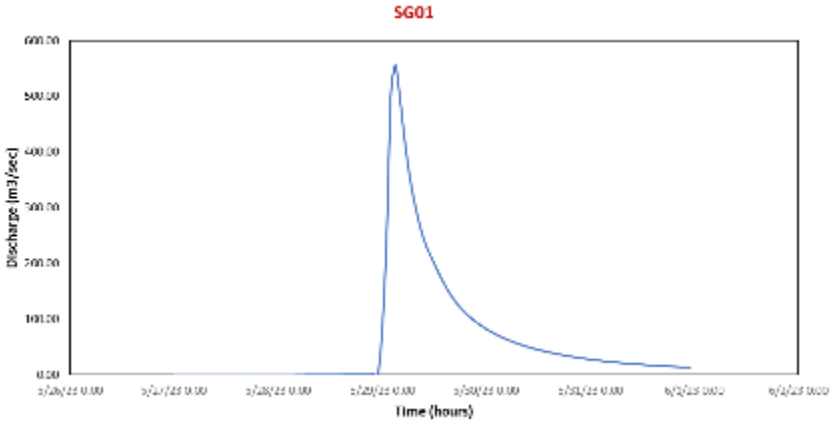


Figure 3-158 Spatial distribution of rainfall of the 29th of May flood event over the simulated area



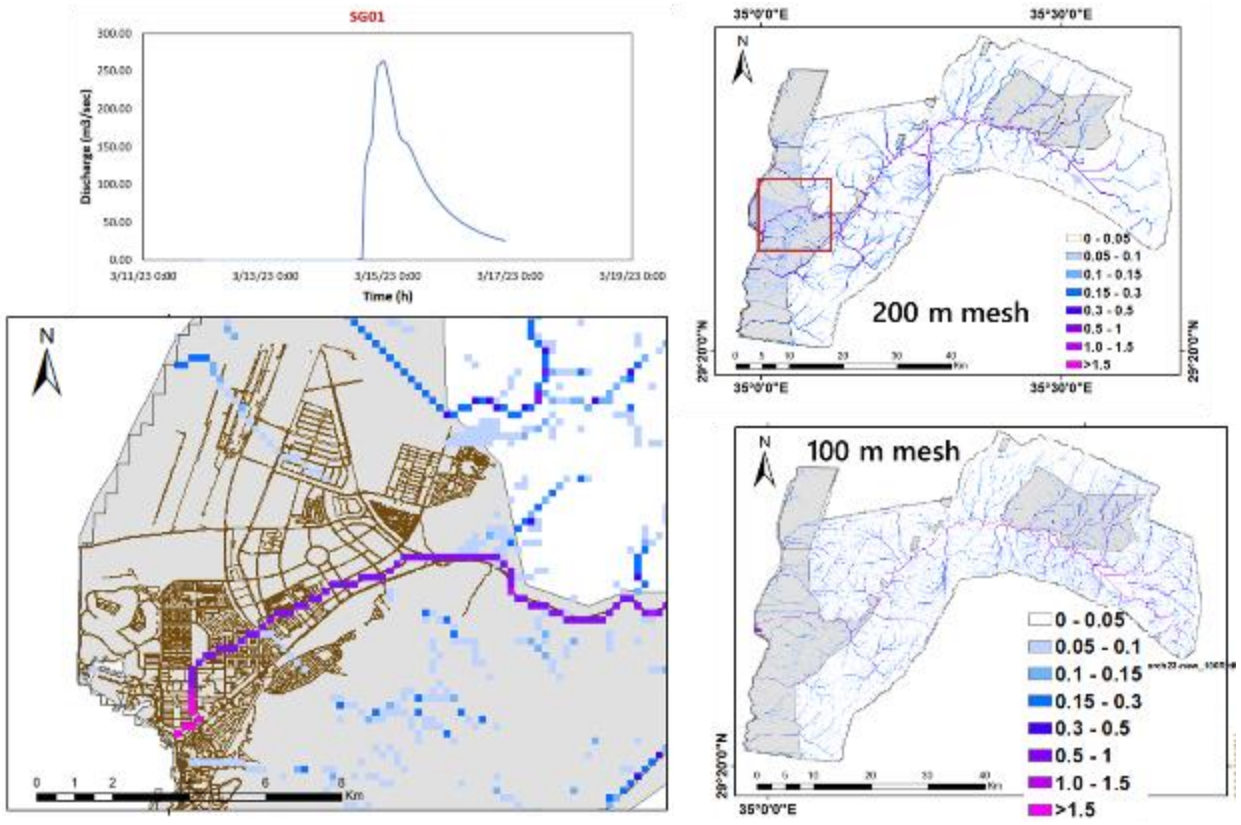


Figure 3-159 Hourly simulated hydrograph for 29th May 2023

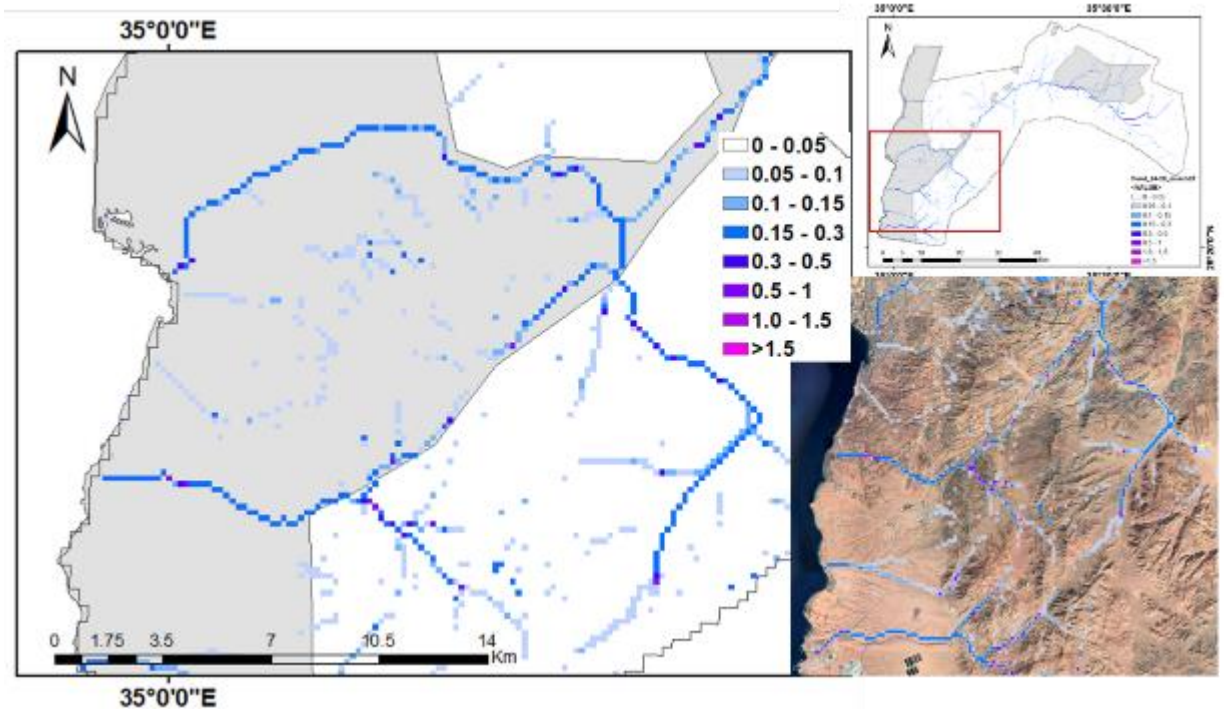


Figure 3-160 Validation results of the RRI model and sensitivity analysis of mesh sizes during 13-15 March 2023 and 24-25 March 2023

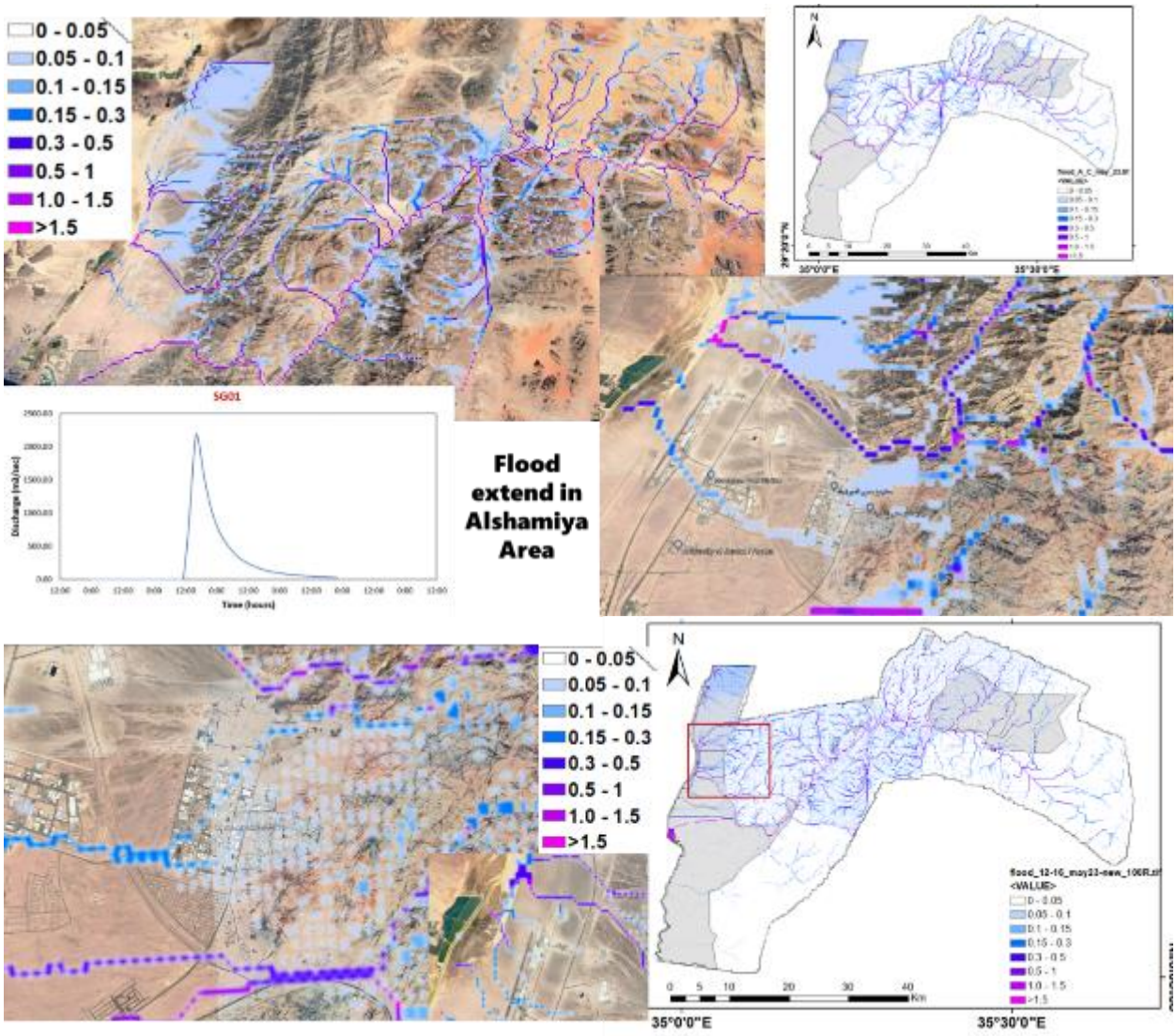


Figure 3-161 Validation results of the RRI model on the 29th of May 2023

b) PCSWMM Software

A second PCSWMM software was used to simulate the catchment- and city-scale mesh, licensed by Computational Hydraulics International (CHI). The PCSWMM software is based on the Storm Water Management Model (SWMM) model. It can simulate rainfall runoff, inundation, and other hydrological components, including surface runoff, infiltration, and flood routing (James et al., 2010). **Figure** 3-162 summarizes the simulation procedures for the PCSWMM model. Two mesh sizes of 200 m (catchment scale) and 40 m (city scale) were used. The model parameters were calibrated using the March 2020 flood event and validated based on the rainfall storm on March 2023. The model needs to consider the city scale and zoning of the flood-prone area for a resilience master plan. Furthermore, PCSWMM enables us to include Low Impact Development (LID) scenarios and other mitigation scenarios, such as disconnected green roofs, rain gardens, porous pavements, and other nature-based solutions to cope, with the increased rainfall events due to climate change scenarios.

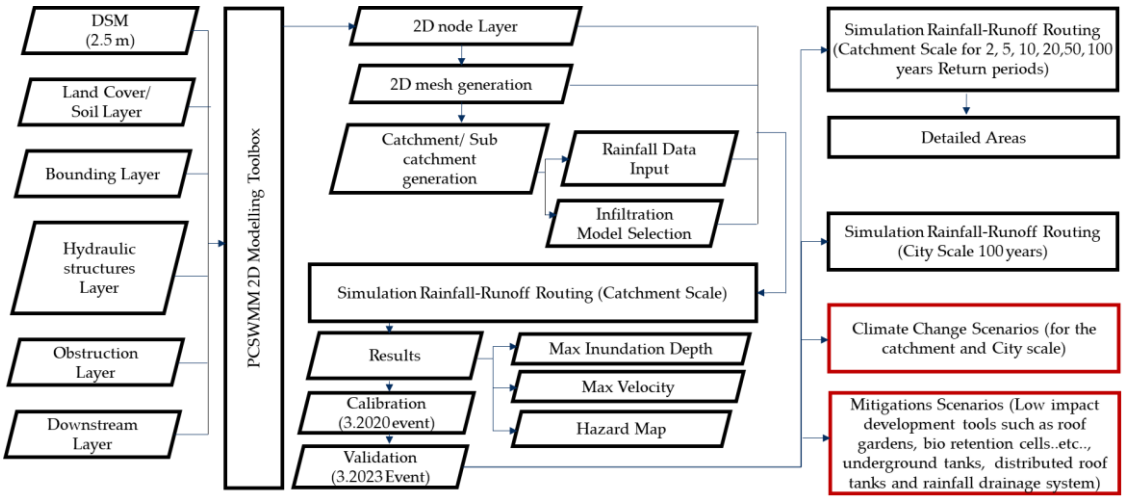


Figure 3-162 Simulation procedure of PCSWMM model

Model Setup, Calibration and Validation

Effectively predicting the flood depths, flow discharges, and velocities in the catchment and the city scale depends on the quality of the model input data and calibration parameters (

Figure 3-163). Various sensitivity analyses for catchment parameters, such as Manning's roughness and initial and maximum soil infiltration capacities. After we selected the storm event in March 2020, we compared the observed inundation depth at SG01 of 65 cm and the simulated depth at the exact location of 68 cm. Additionally, two parameters (percent impervious area and initial abstraction) were adjusted to match the flood inundation depth.



Figure 3-163 PCSWMM model setup of nodes, conduits, and outfalls preprocessing

The results of the PCSWMM flood inundation maps at the catchment scale are shown for model calibration and validation of different storms in different years. The inundation depth in the catchment was found to vary between 0.005 and 0.83 m for 2020 and 0.005 and 0.32 m for the 2023 events. The maximum flood depth in March 2023 was found in the Al Moshtarak area parallel to the South Beach Highway (**Figure** 3-164).

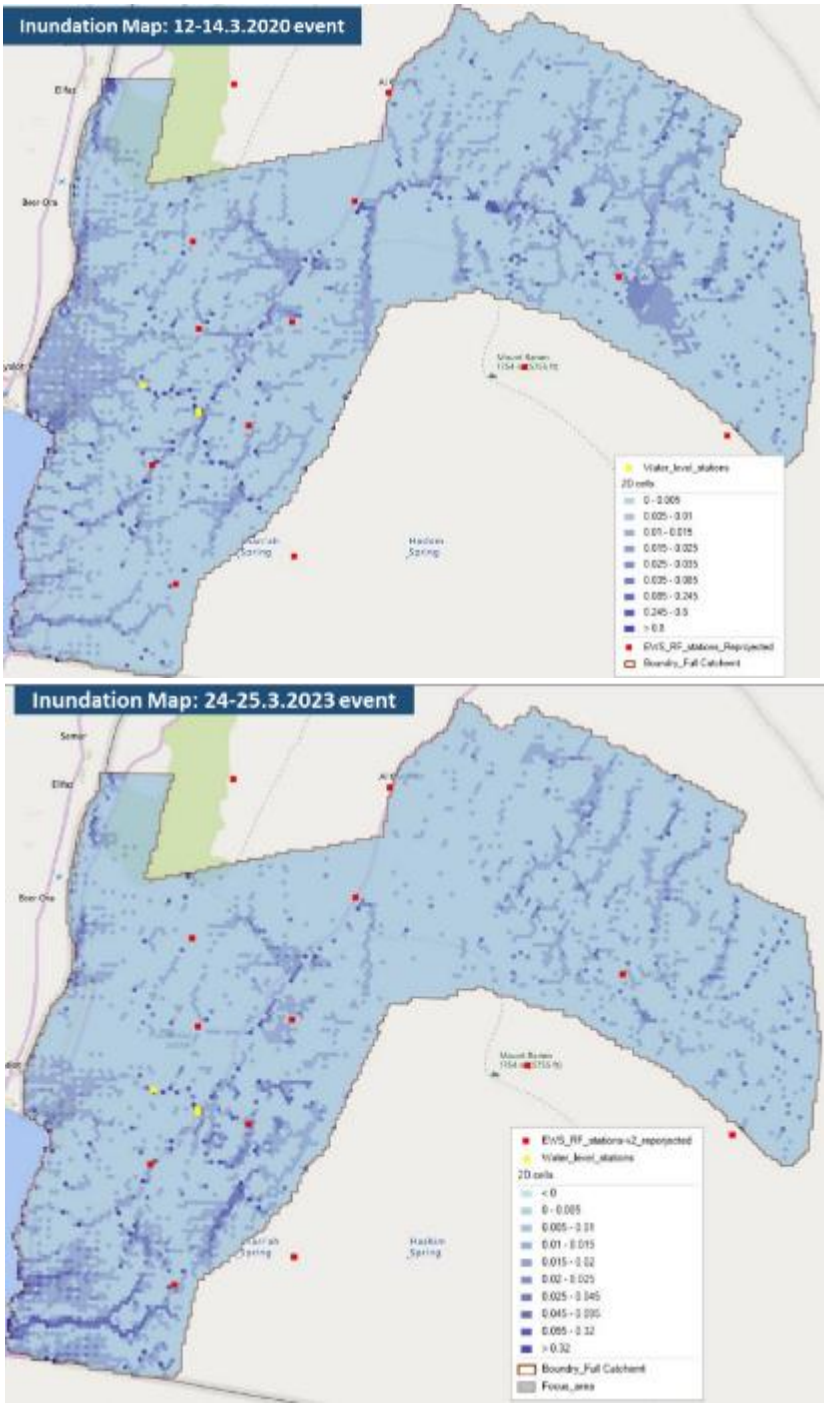


Figure 3-164 Calibration and validation results of flood inundation maps using the PCSWMM model

3) Flood Hazard Maps in the Catchment Scale of Different Return Period

a) RRI simulation results of different return period

The simulated peak inundation depth and flow discharges in different areas of the Aqaba catchments are presented in **Figure** 3-165 and **Figure** 3-166. The simulated inundation depths, flood extent areas, and runoff discharges gradually increase with the return period.

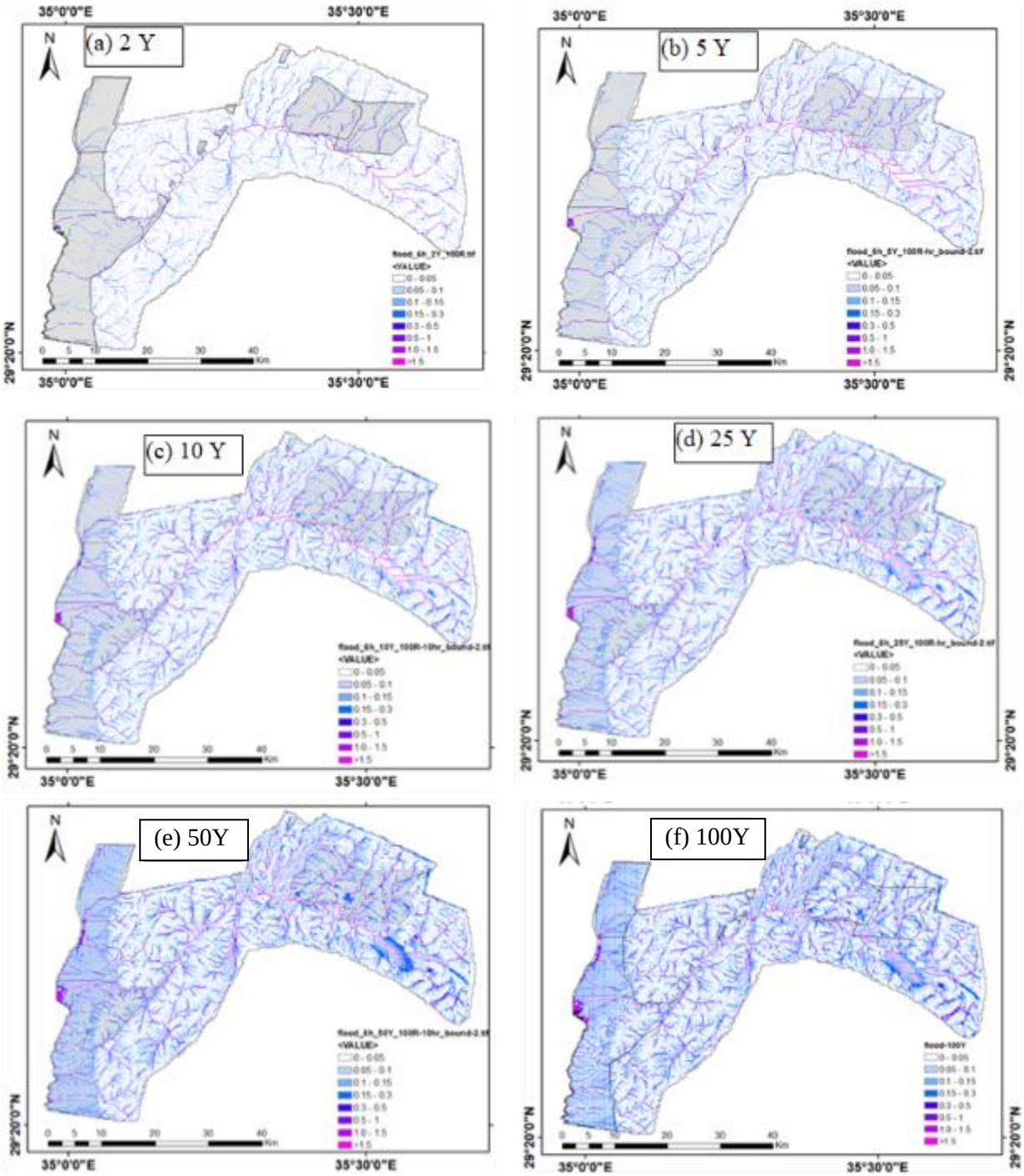


Figure 3-165 Flood map for different return periods (a) 2 Y (b) 5Y (c) 10 Y (d) 25Y (e) 50 Y (f) 100Y

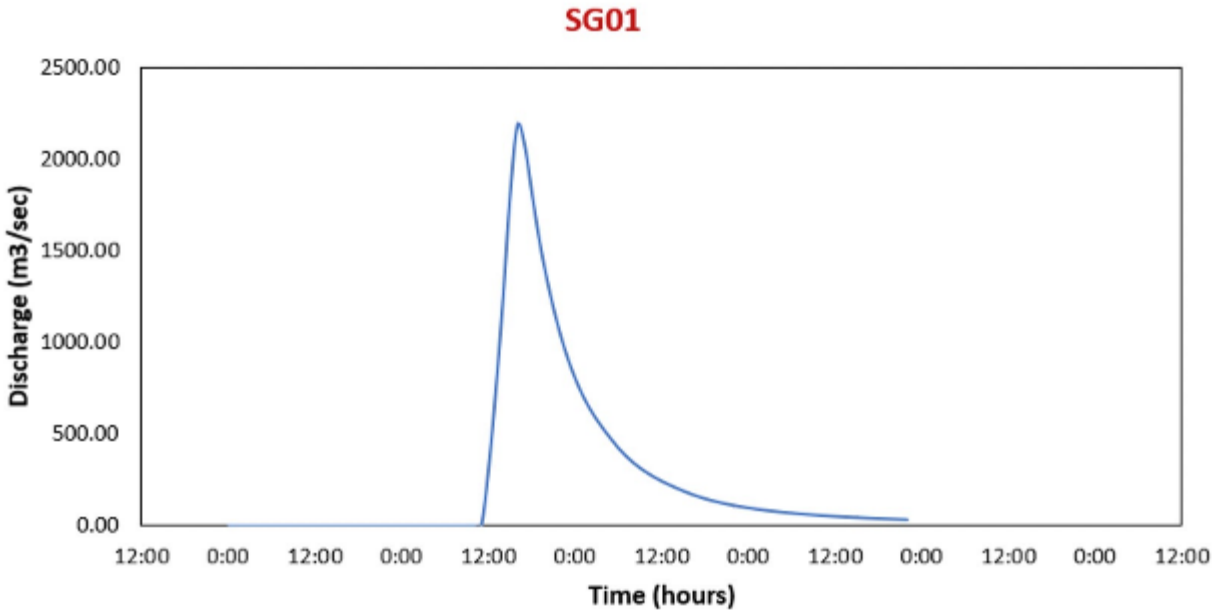


Figure 3-166 Flood hydrograph of the simulated discharge for the 100-year return period

Figure 3-165 reveals the variation in flood inundation depth for different return periods. The flood depth increases gradually by increasing the time step. The simulated 100 Y return period illustrates the worst case compared with the other return periods. Therefore, it is recommended to be considered for future design of the infrastructures constructed in the city. Additionally, it is worth mentioning that the left side region of the K-Hussien International Airport and the areas with the main channel flowing through will be the most affected. This is reflected in the increase in the flood depth from 0.3-0.5 m in the 2 Y simulated results to greater than 1.5 m in the 100 Y simulated results. Similarly, the maximum discharge increased to approximately 2500 m3/sec for the 100 Y return period, as shown in **Figure** 3-166. All simulated results reported in **Figure** 3-165 show the flood spread over Aqaba city and identify the limited flood-prone areas for six different return periods. The flood inundation depths and the total inundated areas can be estimated based on the simulated results by the RRI model. The RRI model is a suitable tool for predicting and assessing future rainfall storms and is shared with stakeholders and different Aqaba directorates and departments.

b) Assessment of Flood Hazard Maps in the Catchment Scale

Figure 3-167 and Figure 3-168 display the flood hazard ranking maps developed based on peak inundation depth and inundated areas simulated by the RRI model of different return periods and the ratio of the flood-prone areas. The flood hazard was categorized into four categories: shallow, low, moderate, high, and very high, with inundation depth ranges of 0–0.1 m, 0.1–0.3 m, 0.3-0.7 m, 0.7–1.5 m, and >1.5 m, respectively. The simulated hazard maps for the 2Y return period for the categories shallow, low, moderate, high, and very high were found to be 96%, 3%, 1%, 0%, and 0%, respectively; however, the simulated hazard maps for the 100Y return period were found to be 76%, 18%, 3%, 2%, and 1%, respectively. These results reveal a significant decrease in the very low category by 10%. On the other hand, the low category increased by 15%. However, the high and very high categories show

a slight increase of 2% and 1%, respectively. In the current climate condition, 2% of the Aqaba area falls under the high flood hazard category in the 100 Y return period. The flood hazard maps indicated that the city's central portion is more prone to floods concerning the flood depth and inundation areas. The flood drainage channels are classified as medium, high, and very high.

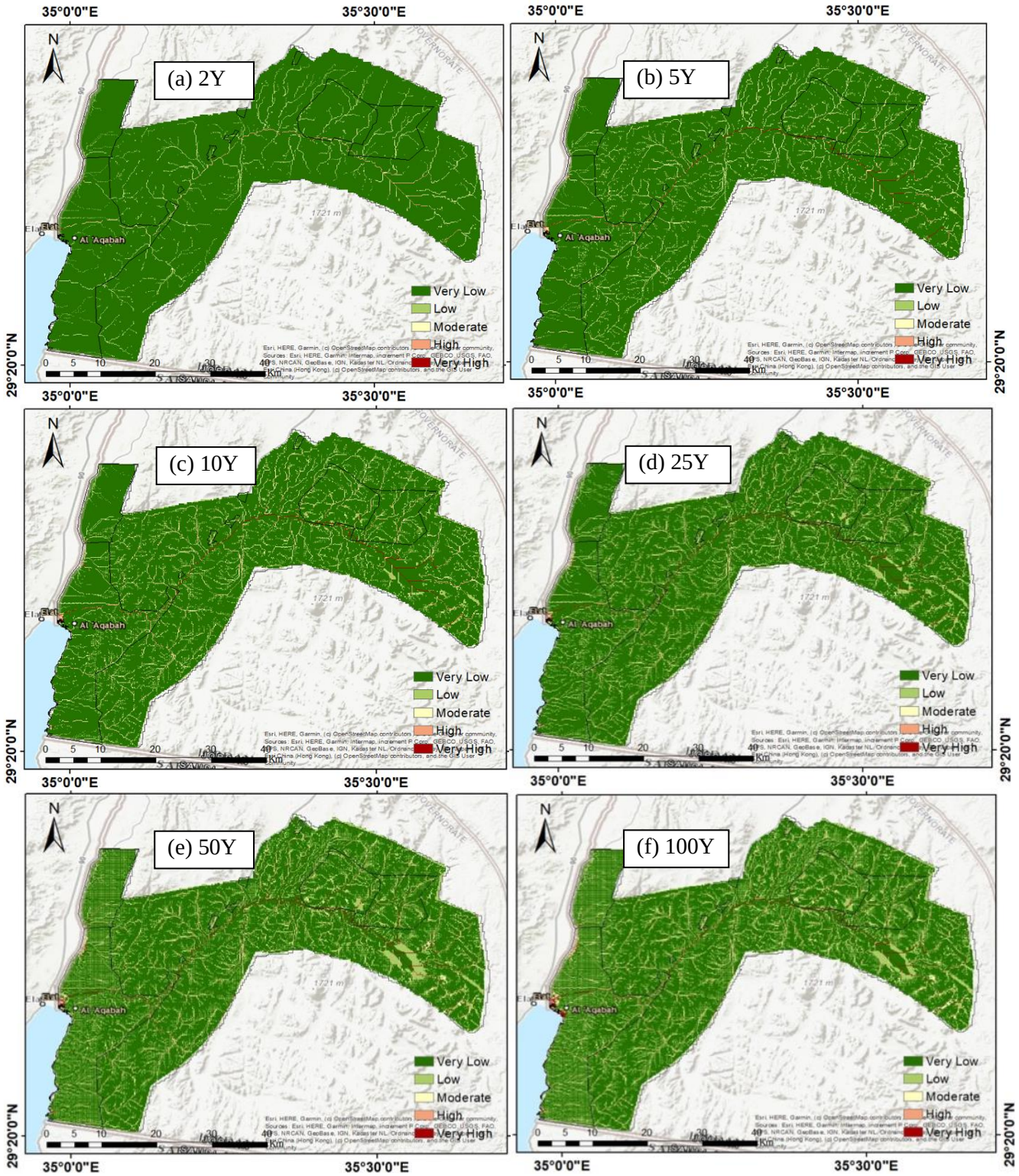


Figure 3-167 Flood hazard maps at the catchment scale using the RRI for different return periods

Figure 3-167 shows that floods can affect the main roads, railways, and most road crossing structures. For instance, the main road entering Aqaba parallel/adjacent to the main Wadi drainage channel is in very high flood hazard areas. According to the channel slope and the upstream drainage stream areas, the flow velocities in the main Wadi channel were much higher than 3.0 m/sec.

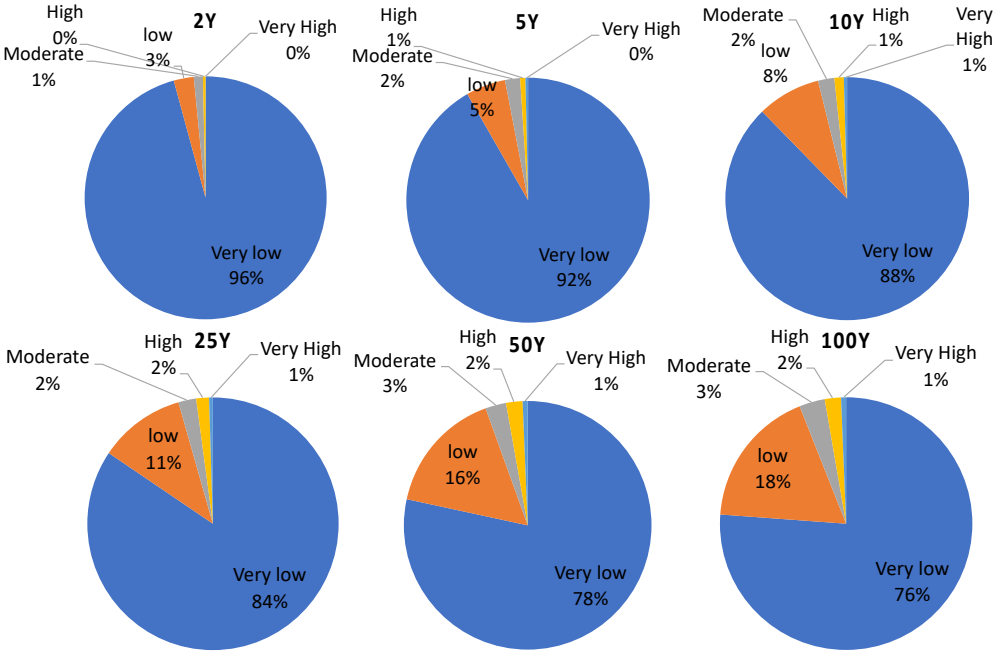


Figure 3-168 Percentage of the flood hazard area in the simulated catchment at different return periods

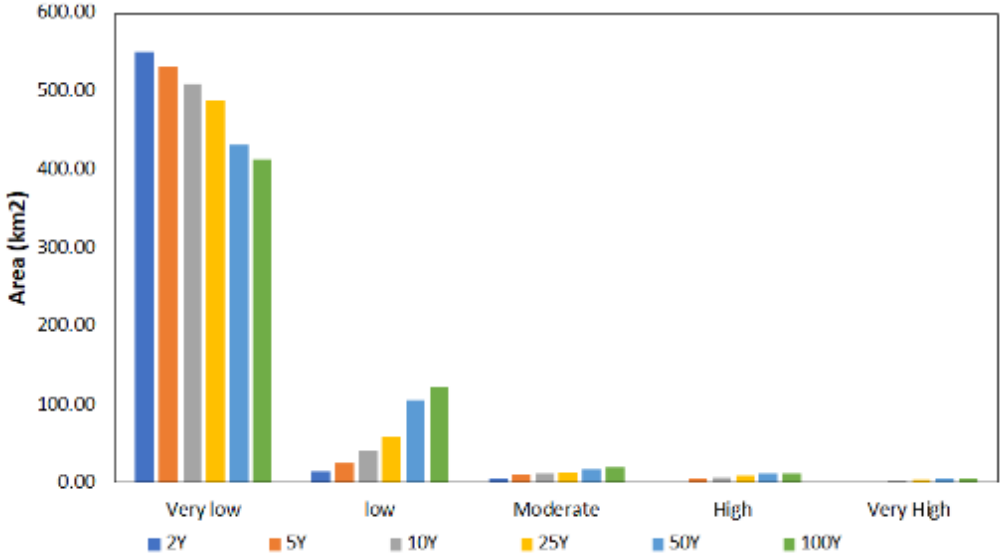


Figure 3-169 The flood hazard area in the target area (ASEZ, Wadi Araba, six scattered areas)

To assess the flood hazard in the newly developed target areas, we calculated the percentages of areas at very high, high, moderate, low, and shallow hazards, which were found to be 1%, 2%, 4%, 21%, and 72%, respectively, for the 100 Y return period (see Figure 3-169). Some parts of the industrial zones of Al-Quwaira target areas and the environmental/touristic target areas in Wadi Rum are located in high flood hazard areas. The high and very high hazard areas for the 2Y return period are estimated at 1.65 km^2 and 0.16 km^2, respectively, and it is expected to grow for the 100Y return period to 12.51 km^2 and 5.17 km^2, respectively. The area exposed for the 100 Y return period was affected by high and very high flood hazards in the Wadi Araba approximately 0.55 km^2 and 0.15 km^2, respectively, and approximately 6.79 km^2 (represents around 1.2% from 2% of the entire target area) and 4.29 km^2 (represents approximately 0.75% from 1% of the entire target area) in the existing city of the ASEZ. The following figure illustrates the flood-prone and hazardous areas within Wadi Araba and Aqaba city.

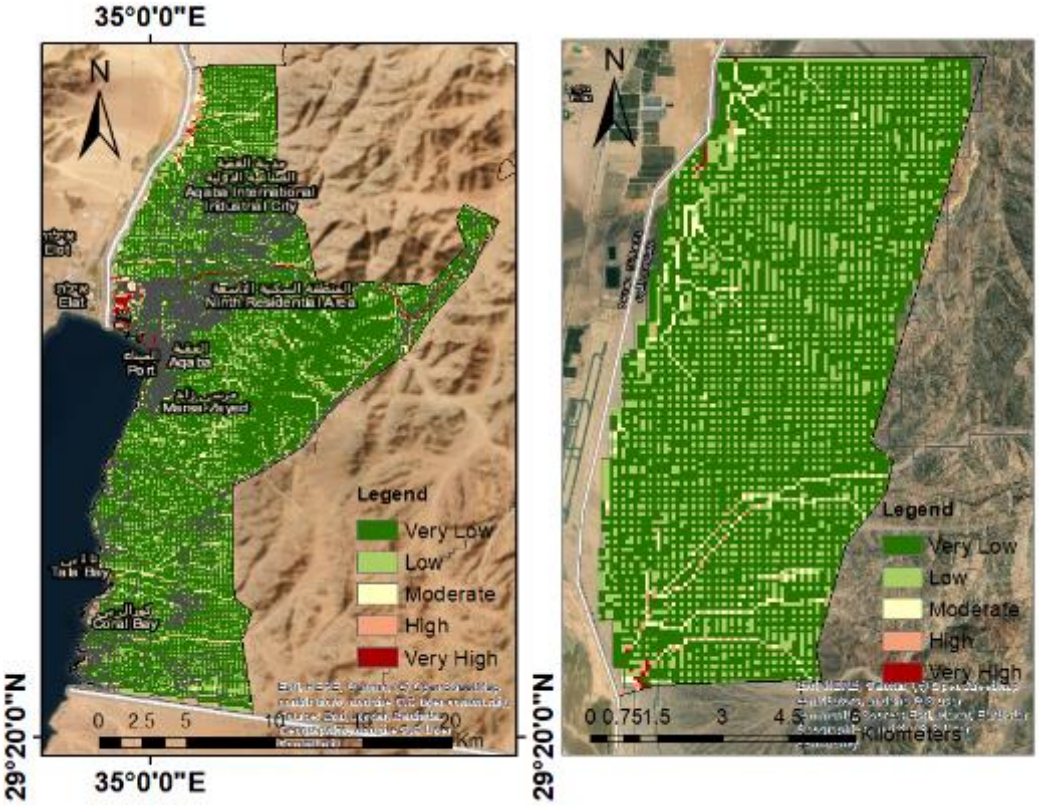


Figure 3-170 The flood hazard area in the ASEZ and Wadi Araba for the 100 Y return period

The same flood hazard maps for the six return periods at the catchment scale were developed using PCSWMM software, and the results are shown in **Figure** 3-171. The flood hazard is high along the Wadi channel network and some city areas. The developed hazard maps in **Figure** 3-171 provide a comprehensive view of the flood inundation threatening existing and newly developed areas in Aqaba. Based on the simulated results, we can conclude that most of the existing city and newly developed areas are safe for low return periods between 2Y to 50Y with very low to moderate hazards, except the main Wadi channels and its adjacent areas. However, for 100 Y, along the Wadi channel, the circled

zones shifted to high and very high hazard ranks. The maps spread of very high flood zones is associated with the existing constructed dams in Aqaba.

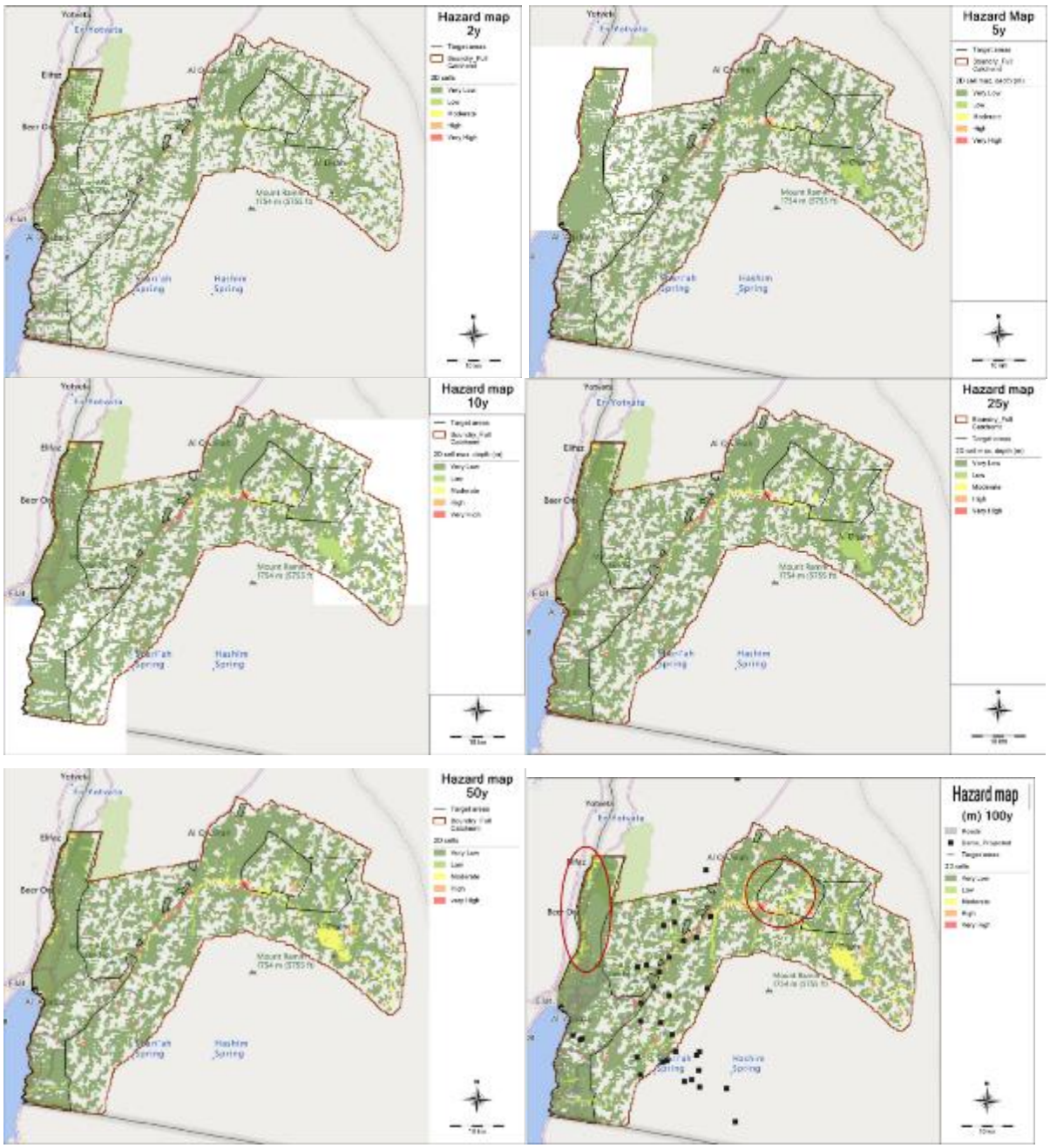


Figure 3-171 Flood hazard maps at the catchment scale using PCSWMM for different return periods

The developed maps in **Figure** 3-171 are helpful to enable more informed decision-making by local communities, decision-makers, and different departments. The development of an interactive flood hazard map in Aqaba is recommended to improve the city's resilience and safety for all people living in or visiting Aqaba. Based on the developed hazard maps, the urban planners are recommended for land use control and flood zoning in newly targeted areas. The urban planning department must consider the avoidance approach and green infrastructure measures in the high and very high-hazard zones.

c) Assessment of Flood Hazard Maps at the City Scale

The catchment-scale simulations have not considered the impact of the buildings. Therefore, additional simulation for the 100-year return period using only PCSWMM software has been conducted on the city scale to assess the impacts of the constructed roads and pavements on the infiltration processes to the subsoil. **Figure** 3-172 identifies the most sensitive roads and local zones for high flood inundation depths related to city urban development and spatial planning strategies. **Figure** 3-172 to **Figure** 3-176 display zoom-in flood hazard maps of the existing city of Aqaba. The city-scale simulation assumes that the plots are 100% built without any setbacks, and accordingly, inundations can only be observed on the main roads. It is also evident that the buildings significantly impact maximizing the inundation depth compared to the catchment-scale (no buildings considered). Most of the city is under very low to low flood hazard categories. However, some roads intersecting with the main Wadi channels or coastal wadis (as circled) are under moderate to very high flood hazard categories. The type of roads is also an effective parameter in increasing the level of flood hazard, as we can see in the southern part of the city, characterized by curved loops and Cul-de-Sac streets (dead-end streets). Furthermore, the slopes and the flow direction have different values within the same street, resulting in flood hazard rank zones with the same road. Based on the DSM analysis, some streets have longitudinal reverse slopes leading to low-lying junctions along the roads, which are considered pools that receives water from all directions. **Figure** 3-172 highlights most of these areas with red circles.

