Japan International Cooperation Agency (JICA)
Danang People's Committee, Vietnam

No.

The Study on Integrated Development Strategy for Danang City and Its Neighboring Area in the Socialist Republic of Vietnam (DaCRISS)

FINAL REPORT / Annex 5

DaCRISS Atlas

December 2010

ALMEC Corporation
International Development Center of Japan

EID
JR
10-194

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
DANANG PEOPLE'S COMMITTEE

THE STUDY ON INTEGRATED DEVELOPMENT STRATEGY FOR DANANG CITY AND ITS NEIGHBORING AREA IN THE SOCIALIST REPUBLIC OF VIETNAM (DACRISS)

FINAL REPORT

ANNEX 5

PLANNING TOOLS

December 2010

ALMEC CORPORATION
INTERNATIONAL DEVELOPMENT CENTER OF JAPAN

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CBD	Central Business District
DaCRISS	The Study on Integrated Development Strategy for Da Nang City and Its Neighboring Area in the Socialist Republic of Vietnam
DARD	Department of Agriculture and Rural Development
DCST	Department of Culture, Sport, and Tourism
DEIAA	Department of Environmental Impact Assessment and Appraisal
DOC	Department of Construction
DOE	Department of Education
DOET	Department of Education and Training
DOF	Department of Finance
DOFA	Department of Foreign Affairs
DOH	Department of Health
DOI	Department of Industry
DOIA	Department of Internal Affairs
DOIC	Department of Information and Communications
DOIT	Department of Industry and Trading
DOJ	Department of Justice
DOL	Department of Labour,
DOLISA	Department of Labor, Invalids and Social Welfare
DONRE	Department of Natural Resources and Environment
DOST	Department of Science and Technology
DOT	Department of Transport
DPC	Danang People's Committee
DPI	Department of Planning and Investment
DWRM	Department of Water Resources Management
DWSC	Da Nang Water Service Company
GOV	Government of Vietnam
GSO	General Statistics Office
GIS	Geographic Information System
HCMC	Ho Chi Minh City
HH	household
HIS	household interview survey
HIV	Human Immunodeficiency Virus
JICA	Japan International Cooperation Agency
M/C	Motorcycle
MARD	Ministry of Agriculture and Rural Development
MOC	Ministry of Construction
MONRE	Ministry of Natural Resources and Environment
N-S	North-South
PC	Peoples Committee
PIIP	Priority Infrastructure Investment Program
UPI	Urban Planning Institute
URENCO	Urban Environmental Company
USD	US Dollar
UTM	Universal Transverse Mercator
VND	Vietnamese Dong
VRA	Vietnam Road Administration

INTRODUCTION

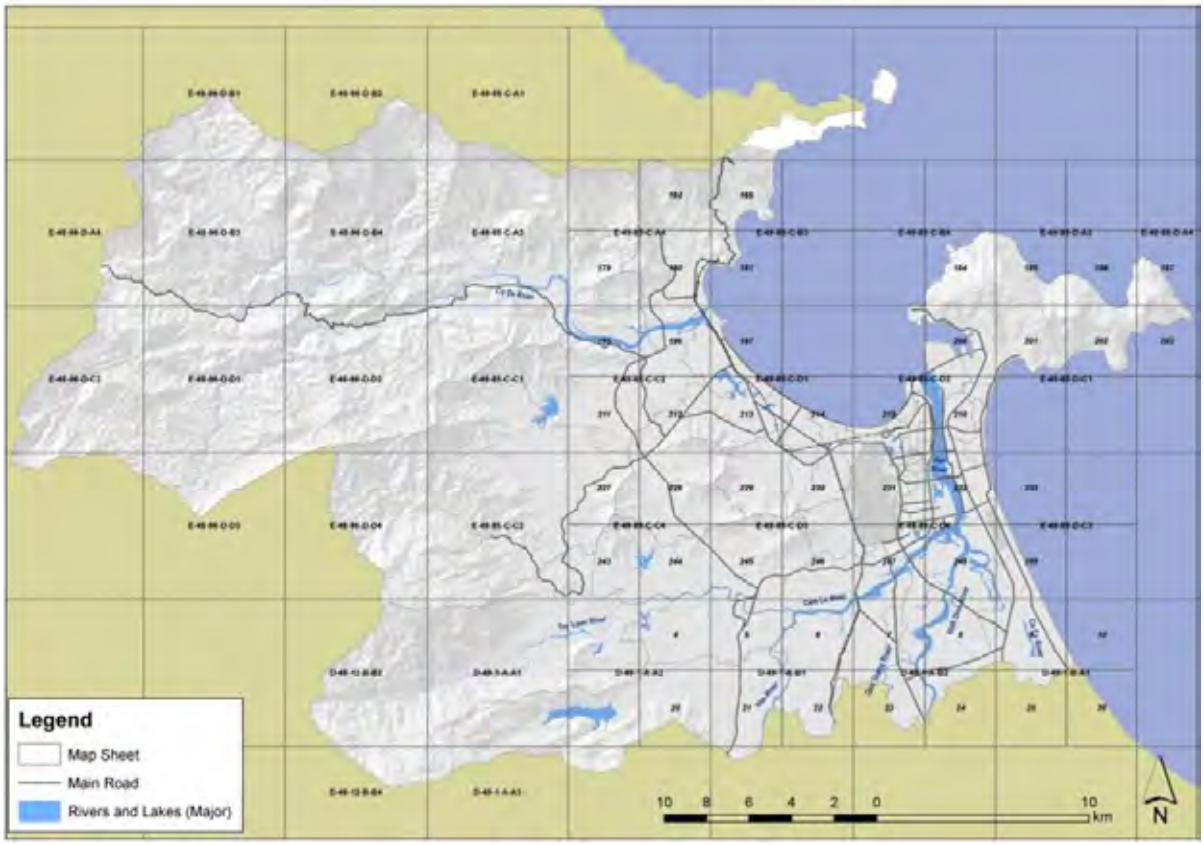
A comprehensive GIS database was developed in “The Study on the Integrated Development Strategy for Danang City and Its Neighboring Areas in the Socialist Republic of Vietnam” (DaCRISS) to understand both the natural and socio-economic conditions of the study area and to know the spatial distribution of development constraints that hinder, and opportunities that support, the development of a comprehensive master plan for Danang City. Based on this GIS database, many thematic maps were produced and analyzed.

In order to facilitate the dissemination of information and encourage the maximum use of the DaCRISS GIS database, the DaCRISS Atlas was developed. The Atlas compiles the GIS outputs of DaCRISS which are categorized according to map themes, from thematic maps showing baseline data used for the study to maps showing the results of analyses conducted for the study. As a companion guide to the Atlas, the Study Team developed the computer-based DaCRISS Map Viewer which allows technical and non-technical users to view and manipulate map data without the need for expensive GIS or CAD software. The map viewer features functions that allow users to view and print mapping outputs in several ways, as well as to access actual GIS data developed for the study. The map viewer uses a menu-based system which lets users navigate through the numerous mapping outputs of DaCRISS easily.

1 BASE MAPS

1.1 Topographic Map Index of Danang City

Figure 1.1 Topographic Map Index of Danang City



Source: MONRE