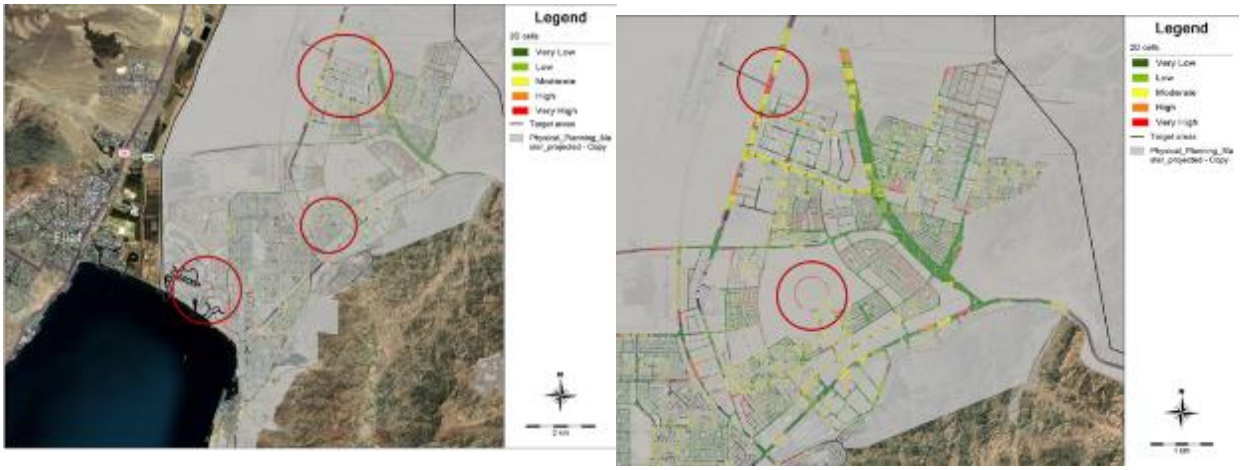


Figure 3-172 Flood hazard maps at the city-scale using PCSWMM for 100Y



Figure 3-173 Flood hazard maps at the city-scale using PCSWMM for 100Y

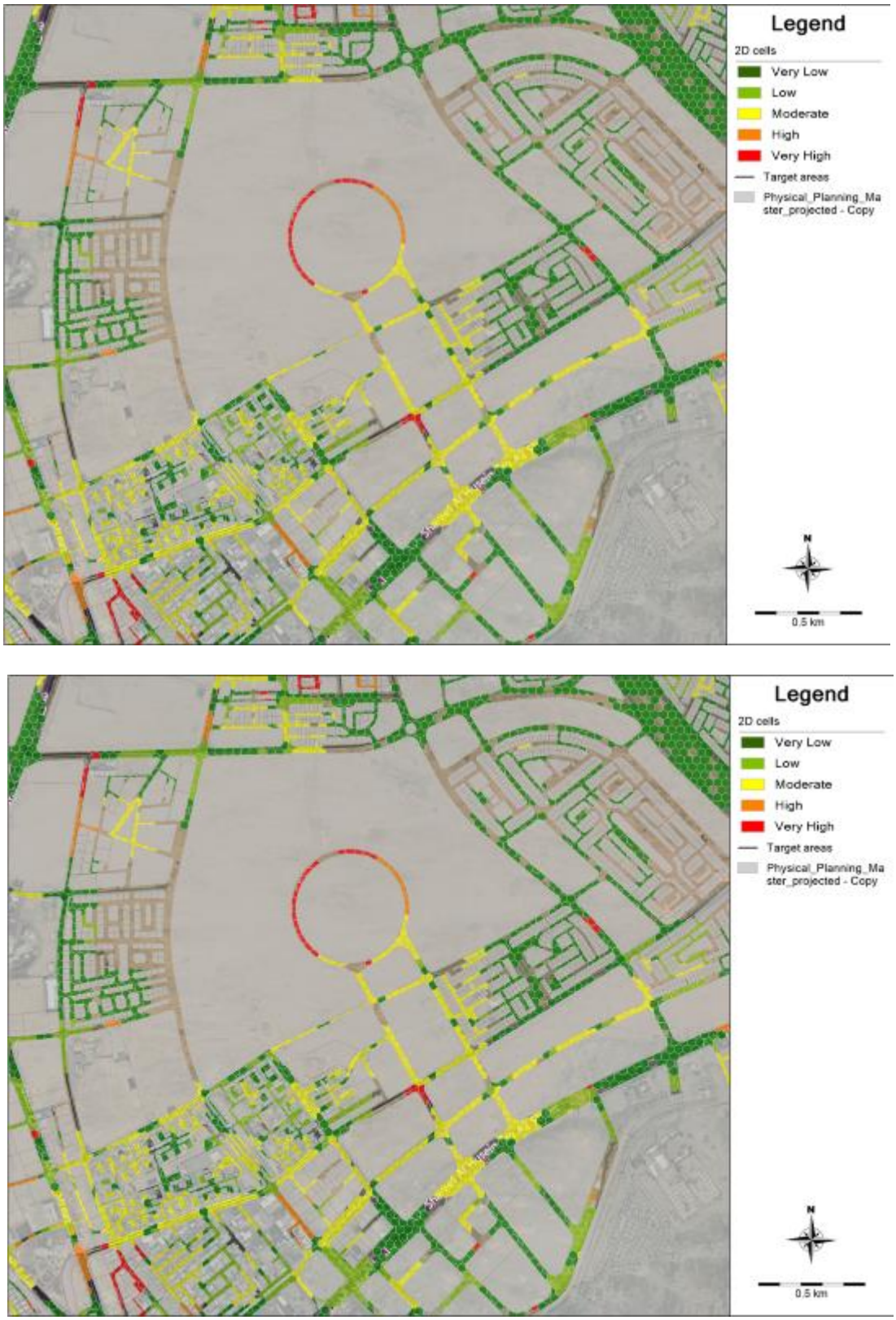
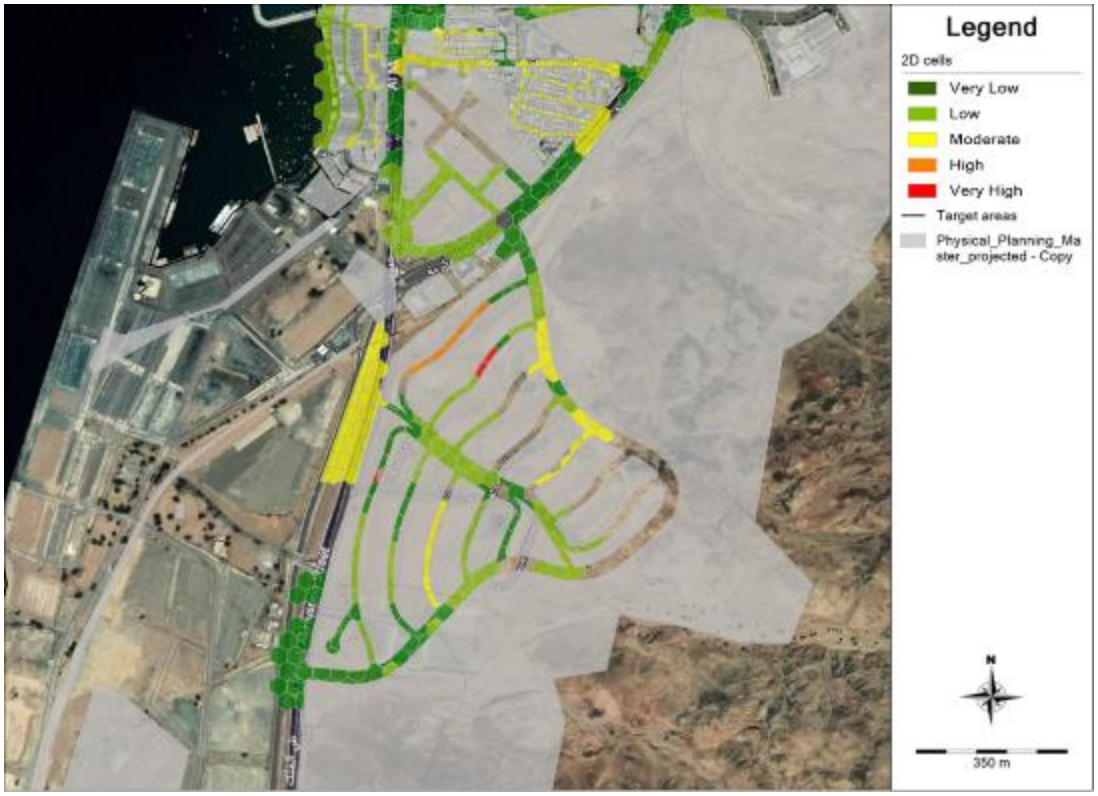


Figure 3-174 Flood hazard maps at the city-scale using PCSWMM for 100Y



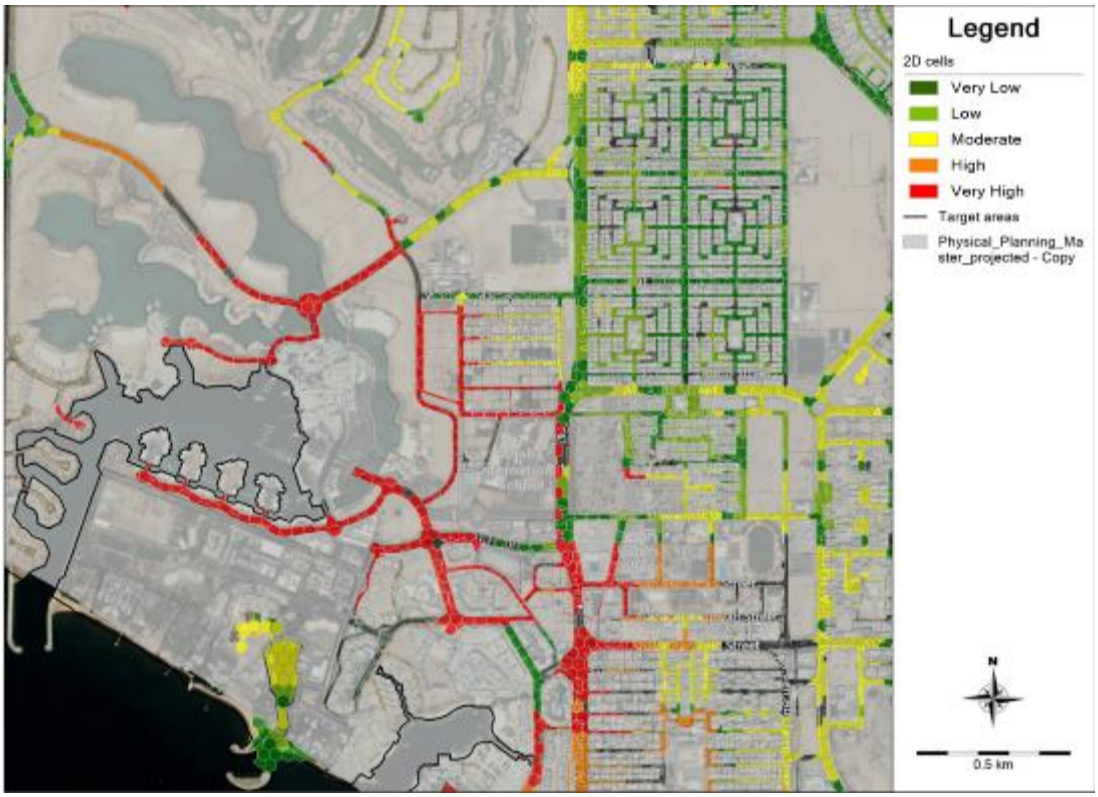


Figure 3-175 Flood hazard maps at the city scale using PCSWMM for 100Y

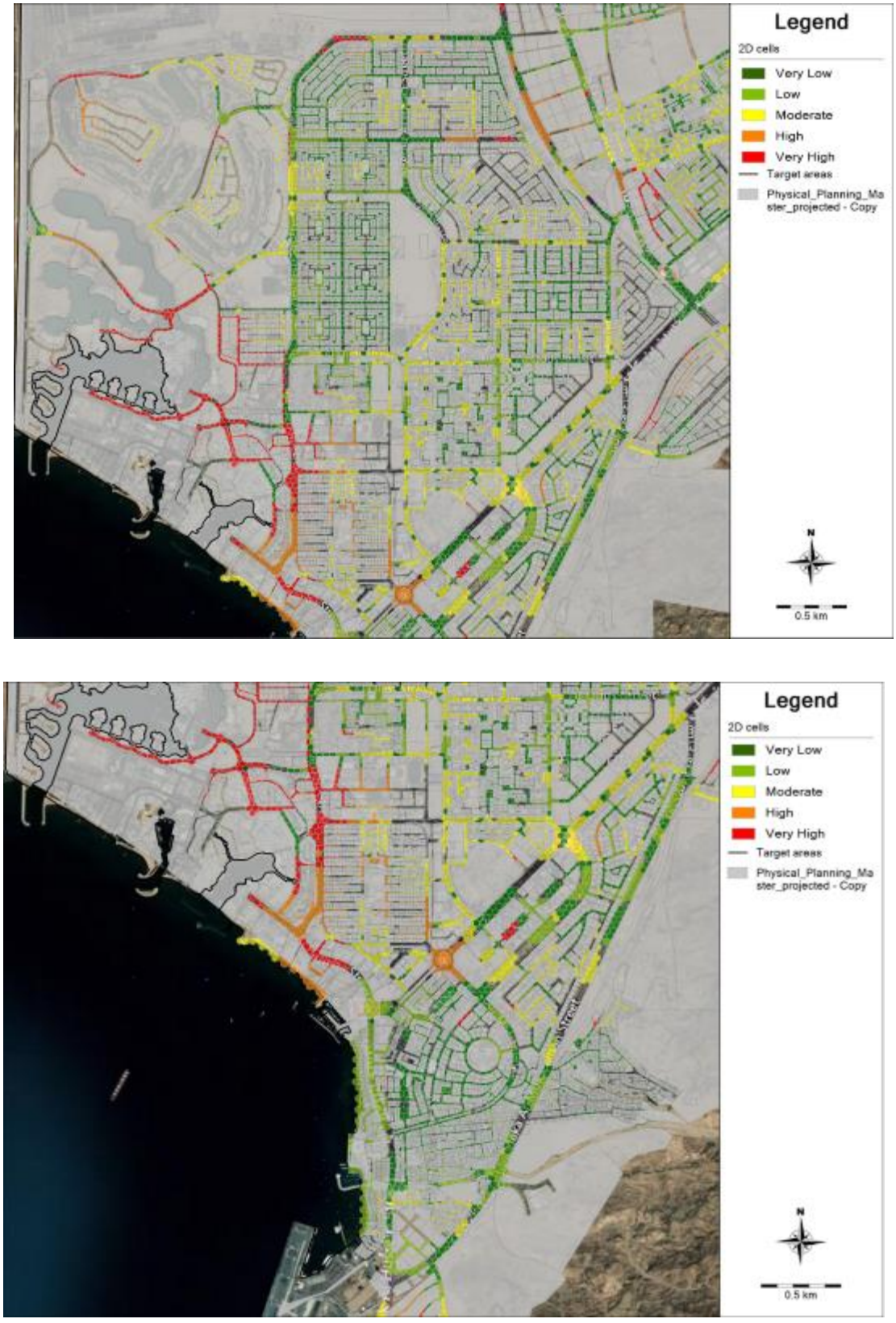


Figure 3-176 Flood hazard maps at the city scale using PCSWMM for 100Y

4) Flood Hazard Maps in the Catchment and City Scales Under Different Climate Change Scenarios

Based on the historical and future analysis of climate change in Aqaba, it was noticed that the increased frequency of scarce rainfall resulted in urban floods. Climate change and urbanization are the main challenges for Aqaba's past, present, and future disaster management. The existing and newly developed areas in Aqaba generally lack a direct inventory of wadi flash floods and their potential hazards, and many tourist developments and solid waste dumps have been placed in flood hazard zones. The effects of industrial development, tourism, and sediment plastic debris discharge from urbanized coastal wadis on Aqaba coral reefs must be monitored, especially during extreme flash floods. As rarer rainfall storms are expected to be more influenced by climate change, the projected changes in maximum rainfall under RCP4.5 represent a 19% increase over Jordan based on 4th NC, (2023). The September 2023 flood in Drena, Libya, is estimated to have resulted from extreme rainfall that was +10 times more than the IDF. Based on detailed climate change analysis by the JICA study team, we decided to consider six climate change scenarios by increasing the existing rainfall of 100-year return periods by 120% (Scenario #1), 140% (Scenario #2), 160% (Scenario #3), 180% (Scenario #4), 200% (Scenario #5) and 300% (Scenario #6).

Table 3.96 Precipitation intensities and cumulative rainfall for 100 Y-RP and climate scenarios

	Remarks	Scenario#1	Scenario#2	Scenario#3	Scenario#4	Scenario#5	Scenario#6
Input							
Precipitation intensity (100Y-RP) (mm)	(before climate change scenarios)	13					
Increase of precipitation (100Y-RP) (%)		120%	140%	160%	180%	200%	300%
Precipitation intensity (mm/h) *		15.6	18.2	20.8	23.4	26	39
Cumulative rainfall of the storm (mm)	Storm (6h)	93.6	109.2	124.8	140.4	156	234

a) Impacts of Scenario #1 Existence rainfall increase by 120% based on the RRI model

In Scenario#1, the rainfall is assumed to increase by 120%. **Figure** 3-177 reveals the variation in the flood hazard compared to the hazard map of the 100Y return period. The potential hazard extent will increase in the affected coastal wadi areas.

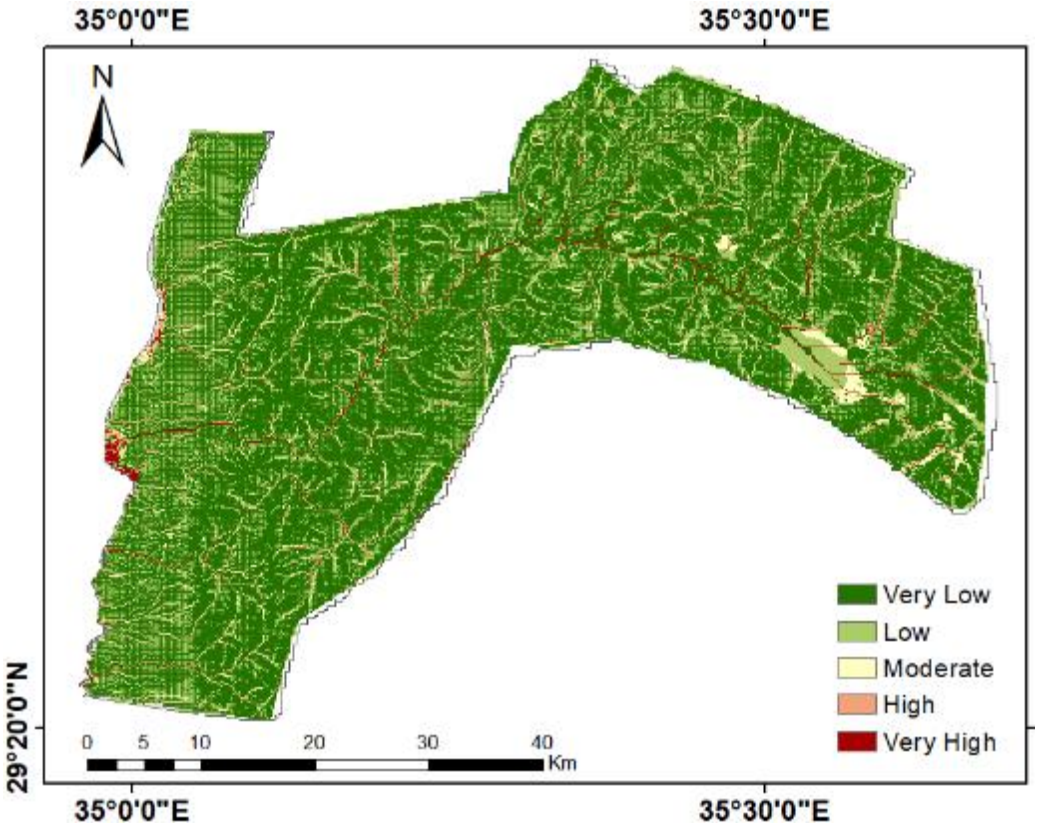


Figure 3-177 The flood hazard map under climate change scenario #1 (20%)

For instance, the Al-Radwan Area and AYLA are the most affected added to the Tenth Residential Area (see **Figure** 3-178and **Figure** 3-179). In addition, the area of the King Hussein Airport will be exposed to high floods by increasing the rainfall by 120% of the 100 Y RP, as denoted in zoom-in **Figure** 3-178.

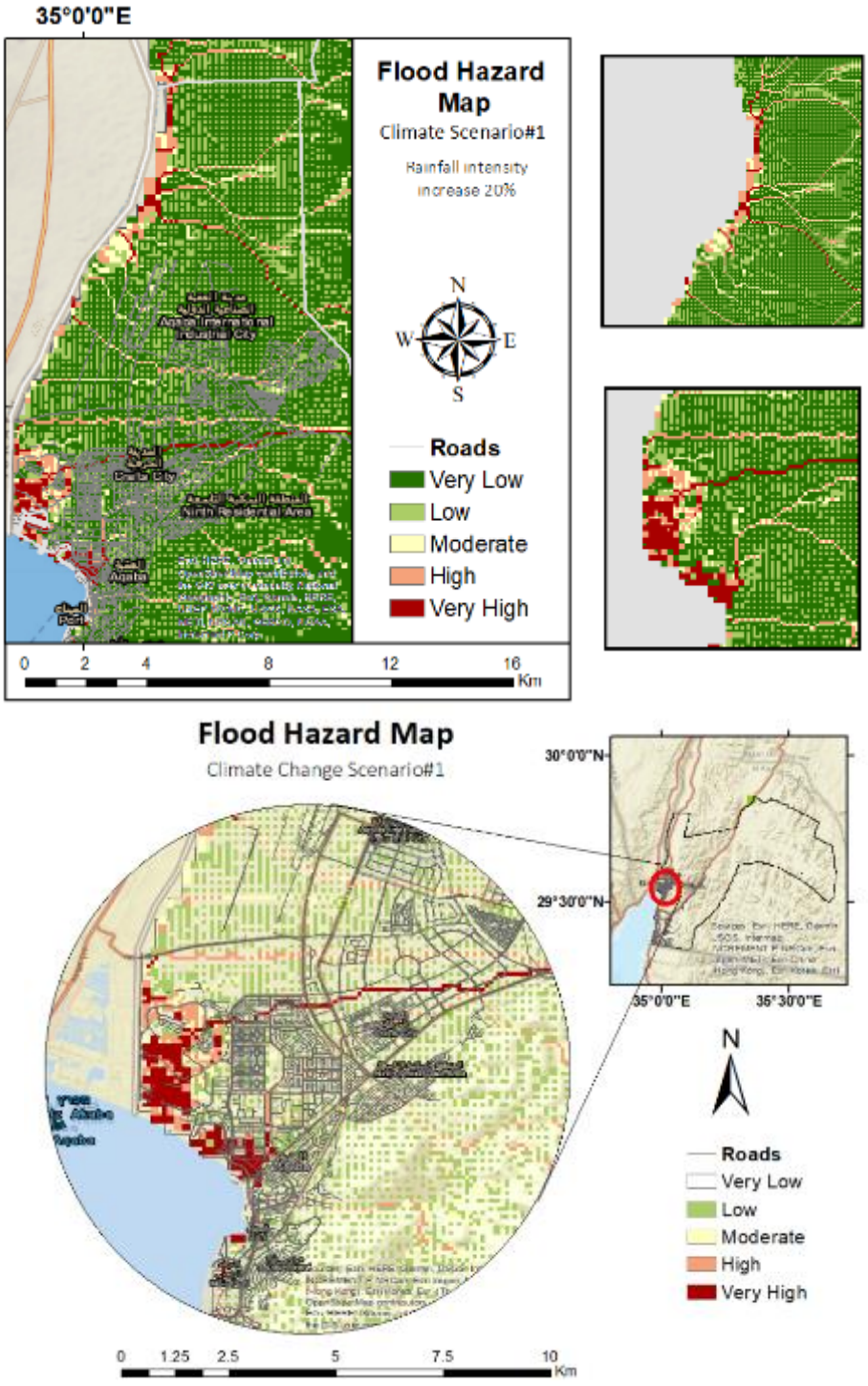


Figure 3-178 The flood hazard map for Scenario #1; zoom in on the affected areas in coastal Wadi, the area nearest the K-Hussein International Airport, and Aqaba City.

Climate change will also affect the lower part of the watershed in the coastal area (nearest to the Aqaba Thermal power station), as shown in **Figure** 3-179. The detailed hazard map under climate scenarios can increase awareness among the various authorities and local communities toward future mitigation measures for disaster risk reduction.

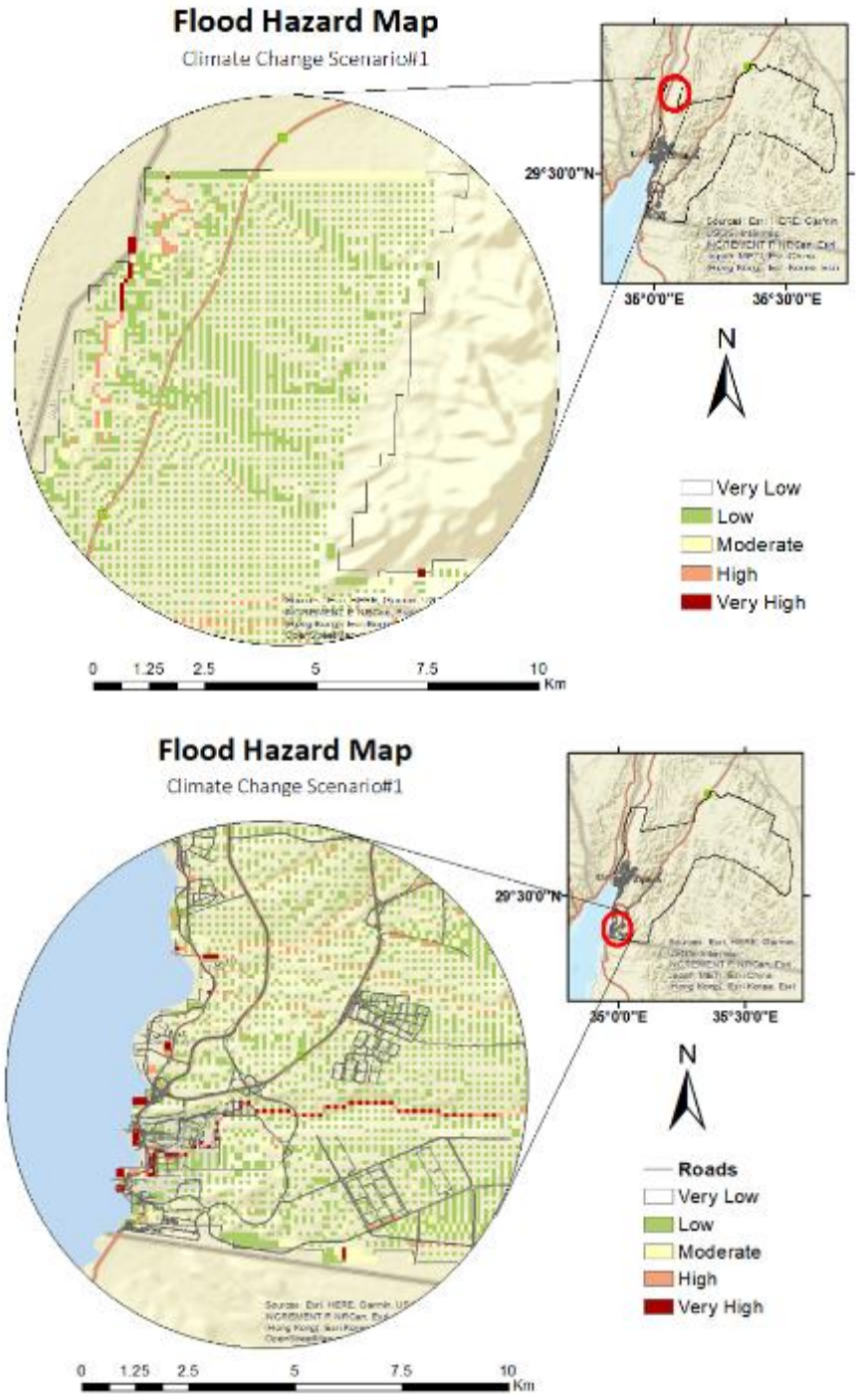


Figure 3-179 The flood hazard map for Scenario #1, the northern region of Aqaba near Wadi Araba and the southern coastal Wadis in Aqaba of the simulated area.

Figure 3-180 shows zoom-in flood hazard maps of the newly developed areas. The main roads and the Al-Quwaira area are exposed to high flood hazards. Additionally, it is recommended to zone the newly developed areas to avoid the high-hazard zone for the other areas.

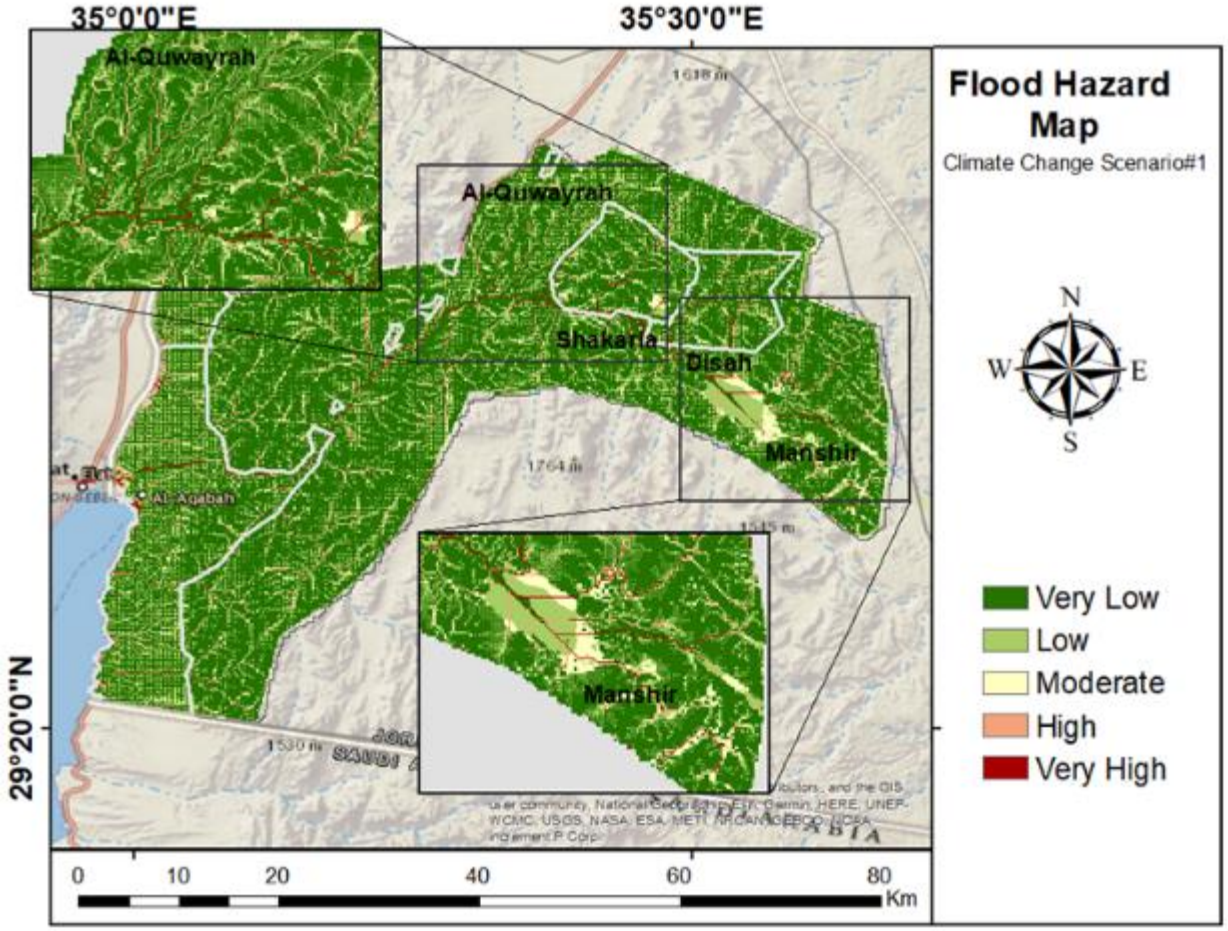


Figure 3-180 The flood hazard map for the first scenario climate change scenarios with Zoom-in at the Al-Quwaira and Manshir regions

b) Impacts of scenario #5 rainfall increase by 200% based on the RRI model

In this scenario, a significant increase in flood hazard is revealed by increasing the rainfall by 100%. Several areas in the coastal wadi show the critical region with the possibility of very high flood hazards, such as ALYA, Al-Hashmi, and Al-Rasheid Streets, the tenth Residential Area and the nearest to K-Hussein International Airport (see

Figure **3-181** and

Figure **3-182**). The zoomed-in **Figure** 3-183 illustrate that the moderate flood hazard in the upper part of the simulated catchment will be extended to a broader extent. Additionally, it is worth mentioning that the Al-Quwaira and Disah regions might be affected by moderate floods in this scenario, as shown in **Figure** 3-184. Meanwhile, the Shakaria and Disah regions appear to have high flood hazards, as shown in **Figure** 3-184. Under climate scenario #5, the flood extents grow most rapidly in the environmental and tourist areas in

Wadi Rum. Furthermore, the flood extension is growing laterally, shifting toward a higher hazard rank from low to moderate or moderate to high due to the steep slopes adjacent to the Wai channel. Most of the main Wadi drainage channels lack confined extensive flood plains to prevent the flood extents from increasing during the rare extreme rainfall intensity. Various services and infrastructures are located in the high flood hazard zones and relocating such utilities outside the flood hazard areas is recommended. These results are helpful for policymakers and ADCs to consider such hazards before installing new infrastructures for planned mega projects. There is a need to establish a practical and functional entity and institutional framework for sharing the results and outcomes of different climate change scenarios in the stakeholder forum.

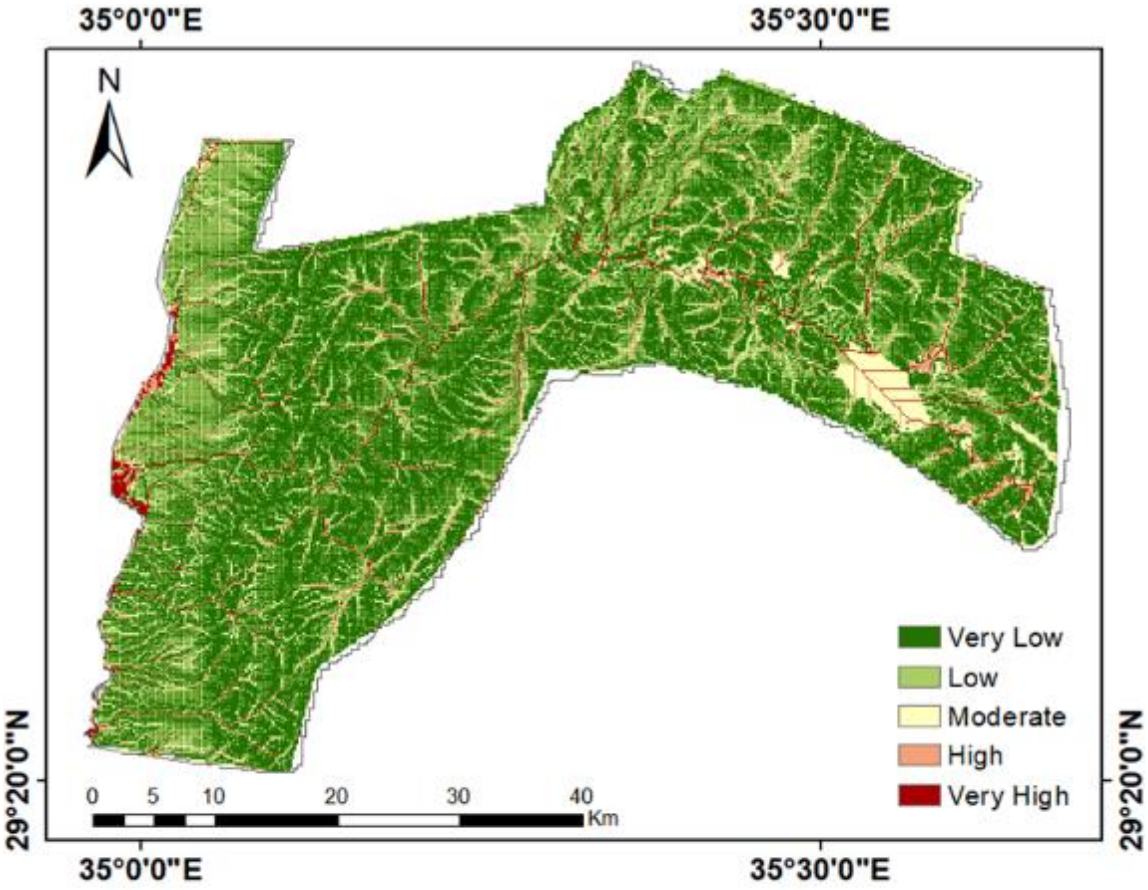


Figure 3-181 The catchment flood hazard map for the fifth climate change scenario

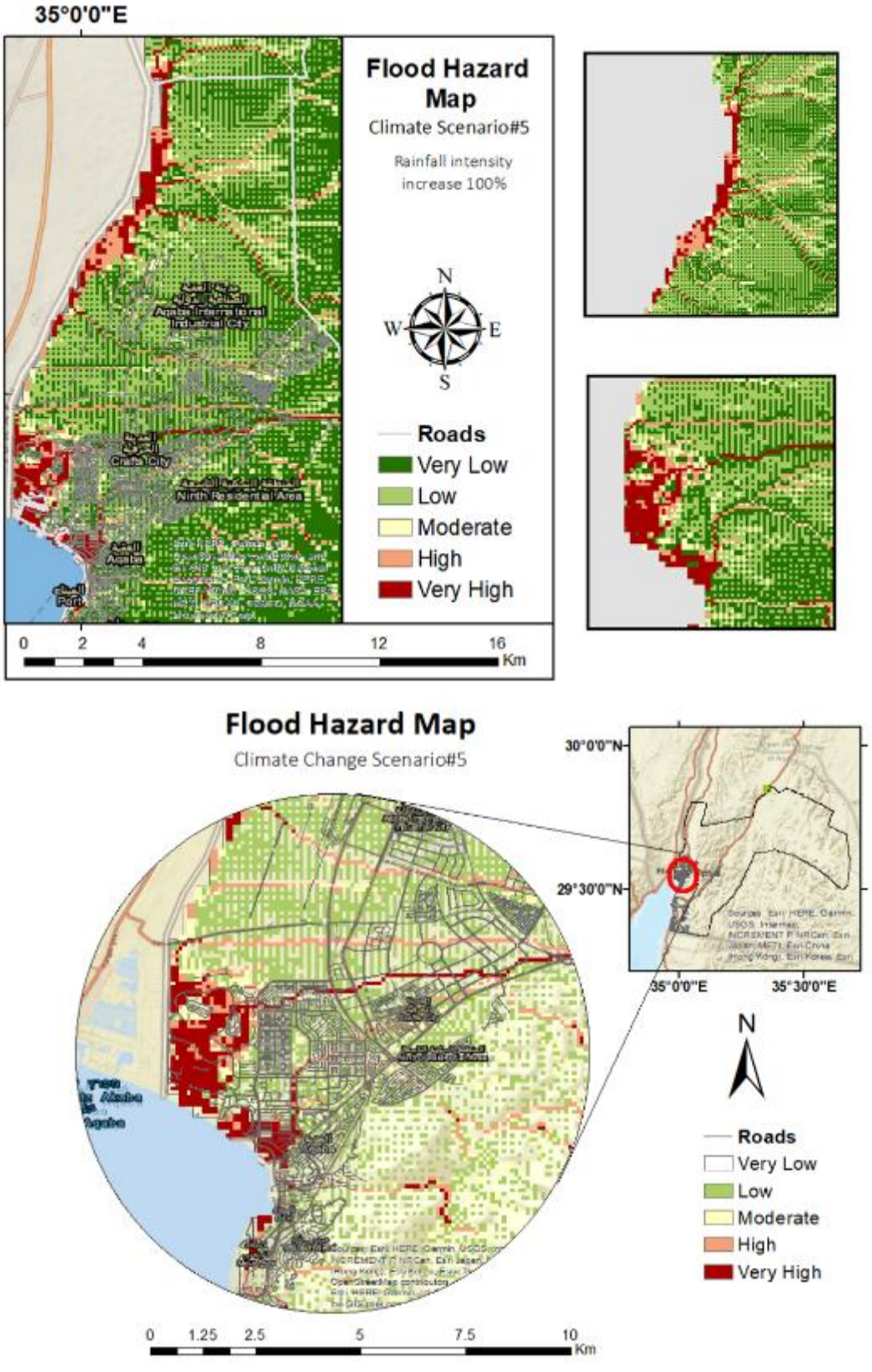


Figure 3-182 The catchment flood hazard map for the fifth climate change scenario

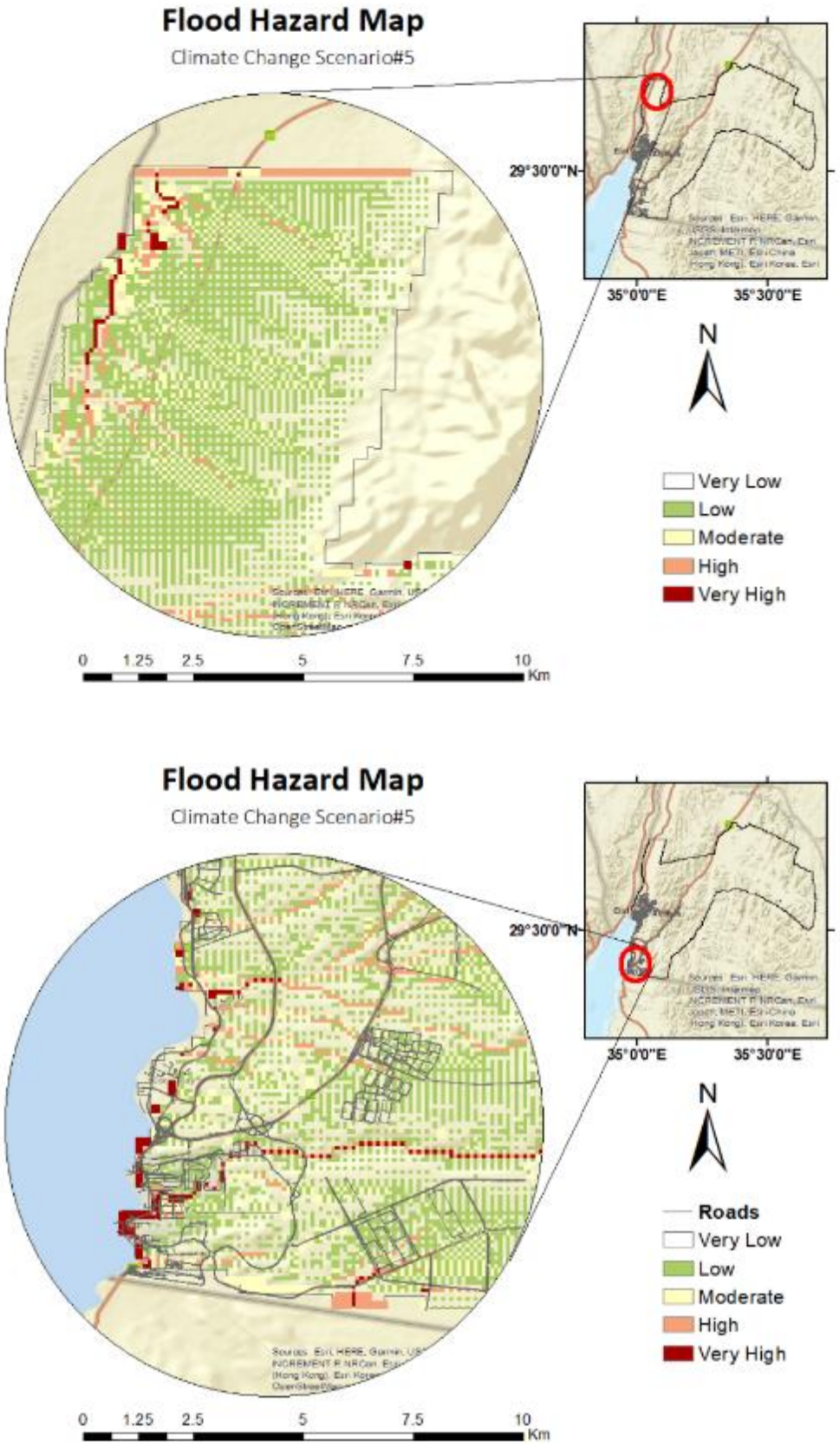


Figure 3-183 The flood hazard map for the high flood-prone areas under the fifth climate scenario

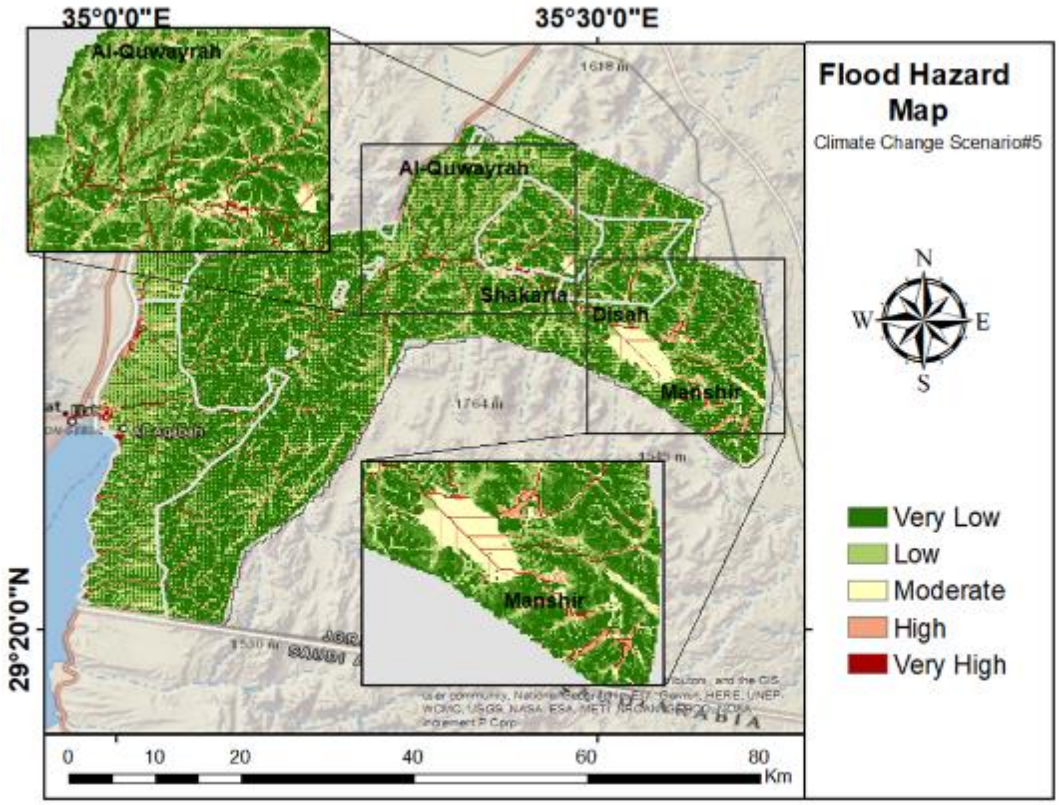


Figure 3-184 The flood hazard map for the fifth scenario zoomed in on the Al-Quwaira and Manshir regions

c) Impacts of scenario #6 rainfall increase by 300% based on the RRI model

This scenario represents the worst-case scenario by assuming that the rainfall will increase three times. The flood hazard map for a 300% increase in rainfall demonstrates a significant change in various regions (**Figure** 3-185 and **Figure** 3-186). In the existing ASEZ city, the affected area will be extended to Prince Hassan Street and El-Farouk Street, adding to the previous area mentioned, as displayed in **Figure** 3-186. It is worth mentioning that the Ninth Residential Area might be exposed to high flood hazards in this scenario (see **Figure** 3-186). Additionally, Tala Bay Resort and the Aqaba thermal power station area might be affected by climate change impacts based on scenario #6. In the northern part of Aqaba, the exceptionally high and high flood hazard will be extended, as shown in **Figure** 3-187. The flood hazard will change from moderate to high in Shakaria areas, located on the border of the more significant scattered areas, to very high in some parts, similar to the Disah and Manshir parts (see **Figure** 3-188). Additionally, the flood hazard will change from low to moderate and high in the Al-Titin Wadi, as displayed in **Figure** 3-188.

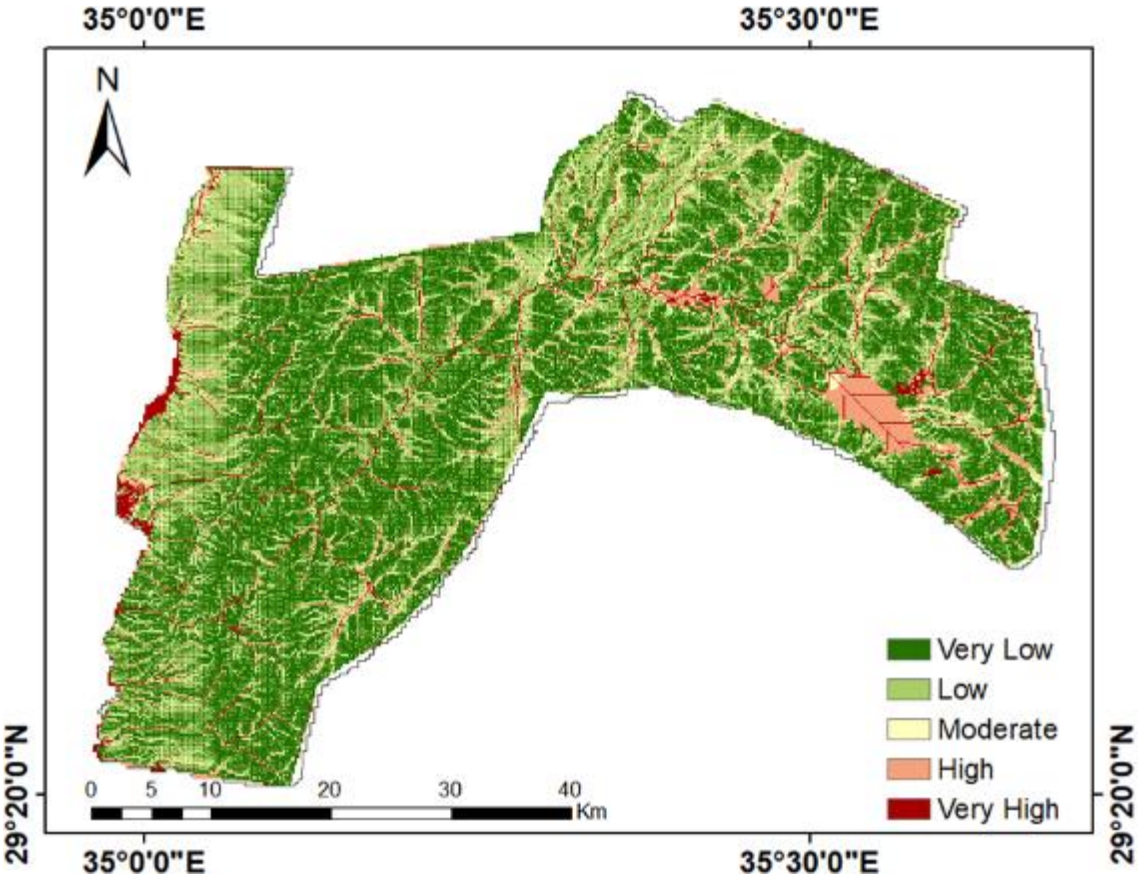


Figure 3-185 The catchment flood hazard map for the six-climate change scenario

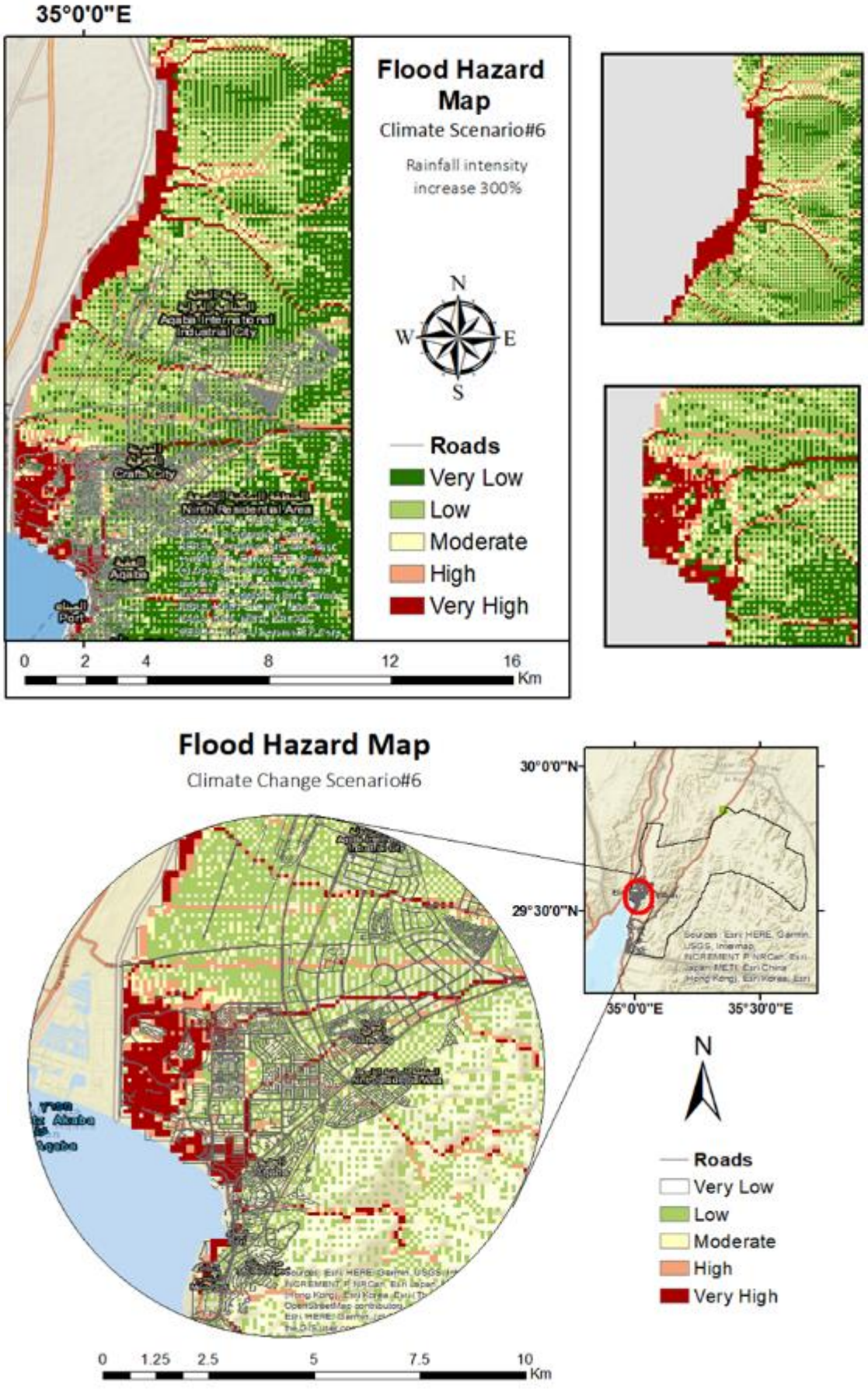


Figure 3-186 The flood hazard map for the fifth scenario zoomed in the coastal wadi's region

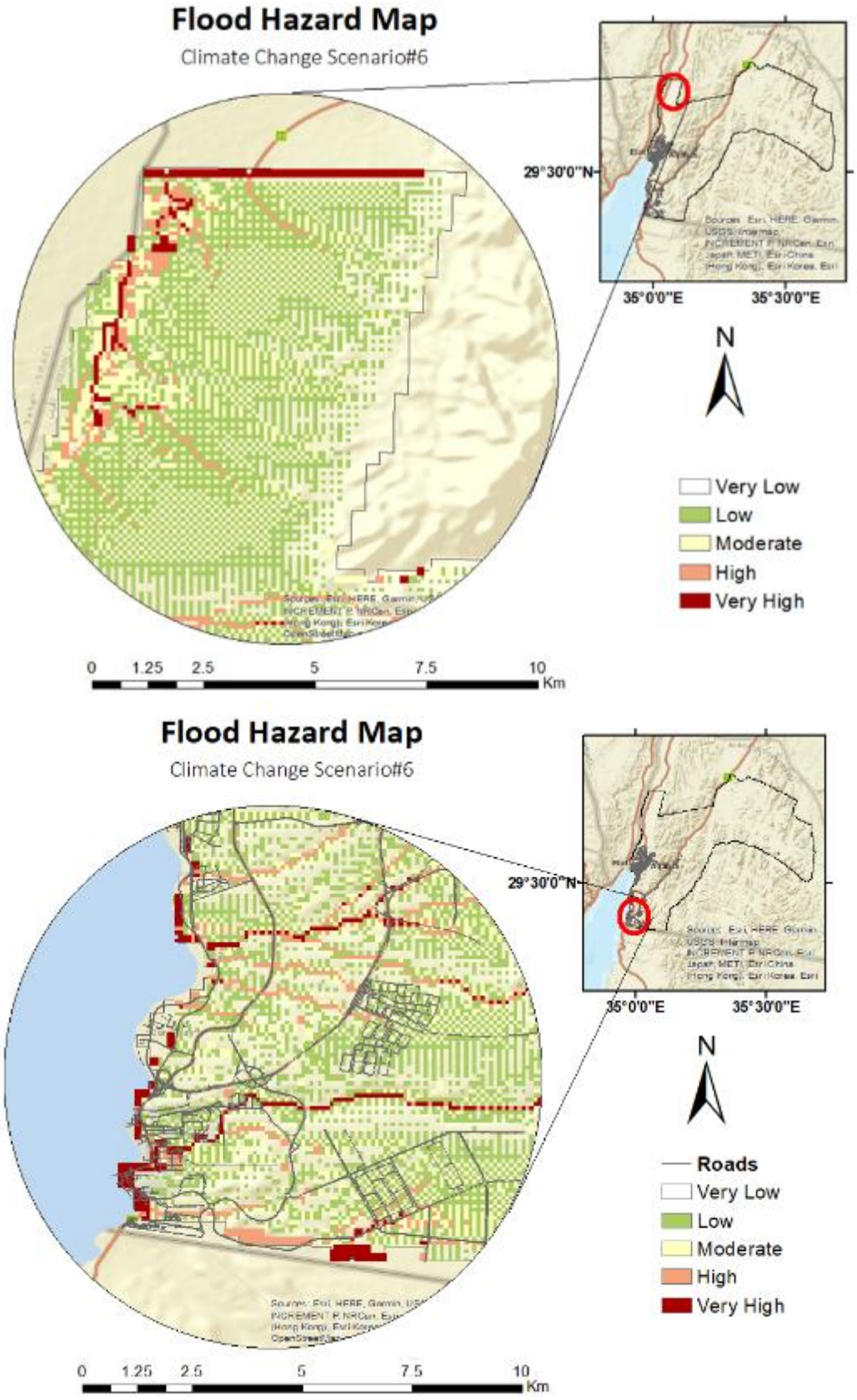


Figure 3-187 The flood hazard map for the fifth scenario zooming in the northern region

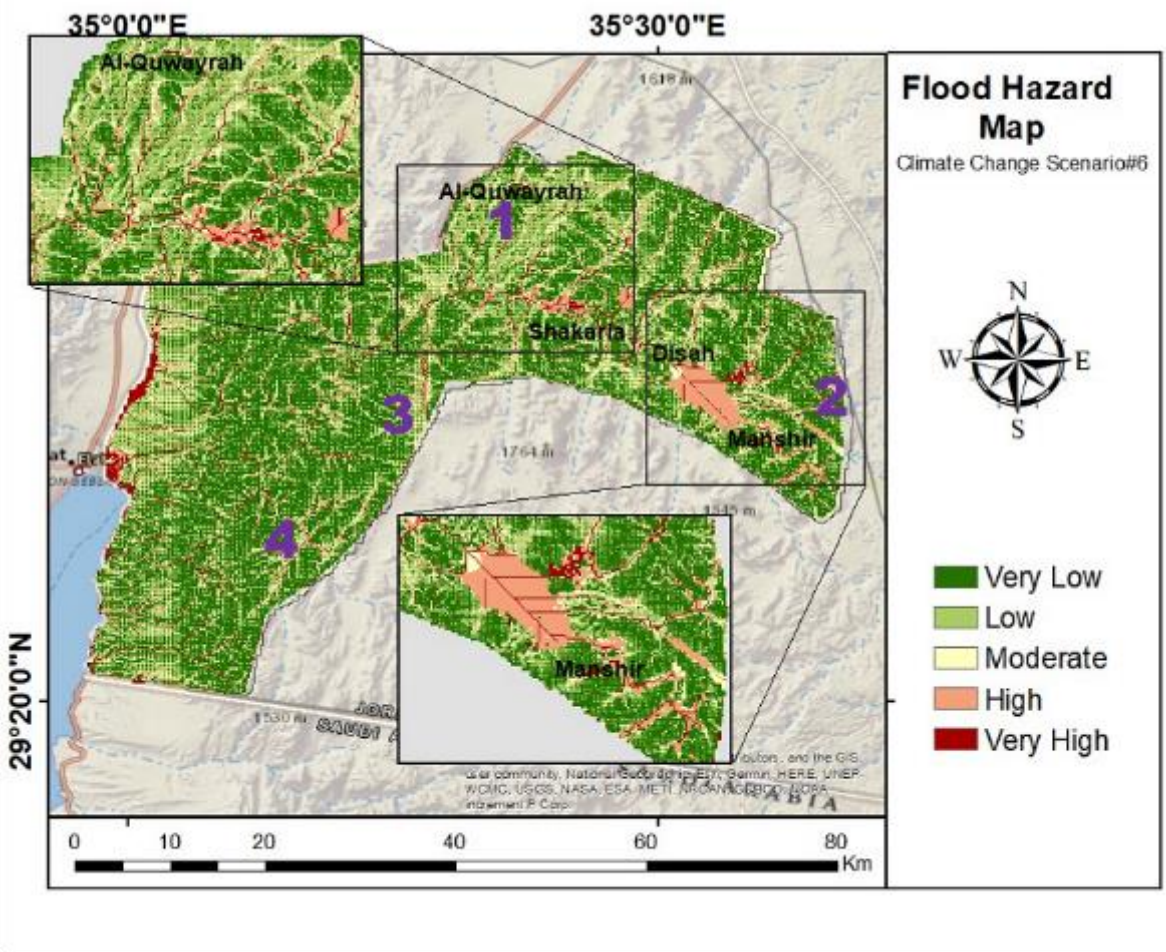


Figure 3-188 The flood hazard map for the sixth scenario zoom-in on the Al-Quwaira and Manshir regions

d) Comparison of Climate Change Scenarios based on the RRI model

Figure 3-189 demonstrates the variation in the peak discharge at SG01 for the six different climate change scenarios. The maximum discharge will reach approximately 6,200 m3/sec in the worst scenario; however, it will be nearly 2,800 m3/sec in the expected scenario by the 4th NC (2023) (Scenario #2). On the other hand, **Figure** 3-190 reveals a significant variation in the area for the different scenarios. By comparing the first scenario with the worst one, we found that the shallow area will diminish from 72% to 51%. In contrast, the high and very high areas will increase by 4%, and 2%, respectively.

For the newly developed target area, the percentages of areas with very high, high, moderate, low, and very low hazards were found to be 5%, 6%, 13%, 35%, and 41%, respectively, under climate change scenario #6 (see, **Figure** 3-190). The high- and very high-hazard areas for the first scenario are estimated at 17.96 km2 and 9.14 km2, respectively, and they are expected to grow for the sixth scenario to 35.51 km2 and 26.16 km2, respectively, as shown in **Figure** 3-190.

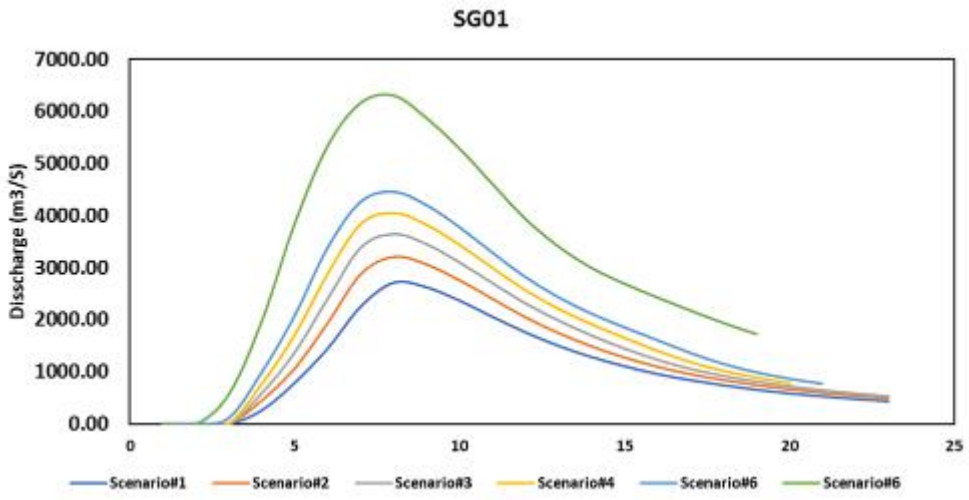
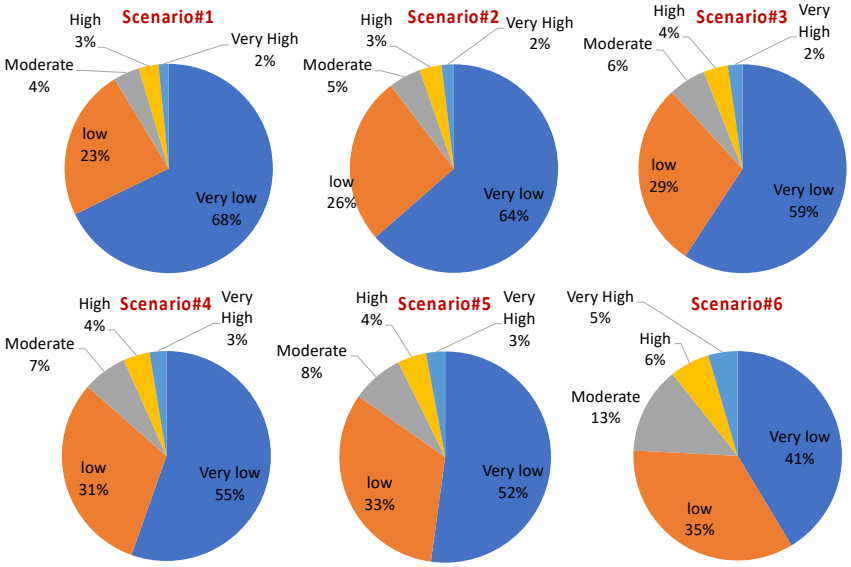


Figure 3-189 Hydrograph of the simulated discharge for the different climate scenarios



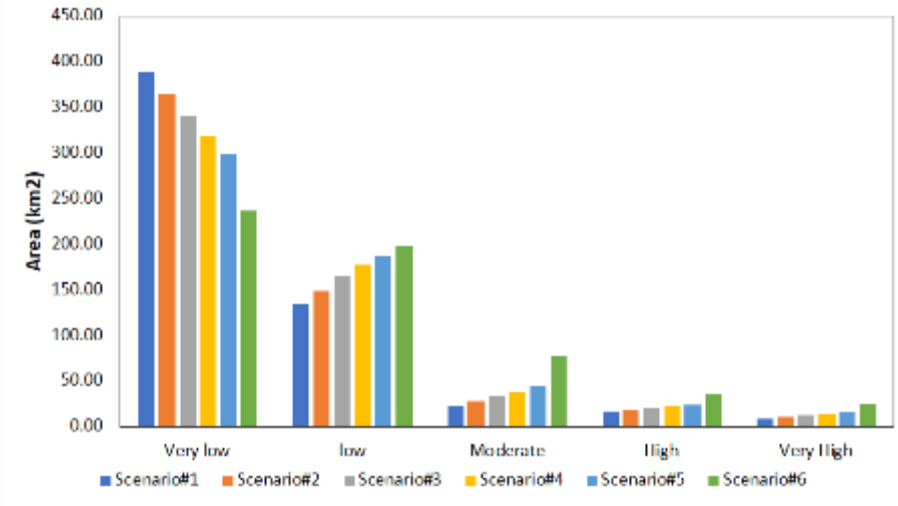


Figure 3-190 Percentage of the flood hazard area in the simulated area for different climate scenarios

e) Impacts of Climate Changes Scenarios on the Catchment Scale based on PCSWMM Software

Aqaba City is growing and plan for future development within wadi Araba and the six scattered target areas. While the ASEZA is progressing in its expansion, the effects of climate change are dynamic, and the urban planning sector at the ASEZA is responsible for planning accordingly. In this section, the JICA study team simulated the effects of four climate scenarios on the Aqaba catchment by increasing the existing rainfall of 100-year return periods by 120% (Scenario #1), 140% (Scenario #2), 200% (Scenario #5) and 300% (Scenario #6). In these four scenarios shown in **Figure** 3-191, we can understand the impacts of climate change on the city with the two-dimensional model (even without the buildings' impact considered) to be in the moderate to high prone areas to flood hazard, especially the areas intersecting with the coastal wadis (**Figure** 3-191). Regarding the newly developing areas, it is recommended to carefully plan the outcomes accordingly by avoiding high flood hazard zones. These zones would be inundated more by 1.5 meters water depths under scenarios 2 to 6. Authority planners and strict urban codes must avoid developing into the high-hazard areas and flat floodplains.

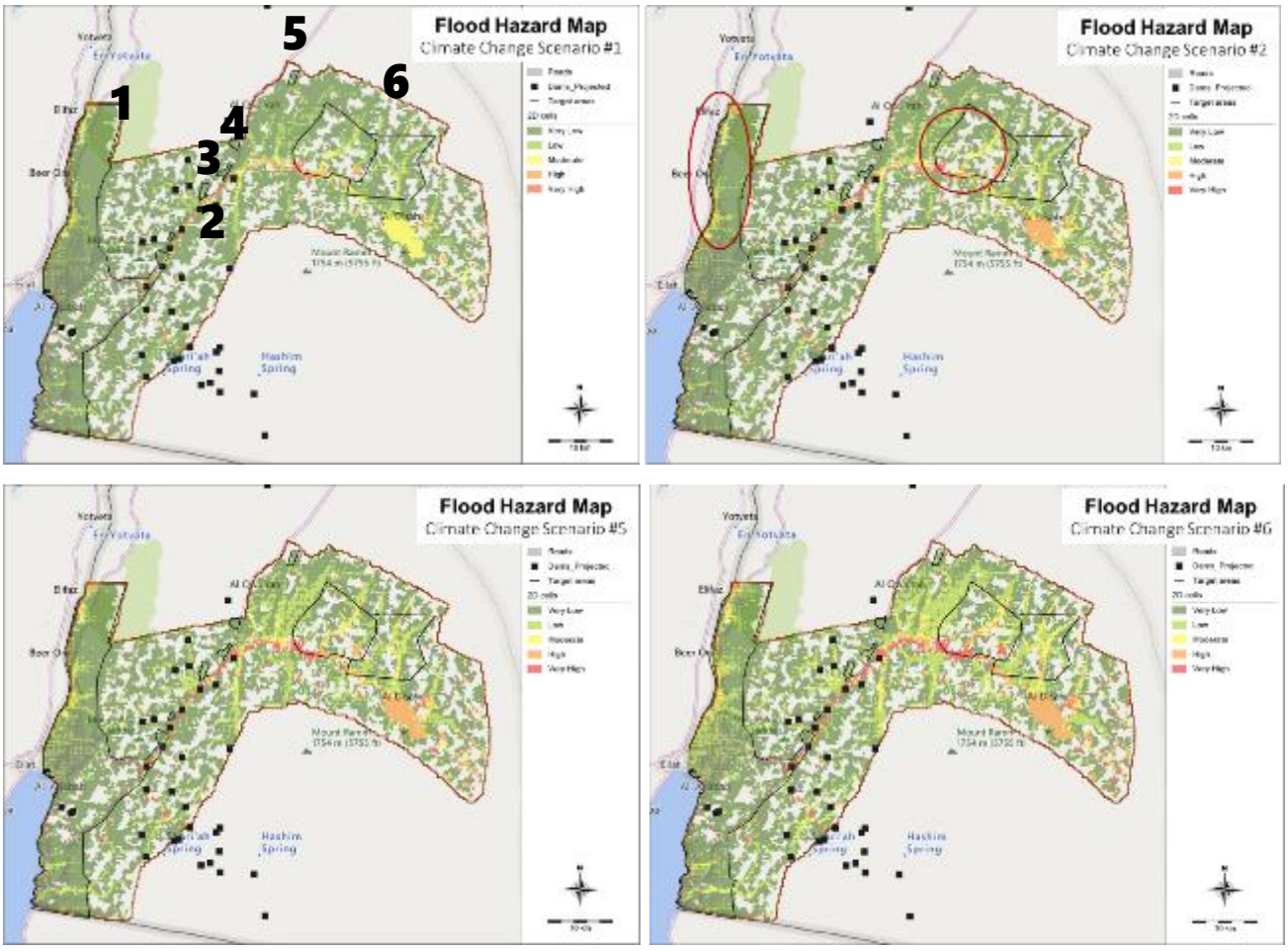


Figure 3-191 Flood hazard maps at the catchment-scale using PCSWMM for four climate scenarios

Figure 3-192 presents a zoom-in flood hazard map focusing on the existing city, newly developing areas of Wadi Araba, and six scattered target areas. The labor and services target area are a low-hazard zone. Additionally, the logistics and trucking services area and mining industries' target areas are located in a low-hazard zone, considering their proximity to the high-hazard zone to the south and from the main road. The touristic and environmental target areas must avoid the high risk due to the intersection with the Wadi main channel. Additionally, it is recommended to propose green areas in the heart of this area to avoid moderate to high risk, as circled and similar to dealing with the area of Al-Quwaira of light and medium industries. It is essential to increase the capacity of the ASEZA for resilience-informed urban development. All flood hazard maps for the newly developing target areas did not consider the impacts of buildings, streets, and complete urbanization on flood hazards. Therefore, a detailed study of the effects of urbanization on these newly developing areas must be performed.

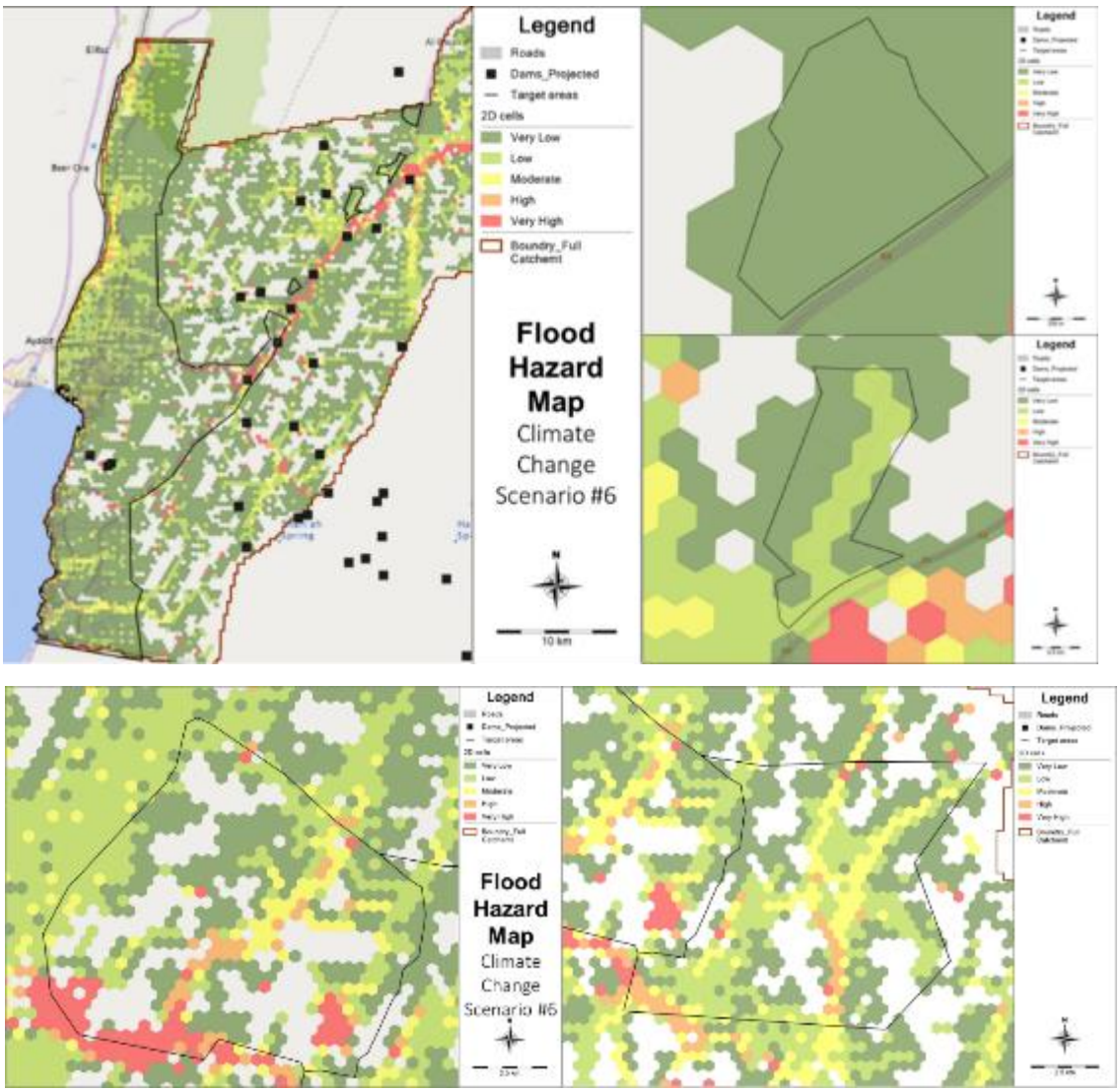


Figure 3-192 The flood hazard map developed by PCSWMM for the six scenarios zoomed in on the newly developed target areas

f) Impacts of Climate Changes Scenarios at the City-Scale based on PCSWMM Software

The climate has been dynamically changing due to city urbanization and human impacts, and the climate severely affects our infrastructures, cities, and the entire urbanized system. It seems that such a closed circle will persist unless we adapt and mitigate at the urban city scale. In this section, as shown in **Figure** 3-193, the simulation considers the spatial patterns of roads and urbanization under climate change scenario #6. The impact of climate change is more severe at the city level than at the catchment scale due to urbanization effects and its impact on the hydrological cycle and flood runoff. Most of the city is under moderate to high flood hazard categories; some streets intersecting with the main Wadi channels or coastal wadies (as circled) are classified as very high hazard. The developed zoom-in maps in **Figure** 3-194 to Figure 3-197 allow the ASEZA to understand the interrelations between flood hazards and spatial urban planning. Furthermore, suitable countermeasures should be considered accordingly. During the field investigations in Aqaba city by the JICA study team, we found that most roofs and buildings drain rainwater to the public sanitary drainage networks, leading to sewer flooding and receiving polluted and contaminated water in the street. It is highly recommended that rainwater be drained away from the sanitary drainage network. The sanitary drainage network in Aqaba cannot cope with rainwater regardless of network efficiency.

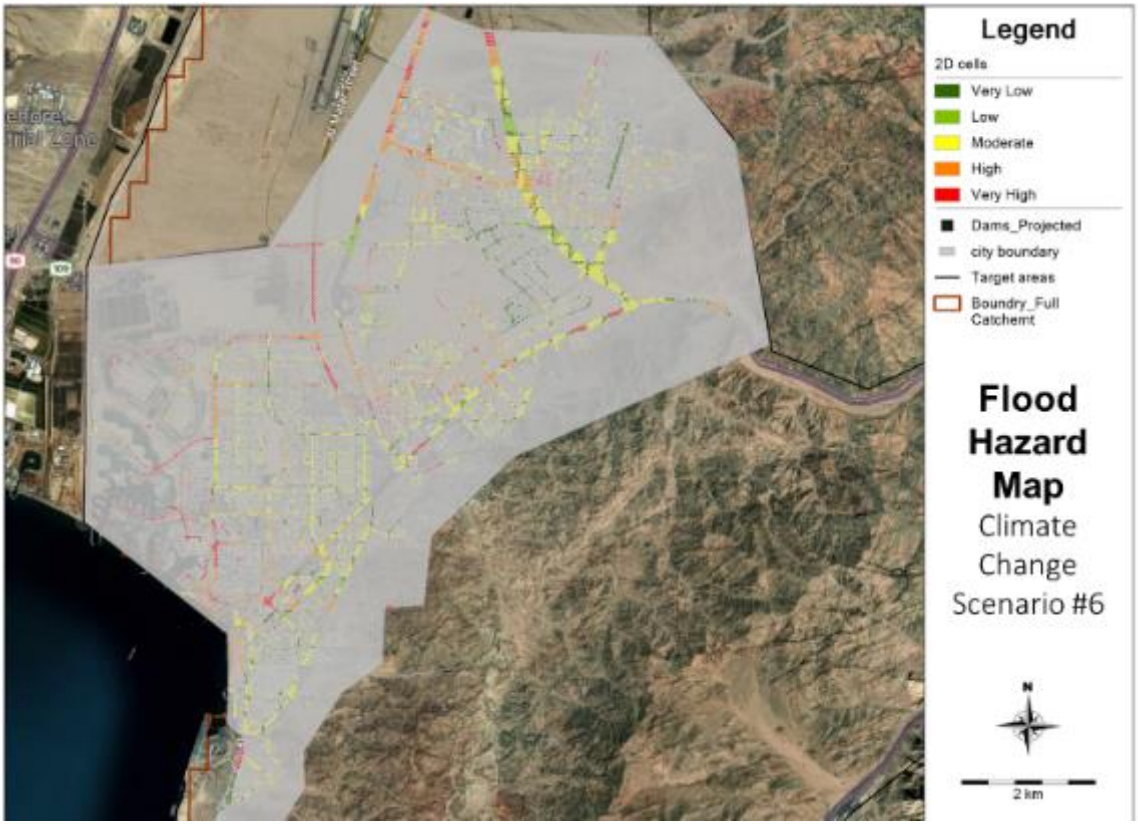


Figure 3-193 City-scale hazard map under the coupled impacts of urbanization and climate change scenario #6 using PCSWMM

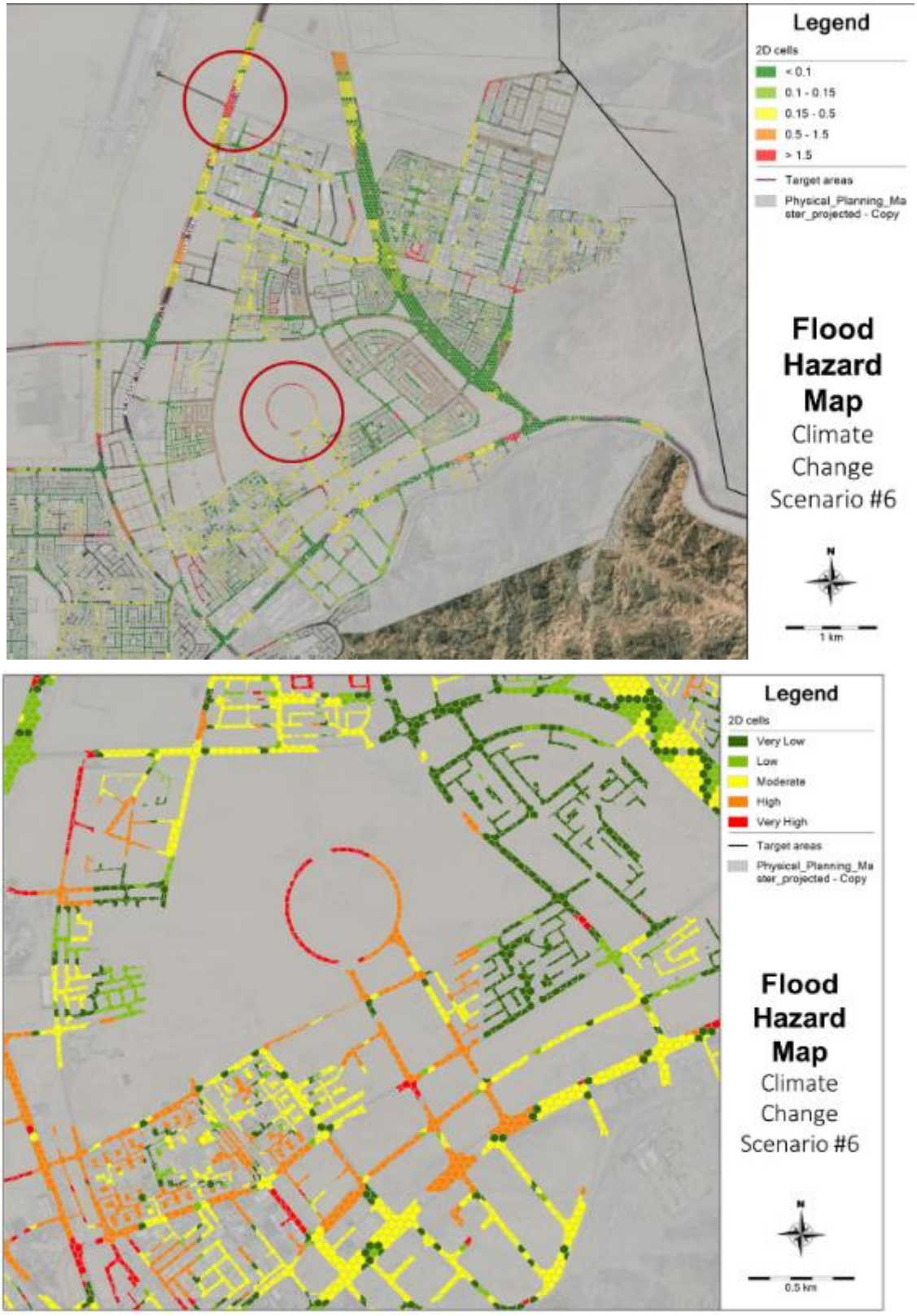


Figure 3-194 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6

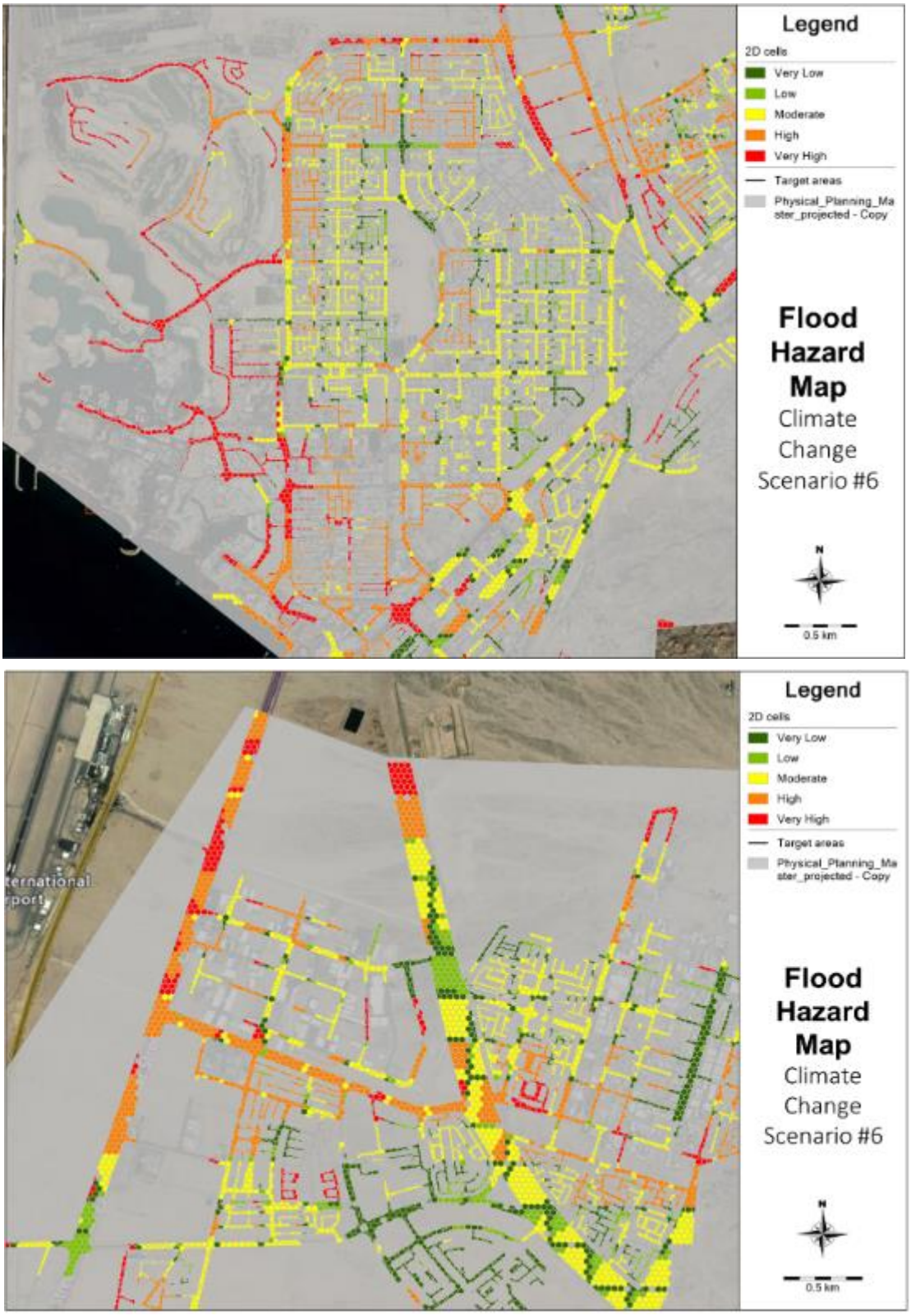


Figure 3-195 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6

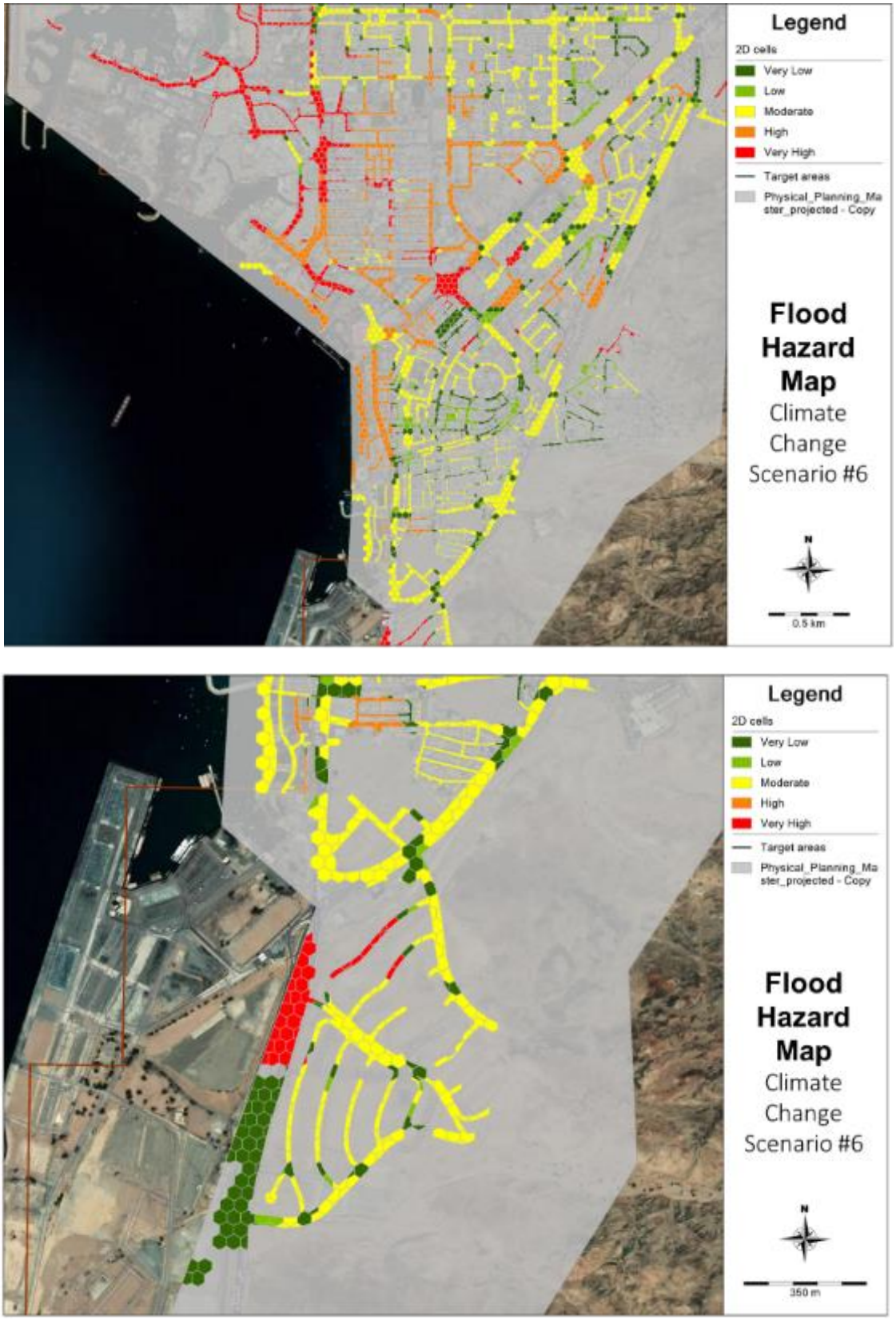


Figure 3-196 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6

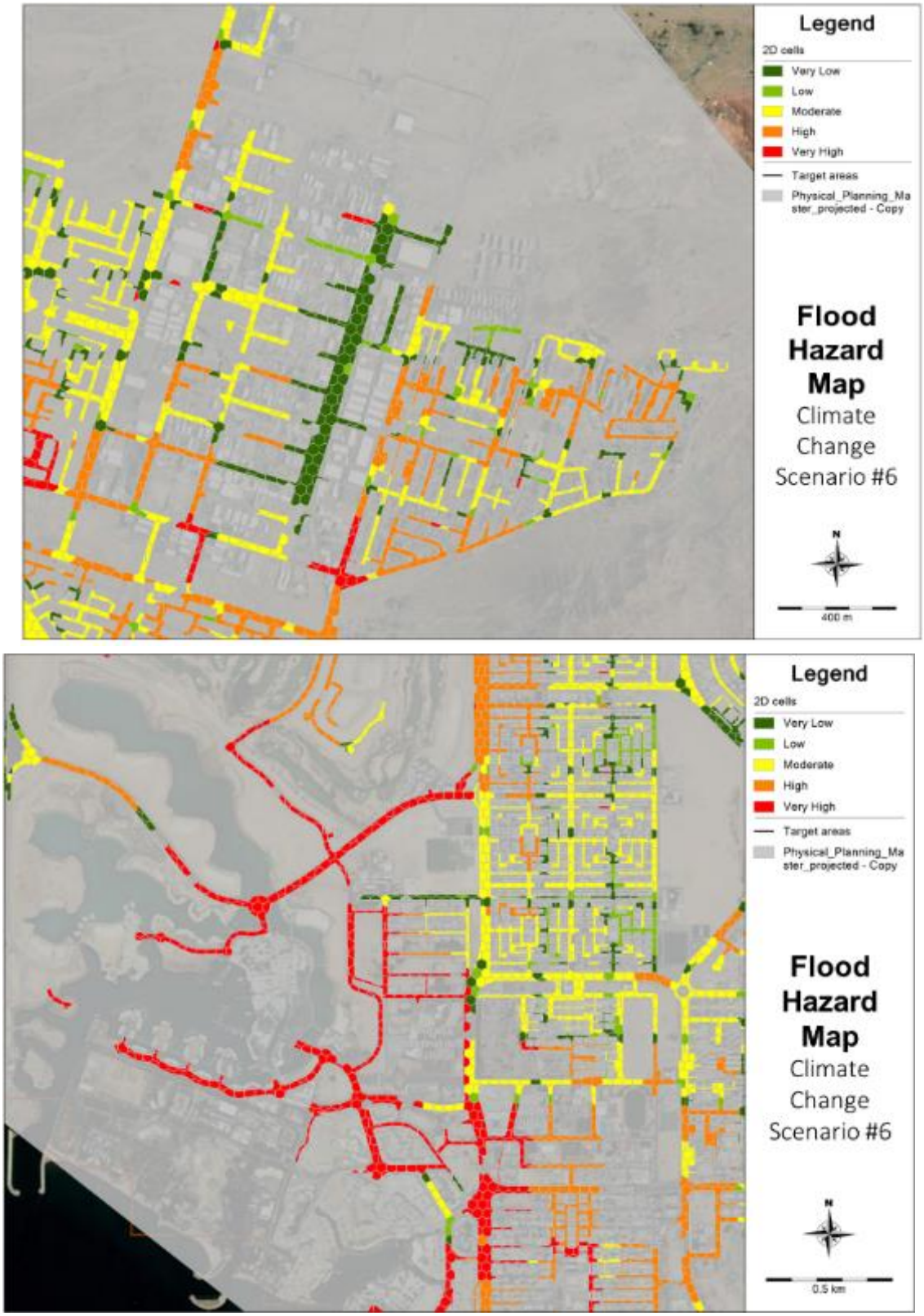


Figure 3-197 Zoomed-in overview of the developed hazard maps at the city scale using PCSWMM under climate change scenario #6

(4) Challenges and Recommendation for Flood Mitigation in ASEZ

The analysis showed that the climate change continues to affect the existing and future developing areas in Aqaba with different ranks of flood hazards. Therefore, the local authorities, urban planners, and stakeholders must understand the urgent need for adequate flood resilience mitigation measures in Aqaba based on clearly understanding of the compound impacts of urbanization and climate changes within all developed hazard maps for the JICA study. The land value and limited short coastal line land in Aqaba sometimes give no options, as geographic constraints push urban planners to develop in high-hazard areas. In such a case, comprehensive resilience-informed planning for mitigation measures systems and preparedness for local communities is highly recommended. The following recommendations are given based on the simulation analysis, site investigations, meetings, and discussions with different ASEZA departments:

- In the ASEZ, the management and monitoring critical data for natural hazards and climate change seem insufficient. Constructing an integrated disaster information database/platform to document and monitor each rainfall event with detailed measurements, counting the losses, damaged and inundated areas, flood depth, flood extent, reservoir sedimentation in dams, and erosion in the main Wadi and flood channels is essential.
- The installed Early Warning System (EWS) is crucial for the ASEZ. However, it does not include rainfall-runoff-inundation forecasting, and EWS components are not operated in an integrated manner. The region still has no flood forecasting and warning system specialized for comprehensive flash floods. Therefore, upgrading the EWS to include weather radar, EW data analyzing system, an EW transmission system with Siren, and ICT (area mail with mobile phone, etc.) is highly recommended.
- There are no guidelines or manuals for designing and constructing the mitigation measures and flood protection for infrastructures crossing Wadi, road network drainage systems, and urban codes. Therefore, upgrading or developing guidelines for infrastructure design standards to involve the risks of natural hazards and climate change is essential.
- It is essential to strengthen the role of urban planning and other disciplines to establish a comprehensive strategic plan and citywide vision to incorporate green infrastructure with an efficient rainwater sewer network and rainwater harvesting systems at the catchment and city scales into urban planning regulations.
- Develop an innovative city resilience framework and means of financing (e.g., public–private partnerships).
- Enhancing the awareness of Aqabaway (promoting public awareness plan) regarding disaster risk management and involving the local people in the action plans for disaster risk reduction.
- It is recommended to restructure the robust Disaster Risk Management Department for a resilient city.
- Consider the impact of climate change impacts and flash flood disasters to design and

maintain road development in Aqaba.

- ASEZA should establish guidelines for climate-resilient road networks and drainage systems that consider the associated risks with climate change.
- It is essential to consider an integrated resilience approach, as shown in Figure 3-198**,** considering different structural and non-structural mitigation measures related to landscape tools such as Low Impact Development tools (LIDs), retention ponds, neighborhood underground water tanks for harvesting and temporarily storing the water as detention tanks, swale infiltration trenches, infiltration wells, sidewalk pervious pavement, permeable paving, sink gardens, open space gardens. Etc.

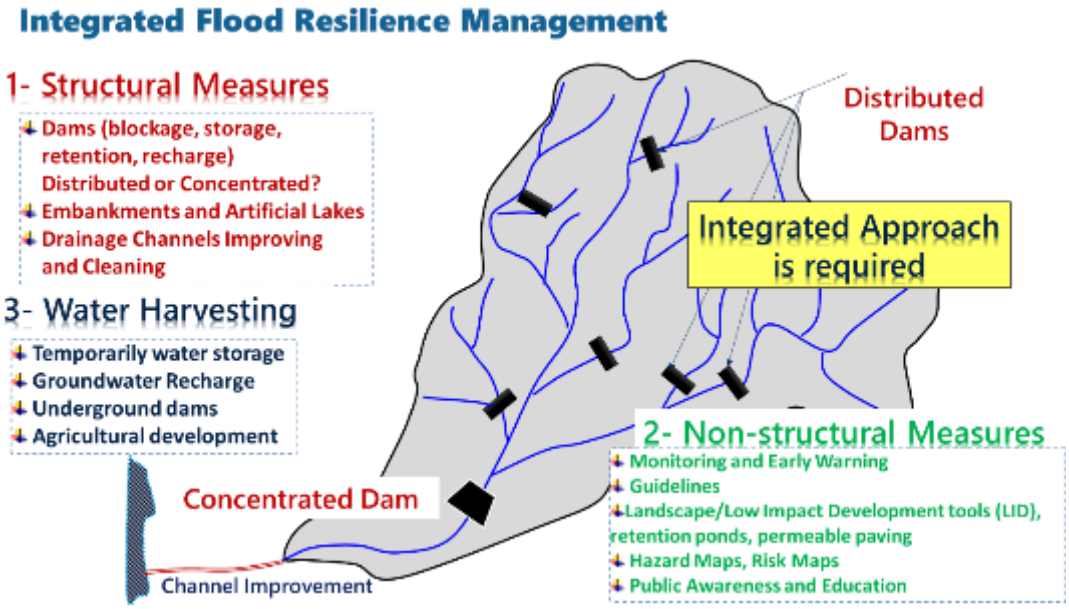


Figure 3-198 Enhancing flood resilience management in Aqaba by considering an integrated approach from the mountains to the sea.

3.8.3 Seismic Risk Management

(1) Summary of Seismic Risk in Aqaba

Aqaba is located in a seismically active region. Jordan lies within the complex tectonic setting of the Dead Sea Transform Fault System, which is known for its seismic activity.

In 1068, a major earthquake in the Hejaz (northwest Arabia) occurred during the morning and was reported to have killed 20,000 people in the whole region. The city of Aila, which was the ancient city of Aqaba was completely destroyed.

Another notable earthquake in the region occurred in 1995, known as the Gulf of Aqaba earthquake. This earthquake had a magnitude of 7.3 and caused damage in several countries surrounding the Gulf of Aqaba, including Jordan, Israel, and Egypt. Minor damage and cracks to the buildings occurred in the city and high waves were reported along the coast. The field survey conducted after the main shock indicated that some hotels along the northern beach suffered serious structural damage, where many gaps in walls were observed and the inner walls collapsed. Some concrete-constructed water tanks in the southern beach collapsed and were severely damaged. The earthquake highlighted the seismic risk in the area and prompted increased attention to earthquake preparedness and infrastructure resilience.

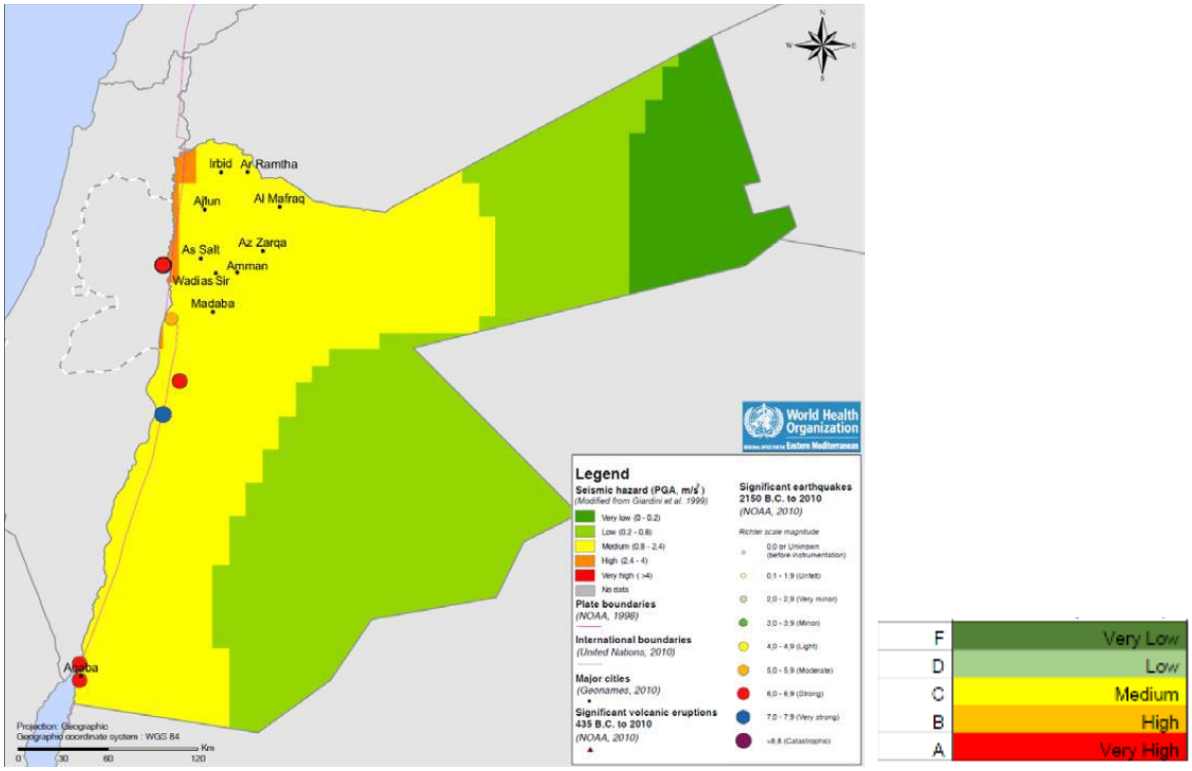
While Aqaba may not experience earthquakes as frequently as some other regions along the fault system, there is still a seismic risk present. Over the past three decades, seismic recordings from the Jordanian Seismic Observatory show that the Gulf of Aqaba and the southern part near Cyprus of the Anatolian Fault are the main sources of tectonic activity in the region. Notably, the earthquakes in the Gulf of Aqaba in 1995 (Mw=7.2) and off the southwest coast of Cyprus in 1996 (Mw=6.8) confirmed their significance.

1) Seismic Hazard

As for the seismic situation in the Aqaba area, it falls within Area A on the seismic hazard map for Jordan illustrated below.

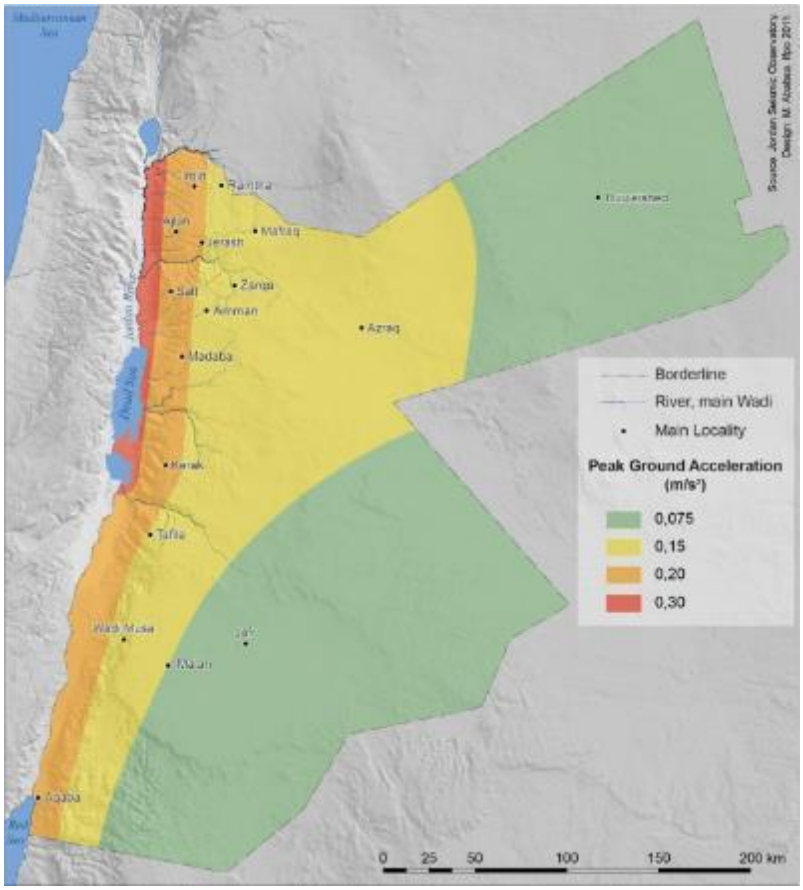
The Peak Ground Acceleration, which is a seismic division used to determine seismic hazards in Jordan within the Jordanian seismic-resistant buildings code, is 0.20 mm/s which is considered a very high risk. Some studies expect this value to be even higher.

The Spectral Acceleration, which is a measure used to describe the acceleration response of a structure or the ground at different frequencies during an earthquake, is also considered high in Aqaba. High spectral acceleration values are of particular concern because they suggest a higher level of seismic hazard and a greater risk of structural failure or damage. Higher spectral acceleration values require stronger and more robust structural design measures to ensure the safety and resilience of buildings and other facilities during earthquakes.



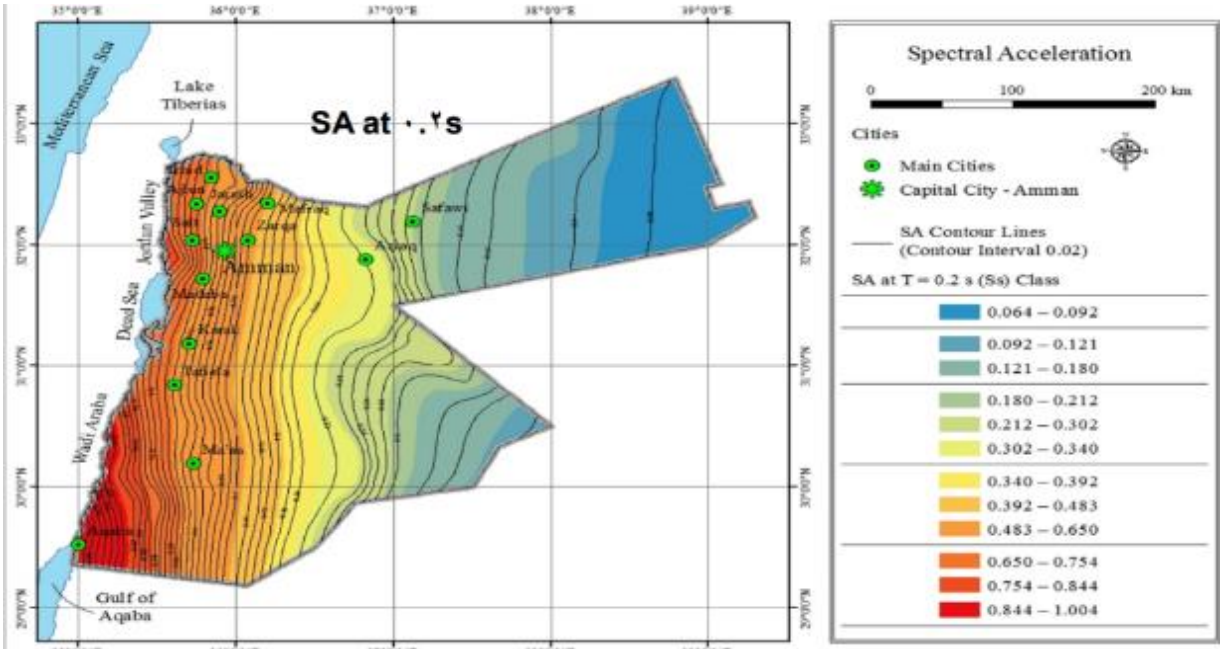
Source: WHIO,2011

Figure 3-199 Seismic Hazard Map in Jordan



Source: Jordan seismic observatory

Figure 3-200 Peak Ground Acceleration



Source: The Arab Center for Engineering Studies (ACES)

Figure 3-201 Spectral Acceleration Map

2) Related major studies for Seismic Risk Assessment

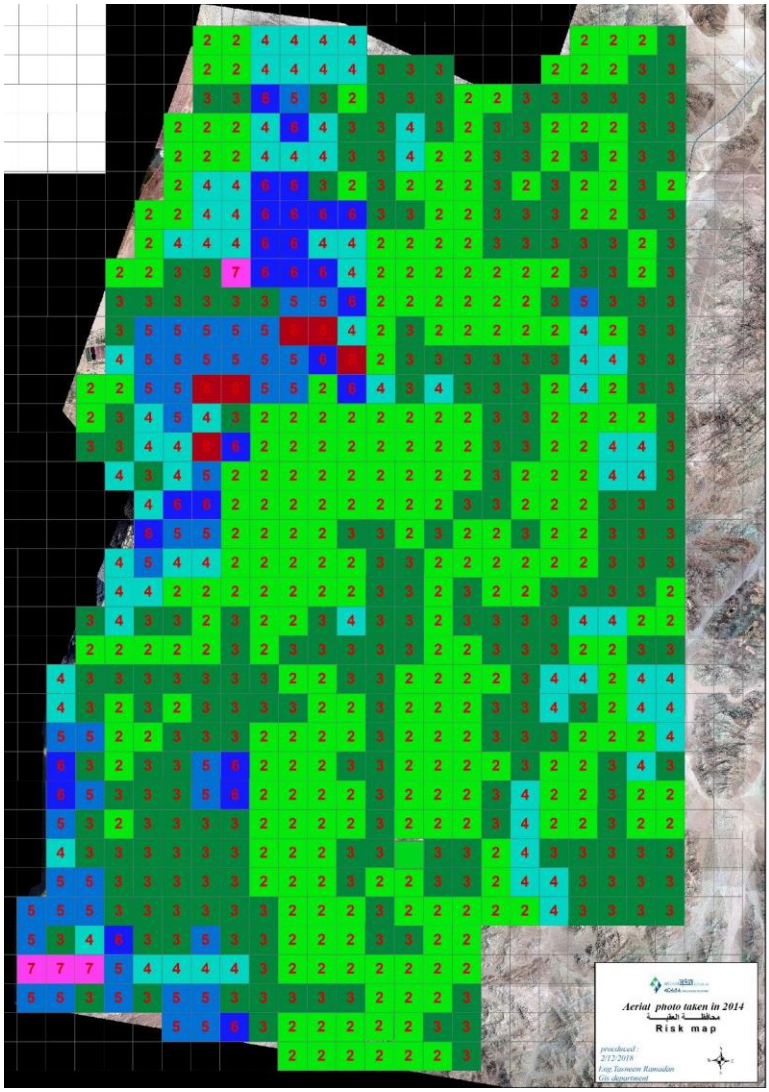
A previous seismic risk-related study conducted for Aqaba are the micro-zonation study (2008) by Royal Scientific Society (SDC funded project) and the Disaster Risk Assessment for Aqaba (2011) conducted by UNDP. The studies quantify the potential hazards and vulnerabilities of Aqaba based on current and future disaster scenarios, assesses its capacity for disaster prevention and emergency response, and suggests strategies and actions for disaster risk management to be incorporated into Aqaba's development plans and policies.

a) Seismic Risk Assessment

According to the 2008 micro-zonation study, an Earthquake Risk Map of Aqaba as shown below was created to provide critical data to guide the preparation of the Land Use Plans for the City. It basically indicated levels of seismic risk from 1 (the lowest) to 8 (highest).

Most of the residential buildings and other commercial, industrial, and leisure locations within ASEZ have a stiff soil foundation material, and in the incident of an earthquake, it is expected that buildings located within this soil type will suffer immense ground shaking levels due to the effect of seismic signal amplification.

Areas with high density population and vulnerable structures are usually at risk. Therefore, structures not subjected to the seismic-resistant buildings codes are vulnerable to high damage consequences.



Source: Seismic hazard mitigation in Jordan (2008), RRS

Figure 3-202 Seismic Risk Factor Map of Aqaba

According to the 2011 study, though saying it is difficult to predict the earthquake accurately, various probabilistic seismic scenarios have been analyzed with a maximum Magnitude of over six that might occur anytime in the next 30 years along the dead sea fault system. The overview of the seismic risks is as follows. It should be noted that this risk assessment reflects the situation when the population was 106,000. Today, the population has more than doubled, and more buildings and infrastructure have been constructed, so the damage could be even more severe.

- Probabilistic seismic analysis estimates a major earthquake (Magnitude over 6) might occur anytime in the next 30 years along the Dead Sea Fault System (1,000 km) with a maximum magnitude of 7,5 (Mw).
- Aqaba Fault system is the main seismic source within the region, which runs through the offshore-onshore boundary of the northern gulf region across the city of Aqaba.
- The estimation of the damage of residential buildings 12,125 in total. The most exposed eight neighborhoods due to the earthquake are: Al-Shalaleh, Old City,

Al-Kazan, East Region-Industrial South, Al-Radwan, Al-Naser, Al-Rawdah Middle and Al-Remal.

- The estimation of the repair costs for the residential buildings is 233,194,452JOD in total and the estimation of number for required shelters are 52,420 in total.
- The estimation of number for human casualties is 5,470 in total (2,527 for minor injuries, 1,240 for medium injuries, 640 for medium severe injuries and 640 for Dead). It is said that the number of casualties could increase by 10 to 25% with an earthquake happening during high tourist peak season. (e.g. Weekend, Ramadan).
- The earthquake is estimated to damage infrastructure (roads, water and wastewater systems, electricity, etc.) and facilities (schools, hospitals, tourism facilities, ports, etc.) will require time for restoration.
- The potential for a Tsunami and soil liquefaction is considered as minimal, though the northeastern shoreline corner of the Gulf of Aqaba has higher risk for soil liquefaction.

b) Impact assessment

The overview of the impact occurred by the earthquake is as follows.

- Many Aqaba inhabitants may need shelter or relocation, and humanitarian assistance to fulfill basic human needs will be required by the government in addition to emergency medical care.
- The earthquake will hit the only Jordanian seaport through which most of imports and exports are shipped. The consequence on national output and income will be severe.
- There are possibilities that all the economic activities in Aqaba including the production in the southern coast will shut down for few months and some economic activities will not recover to the pre-earthquake level for few years. The situation will depend on how the government will launch the reconstruction shortly after the relief of the disaster.
- Tourism will be severely affected affecting hospitality sector as well as wholesale and retail trade, causing immediate loss of employment.
- There are possibilities for secondary effects on overall economic performance (regionally and nationally) such as the implications for the fiscal accounts (tax losses – VAT, income, corporate, customs, tourism- for ASEZ and Jordan Government) and the balance of payments.

c) Adaptation measures

The overview of the adaptation measures proposed in the report are as follows.

- Updating earthquake risk maps
- Enforcing seismic-resistant buildings codes to improve structural design to withstand shaking
- Establishing EWS
- Enhancing public awareness

(2) Current situation

1) Seismic-resistant Buildings Code

a) Outline of the Seismic-resistant Buildings Code

In 2005, the Jordan Engineers Association Council started seismic auditing of designs and to request engineering design offices to begin comprehensive structural design according to the Seismic-resistant Buildings Code.

This seismic-resistant buildings code addresses the conditions and requirements related to seismic actions and their effects, as well as the design of reinforced concrete and steel structures to withstand earthquakes. This applies to both new buildings and existing structures, whether undergoing modifications or changes in use and occupancy conditions. The aim is to take comprehensive precautions in buildings, ensuring safety and security measures. These provisions should also be followed for special structures (non-buildings) such as arches, tanks, silos, chimneys, and power stations. All areas in Jordan adhere to the unified seismic-resistant buildings code.

The Jordanian National Building Council later noted that buildings constructed before 2005 lacked seismic design requirements. Consequently, it introduced the Seismic Design Preparation Code for Resilient Buildings in Jordan and the role of a chief specialist in building assessment and rehabilitation was also established by the Jordanian Engineers Association in 2020. Also, a new seismic-resistant buildings code was issued in 2022, introducing a chapter on assessing and rehabilitating existing structures. The oversight of buildings involves plan approval, with the supervision role ensuring construction adherence to approved plans.

b) Implementation of the Seismic-resistant Buildings Code

The implementation of the seismic-resistant buildings code goes through several stages.

Initially, a site inspection is conducted to assess the nature of the geographical terrain and its alignment with the seismic map of Aqaba. This ensures that the construction is to the actual conditions. The site inspection report, incorporates all technical examinations, including soil testing and borehole examinations. These tests reveal the spread of seismic waves based on the nature of the soil or rock present. The results are then compared to the established table in the report, following the seismic-resistant buildings code, to determine the design approach. Only two laboratories in Aqaba are responsible for preparing these reports: Aqaba Modern Laboratories and the Arab Laboratory. Peak Ground Acceleration (PGA) map and Spectral Acceleration Map for the s referred during inspections to determine the seismic velocity in that area.

The second step involves taking the report to the Jordanian Engineers Association for thorough examination and approval. This ensures that the inspections meet the required standards and are not deficient. After approval, the green light is given to commence the design process. The Jordan Engineers Association functions solely as an auditor, verifying the inspections, without conducting the actual examinations.

After completing the designs, they are resubmitted by the design offices to the association for further scrutiny. Once approved, a permit is granted, and work can commence under the authority of the Aqaba Special Economic Zone. ASEZA's role involves granting a permit for

direct commencement of work.

For quality control and by the standards outlined in the plans, there is an oversight committee from the Jordan Engineers Association responsible for monitoring the work. This is implemented in most housing projects of the Aqaba Special Economic Zone.

c) Challenges

The process outlined appears to be a comprehensive and systematic approach to ensuring the seismic resilience of buildings in the Aqaba Special Economic Zone. However, there are a few potential challenges or concerns that might be considered.

- Existing Inappropriate Buildings

Dr. Anis Shatnawi, a seismic engineering specialist in the University of Jordan, highlighted that buildings in Jordan constructed before the 2005 seismic-resistant buildings code are considered old and vulnerable to earthquakes, and approximately 99% of structures of the buildings from 1945 to 2005 were built without considering seismic impact. The cost of building inspection and rehabilitation varies, with demolition recommended if renovation costs exceed 40-50% of the total building value.

- Limited Number of Testing Laboratories:

Relying on only two laboratories in Aqaba (Aqaba Modern Laboratories and the Arab Laboratory) might pose challenges in terms of capacity and potential delays in the testing process.

- Stringency of Approval Process:

Depending solely on the Jordanian Engineers Association for approval could lead to a rigorous and time-consuming examination, potentially causing delays in project timelines.

- Monitoring Challenges:

Monitoring agency may not coordinate effectively to ensure the application of seismic design standards outlined in the seismic-resistant buildings code.

2) Enhancing public awareness

Operations Department in ASEZ conducts essential training for various teams, entities under the authority, and even security forces. There was a training session called "Safety Path 3," simulating an earthquake in the Aqaba region. The goal was to practice evacuation procedures, where relevant authorities controlled and closed several roads to redirect people to shelter centers, mostly schools. One of these centers is in the Rabia area, capable of accommodating 5000 people, and serving as the primary evacuation center. The final evacuation destination is in the Zayziah area near Amman.

However, the training was conducted with no realistic application, and the training ratio did not include the private sector or civilians. Also, the resources and equipment seemed insufficient for large size catastrophe.

3) Establishing EWS

EWS for seismic activities are not available up to date.

However, the Jordanian Seismic Observatory project, established in 1983, aims to monitor seismic activity in Jordan and neighboring regions to assess seismic risks and estimate the potential damage in the unfortunate event of a destructive earthquake. The observatory operates 24/7, recording seismic events through a network of seismic monitoring stations (both short and long frequency) and stations monitoring strong motion distributed across vital structures in Jordan. This is essential for recording ground acceleration necessary for earthquake-resistant engineering designs. The Seismic Observatory issues daily and annual reports on the seismic events observed, with copies sent to all relevant authorities.

(3) Challenges for Seismic Risk Reduction in ASEZ

Possible challenges in improving Aqaba's earthquake disaster preparedness include.

- Urban planning based on earthquake risk maps: mitigation measures based on the earthquake risk maps need to be considered.
- Improving densely populated residential areas: in high seismic risk areas where vulnerability should be addressed at the local level. Al-Shalaleh, Old City, Al-Kazan, East Region-Industrial South, Al -Radwan, Al-Naser, Al-Rawdah Middle and Al-Remal
- Improving the earthquake resistance of housing: It is necessary to encourage the earthquake resistance or reconstruction of buildings built before 2005 that are not earthquake resistant. The possibility of using more earthquake-resistant structures and materials and introducing earthquake-resistant designs for new buildings should also be considered. Also, strengthen the operation of earthquake resistance standards: ensure that appropriate building standards for earthquakes are strictly adhered to at the time of construction, and educate designers and builders. Consider reviewing and tightening development plans and seismic-resistant buildings codes in particularly vulnerable areas such as coastal and mountainous regions.
- Improve earthquake resistance of public buildings: critical facilities such as hospitals, schools, power plants, and water supply systems need to be retrofitted and reinforced to increase their seismic capacity and reduce potential damage and disruption.
- Improving earthquake resistance of tourist facilities: Measures need to be taken to ensure higher earthquake resistance in buildings such as hotels, tourist attractions, and shopping areas that attract large numbers of tourists. This includes seismic design, retrofitting, and periodic seismic inspections.
- Improving the Earthquake Resistance of Infrastructure: Improving the earthquake resistance of infrastructure such as roads, bridges, water supply, and electricity will enable faster post-quake recovery and disaster response. In addition, regular inspection and maintenance of existing buildings and infrastructure will be conducted to ensure safety and functionality.
- Develop an emergency response plan: a response plan needs to be developed to ensure that local residents and authorities can respond quickly and effectively in the event of an earthquake or other disaster.

- Provision of Emergency Information: A system to promptly provide emergency information on earthquakes and disasters needs to be put in place. This includes the introduction of systems and applications that provide disaster information, especially for tourists and foreign workers.
- Secure shelters: provide a safe environment for everyone to evacuate in the event of an earthquake by establishing outdoor open spaces and secondary evacuation facilities and shelters where residents and tourists can safely take primary shelter.
- Securing evacuation routes: It is important that safe roads are secured to provide escape routes and transport routes for relief supplies in the event of an earthquake.
- Educate and raise awareness of the local community: it is important to educate local residents about the risks of earthquakes and appropriate ways to deal with them, and to raise earthquake awareness.

3.9 Smart City (Utilization of ICT in ASEZ)

3.9.1 Smart City Approach in General

(1) What is "Smart City"?

As the comprehensive definition of a smart city is still evolving, a smart city is defined by different authors and organizations differently. There is no universally accepted definition of a smart city.

Some of the different definitions for a Smart City are:

The British Standards Institute - "the smart city is an effective integration of physical, digital, and human systems in the built environment to deliver a sustainable, prosperous, and inclusive future for its citizens".

The Government of India, "Smart cities provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which will act like a lighthouse to other aspiring cities".

European Union - "A smart city is a place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and business".

Government of Japan (Ministry of Land, Infrastructure, Transport and Tourism) - A holistically optimized, sustainable city or district where management (planning, building-up, management/operation, etc.) is executed leveraging such advanced technologies as ICT for the resolutions of various issues of the city.

UN HABITAT - "People-centered" smart cities leverage data, technology and services for common good, delivering the inclusive and sustainable cities that are needed in the 21st century.

The concept of smart cities has evolved over time and has become an important topic in discussions related to enhancing a city's performance and the quality of life for its residents. These cities use technology and innovation to address urban issues and employ various policies and strategies to improve social integration, economic competitiveness, and environmental sustainability. In this way, smart cities play a role in achieving SDG 11 "Make cities and human settlements inclusive, safe, resilient, and sustainable".

Smart cities use smart technologies and smart solutions including Internet of Things (IoT), Information and Communication Technologies (ICT), big data to increase operational efficiency, to monitor, control, and integrate various urban systems. A major feature of smart city initiatives is to use digital solutions and innovations in technology to improve, upgrade and make urban public service delivery more efficient. However, data alone will not lead to higher levels of efficiency and productivity. Data must be correctly applied, based on a sound scientific approach, and linked to appropriate applications.

Cities and countries have tailored the smart city concept to their respective contexts, based on local factors, such as development stage, digital development maturity and each individual government's capacity.

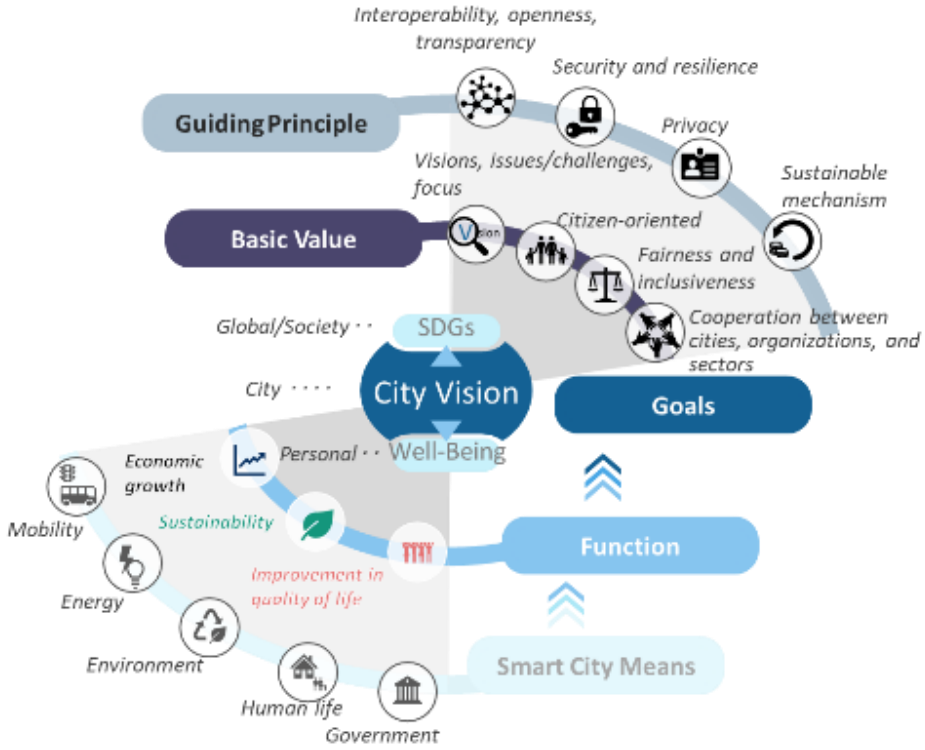
(2) Smart City Concept

As mentioned, the definition of smart city is different by country and city, and thus their goals and focus may also differ. Having said that, there are some common aspects in terms of principles and basic values, and functions. Referring to the definition set out in the "Smart City Guidebook "of the Smart City Public-Private Collaboration Platform Secretariat of Cabinet Office in the Government of Japan (hereinafter referred to as the "Smart City Guidebook"), while also incorporating the context of smart city in developing countries, smart city can be generally described as follows.

A Smart City is an initiative which:

- follows fair and transparent principles and rules. [Guiding Principles]
- is based on common value and principles such as public interest in society, promotion of the well-being of citizens, respect of diversity, and realization of social inclusion. [Basic Concept]
- comes from urban management and services in each field with digital technologies and utilization of various data. [Smart City Means]
- continuously creates new values while maintaining harmony between citizens' lives and natural environment. [Function]
- resolves problems in respective cities and achieves the vision, SDG's and well-being of citizens. [Goals]

Figure 3-203 below illustrates the image of the smart city system according to the preceding basic principles, values, means, functions, and goals.



Source: JICA Study Team

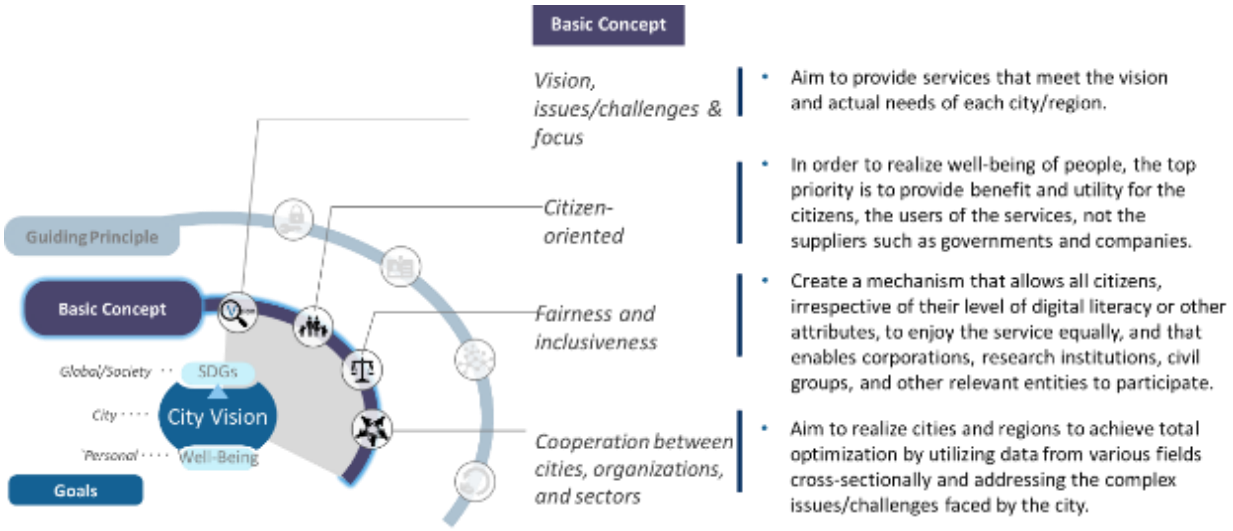
Figure 3-203 Image of Smart City System

(3) Values and Principles of Smart City

The four basic values of smart city are as follows: "Vision-Task focused", "Citizen-oriented", "Fairness and Inclusiveness", and "Cooperation between cities, organizations, and sectors".

- Vision-Task focused: Aim to provide services that address the visions and actual needs of cities and regions, as well as international and social issues including SDGs.
- Citizen-oriented: In order to realize the well-being of people, the top priority is to provide benefit for the citizens and the users of the services, not the suppliers such as governments and companies.
- Fairness and Inclusiveness: Create a mechanism that allows all citizens, irrespective of their level of digital literacy or other attributes, to enjoy the service equally, and that enables corporations, research institutions, civil groups, and other relevant entities to participate.
- Cooperation between cities, organizations, and sectors: Aim to realize cities and regions to achieve total optimization by utilizing data from various fields cross-sectionally and addressing the complex issues and challenges faced by the city.

Although "fairness and inclusiveness" is classified as a principle in the Cabinet Office Smart City Guidebook, the study team positioned it in the domain of "value" because this is more appropriate when capturing the context of cities in developing countries and international development.



Source: JICA Study Team

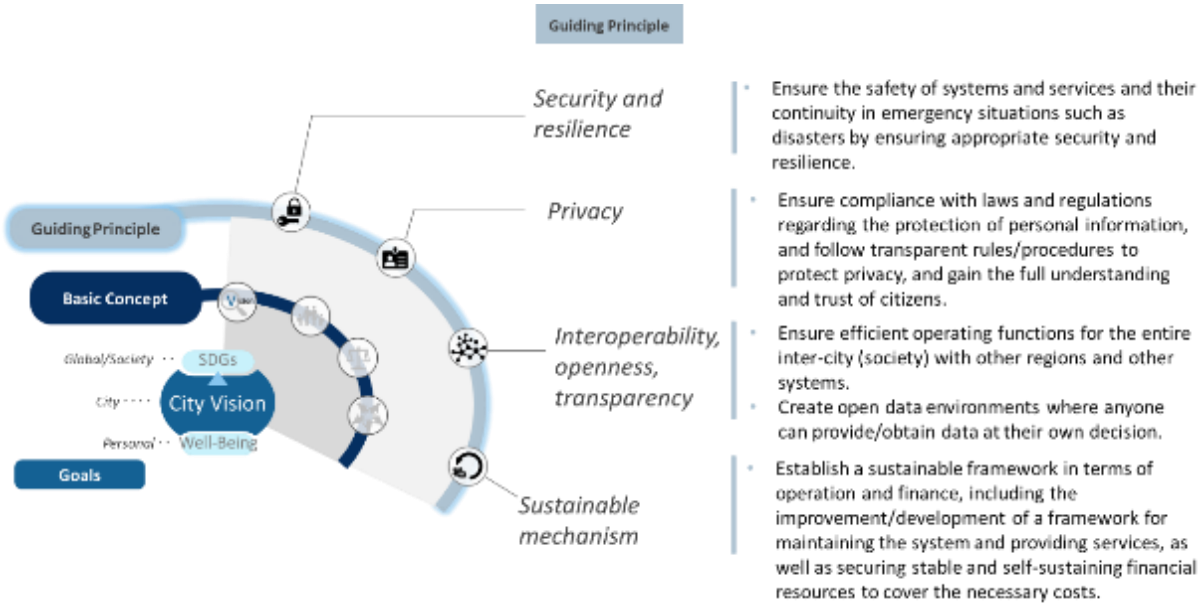
Figure 3-204 Basic Values of Smart Cities

The four guiding principles of Smart Cities are "Security and Resilience", "Privacy," "Interoperability, openness, transparency", and "Sustainable mechanism".

- Security and Resilience: Ensure the safety of systems and services and their continuity in emergency situations such as disasters by ensuring appropriate security and resilience.
- Privacy: Ensure compliance with laws and regulations regarding the protection of

personal information and follow transparent rules and procedures to protect privacy and gain the full understanding and trust of citizens.

- Interoperability, openness, transparency: Ensure efficient operating functions for the entire "inter-city" (society) with other regions and other systems. Develop an open data platform where everyone can provide and obtain data at their discretion and make data available under appropriate rules.
- Sustainable mechanism: Establish a sustainable framework in terms of operation and finance, including the improvement and development of a framework for maintaining the system and providing services, as well as securing stable and self-sustaining financial resources to cover the necessary costs.



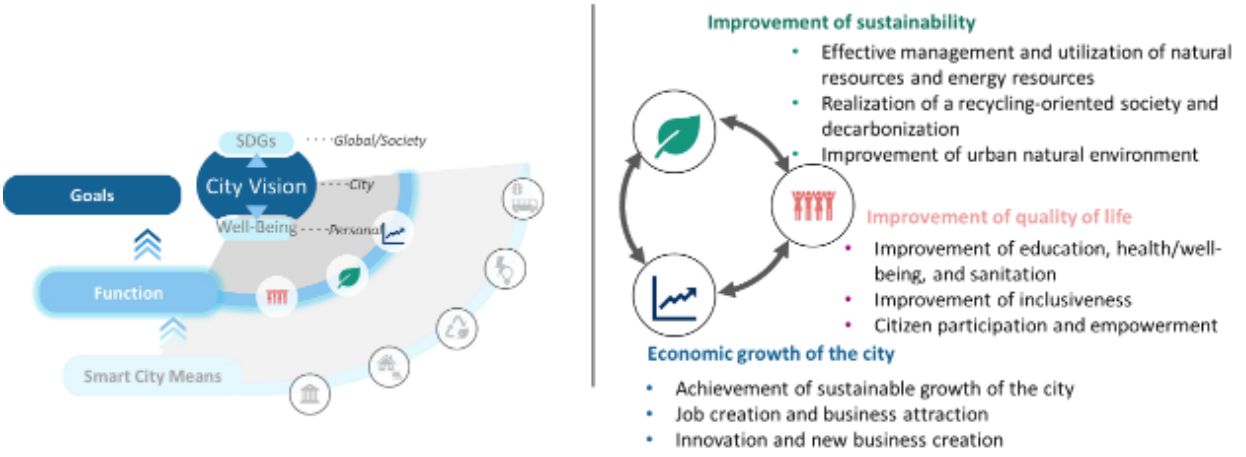
Source: JICA Study Team

Figure 3-205 Basic Principles of Smart Cities

(4) Smart City Function and Means

By implementing smart city initiatives based on the basic values and principles previously described, it is possible to maintain harmony between citizens' lives and the natural environment while creating new sustainable values. This can lead to solving each city's urban challenges and achieving visions, SDGs, and well-being.

To this end, important functions for smart city will be ensuring sustainability for natural resources, energy, society and economy as well as growth of city by promoting employment and economic activities and creating innovations and improvement of the quality of life of citizens.

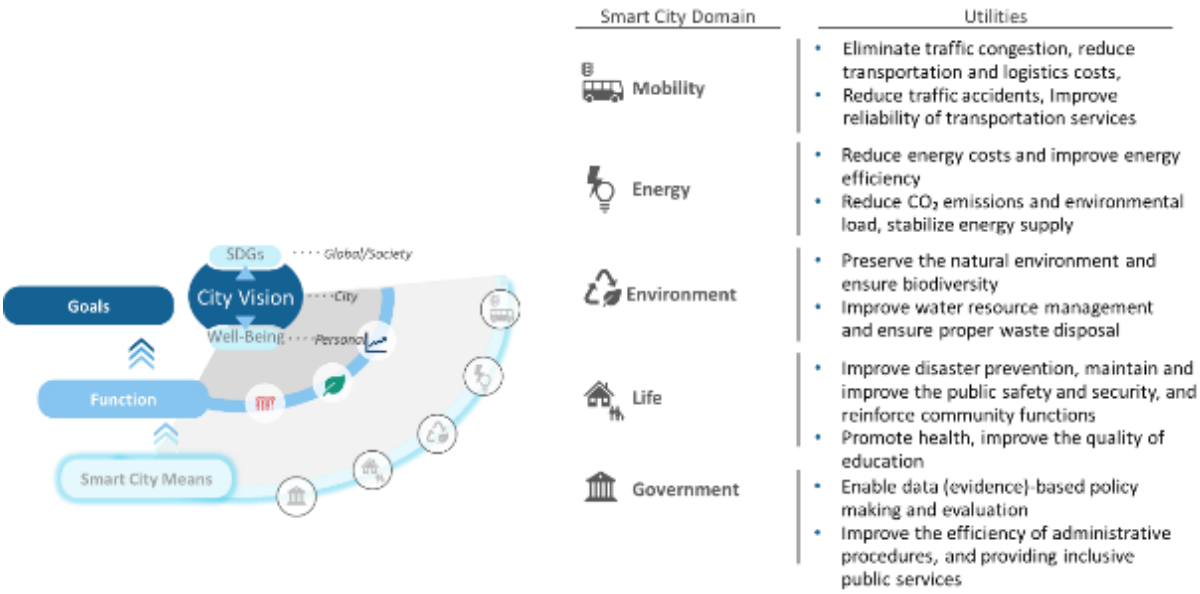


Source: JICA Study Team

Figure 3-206 Smart City Functions

In the concrete urban management, new methods or means of urban management that utilize digital technology and data are expected to provide holistic solutions for various urban challenges.

Figure 3-207 below shows examples of the content of Smart City Means in mobility, energy, environment, life, and government.



Source: JICA Study Team

Figure 3-207 Smart City Means

(5) Smart City Domains

As mentioned earlier; in order to achieve a better urban environment, well-being, and a city's vision, it is important to have initiatives in each sector of the smart city domain and to operate them more efficiently by integrating them, as well as creating new value through collaborative and integrated initiatives. How to define the smart city domain depends on the characteristics of each city, urban challenges, and development situation, but the following

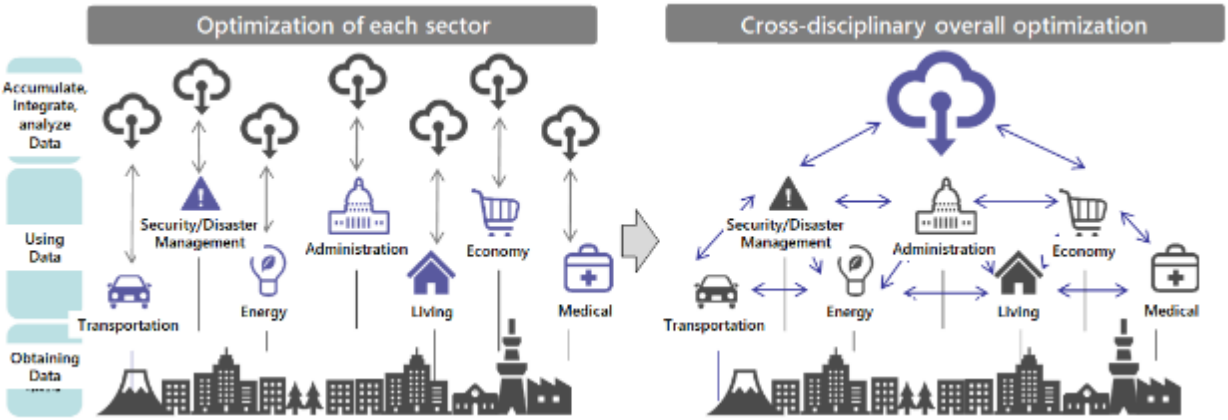
provides examples of smart city domains and the activities each domain covers, as a reference.



Source: JICA Study Team

Figure 3-208 Smart City Domains and its activities (Example)

In addition, it is important that each area does not aim for optimization individually, but rather that all areas work together to achieve a cross-disciplinary overall optimization.

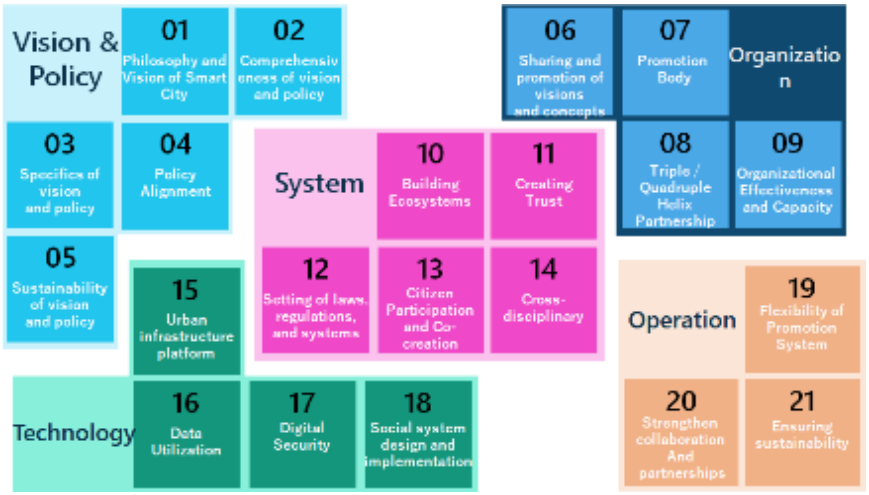


Source: Ministry of Land, Infrastructure and Tourism (MLIT), Japan

Figure 3-209 From sector-wise optimization to Cross-disciplinary optimization (Image)

(6) Success Factors for Realization of Smart City

Referring the report of "Data Collection Survey on the Application of Smart City Approach" (JICA, March 2022), 5 success factors (Vision & Policy, Organization, System, Technology, and Operation) consisting of 21 items have been identified.



Source：“Data Collection Survey on the Application of Smart City Approach” (JICA, March 2022) compiled by Study Team

Figure 3-210 Success Factors for Realization of Smart City

Those success factors should be taken into consideration when we will implement Smart City Initiatives in ASEZ.

The table is the detail explanations of 5 success factors and 21 items as for the reference.

Table 3.97 Success Factors for Realization of Smart City (Reference)

No		Theme	Points	Detailed Perspectives
Policy	1	Establishing concepts and vision	Aligned with national strategy and urban planning, positioned as an approach to creating new value in cities, improving the well-being of citizens, and achieving sustainable urban development.	• The concepts and vision of SC have been set based on overall national strategy and urban planning. • In addition to solving the social problems associated with urbanization, SC is also expected to create value that leads to urban development. • Elements of digitalization and decarbonization are incorporated, and it is clearly stated that they will contribute to improving the QoL of citizens.
	2	Comprehensiveness of vision and policy	The vision is positioned as a comprehensive approach, and it includes the possibility of spreading to various areas and creating new value.	• Comprehensive elements are envisioned (SDGs linkage, urban growth and improvement of citizens' well-being, etc.), rather than just vertical approaches in individual fields. • Perspectives of innovation and value creation are incorporated.
	3	Specifics of vision and policy	A clear message, purpose, direction, and measurable targets for Smart City are presented.	• The SC vision is not just a universal and abstract message but is organized in a way that reminds us of concrete method of making the best use of regional characteristics. • The purpose and direction of the SC vision are clearly stated. • Specific measures (initiatives) and roadmaps to achieve the SC vision are defined. • Numerical targets have been set and their operation has been clarified.
	4	Policy Alignment	The target domain of Smart City is clear and consistent with existing urban planning and DX strategies (SC and urban planning/DX strategies are not separated)	• The objectives of SC are closely linked and aligned with national development and urban planning. • KPI of urban planning and the objectives of SC are linked. • Digitalization and decarbonization elements are incorporated.
	5	Sustainability of vision and policy	Business cases, investment strategies are considered, and business models are (at least partially) in place.	• A budget for implementing the measures is formed and business models are being tested.

No		Theme	Points	Detailed Perspectives
Organization	6	Sharing and PR of visions and concepts	Each entity involved shares the concept, vision, and values of Smart City, and promotional activities is conducted for citizens.	• Each of the entities involved in the smart city project understands the vision of SC that the country or city has, and the mission and role of each entity within that vision are clearly defined. • The concept and vision of SC are accurately and regularly publicized to citizens, and the relationship between SC-related entities and citizens is close.
	7	Promotion Body	A competent organization or organizational structure is in place to take on a leading and pivotal role in the implementation of Smart City strategies and policies.	• Organizations, councils, clusters, etc., that have the capacity and authority, including human, material, financial, information, and technological resources, have been established for the construction of SC.
	8	Collaboration among public, Private, citizens, academia	A triple-helix (or quadruple-helix with the private sector) system of industry, government, and academia is incorporated into the Smart City ecosystem.	• Cross-sectoral and cross-organizational collaboration and cooperation among industry, government, and academia (and private sector), with authority and capabilities, such as clusters, are being established.
	9	Organizational effectiveness and capacity	There is an internal or an external organization that functions to steer the technical side of Smart City initiative, able to draft specification; manage selection, demonstration, implementation; and evaluation of smart technologies and solutions.	• An expert (e.g., Chief Technology Officer), a specialized team, or an external specialized organization exists within the organization as the entity that selects, demonstrates, and evaluates technologies based on the latest technologies. • An external organization exists to impartially evaluate, demonstrate, and recommend technologies and solutions to the city.
System	10	Building Ecosystems	An effective, functional, and sustainable ecosystem has been formed to promote Smart City.	• There is an open system that allows various entities such as private companies (including start-ups), sponsoring organizations and investors, universities and research institutions to participate freely. • In the advanced technology verification experiment, there is a mechanism to ensure the development from a verification experiment to social implementation by linking the formulation of a business case, compliance with laws and regulations, and human networks for business development.
	11	Creating a Trust	Trust has been built among stakeholders (government, businesses, and citizens) in the formation of Smart City, especially in urban management process of planning, implementing, and operating the city to promote Smart City.	• Trust in the social system has been formed to some extent in terms of history, climate, and culture. • Cross-sectoral trust-based institutional design and communication among government, business, and citizens is in place. • Legal frameworks for open systems, process transparency, data management, and personal information protection are in place to ensure trust.
	12	Setting of laws, regulations, and systems	Norms regarding legal and administrative processes, etc. necessary for Smart City have been clearly defined, and incentive mechanisms and facilities for promotion are in place.	• A standardization process has been set up, including guidelines that define smart city development. • There are effective laws, regulations, and systems to ensure public-private partnerships in smart city development. • Facilities such as special zone system (deregulation), incentive and financial support system, information sharing portal site, and platform development for collaboration.
	13	Participation and co-creation with Citizens	A system for citizen participation is in place (a system for citizen co-creation is being considered or implemented for Smart City).	• A system for citizen participation in identifying urban issues and needs, deciding on measures, and providing feedback on measures has been established or is being implemented. • A mechanism to reflect citizens' needs and perceptions in city administration is being established or studied (citizen-participatory city

No		Theme	Points	Detailed Perspectives
				management).
	14	Cross-disciplinary	Smart City is linked to decarbonization, digitalization, urban (industrial) development, environmental consideration, crisis response, and improvement of the quality of life of citizens.	• There is a structure to build and promote mutually beneficial relationships through collaboration across industrial and business domains. • Approaches and mechanisms to connect the domains are being considered and established (e.g., decarbonization through bicycle use, health promotion, stress reduction of COVID-19, integrated value creation by reducing social security costs through healthier citizens, etc.)
Technology	15	Urban infrastructure and ICT platform	ICT platform (City Operating System) that connects the infrastructure for the Smart City solutions and data collaboration is established or being planned (either partially or at full scale).	• IoT, cloud systems, and City as a Service (CaaS), which are the foundation of SC infrastructure, have been built, partially prepared, or under consideration.
	16	Data utilization	Urban open data has been organized and is being used (or considered) as big data for Smart City, while also sufficiently accounting for data privacy.	• Open data collected through sensors installed in the city is managed and utilized as a shared asset in a form that protects personal information (including in the planning stage). • Basic urban data is maintained as a base registry and is used for developing the SC solutions (including the planning stage). • Guidelines for the use of personal information have been established and citizens' understanding has been obtained.
	17	Ensuring Cyber Security	ICT infrastructure (servers, DBs, NWs, sensors, various control systems) is secured from cyber-attacks and contingencies.	• Operational systems such as guidelines, defense systems, and action plans are in place to respond to cyber-attacks and other crises.
	18	Social system design and implementation	In the construction of Smart City, the aspect of social design has been introduced, and the selection and implementation of smart technologies and solutions have been optimized.	• Smart initiatives are being developed while making effective use of existing infrastructure, services, and other resources (Integration of traditional assets and advanced technology). • Appropriate smart technologies and services that meet the challenges and needs of the city and are consistent with its vision and strategy are integrated harmoniously with existing infrastructure and services, as well as with the local natural environment and culture.
Operation	19	Ensuring flexibility in the implementation	A system that can flexibly modify and respond to changes in the political situation, social environment, and technological trends, as well as to the diverse needs of citizens, is incorporated.	• The status of achievement of goals is monitored, and feedback on measures is provided so that improvements and countermeasures can be taken in a timely and appropriate manner. • In promoting SC, a gradual approach through trial and error is allowed, and while accepting a wide range of opinions and views, an operational system that can flexibly respond to changing social trends and citizen needs is being developed and reviewed.
	20	Strengthen collaboration and partnerships	Inter-city partnerships with neighboring regions and other countries to share the latest knowledge is established.	• Promoting the sharing of information and lessons learned on SC measures (knowledge sharing including best practices) among entities involved in SC and among regions, and support for matchmaking, etc.
	21	Ensuring sustainability	A mechanism for making medium- to long-term commitments to Smart Cities is established.	• Political commitments, legal frameworks, and ecosystem linkages are in place to sustain SC. • Tech companies, including IT and utility companies and other start-ups, that share the vision of the city and are committed to the development of the area are involved.

Source：“Data Collection Survey on the Application of Smart City Approach” (JICA, March 2022) compiled by Study Team

3.9.2 Smart City Related activities in Jordan

While there is no national-level vision or policy in Jordan explicitly promoting "smart cities," the country has implemented digital transformation efforts, including the National Digital Transformation Strategy & Implementation Plan 2021-2025 established in 2020, and has been advancing e-government initiatives. In Amman, there are also movements to promote smart city initiatives. In this section, we will provide an overview of these developments.

(1) National Digital Transformation Strategy & Implementation Plan 2021-2025

See Chapter 2.

(2) Amman Smart City[8]

In 2019, the Greater Amman Municipality (GAM) collaborated with CDM Smith and ENGICON to develop a 10-year roadmap for a comprehensive smart city strategy using the latest AI technology and big data innovation to address urban planning challenges. The platform is expected to provide better access to transportation systems for Amman residents and tourists and contribute to the city's economic development. Although Jordan does not have a national-level vision or policy that claims to be a "smart city," the GAM has taken steps to advance the smart city initiative in Amman. In 2021, the first phase included ten projects that were selected for implementation.

- ✓ Expanded BRT Feeder Services by Neighborhood
- ✓ Walking and Biking Project
- ✓ Curb side Management Project
- ✓ Expanding Ride Sharing Services
- ✓ Traffic Monitoring Platform Project
- ✓ Smart Road Asset Management Project
- ✓ Transportation Electrification Project
- ✓ Flood Early Warning System (FEWS)
- ✓ Smart Streetlight Project
- ✓ Smart Traffic Control System

A five-year strategic plan is reportedly in place for 2022, but no published information on the details has been found.

[8] https://www.cdmsmith.com/en/Client-Solutions/Projects/Smart-Amman
http://www.engicon.com/index.php/sample-projects/transportation/40-amman-smart-city-roadmap-and-traffic-monitoring-platform-project
https://www.facebook.com/cityofamman/videos/amman-smart-city/283704620344158 (18/11/2021)
https://www.jordannews.jo/Section-109/News/Amman-municipality-s-smart-city-plan-draws-mixed-opinions-12216

3.9.3 Smart City Related Activates in ASEZ

While ASEZ does not have a comprehensive vision or plan as "Smart City," various initiatives utilizing ICT have been implemented in each sector. These activities should be considered and coordinated for future comprehensive Smart City initiatives.

This section summarizes the overview of the Smart City-related activities already being carried out in ASEZ.

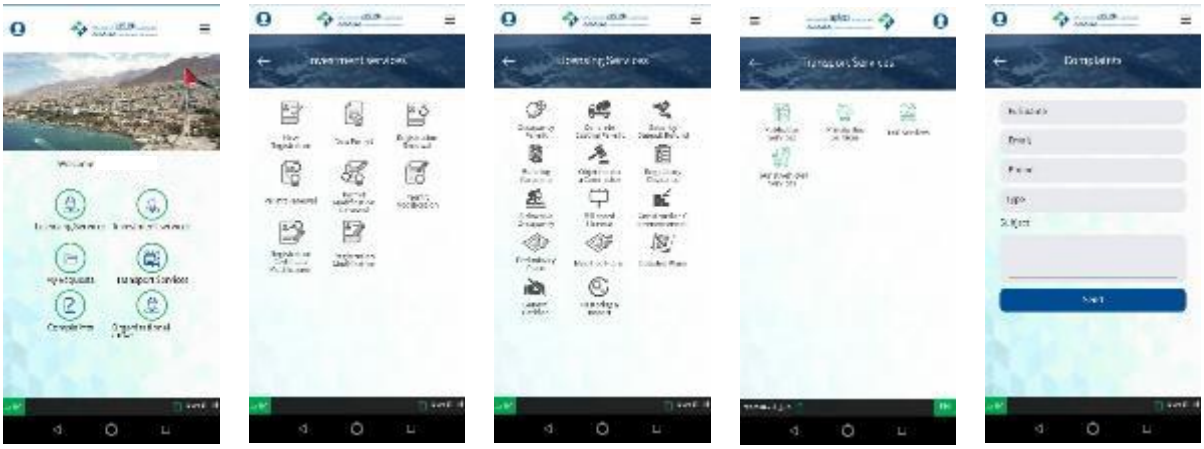
(1) E-services to enterprises/citizens by ASEZA

ASEZA provides an e-service for permits and licenses for various business activities in ASEZ.

As of 2022/12, it is possible to apply online for 105 permits and licenses, including applications for work permits, work visas and other permits and licenses, applications related to building permits and applications related to investment permits and licenses.

Complaints to ASEZA and appeals against decisions of the various committees can also be submitted via the E-Service.

The E-Service is available on ASEZA's website and from smartphones by downloading the ASEZA app.



Source：ASEZA App

Figure 3-211 ASEZA application
(Top page, Investment Services, Licensing Services, Transport Services, Complaints)

The utilization of these E-services is limited in terms of the overall electronic administration of government services, as they are primarily focused on the electronic processing of various applications. Furthermore, there is no provision for tourism information or information dissemination from ASEZA through the app.

On the other hand, a certain degree of system has already been developed, and there is potential to expand the scope of activities, such as information dissemination and service provision, by utilizing the relevant app and system.

The Jordanian government offers an electronic government service app called "SANAD," which provides access to various services by logging in with a personal ID. ASEZA is also planning to transition using "SANAD" in the future, and once the transition is completed, the use of the ASEZA app will be discontinued.

(2) Data Dashboard/Open Data Platform by ASEZA

ASEZ was supported by the UK Foreign, Commonwealth and Development Office (FCDO) and the Boston Consulting Group (BCG) to develop and implement the "Aqaba Special Economic Zone (ASEZ) economic strategy and implementation project" initiated as part of the Accelerated COVID-19 (C-19) Economic Support (ACES) Programme.

The work was completed in two phases with the following objectives (October 2020 – April 2021)

• Phase 1: Diagnosis of the situation and development of an economic strategy

• Phase 2: Implementation design and activation of strategy

In the phase 2, The Delivery Unit has been designed to have a "Strategy & Active Project Management Office" in ASEZA and an "Investment Acceleration Team" in ADC. This combined Delivery Unit will be staffed with high caliber talent and overseen by a high level "Fast Track Committee" chaired by the Prime Minister. The project team has developed priority initiatives in close collaboration with ASEZA and ADC teams, defined plans, onboarded two high caliber staff members and designed training materials.

A dynamic digital dashboard has been custom built to support monitoring and decision making.

The objectives of a dynamic digital dashboard are:

- ✓ Create transparency around progress towards strategic goals
- ✓ Facilitate escalation of issues and blocking points, inform decisions
- ✓ Help structure discussions and facilitate understanding of root causes

From the viewpoint of "Smart City", data is the key to accelerate evidence-based policy making which is one of the agenda of "Smart City". Although data for this dynamic digital dashboard have been gathered still in manual and not yet opened to public, but this could be transformed and used as a platform for data management of Smart City activities.

(3) GIS Data Utilization in ASEZA

ASEZA, ADC and infrastructure service providers such as Aqaba Water Company have been developing and utilizing GIS data.

However, data management, updating to the latest data, and sharing and utilization of data between organizations are almost non-existent, and advanced utilization of GIS data has not been achieved. Additionally, data is not publicly available for use as open data and is limited to data management within the organization.

These GIS data could become an essential platform for efficient urban management and monitoring. It is expected that the GIS data maintained by relevant agencies will be integrated into a single data platform for urban management.

1) ASEZA

GIS data of ASEZA was developed around 2010 and is managed by the GIS Department, which has established various data including land use and the locations of public facilities. It appears that these GIS data are also utilized for various planning within ASEZ.

However, the data is limited to what can be obtained and managed within ASEZA, and there is less integration with GIS data owned by ADC.

2) ADC

The GIS Division at ADC manages GIS data, which is used for the development of various infrastructures. Newly developed GIS data is centrally managed by ADC.

The application used to handle GIS data is ArcGIS.

(4) Aqaba Water Company (AWC)

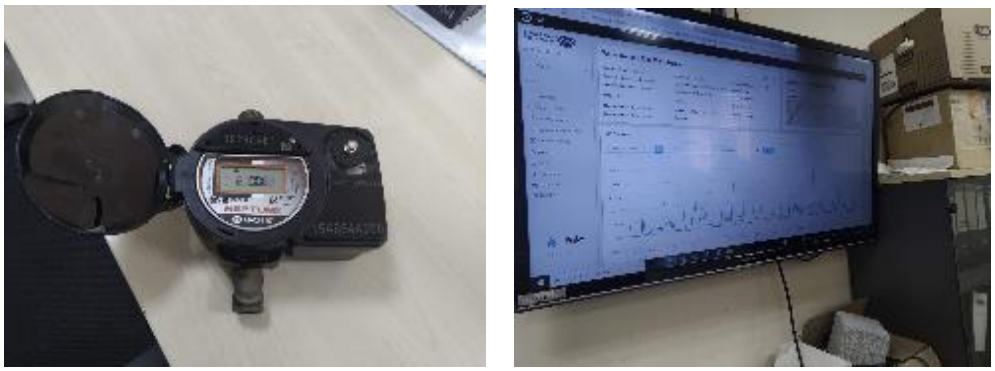
The Aqaba Water Company manages all of its water supply and sewage facilities, including wells and pipes, using GIS (ArcGIS). In addition, with the support of USAID, a SCADA system has also been introduced, which monitors in real time the water volume of each well and the operational status of the sewage treatment facilities.



Source: Photos taken by JICA study team

Figure 3-212 GIS System of AWC (Left picture) and SCADA System (Right picture)

Moreover, AWC is considering the introduction of smart meters, and as of March 2023, they have been tentatively installed in several districts for testing. There are plans to expand the installation area in the future. Smart meters will enable real-time monitoring of water consumption for each household, allowing for accurate billing and improvements in non-revenue water rates. Also, users will be able to see their water usage more accurately, which is expected to raise awareness of water conservation.



Source: Photos taken by JICA study team

Figure 3-213 Smart Meter (Left picture) and Monitoring System (Right picture)

(5) Environmental Monitoring

1) Aquatic environmental monitoring

In the Gulf of Aqaba, two water quality environmental monitoring stations have been established in the sea area.

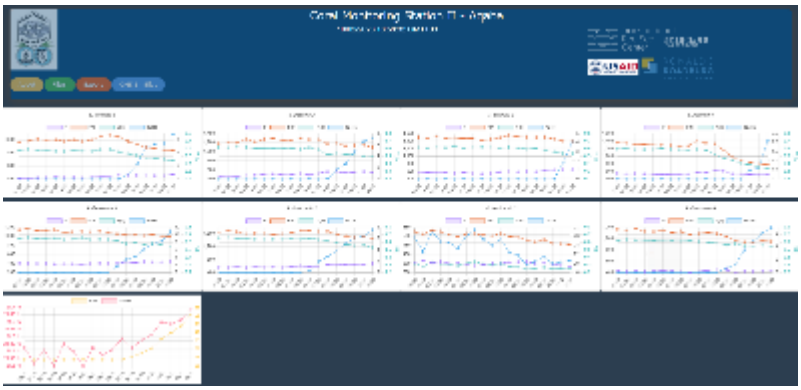
Table 3.98 Overview of Water Quality Environmental Observatory

Monitoring Station	Location	Implementation Year	Note
Aqaba Marine Park (AMP) Monitoring Station	7km offshore of AMP	2016	Data is open to public in AMP visitor center
North Aqaba Monitoring Station	Near the hotels in north Aqaba	2013(?)	

Source：https://jordantimes.com/news/local/new-seawater-quality-monitoring-station-installed-aqaba

It measures sea temperature, salinity, oxygen levels, sunlight and radiation levels in air and sea water, sea turbidity, waves and currents, wind speed, and concentrations of harmful chemicals such as chlorophyll, ammonia, nitrates and phosphates.

In addition, The University of Jordan & Yarmouk University has installed two Coral Monitoring Stations in the Aqaba gulf (one on the Israeli coast and one on the Aqaba coast) and the monitoring status is available in real time (every 30 minutes) on the website.



Source：https://iui-eilat.ac.il/Info/PamDashboardAqaba.aspx

Figure 3-214 Observation data from the Water Environment Observatory

2) Environmental Monitoring

Three stations have been set up in Aqaba by Ben Hayyan - Aqaba International Laboratories, where the following items are measured:

Sulfur dioxide (SO2), Nitrogen oxides (NO, NO2, NOX), Carbon monoxide (CO), Ozone (O3), Inhalable particulates (PM10, PM2.5), Volatile organic compounds (VOCs), Ammonia (NH3), Hydrogen sulfide (H2S), Hydrogen fluoride (HF), Wind direction, Wind speed, Temperature, Humidity, Atmospheric pressure, Incoming solar radiation

The information obtained is consolidated in the Air Quality Information Centre at Aqaba International Laboratories - Bin Hayyan and automatically sent to an environmental information board in Aqaba city, where citizens can view real-time environmental

information.





Source: JICA study team

Figure 3-215 Environmental information board (left) and location (right)

These environmental monitoring data for marine areas and air quality are managed separately and some of them are publicly available. They are, however, not widely available as open data and are not managed centrally, which means that they cannot be used for various purposes or linked to other data.

(6) Disaster Management (Early Warning System (EWS))

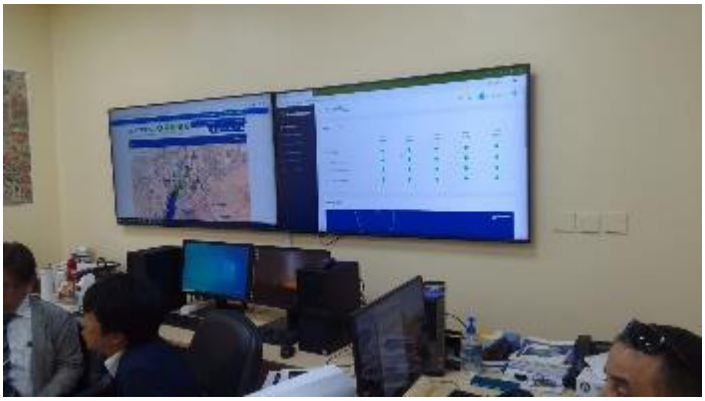
An early warning system is being developed in the ADC to alert authorities when flooding (flash floods) is likely to occur within the ASEZ, with the aim of strengthening coordination between the various agencies involved in the warning issuance and evacuation process, including the ASEZA, ADC, relevant government agencies, military and police, and the accumulation of historical flooding data.

Aims of EWS

- Setup an early warning system to alert authorities in cases where flash flooding is eminent within ASEZ during sufficient lead time of flood risk.
- Enhance the coordination of different agencies involved in the process of issuing warning and evacuations including ASEZA, ADC, and responding authorities such Governorate, Jordan Civil Defense, Police.
- Develop a sustainability plan for the project to ensure the continuity.
- Accumulated historical data related to precipitation events.

Specific facilities maintained include the following.

- 14 rainfall gauges distributed in yutum, titin, and coastal area.
- 11 flow meters in wades surrounding Aqaba.
- 3 weather stations in north, south and center of Aqaba.
- Seven monitoring cameras
- Arabia weather application

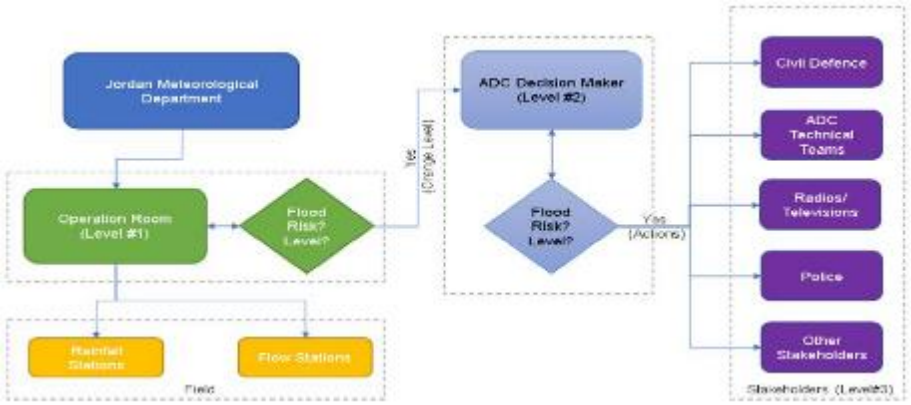


Source: Photos taken by JICA study team

Figure 3-216 EWS Operation Room in ADC

This information is not directly provided to citizens but is provided to the relevant administrative bodies after ADC has made a risk assessment based on the information collected in the operation room, and specific actions are taken by relevant authorities (see diagram below). For example, information from surveillance cameras, flow meters and rain gauges are not yet available for citizens to view in real time. The observed data is also not made available to the public as open data.

Flood simulations using this information are not conducted at this time.



Source: provided by ASEZA

Figure 3-217 Information flow of flood risk

(7) Public Transportation/Traffic Monitoring

1) City Public Bus Service

Bus services in Aqaba are mainly provided by Aqaba Transport Company, which has installed a monitoring system that collects real-time GPS location data of bus vehicles in a monitoring room on the company's premises. The system is used to ensure that there are no irregularities in bus operations and that buses do not deviate from the authorized routes.

Each public transport service in Aqaba provides its own services at its own service level, making it impossible to obtain information on public transport services centrally and making it less convenient. Public bus services in the city are not convenient for citizens and are very difficult for tourists and other visitors to use.



Source: Photos taken by JICA study team

Figure 3-218 Bus Monitoring System in Aqaba Transport Company

This information is only used within the Aqaba Transport Company and is not made available to users (the general public).

Currently, there are no bus stops in Aqaba, and people wait for buses to arrive along the bus routes, and when a bus arrives, they raise their hands to get on the bus. Users do not know where the buses are currently running or when they will arrive.

2) Intercity Bus Service

There are a number of inter-city long-distance bus services operating from Aqaba to other cities in Jordan, such as Amman, as well as to neighboring cities.

JETT operates the largest number of routes, and it is possible to book and purchase tickets on the JETT website (https://www.jett.com.jo/en).

These services are limited to bus services and sightseeing tour services provided by JETT and are not linked to information on inter-city long-distance buses operated by other companies, nor to tourist information, hotel reservations, etc.

3) Taxi Service

As for public taxis in Aqaba, the taxi service is a regular taxi service where empty taxis are parked on the street for boarding, and no system has been introduced for hailing and paying for taxis via the web or applications.

In addition, taxi apps such as Uber and Careem are not available in Aqaba as of February 2023 (Uber & Careem are available in Amman).

(8) CCTV Monitoring

In 2017, CCTV cameras were installed throughout the ASEZ (including Wadi Rum) on the instructions of the King of Jordan. The main purpose is security, but also to contribute to tourism and the economy, with approximately 500 CCTVs installed across the ASEZ.

The CCTVs are managed by the military, which has a command room in the ASEZA office. The command room is monitored 24/7, with people from the Traffic Police, Civil Police and Intelligence Dept. as well as the military coming and staying in the room. The border with Israel, the border with Egypt, mountainous areas and beaches are also monitored; some of the CCTV can be moved, zoomed and manipulated in the command room.

Currently, surveillance is basically done by human eyes looking at the images, and no AI or other means are used. (The system has a function that searches past recorded image when the vehicle number is entered to determine the vehicle's movements.)

*The system is installed by 'Milestone' (https://www.milestonesys.com/).

Between 500 and 700 Incidents are reported per month. The system is also linked to the Jordanian Government, which connects directly to the Crisis Centre if it finds anything unusual.

The recorded data is stored for one month. Expansion is currently being considered to allow for even longer storage.

As mentioned above, CCTV is currently used for security purposes and the recorded image is not widely available to the public. The introduction of image analysis technology has been limited and has not been utilized for purposes other than security, such as monitoring traffic and human flow.

(9) Tourism

Various tourist information is provided on the Aqaba Tourism Information Centre website (https://aqaba.jo/Default).

The website also provides information on Wadi Rum and Petra and is a good source of information on tourist destinations.

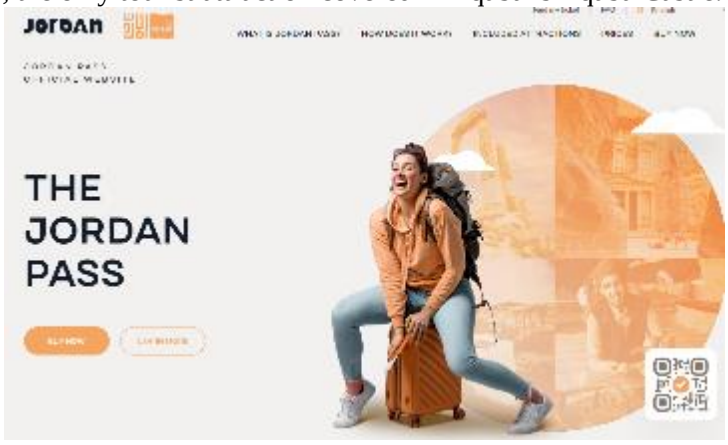
The website can only be used to provide tourist information and does not offer services such as direct hotel and sightseeing bookings or the purchase of local products.

Jordan Pass

The Jordan Ministry of Tourism and Antiquities has introduced a pre-paid tourist pass called the Jordan Pass (https://jordanpass.jo/Default.aspx). Purchasing a pass means that you have pre-paid for admission to over 40 tourist attractions in Jordan, and you only need to show (scan) your ticket at the entrance of the attraction covered by the pass to enter the facility, saving time, money and effort.

It is valid for 12 months from the date of purchase and automatically expires two weeks after the date it was first scanned at the first attraction.

As of 2023/2, the only tourist attraction covered in Aqaba is Aqaba Castle.



Source: https://jordanpass.jo/

Figure 3-219 The Jordan Pass Website

(10) Voice of Aqaba Radio

The ASEZA office has a 'Voice of Aqaba Radio' studio, which broadcasts various

information on Aqaba.

The table below is a summary of issues and challenges by smart city sector organized above.

Table 3.99 Sector-wise activities and challenges in ASEZ

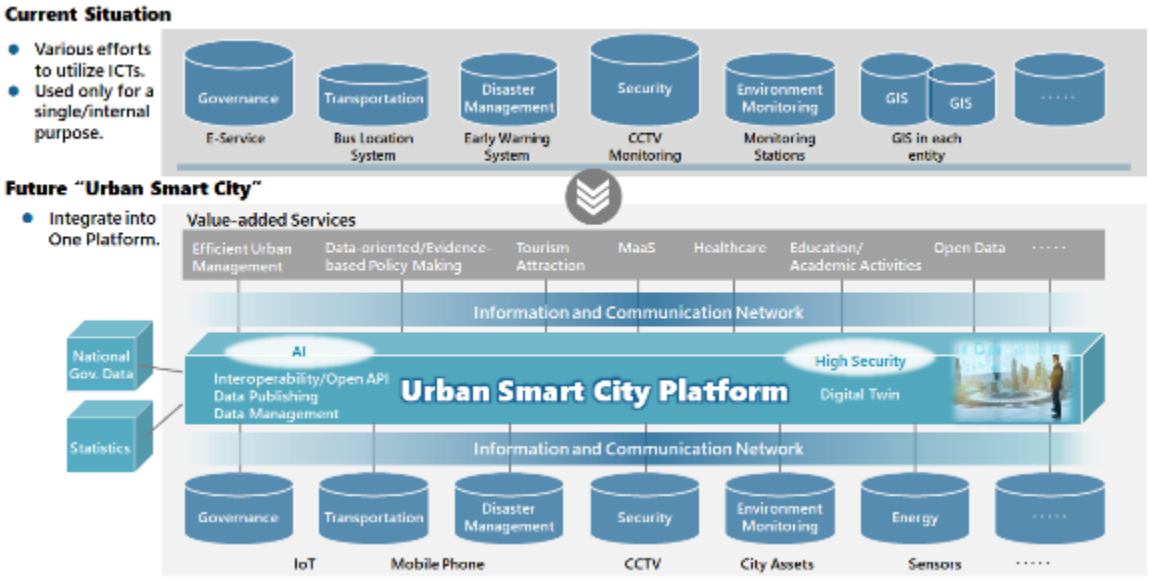
Sector	Items	Issues/Challenges
Governance	E-Services (Digitalization of administrative Services)	■ The use of these E-Services is limited to the digitization of various applications and the digitization of administrative services. ■ The apps do not provide any other service such as tourist information, information from ASEZA, etc.
	Open Data /Digitalization of Statistical data	■ Statistical data is not well organized in ASEZA. ■ No mechanisms for collecting and organizing data. ■ Data collected are not well shared (opened) to the public, even within ASEZA.
	Use of Spatial Data (GIS)	■ Less activities of data management and updating to the latest data, as well as sharing and utilization of data between organizations. ■ Advanced use of GIS data is not being made. ■ Data is not open to the public (not used as open data) and is only managed within an organization.
	Public Participation	■ There is no mechanism (or not well organized/systematic) for public participation in the planning and implementation phases of the project.
Mobility	Public Transportation Services	■ Bus Location System has been established in Aqaba Transport Company, but the information is only used within the Aqaba Transport Company and is not made available to users. ■ Service level is very low (Currently, there are no bus stops in Aqaba, and people wait for buses to arrive along the bus routes, and when a bus arrives, they raise their hands to get on the bus. Users do not know where the buses are currently running or when they will arrive.
	Mobility as a service	■ Each public transport service in Aqaba provides its own services at its own service level, making it impossible to obtain information on public transport services centrally and making it less convenient. In particular, public bus services in the city are not convenient for citizens and are very difficult for tourists and other visitors to use.
Environment	Environment Monitoring	■ Monitoring Stations have been established in marine and land areas, and real-time monitoring is being carried out, but they are not widely available as open data and are not centrally managed, so they cannot be used for a variety of purposes or linked to other data.
	Disaster Management (EWS)	■ The system is designed for administrative purposes and does not provide real-time information to citizens. ■ The observed data is also not available to citizens as open data.
Living	Security (CCTV Monitoring System)	■ CCTV is used for security purposes and its images are not widely available to the public. ■ The implementation of image analysis technology is limited and has not been utilized for multipurpose other than security, such as monitoring traffic and human flow.
Economy	Use of ICT for Tourism	■ The use of the website is limited to providing tourist information and does not offer services such as direct hotel and sightseeing reservations or selling local products.
People	Healthcare, Education	■ Not yet observed.
Energy	Renewable energy, Smart Grid, etc.	■ Not yet observed.

3.9.4 Smart City Approach in ASEZ

It is expected that ASEZ will continue to develop as a city that accommodates various industries, tourists, and investments, as well as diverse residents, serving as an engine of economic growth for Jordan. To make this growth sustainable and develop ASEZ as a live able, lovable, and attractive city, more efficient city management is required. Therefore, it is necessary to provide city services that make the most of ICT technology and utilize the data obtained through these activities to the fullest potential.

ASEZA, ADC, and related organizations are each making efforts to utilize ICT. However, in each of these activities, the utilization of ICT introduced is insufficient, and many challenges remain, such as limited consideration of use in other fields or cooperation, and appropriate management and storage of data obtained through these activities, as well as the utilization of data (including public disclosure to citizens) is very limited.

On the other hand, each of these activities is considered to be connected to the activities of Smart City in each field. It is necessary to upgrade these activities and connect them across fields in order to create activities that can be called Smart City.



Source: JICA study team

Figure 3-220 Current situation and future directions of Smart City initiatives in ASEZ (proposed)

Based on the current situation and challenges identified, the following directions are proposed for the Smart City approach in ASEZ.

(1) Development of Vision and Strategies

The aim of developing the vision and policies for smart city initiatives in ASEZ is to clarify the direction of ASEZ's smart city initiatives. The development of the vision and strategies will encourage citizen participation and indicate the direction of smart city development.

(2) Realization of a Data Platform for Efficient Urban Management

The aim is to create a data platform to collect and analyze the data necessary for ASEZ's operations. By collecting and analyzing the necessary data for urban management through

the data platform, more efficient urban management can be achieved. Security is important in introducing ICT and building a data platform. Measures to ensure security such as preventing data leakage and hacking must be fully implemented before proceeding with the project.

(3) Realization and Enhancement of Smart Services in Each Domain

The aim is to improve the quality of life for residents by providing smart services using ICT technology in various domains such as administrative services, transportation, environment, energy, education, etc. and by upgrading existing services. The aim is to achieve more efficient and sustainable urban management by enhancing smart services in each domain.

(4) Establishment of Organizational and Operational Structure

To efficiently develop, introduce, and operate a smart city, it is important to establish an organizational structure responsible for the operation of the smart city. Furthermore, in building the organizational and operational structure, consideration should be given to incorporating citizen participation, aiming to provide services and systems that better meet their needs. Through citizen participation, residents can understand how to use the smart city, enabling more effective urban management.

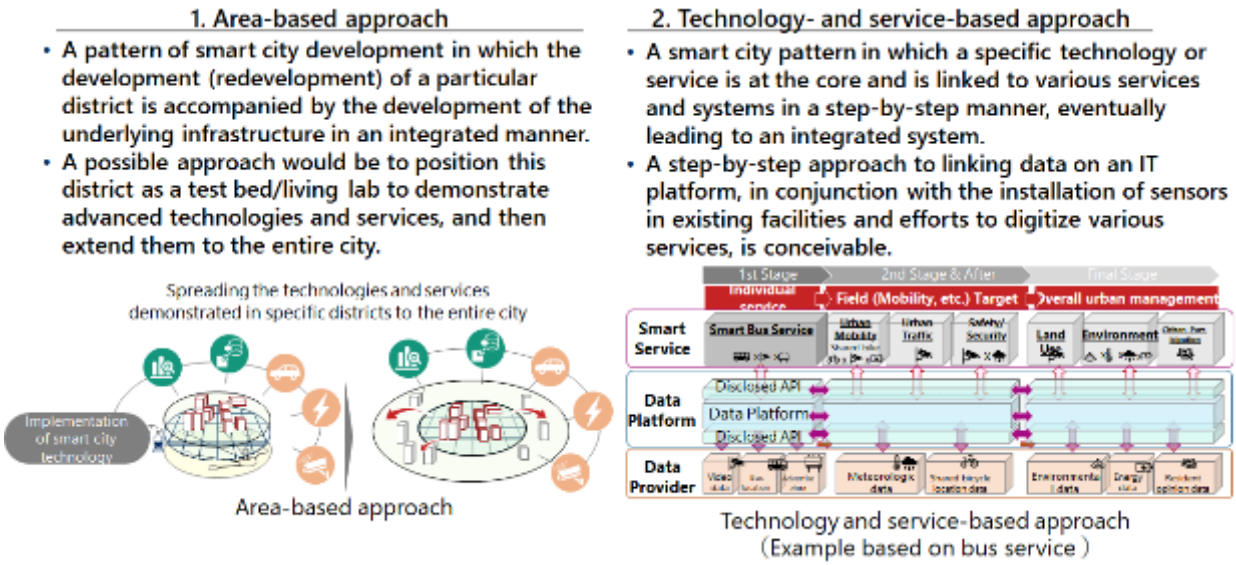
In establishing the organizational and operational structure, the following points should be considered:

- ✓ Design of organizational structure:
  Clarification of roles and responsibilities for each department or team, relationships and communication flow between organizations, and personnel allocation.
- ✓ Recruitment and development of personnel:
  Clarification of roles and responsibilities within the organization, recruitment and placement of personnel with necessary skills and knowledge, and implementation of regular training and education.
- ✓ Introduction of project management:
  Introduction of processes and tools for planning, executing, and evaluating projects, as well as management of the progress and quality of each project.
- ✓ Establishment of governance:
  Appropriate implementation of communication and coordination with stakeholders within and outside the organization, sharing progress and results of projects, and management of risks.
- ✓ Monitoring and improvement:
  Regular monitoring of organizational operations and project progress, identification of problems, and continuous monitoring and improvement.

(5) Agile Development and Implementation through Pilot Projects

The aim is to develop and implement smart cities in an agile manner. Pilot projects can be, for example, by operating various technologies on a trial basis in specific sectors (e.g., transportation) or specific areas. Based on the results, agile development and implementation can be carried out to develop and implement services with some update or modification and systems that meet the needs of citizens quickly. In conducting trial implementations, citizen participation methods will be incorporated to provide services that

reflect the needs of users more effectively.



Source: JICA study team

Figure 3-221 Example of Agile Development: Expansion of Smart City Activities In the case of targeting a specific area (left figure) and in the case of targeting a specific sector (right figure).

3.10 Questionnaire Survey Results

A questionnaire was conducted to confirm the current situation and issues of ASEZ and the direction of future urban development from the viewpoints of residents and visitors. Questionnaires for residents and visitors were prepared in both English and Arabic using Google Forms.

3.10.1 Survey Method

The summary of the questionnaire survey is shown in the table below.

Table 3.100 Overview of Questionnaire Survey

	For residents	For visitors
Survey period	December 2022 to March 2023	From January 2023 to May 2023
Method of distribution	December 2022 to January 2023: Distribute URL to ASEZA/ADC employees via intra-organizational email February-March 2023: ・Requested ZAIN, a telecommunications company in Aqaba, on February 8 to send an SMS containing a link to a questionnaire survey to a total of 60,796 residents in ASEZ. ・Place posters in various locations in the city ・Distribute flyers at shopping malls and public facilities in the city with university student volunteers ・Place posters, etc. in the facilities of hotels and bus companies	・Place posters in various locations in the city ・Installing posters, etc. in the facilities of hotels and bus companies ・Place posters and flyers at airports and directly request questionnaire responses to airport users

Source: JICA study team



Source: JICA study team

Figure 3-222 Questionnaire Flyers (left: for residents / right: for visitors)



Source: JICA study team

Figure 3-223 Posters in the city

3.10.2 Contents of Questionnaire

The contents of the questionnaire survey were proposed and discussed at regular meetings with the counterparts, and their confirmation was obtained. The contents of the questionnaire are as follows.

Table 3.101 Items in the Questionnaire (for residents and visitors)

Residents	
Attribute	Gender, age group, residential area, occupation, household structure
Reason of living in ASEZ	What brought you to live in ASEZ How long have you lived in ASEZ Type of Accommodation
Intention of Living in the Future	Do you want to continue living in the same area? Conditions that are important to you when choosing a place to live Where do you wish to move to
About the Attractiveness of the Town	What kind of impression do you especially have of ASEZ as a city How do you perceive the attractiveness of each function in the town center What is the especially attractive landmark/landscape that could become an icon for ASEZ
Daily Life Activities	Destinations and means of transportation to work or school Destinations and means of transportation for daily shopping Destinations and means of transportation for leisure activities on weekends
Satisfaction and priorities of living environment	Quality of Life, Urban and Regional Economies, Local Finances, Social cohesion and equity, Infrastructure Development, Urban Ecology and Environment, Urban Management
Pedestrian environment	Expectations for Pedestrian Environments in Town Centers and Public Beaches
Public transportation	Expectations for improvements in commuting to work, school, downtown, etc.
Landscape	What do you think about the landscape regulation and guidance on the color and shape of building
Disasters	What initiatives do you think should be strengthened for disaster prevention
Electronic service	Services that should be further digitized
Future vision of ASEZ	What kind of city do you wish ASEZ to be in 10 years

Visitors	
Attribute	Gender, age group, residential area, occupation, household composition
Purpose of visit	How you heard about Aqaba, your purpose for coming to Aqaba, where you are staying, and where you will be staying
Intention to revisit	Do you want to come back to ASEZ repeatedly? ⇒How often do you want to come? ⇒If you are not coming back, why not?
Town attraction	What is the impression of ASEZ and is the town center attractive? Attractive structures and landscapes that can become symbols of ASEZ
Visit & stay	Places visited within Aqaba, places visited outside Aqaba, number of days spent, amount spent, places visited before and after, means of transportation
Satisfaction with the visiting environment	Accommodation and lodging environment, consumption environment, urban landscape
Pedestrian environment	Expectations for Pedestrian Environments in Town Centers and Public Beaches
Public transportation	Expectations for improve public transportation in Aqaba.
Urban landscape	Characteristics of the town, color of buildings, atmosphere of the town and streets
Disasters	Efforts that should be strengthened for disaster prevention
Electronic service	Services that should be further digitized
Future vision of ASEZ	What the city will look like in 10 years

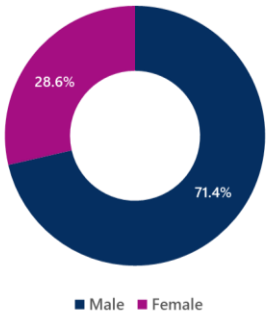
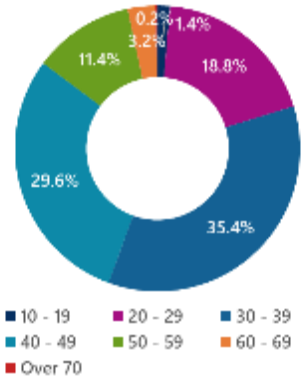
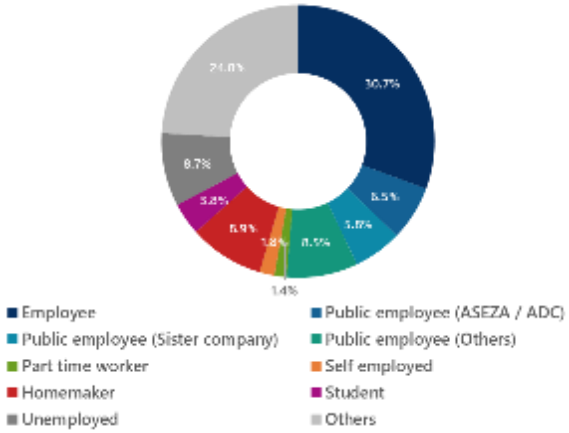
Source: JICA study team

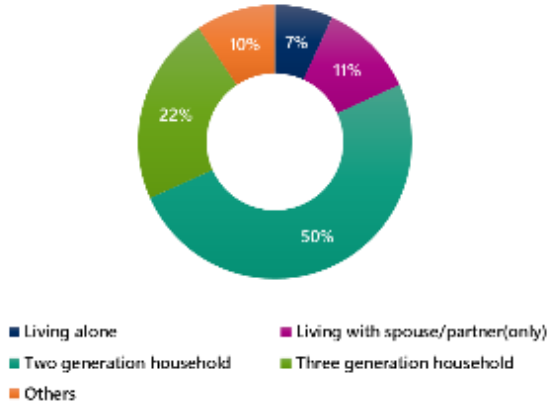
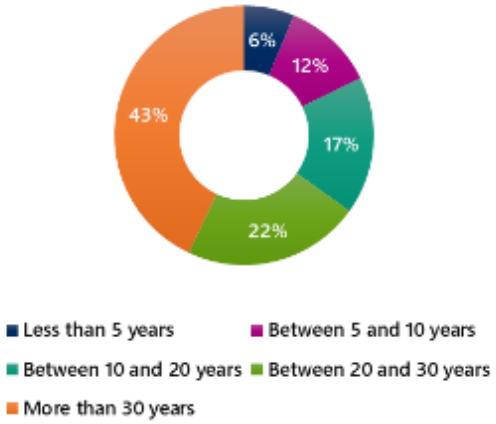
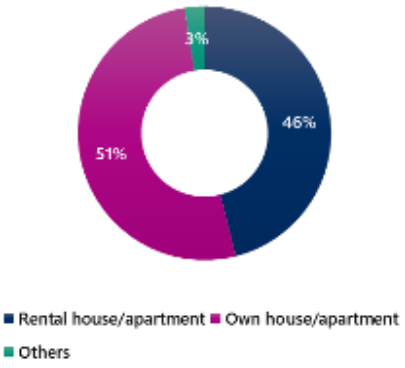
3.10.3 Questionnaire Results

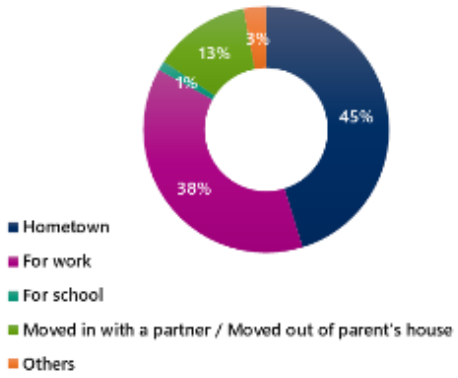
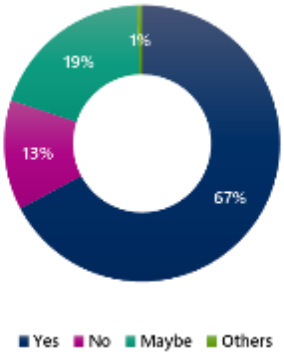
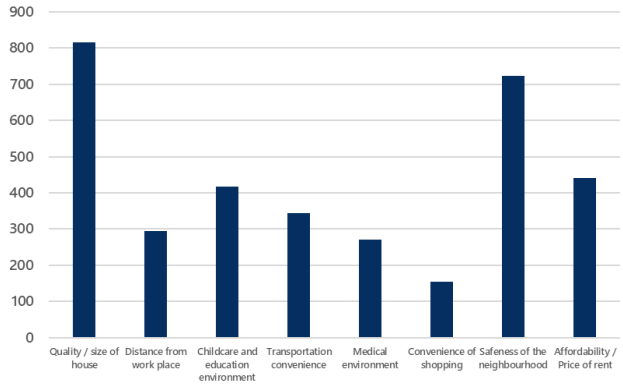
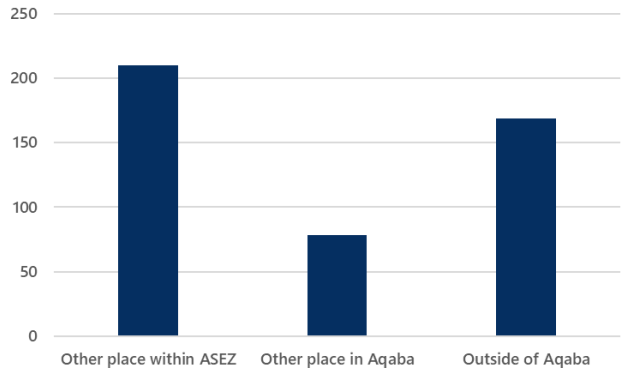
(1) Questionnaire for residents

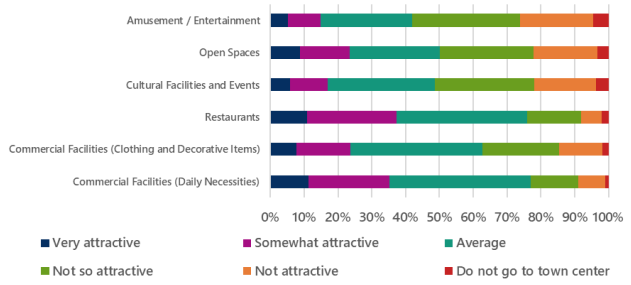
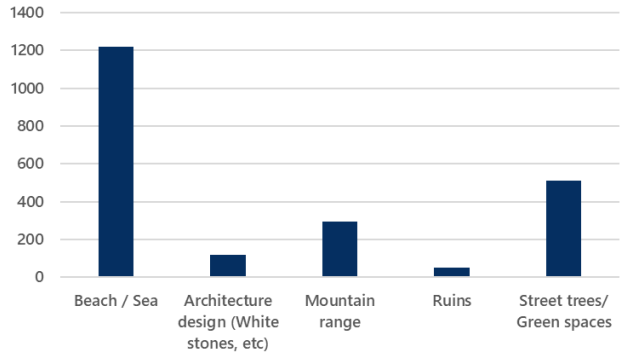
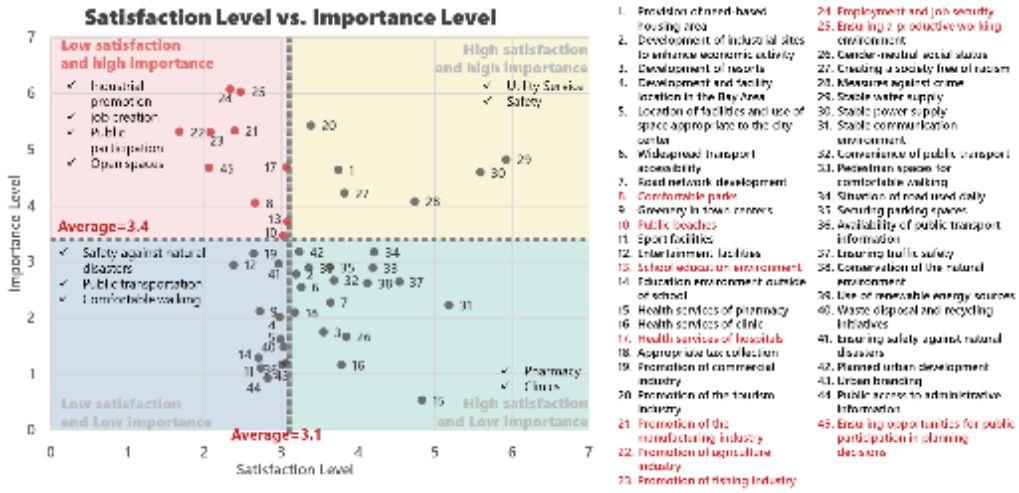
By March 31, 2023, 1482 responses were received. The results of the simple tabulation are shown below.

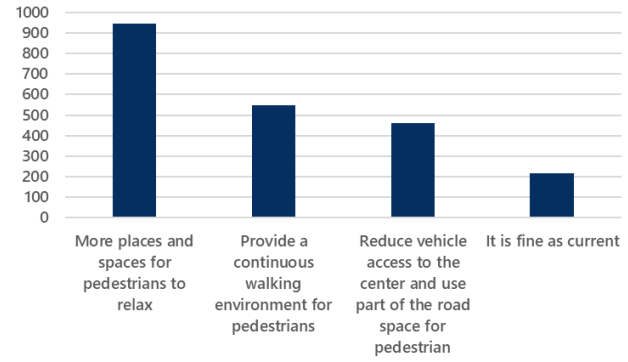
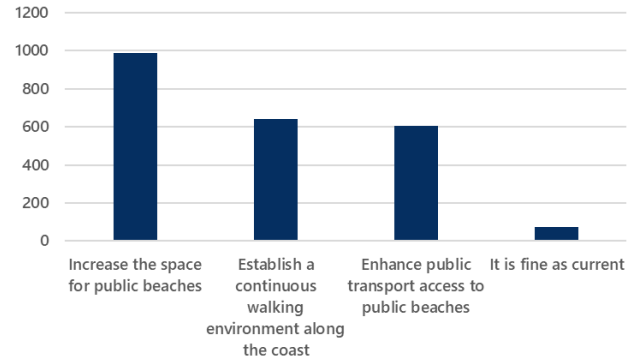
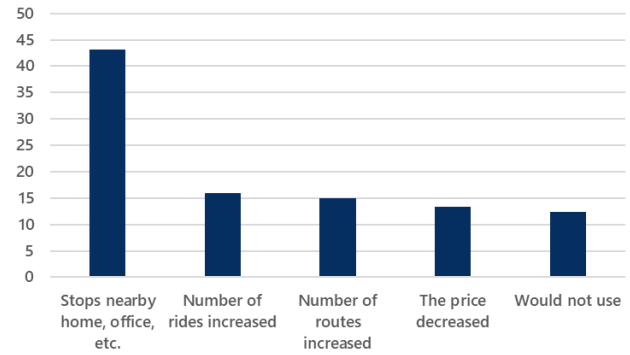
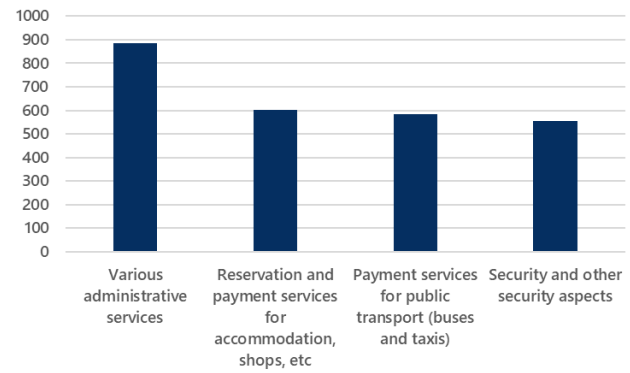
Table 3.102 Questionnaire Results

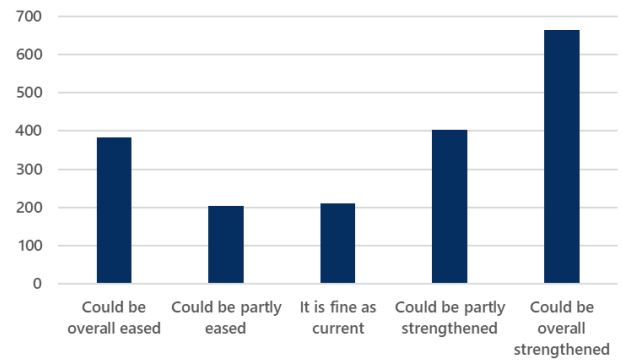
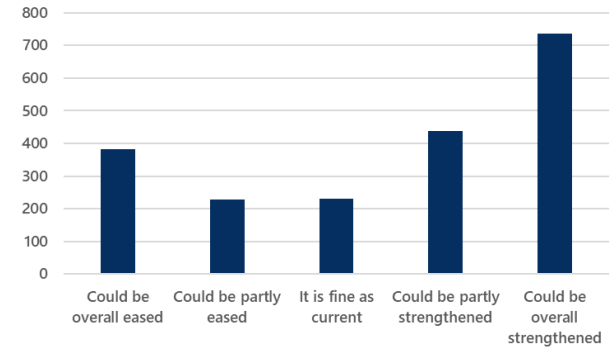
Question	Results	
Attribute		
Sex		The number of male respondents far outnumbered the number of female respondents, with 71.4% of men and 28.6% of women.
Age		The number of respondents in their 30s and 40s was large, followed by those in their 20s and 50s.
Occupation		The largest percentage of respondents were employed, followed by housework, students, and self-employed. The number of respondents from ASEZA/ADC and its sister companies included 12.3% of those working for the company.

Question	Results	
Household structure		The most common household composition in the ASEZ is a two-generation family, accounting for half of the total, followed by a three-generation family, a two-person family with a married couple or partner, and a single person household.
Reason of living in ASEZ		
How long have you lived in ASEZ		The largest percentage of respondents have lived in ASEZ for more than 30 years (43%), followed by 22% for 20-30 years, 17% for 10-20 years, and 18% for less than 10 years.
Type of Accommodation		51% homes are owned and 46% are rented.

Question	Results	
What brought you to live in ASEZ		The most common reason for living in ASEZ was to be born and raised here (45%), followed by work (38%), and then by living with a partner (13%).
Intention of Living in the Future		
Do you want to continue living in the same area?		A large number of people (67%) want to continue living in the ASEZ, followed by 19% who probably will, and 13% who do not want to continue living in the ASEZ.
Conditions that are important to you when choosing a place to live		The size and quality of the house is considered most important, followed by the security of the residential area, the price of the house, and the environment for raising children and education. On the other hand, shopping convenience was not a condition that was considered important, but this is presumably because convenience is already high in the current situation.
Where do you wish to move to		More respondents who are considering relocating to another region within the ASEZ or another region within the Aqaba Prefecture than those who are considering relocating outside of the Aqaba Prefecture.

<table>
<tr><th>Question</th><th colspan="2">Results</th></tr>
<tr><td colspan="3">About the Attractiveness of the Town</td></tr>
<tr><td>How do you perceive the attractiveness of each function in the town center</td><td colspan="2">
</td></tr>
<tr><td></td><td>The overall attractiveness of the
city is low, especially for entertainment, open space, and
cultural facilities.</td></tr>
<tr><td>What is the especially attractive landmark/landscape that could become an icon for ASEZ</td><td colspan="2">
</td></tr>
<tr><td></td><td>While most residents perceive
the beach and ocean as landmarks of the town, they are
less aware of the ruins and architecture.</td></tr>
<tr><td>Question</td><td colspan="2">Result</td></tr>
<tr><td>Comparison of the Satisfaction Level and Importance Level</td><td colspan="2">
</td></tr>
<tr><td></td><td colspan="2">A survey on the satisfaction and importance of 45 items related to the living environment situation was conducted, and the results were analyzed in the portfolio shown above. Items with low satisfaction and high importance (red area in the portfolio) are considered to be important for future measures.
Specifically, comfortable parks, public beaches, schooling environments, medical services provided by hospitals, promotion of manufacturing, agriculture, fisheries, employment security, good work environments, and residents' participation in urban development fall into these areas.
In particular, it should be noted that several areas related to industry are included.
On the other hand, the perception of importance of items that are considered important urban issues, such as safety against natural disasters, public transportation, and a comfortable walking environment, was low, suggesting the need for further promotion and education of residents.
In addition, both satisfaction and awareness of the importance of utility services and safety were high, and these items should be further improved as an advantage for the city.</td></tr>
</table>

Question	Result	
Pedestrian Environment		
Walking environment in Aqaba city center		The most common response was that more space is needed for pedestrians to relax, and a large percentage felt that there is a need for a continuous pedestrian environment and a shift of vehicular space to pedestrian space.
Walking Environment on Public Beaches		Very few respondents indicated that the current situation is not a problem, and many citizens feel that there is a need to expand the public beach itself, ensure pedestrian continuity, and improve accessibility by public transportation.
Public Transportation		
Most important factors in using public transportation		A prominent number of respondents said they would use public transportation if the location of the bus stop was closer to their home or workplace, suggesting that the fact that the route does not cover the area is the primary reason for not using it.
Electronic Services		
Services that should be digitized		Although the results show that the digitization of administrative services is the most important, there is a growing demand for digitization with regard to other services as well.

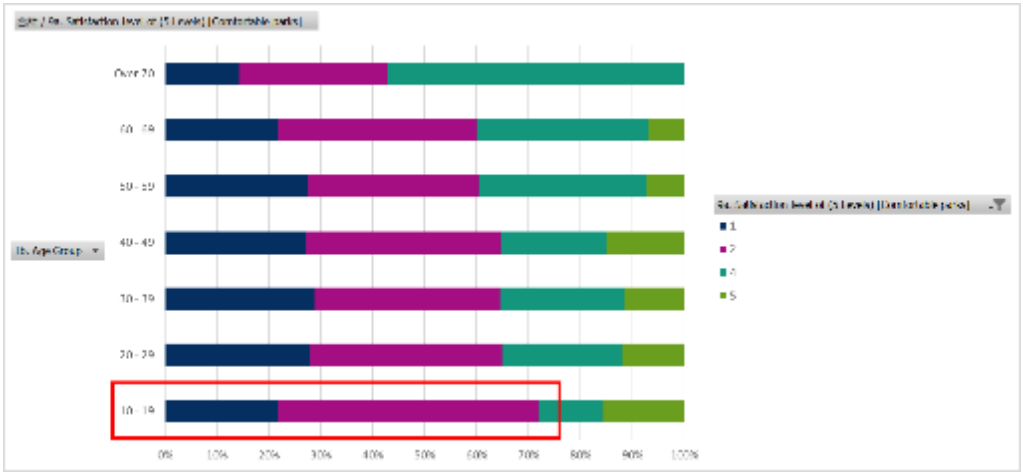
Question	Results	
Landscape		
What do you think about the landscape regulation and guidance on the color and shape of building		The most common opinion was that further strengthening was necessary overall, followed by partial strengthening and overall mitigation. Although there are many opinions calling for relative strengthening, there are also opinions calling for easing, and there are few opinions that the status quo is acceptable.
Regarding the color and shape of commercial buildings		The results were almost the same as for residential areas. It is necessary to review regulations and guidance according to location.

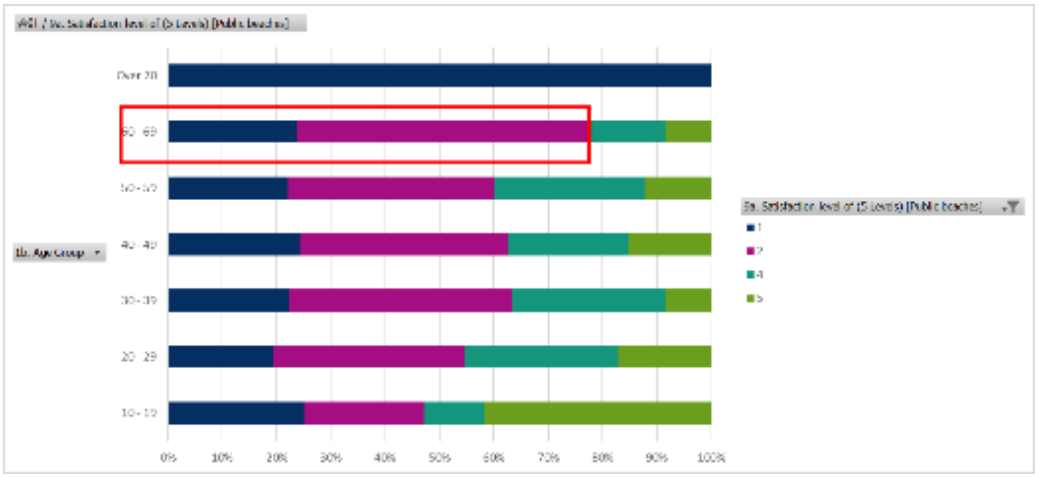
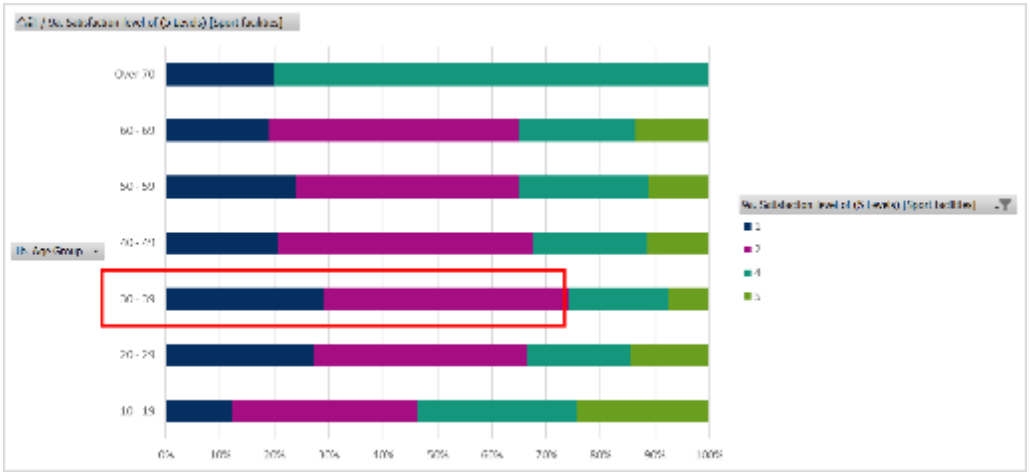
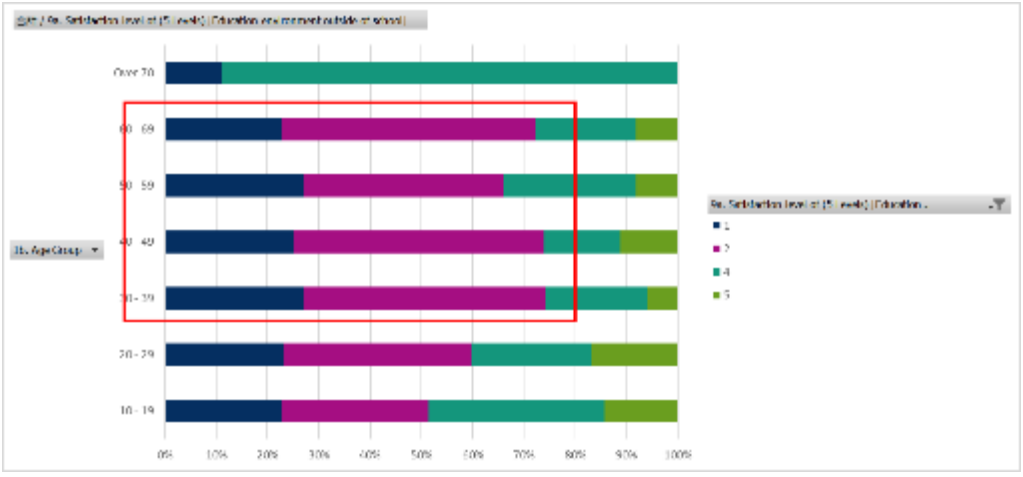
Source: JICA study team

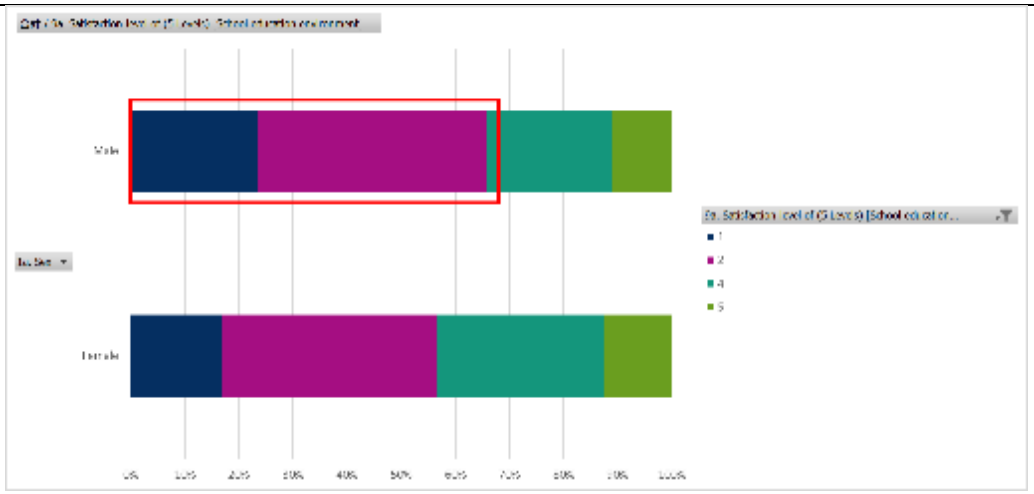
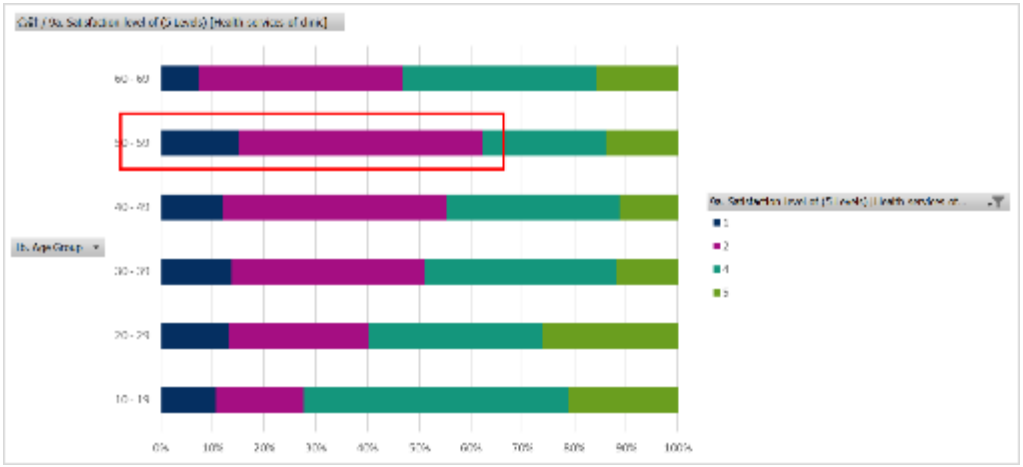
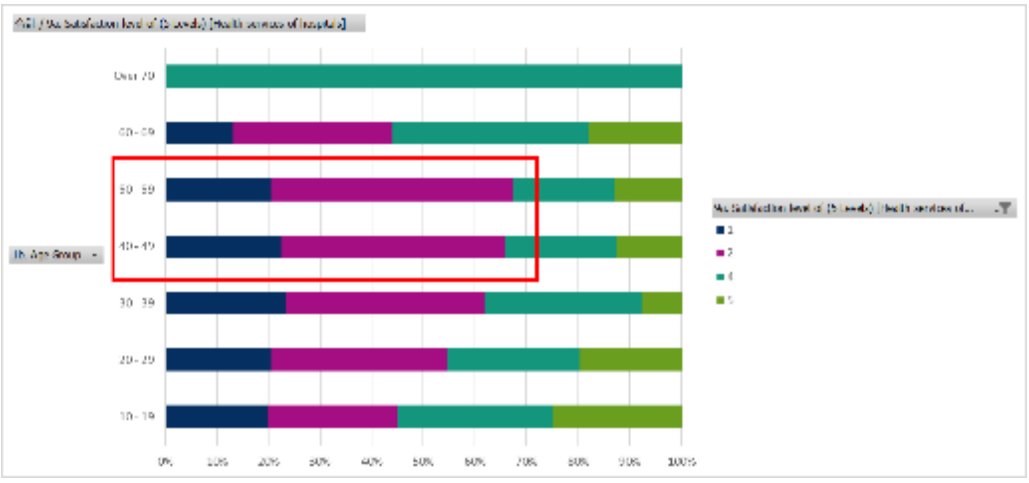
1) Cross Analysis by gender and age

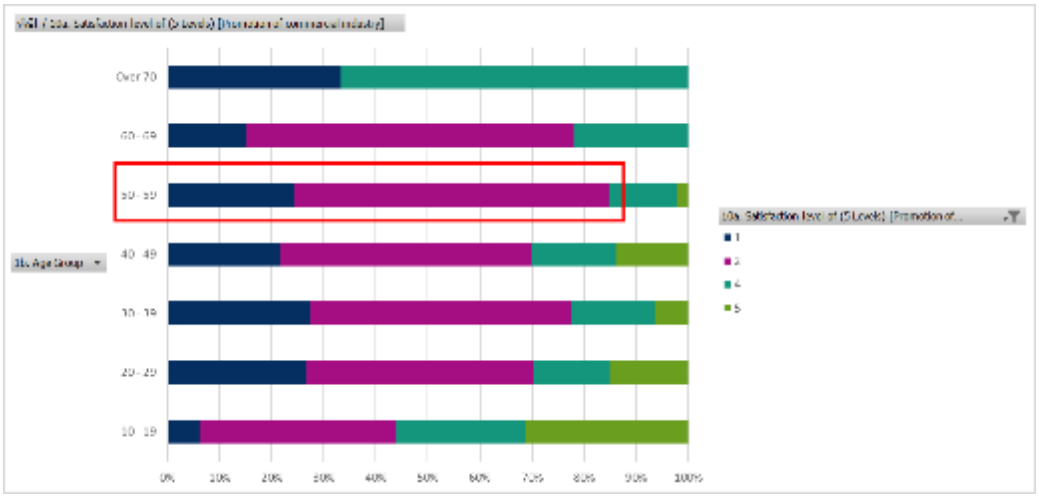
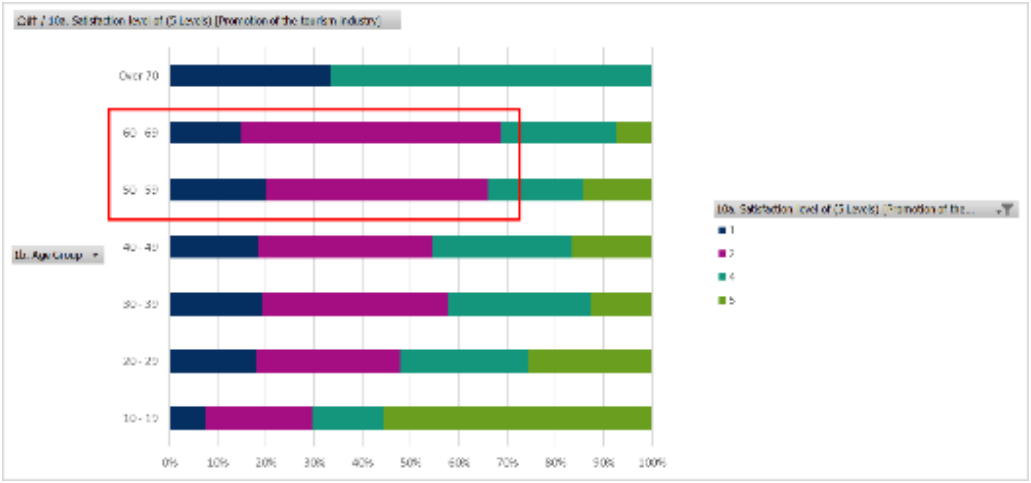
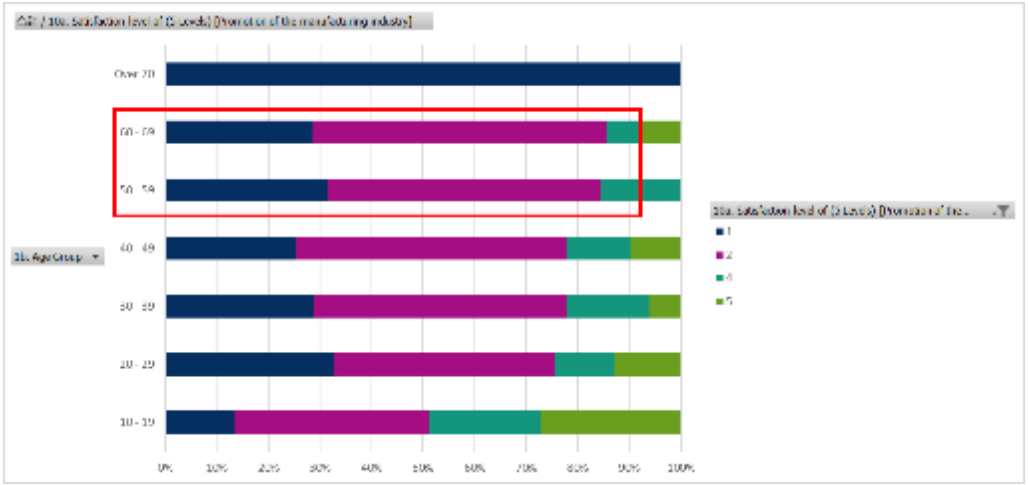
The results of the cross analysis by gender and age for the questionnaire for resident are as below.

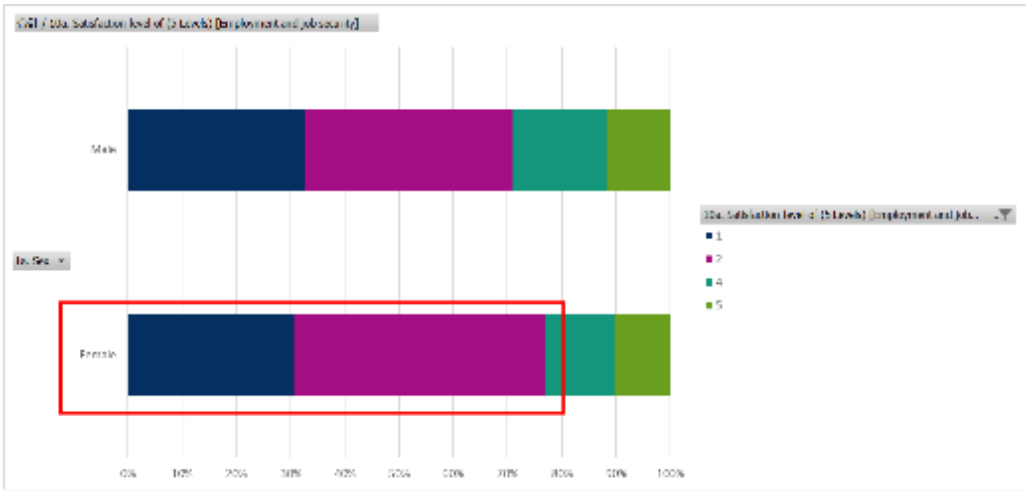
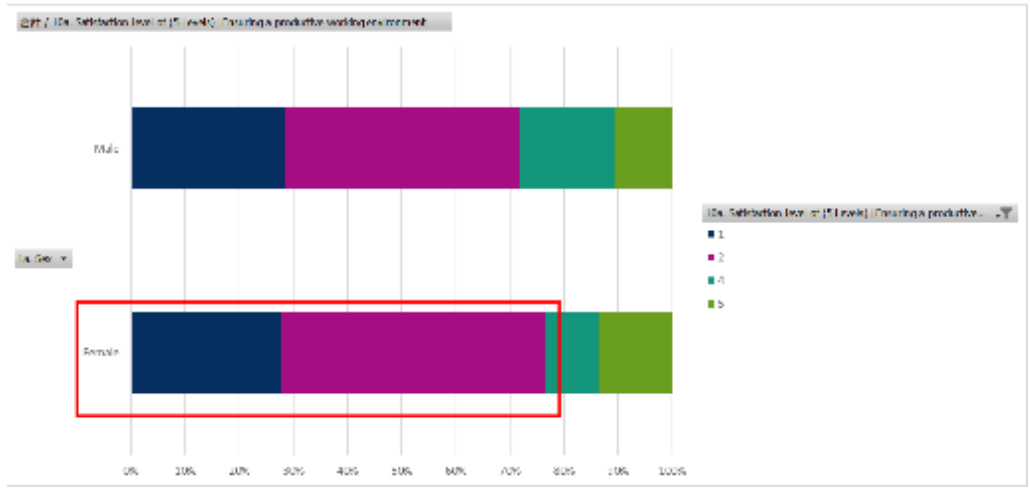
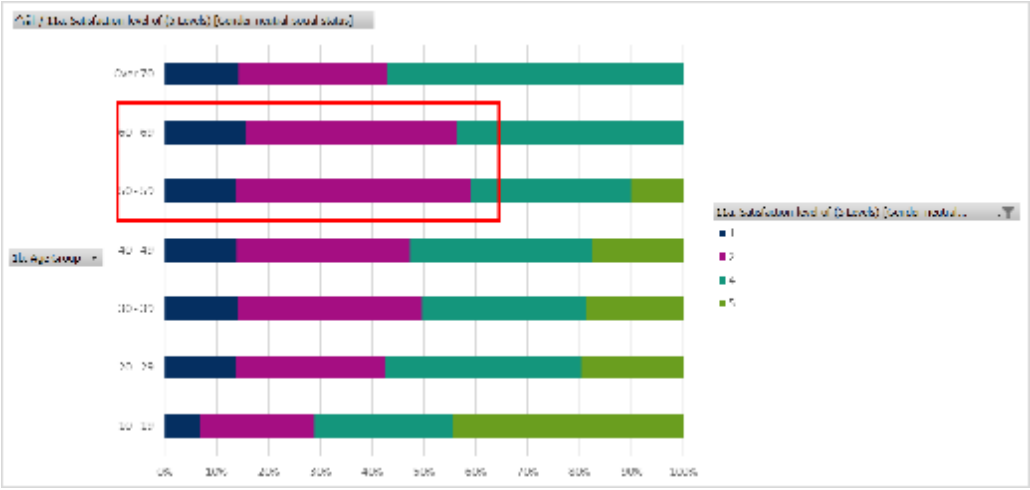
Table 3.103 Results of the cross analysis by gender and age

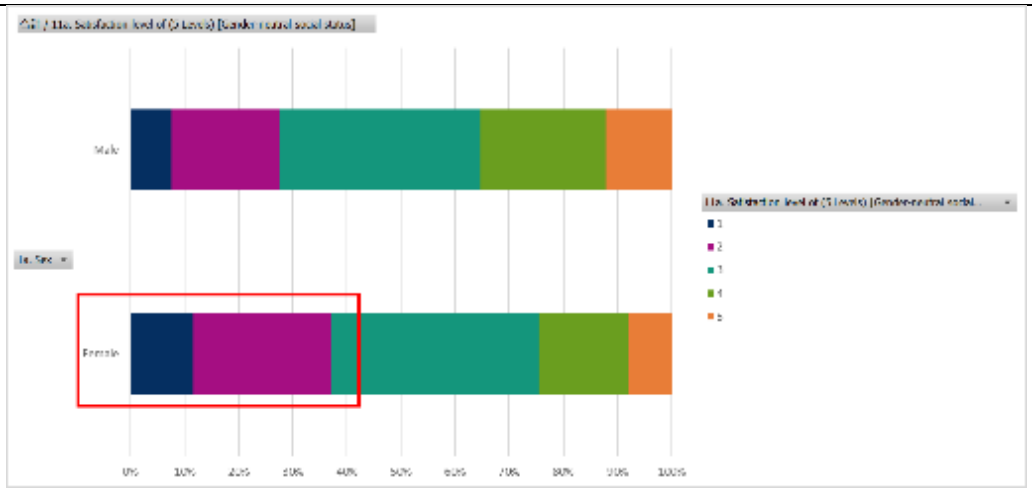
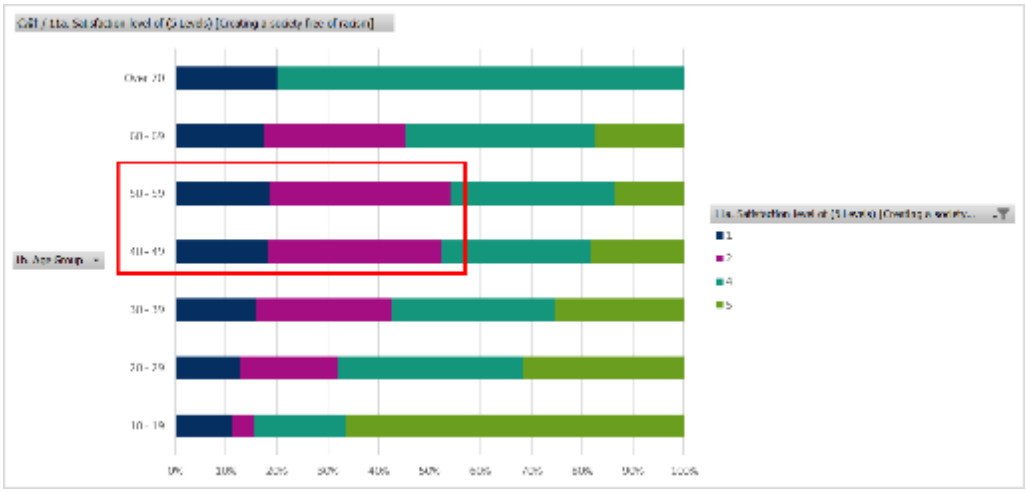
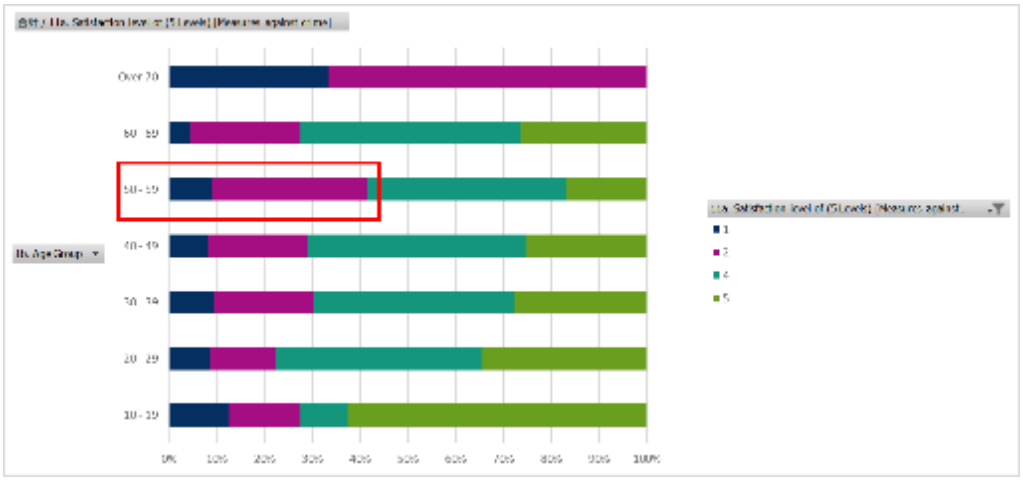
Question	Results
Comfortable parks	
	Satisfaction with comfortable parks was lower among teenagers, suggesting a lack of parks where children can enjoy themselves.

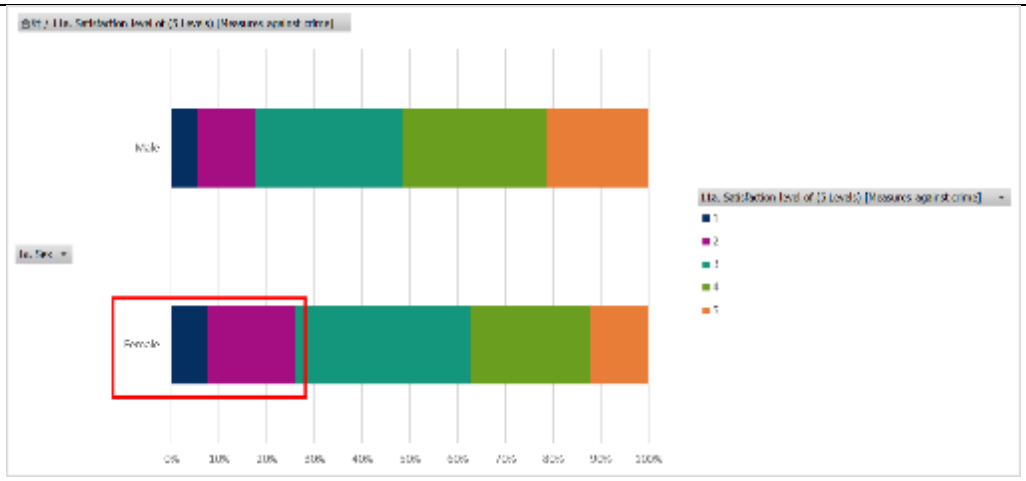
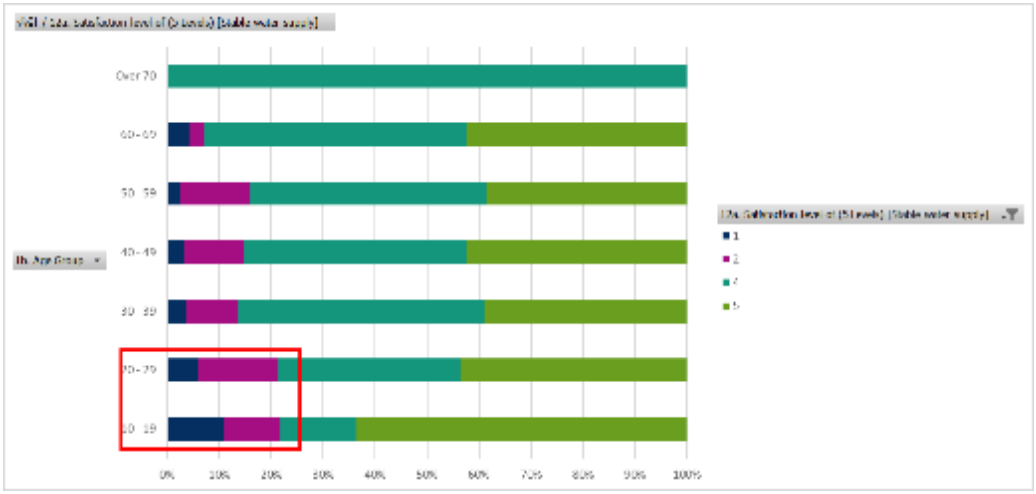
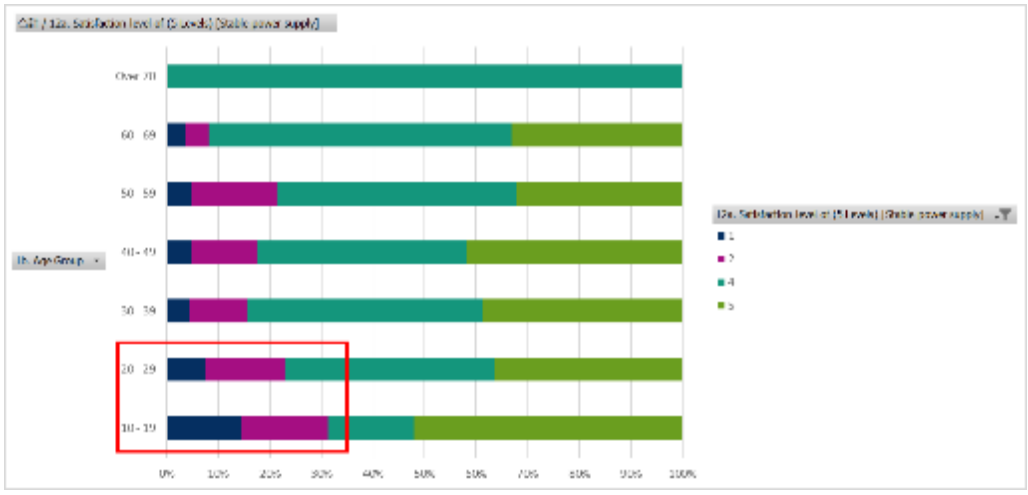
Question	Results
Public beaches	
	As for public beaches, satisfaction among those in their 60s was lower, suggesting the need for a beach environment that can be enjoyed by older generations.
Sports facilities	
	Satisfaction with sports facilities was lower among those in their 30s, suggesting the need for sports facilities that can be enjoyed not only by children but also by adults.
Education environment outside of school	

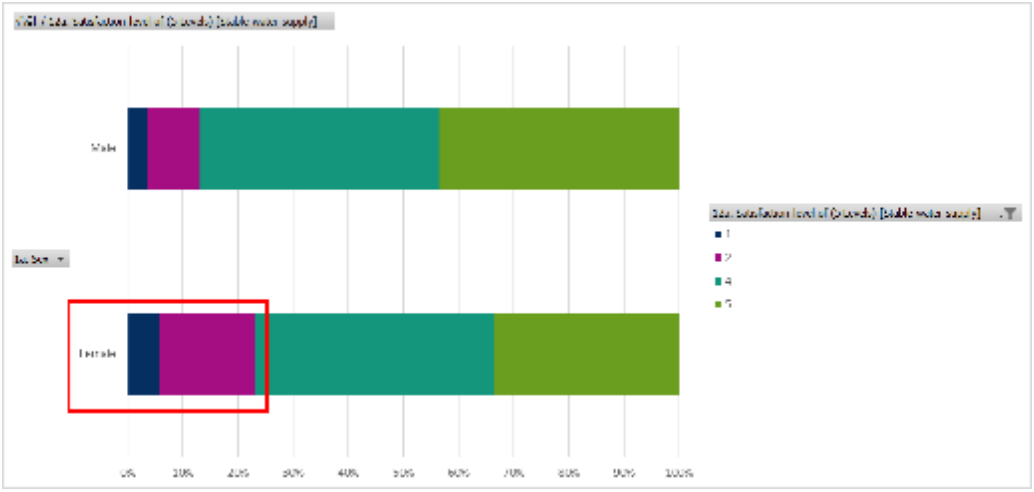
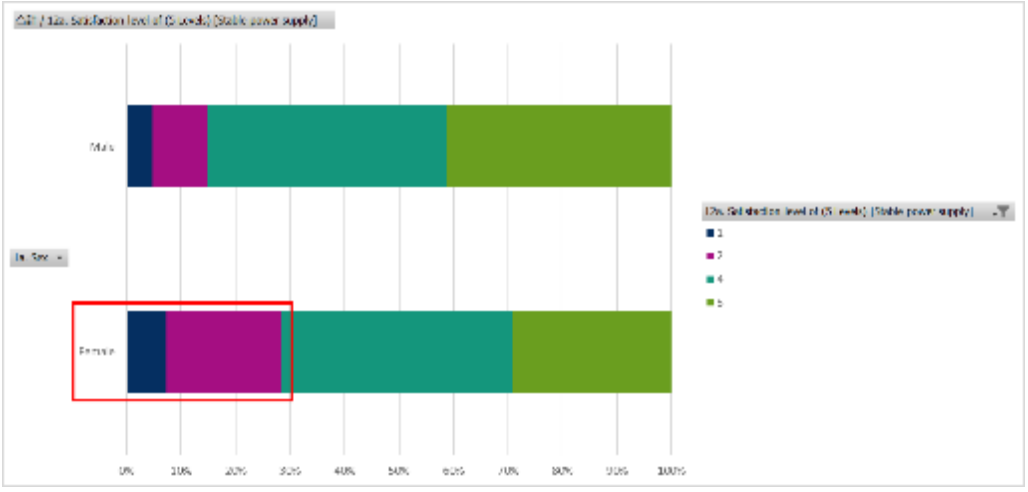
Question	Results
	
	Satisfaction with the educational environment (schools and after-school education) is lower among parents and men, suggesting that there is a need for quality education for their children, not only for females.
Health service of clinic and hospitals	 
	Satisfaction with the medical environment (clinics and hospitals) was lower among those in their 40s and 50s, suggesting that there is a need to respond to more severe illnesses that increase in incidence with aging.

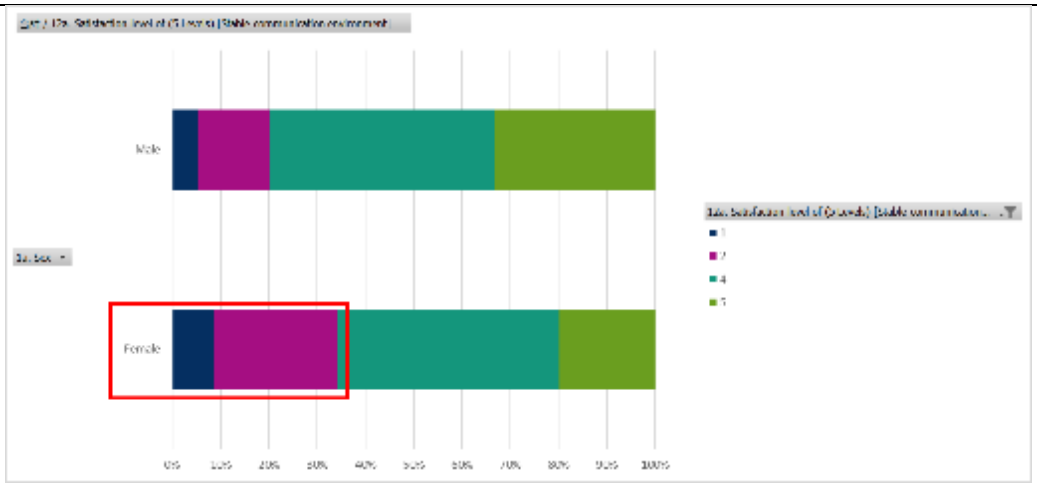
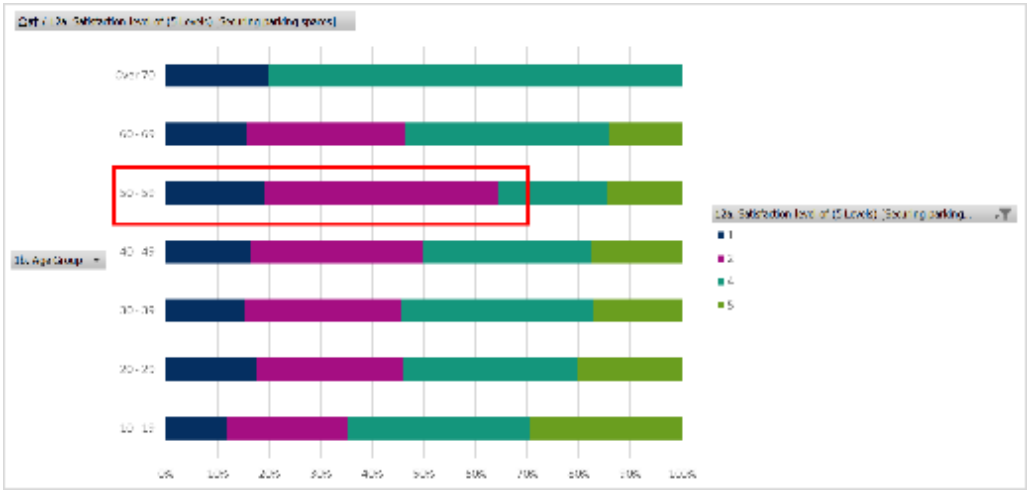
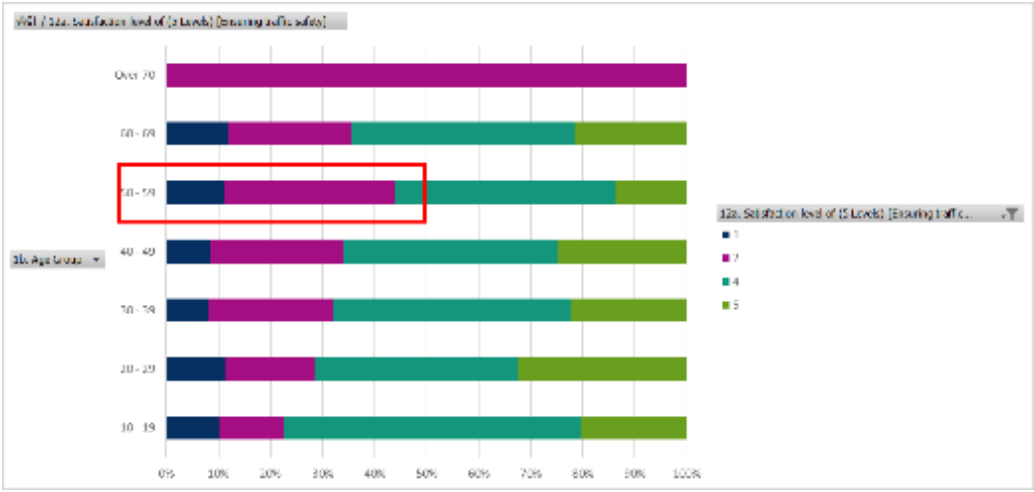
Question	Results
Promotion of commercial industry	
	Satisfaction with commercial facilities is lower among those in their 50s, suggesting either a lack of products that meet their needs or a poor user environment for commercial facilities.
Promotion of tourism industry	 
	Satisfaction among those in their 50s and older with the promotion of tourism and manufacturing is lower, probably due to the lack of employment opportunities for themselves or their children.

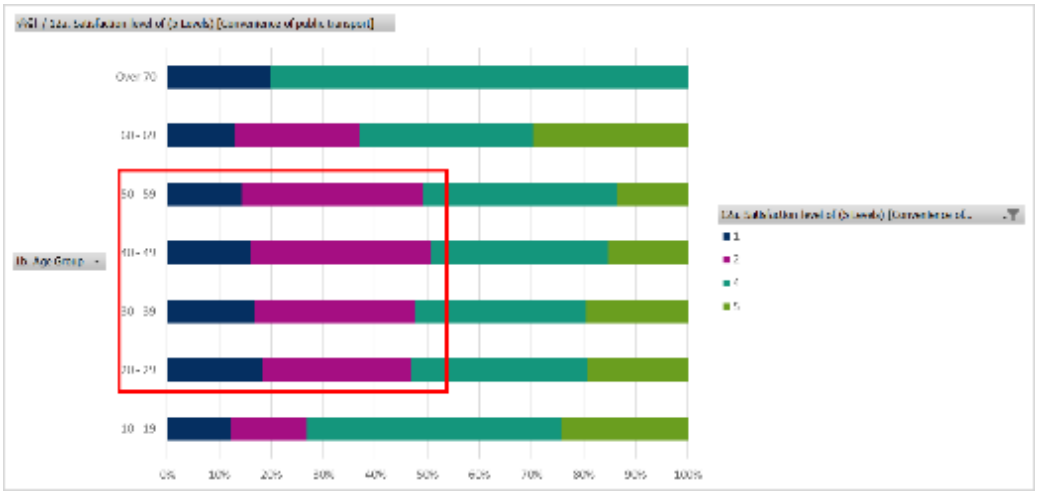
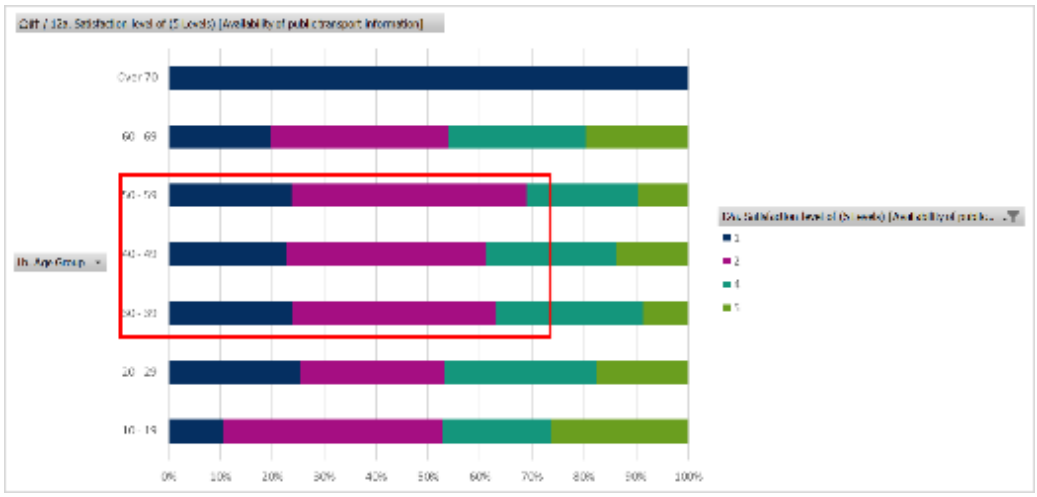
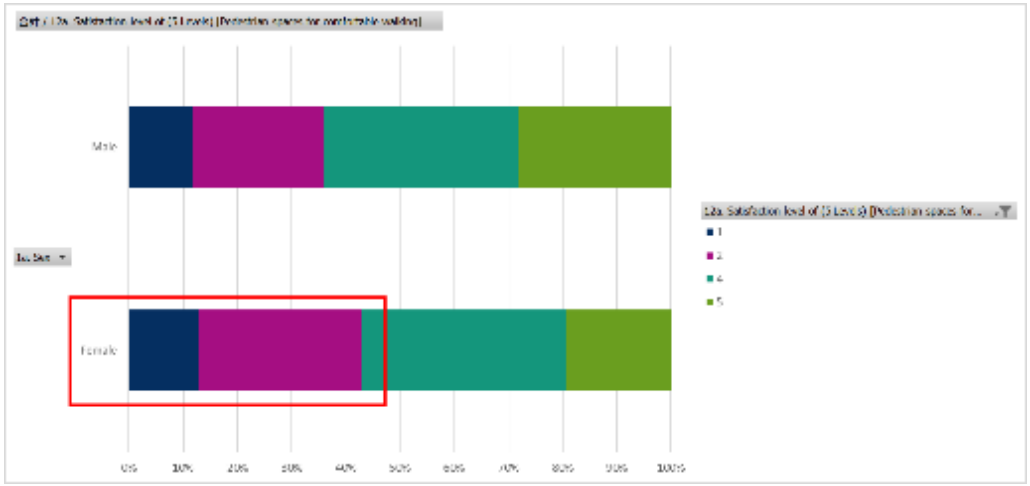
Question	Results
Employment and job security / ensuring a productive environment	 
	Satisfaction with employment and work environment is low for both men and women, but is even lower for women, suggesting that there is a need for a more comfortable work environment for women.
Gender-neutral and status	

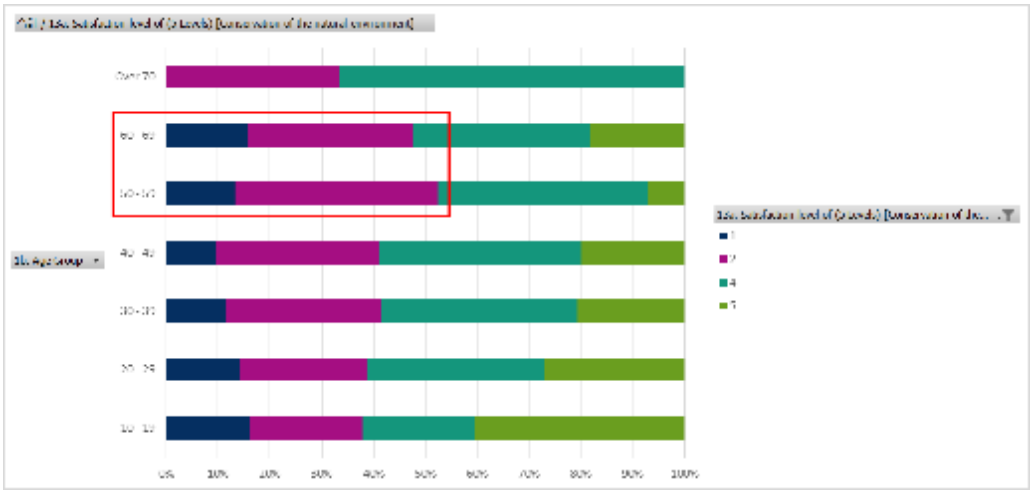
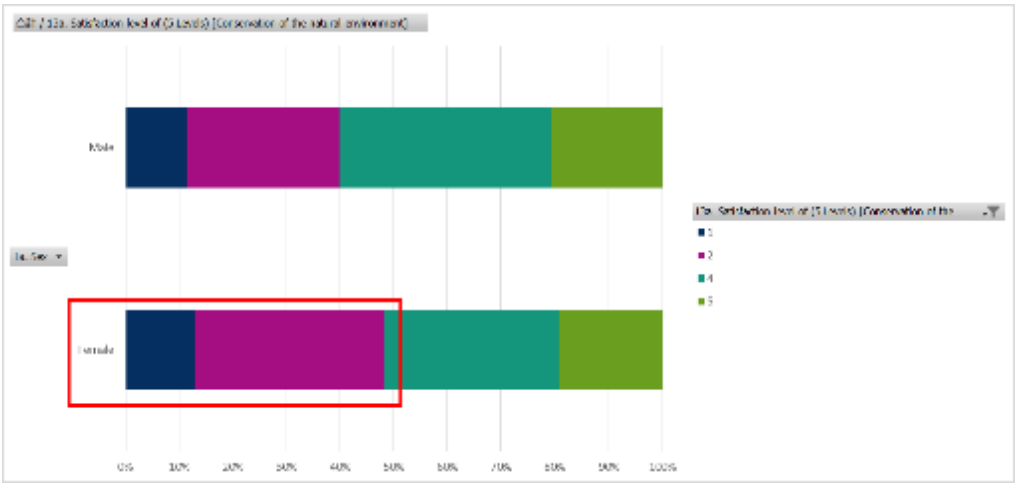
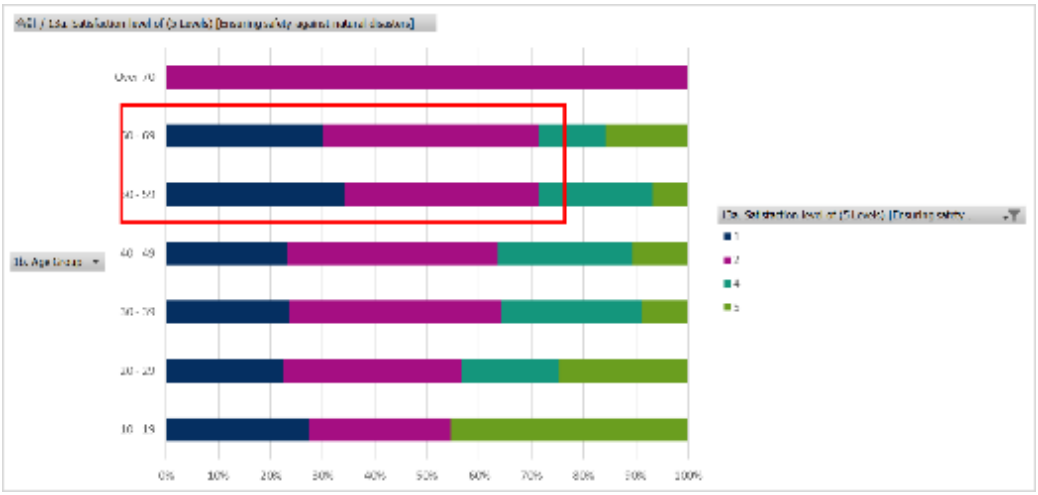
Question	Results
	
	Regarding gender equality, the satisfaction of those in their 50s and older and that of women are lower, and this should be considered as an issue to be addressed in the future.
Creating a society free of racism	
	Satisfaction with racial discrimination was found to be lower among those in their 40s and 50s.
Measures against crime	

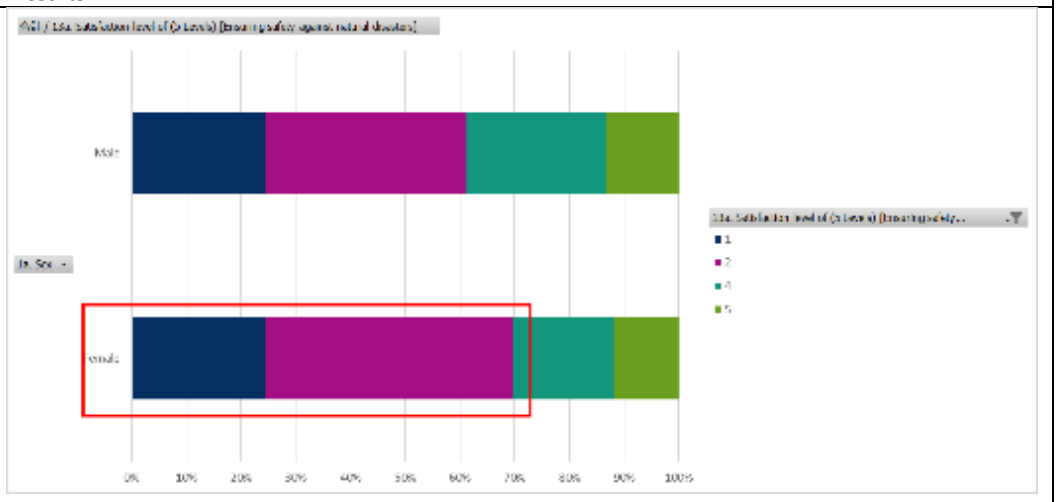
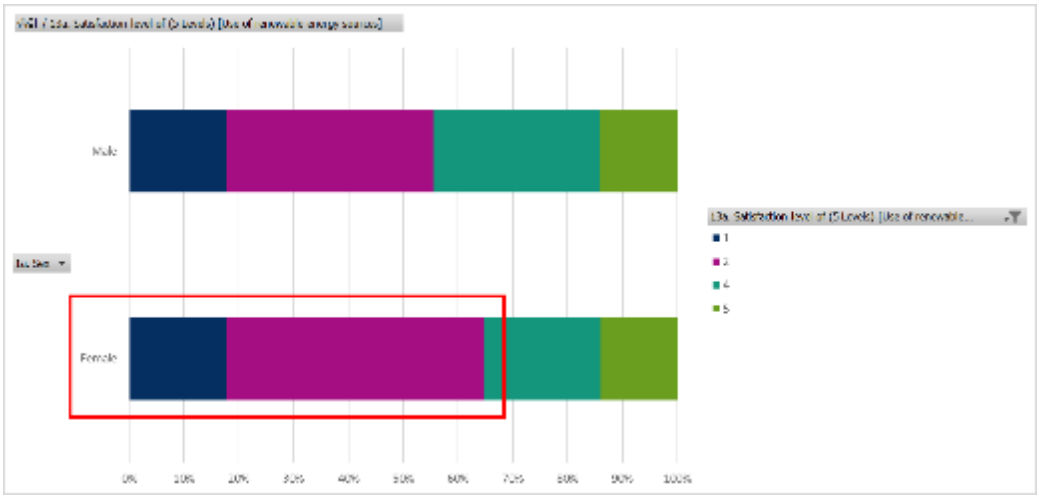
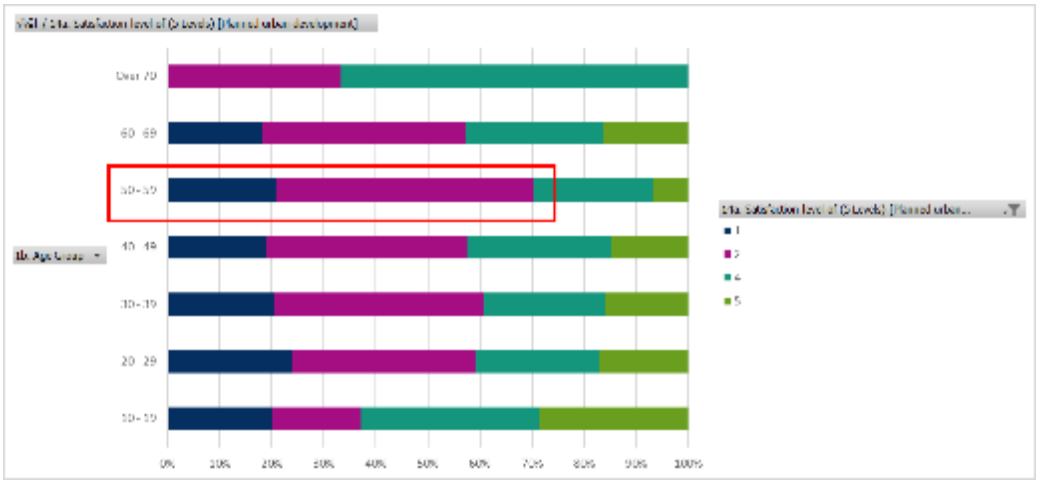
Question	Results
	
	Regarding crime prevention, the satisfaction of those in their 50s and the satisfaction of women is lower, so it is necessary to confirm what kind of crimes they are most often victims of.
Stable water, power supply and communication environment	 

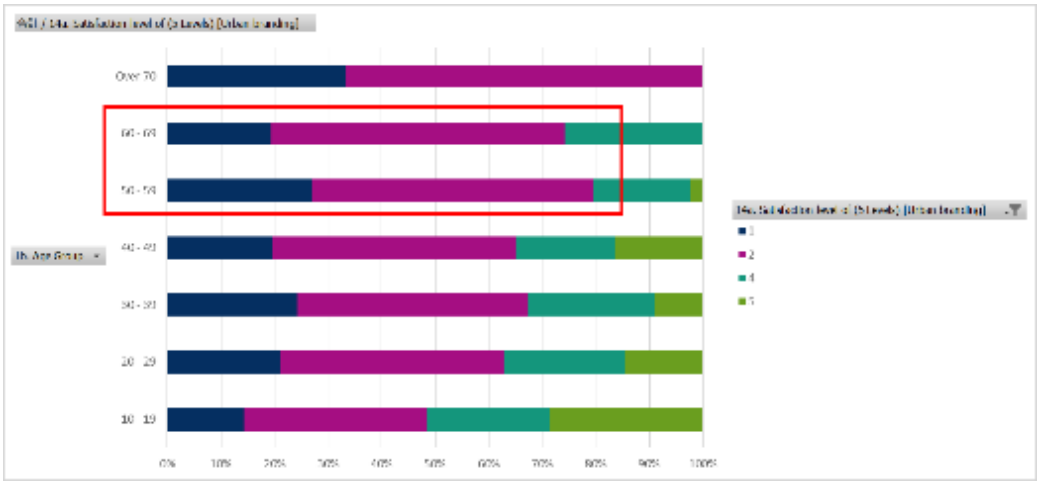
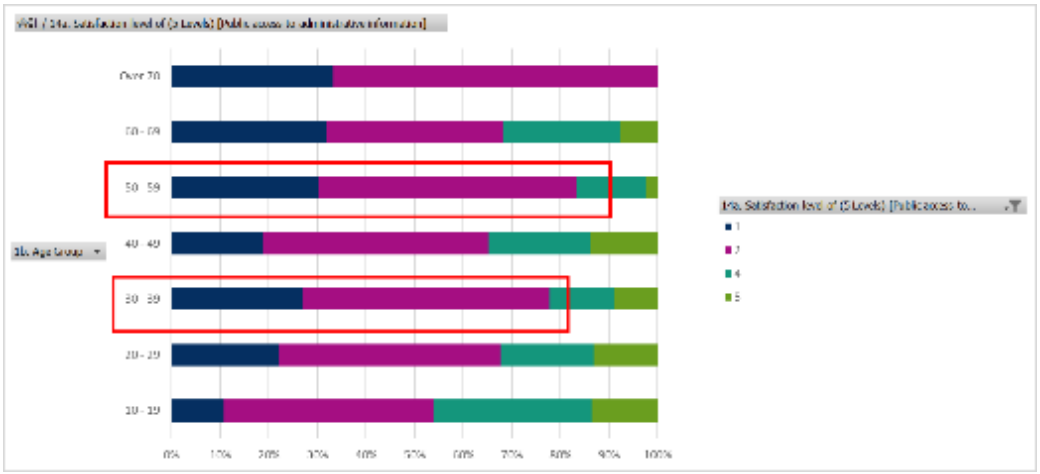
Question	Results
	

Question	Results
	
	Satisfaction with water supply, power supply, and communication environment is lower among teens and 20s, and among women, and it is necessary to have a hearing to understand this situation.
Securing parking spaces and ensuring traffic safety	
	Satisfaction with parking and traffic safety was lower among those in their 50s, which is thought to be due to them being the car-owning generation.

Question	Results
Convenience of public transport and availability of public transport information	 
	Satisfaction with public transportation (convenience and availability of information) was lower among those in their 20s to 50s, suggesting the commuting needs of the working generation.
Pedestrian spaces for comfortable walking	
	Women's satisfaction with a comfortable walking environment was lower, probably due to high steps and other factors, suggesting a need for a safe environment in which they can walk safely with their children.

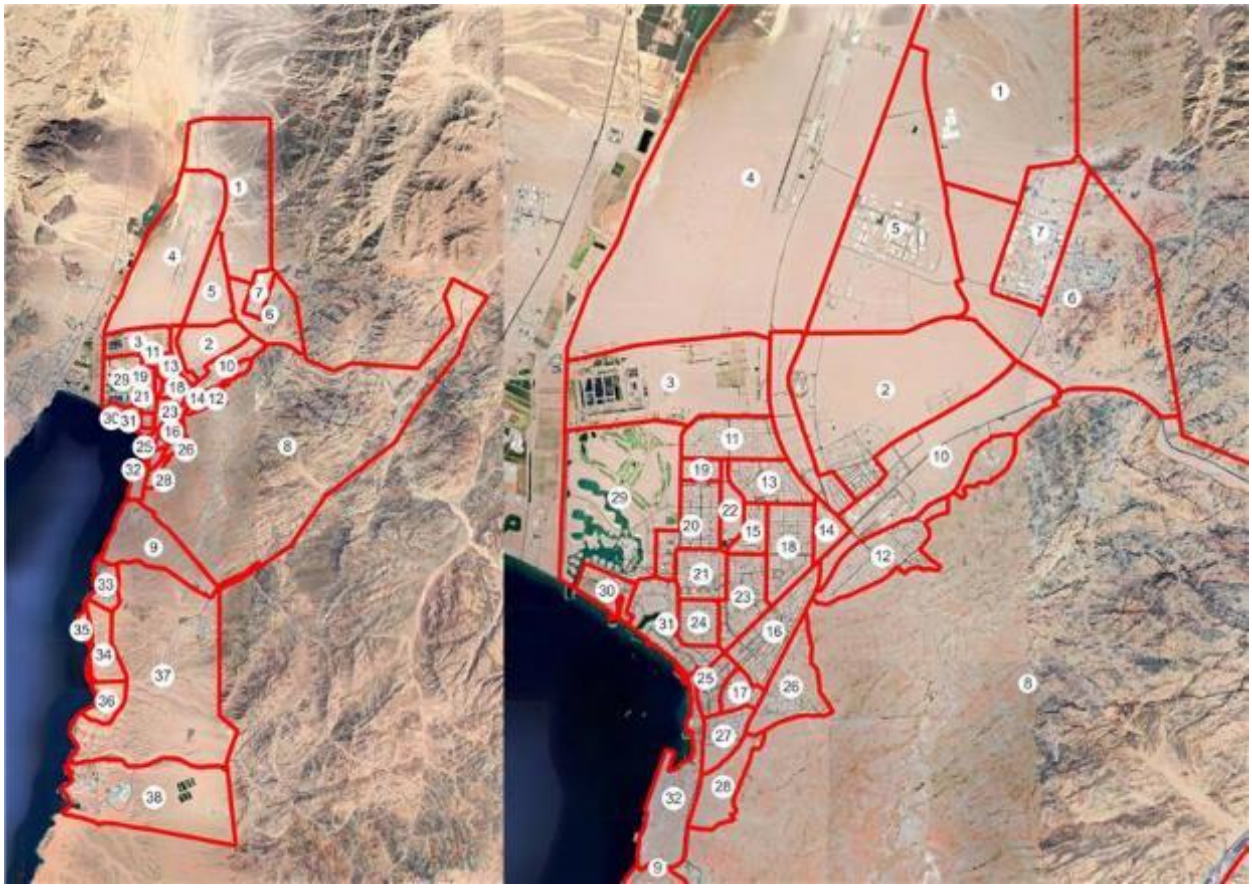
Question	Results
Conservation of the natural environment and ensuring safety against natural disasters	

Question	Results
	
	Satisfaction levels among respondents in their 50s and older and among women were lower for conservation of the natural environment and ensuring safety against natural disasters.
Use of renewable energy source	
	The satisfaction level among the woman was lower for the use of renewable energy source.
Planned urban development	
	Satisfaction with planned urban development is lower in the 50s.

Question	Results
Urban branding	
	Satisfaction with urban branding is lower among those in their 50s and older.
Public access to administrative information	
	Satisfaction with access to administrative information is lower among those in their 30s and 50s, indicating the need to consider making administrative information more transparent through digitalization.

2) Cross analysis based on residential area

A cross analysis of satisfaction levels was done and analyzed based on the residential area, and the results are as below.

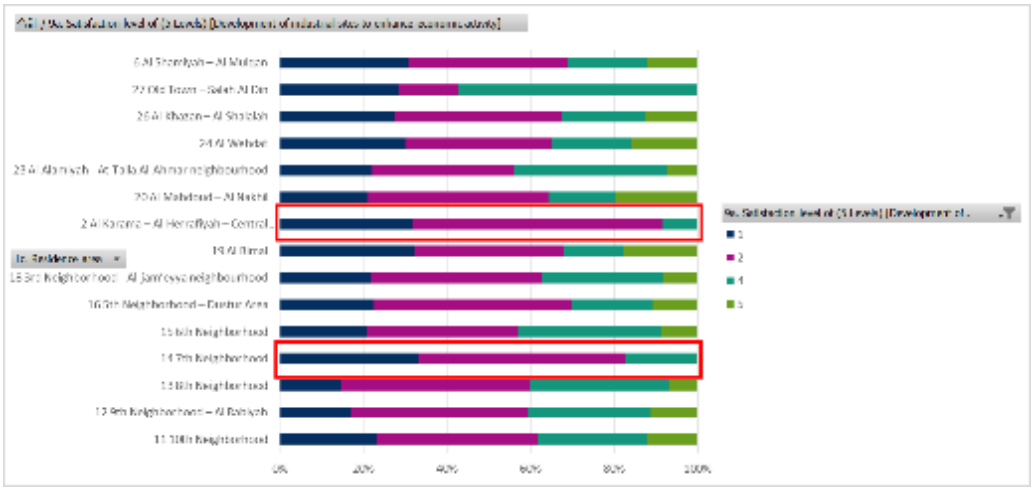


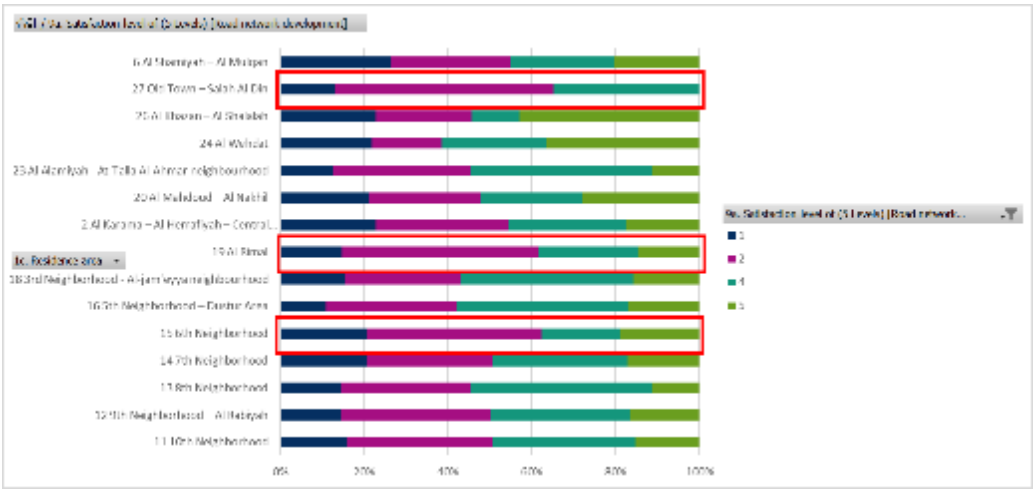
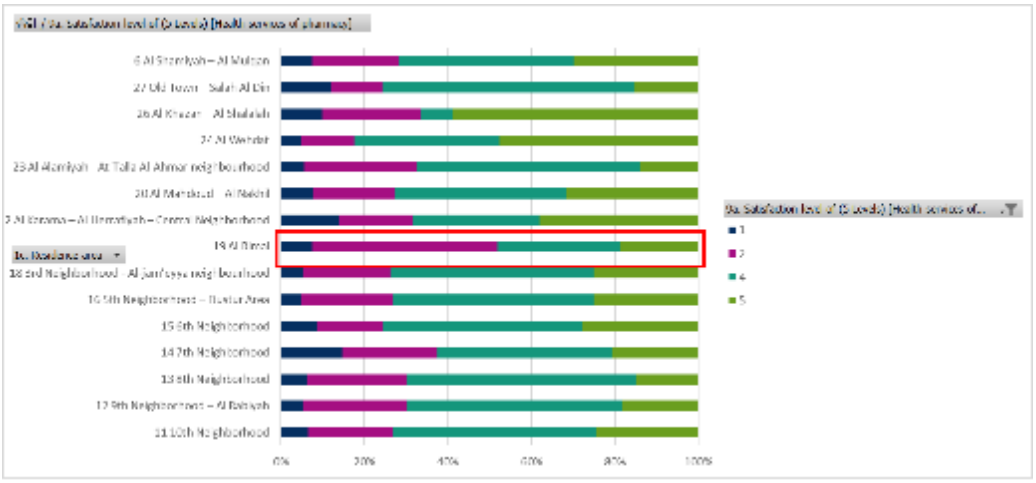
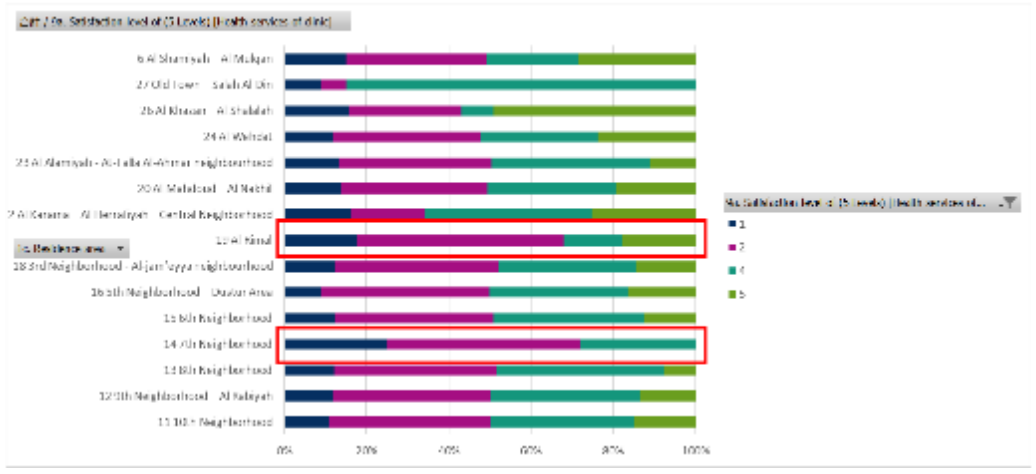
Source: JICA Survey Team

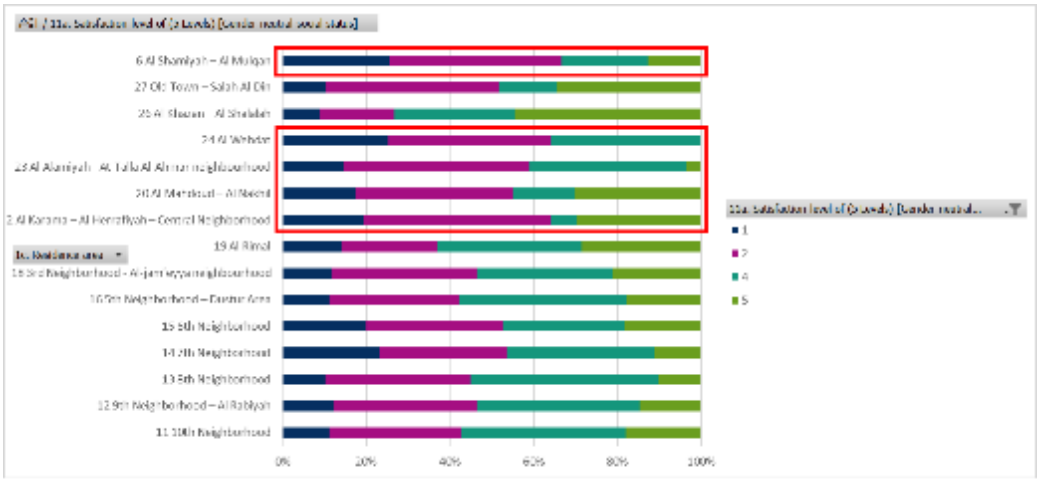
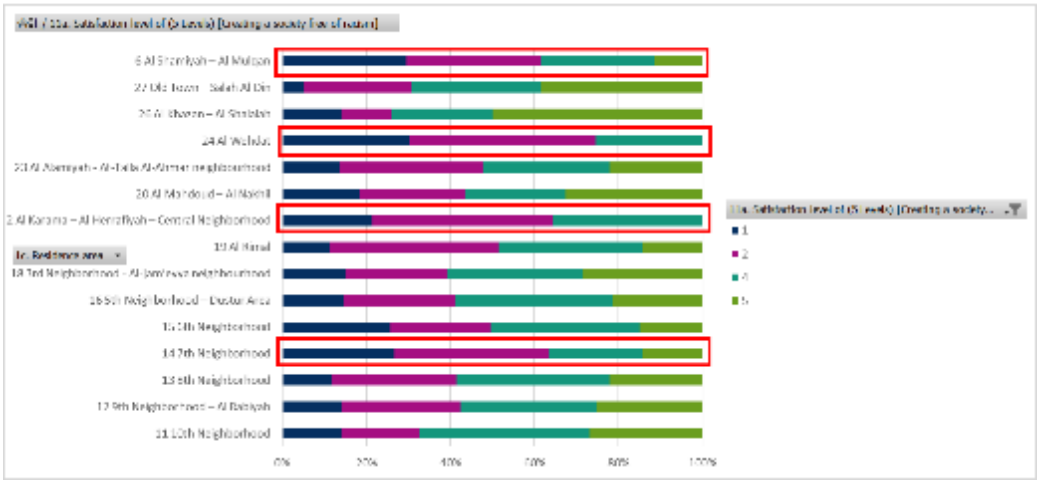
Figure 3-224 Zoning of residential area for the questionnaire survey

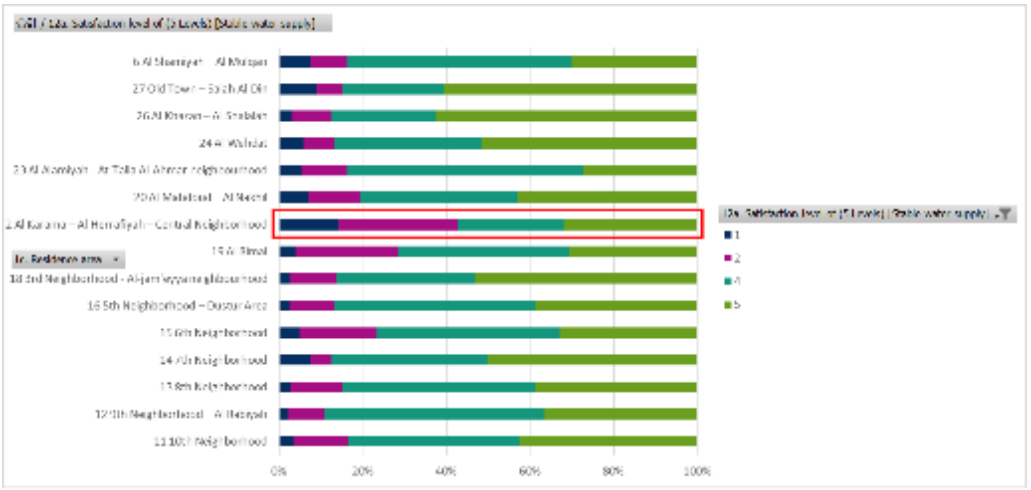
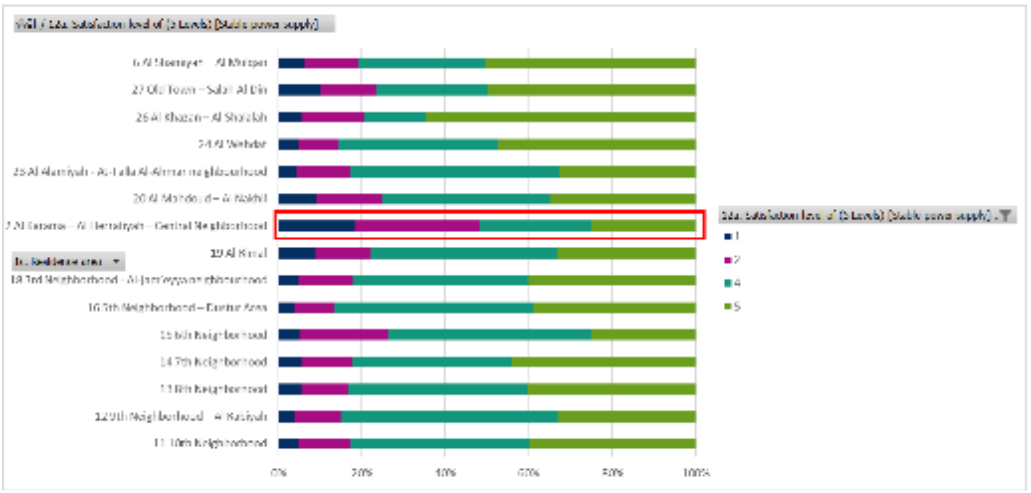
Table 3.104 Results of cross analysis based on the residential area

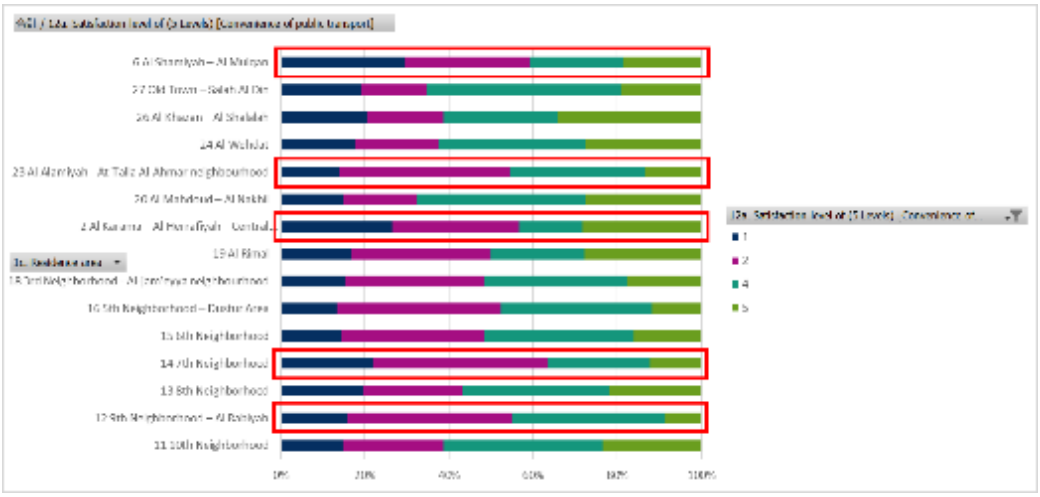
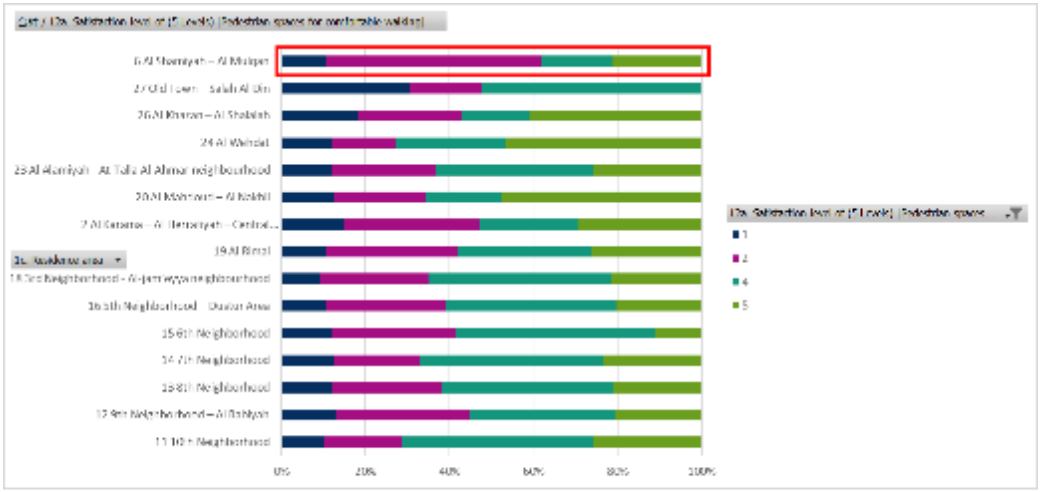
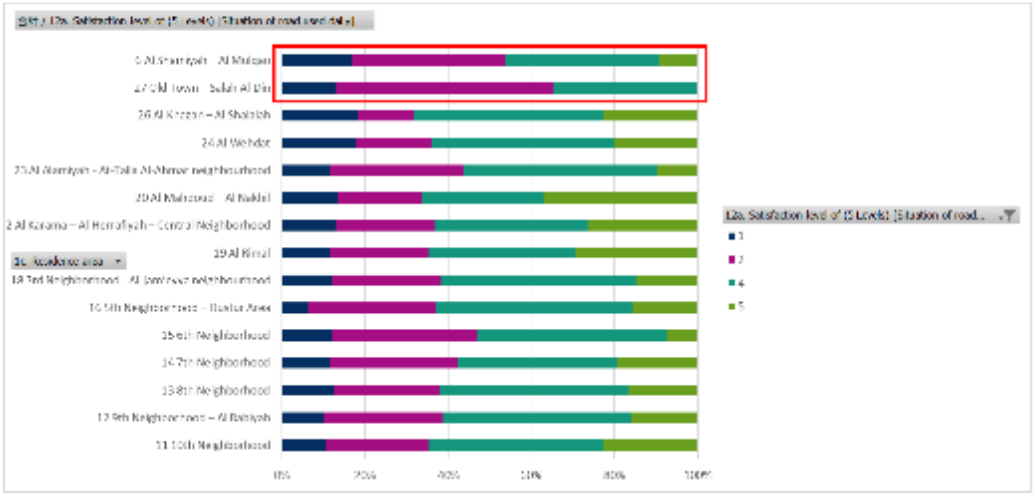
Questions	Results
Provision of need-based housing area	
	The level of dissatisfaction with the provision of need-based housing was particularly high for (2), (19), and (14), while satisfaction with (14) was the highest.

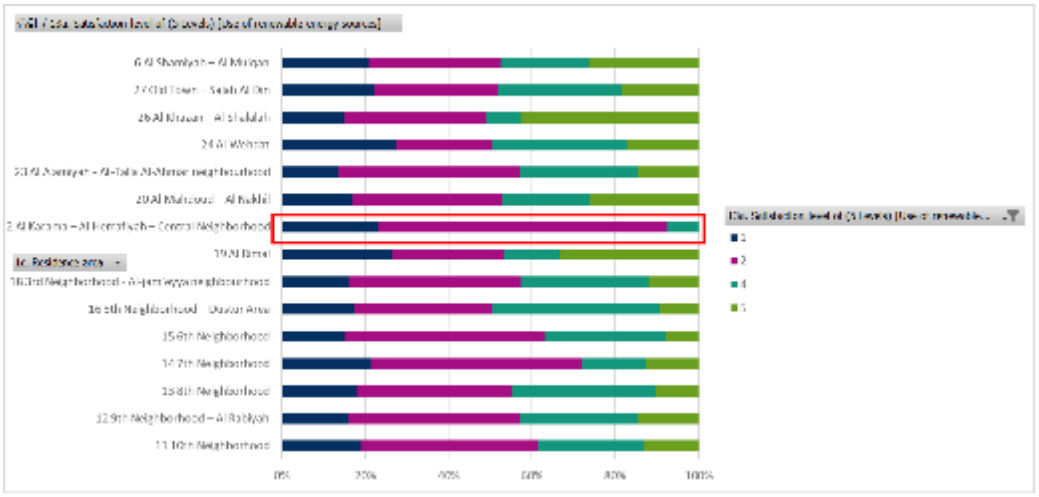
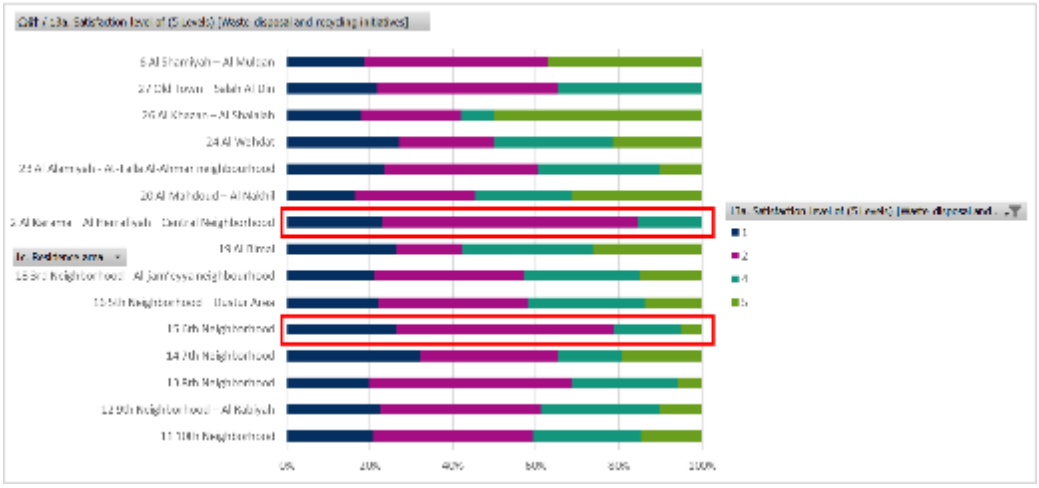
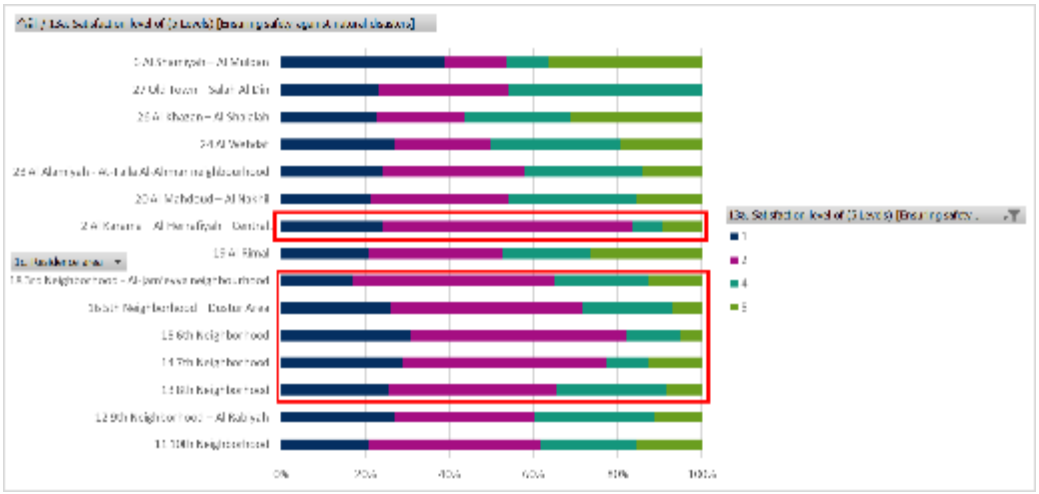
Questions	Results
Development of industrial sites to enhance economic activity	
	Regarding industrial development, dissatisfaction was high in (2) and (4), while satisfaction was highest in (4).
Development of resorts	
	The level of dissatisfaction with resort development was high for (2) and (4).
Widespread transport accessibility	
	The level of dissatisfaction with access to wide-area transportation was high for (14).

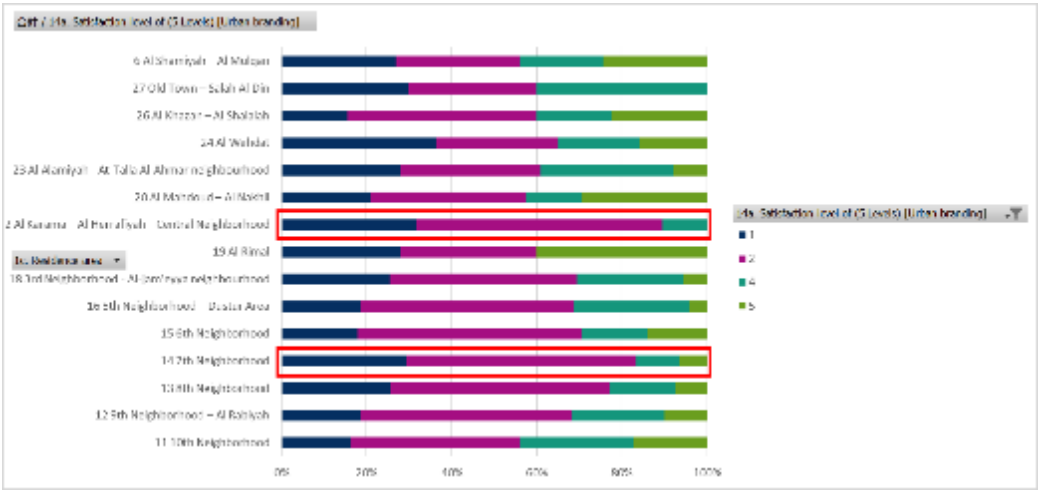
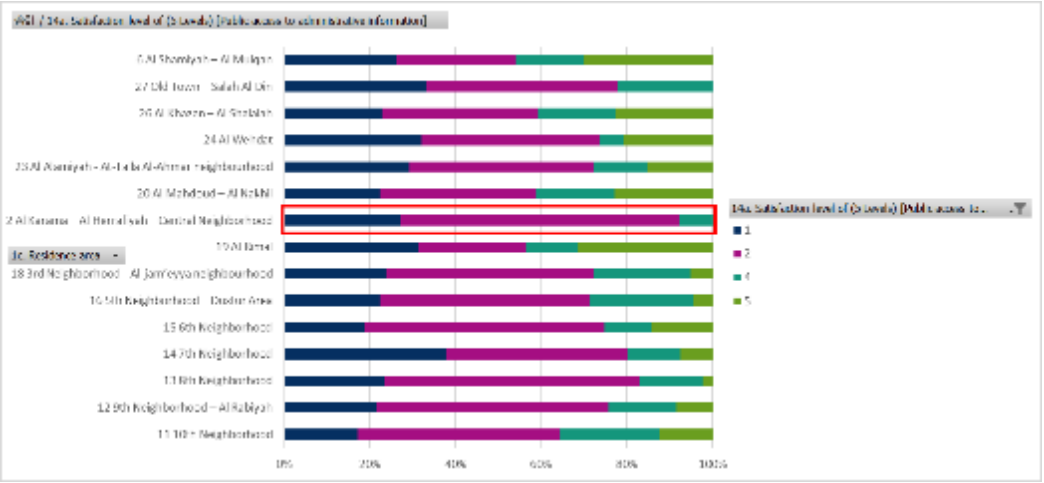
Questions	Results
Road network development	
	Regarding the road network, the level of dissatisfaction is high in (27), (19), and (15), and the road network in these areas needs to be analyzed.
Health services of pharmacy and clinic	 
	The respondents from area (14) and (19) were dissatisfied with medical services.

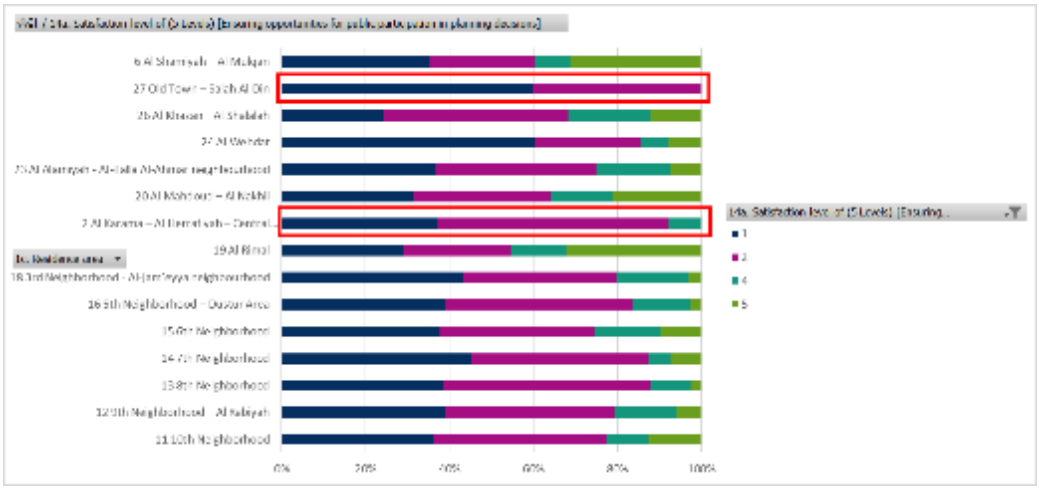
Questions	Results
Gender-neutral social status and creating a society free of racism	
	The respondents were dissatisfied with gender-neutral social status and creating a society free of racism in area (12), (16), and (24), and in (20), (23) for gender-neutral social status, and creating a society free of racism in (14).

Questions	Results
Stable water, power supply and stable communication environment	   The level of dissatisfaction with infrastructure (water, power, communications) was around 40% in (2), compared to around 20% in the other regions, suggesting the need to consider infrastructure rehabilitation in this region.

Questions	Results
Convenience of public transport	
	Concerning the convenience of public transportation, dissatisfaction is high in (6), (7), (8), (9), (10), (11), (12), and (13), so it is necessary to consider introducing more convenient public transportation in these areas.
Pedestrian spaces for comfortable walking and situation of road used daily	 
	The level of dissatisfaction with the condition of roads was high in (6) and (27), and the level of dissatisfaction with the walking environment was also high in (6).

Questions	Results
Use of renewable energy source and waste disposal and recycling initiatives	 
	The level of dissatisfaction with waste disposal/recycling was high for (2) and (15), and dissatisfaction with the use of renewable energy was also high for (2).
Ensuring safety against natural disasters	
	Ensuring of safety against natural disasters was highly unsatisfactory in (2), (13), (14), (15), (16), and (18), and needs to be considered in light of the hazard map.

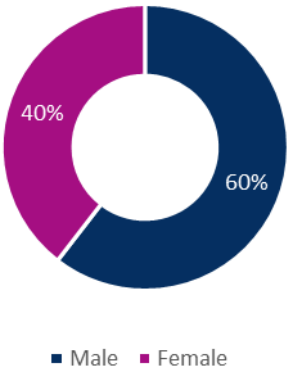
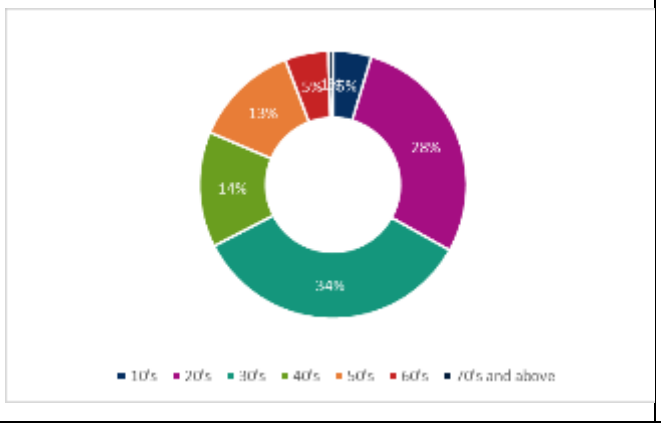
Questions	Results
Planned urban development	
	Respondents from area (12), (14), and (15) were highly dissatisfied with planned urban development
Urban branding	
	Regarding the urban branding, dissatisfaction was high in (2) and (14)
Public access to administrative information	
	Regarding the public access to administrative information, dissatisfaction was high in (2)

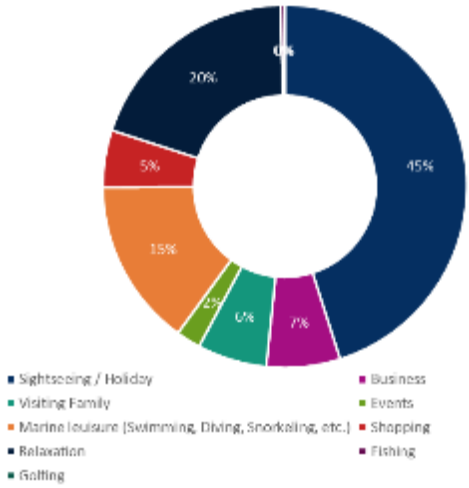
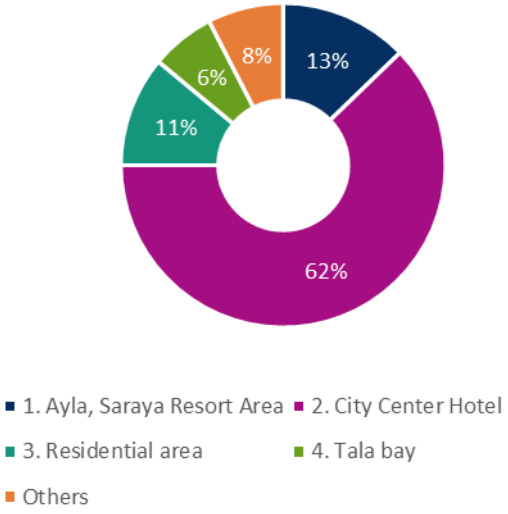
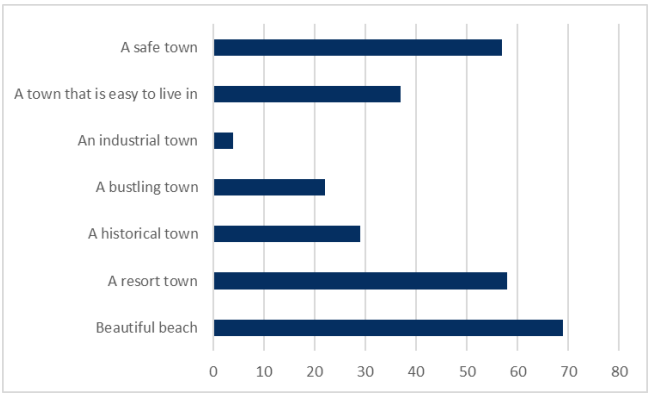
Questions	Results
Ensuring opportunities for public participation in planning decision	
	Regarding the ensuring opportunities for public participation in planning decision, dissatisfaction was high in (2) and (27)

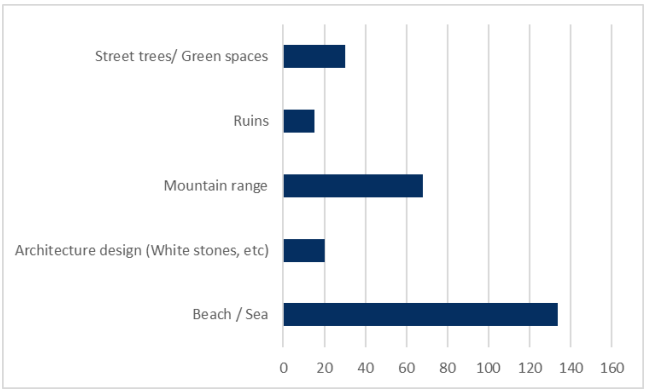
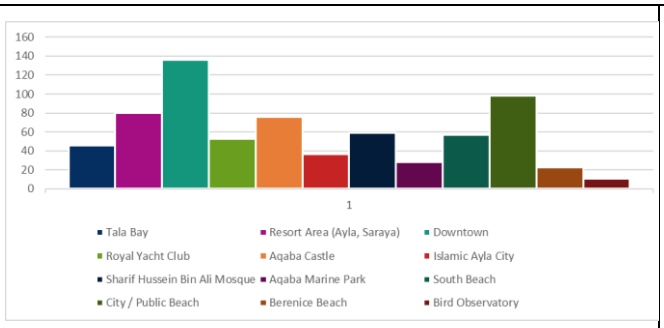
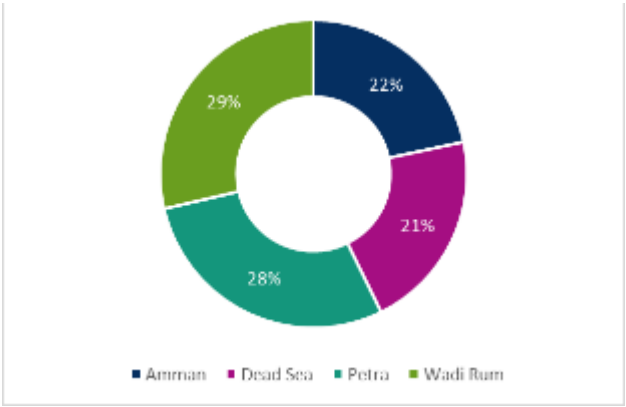
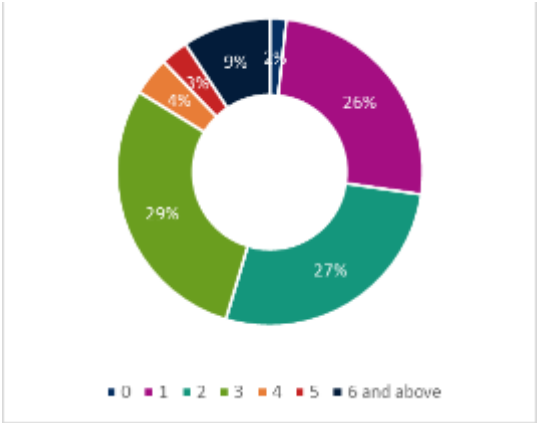
(2) Visitor Survey

The visitor survey began in February 2023 and 172 responses were received by March 31, 2023. The results of the simple tabulation are shown below.

Table 3.105 Questionnaire Results

Attributes		
Question	Results	
Sex		The total number of male participants who answered the questionnaire was 60% out numbering the 40% of females.
Age		Answers from participants in their 20s and 30s were the most at about 30% each, following were participants from theirs 40s and 50s at 14% and 13% respectively. Answers from participants in their 10s and above their 60s were the lowest at only a few percent.

Question	Results	
Purpose of visit		
Reason of visiting Aqaba		Sightseeing / holiday was the most common reason for coming to Aqaba at 45%, followed by relaxation at 20% and marine leisure at 15%. Only a few per cent of participant came for business, returning home, shopping, etc.
Place of stay		The results shows that the preferred location of stay was at city center hotel with 62% of participants answering so.
Town attractiveness		
What is the image of Aqaba as a town		It was found that the image of Aqaba is strongest for its beautiful beaches, followed by its image as a safe town and resort. Most tourists do not have an image of Aqaba as an industrial city.

Question	Results	
Attractive structures and landscapes that can become symbols of ASEZ		While most tourists perceive the beach and the sea as landmarks of the town, they are less aware of the archaeological sites and architecture attractiveness of Aqaba.
Visit & Stay		
Places visited within Aqaba		Downtown was the most visited location within Aqaba, with similar visitation trends observed at other locations, but with less tendency to visit Aqaba Marine Park, Berenice Beach and the bird observatory.
Places visited outside Aqaba		Similar visitation trends were observed in Amman, the Dead Sea, Petra and Wadi Rum as destinations outside Aqaba.
Days of stay		The results show that one to three days are the average length of stay in Aqaba.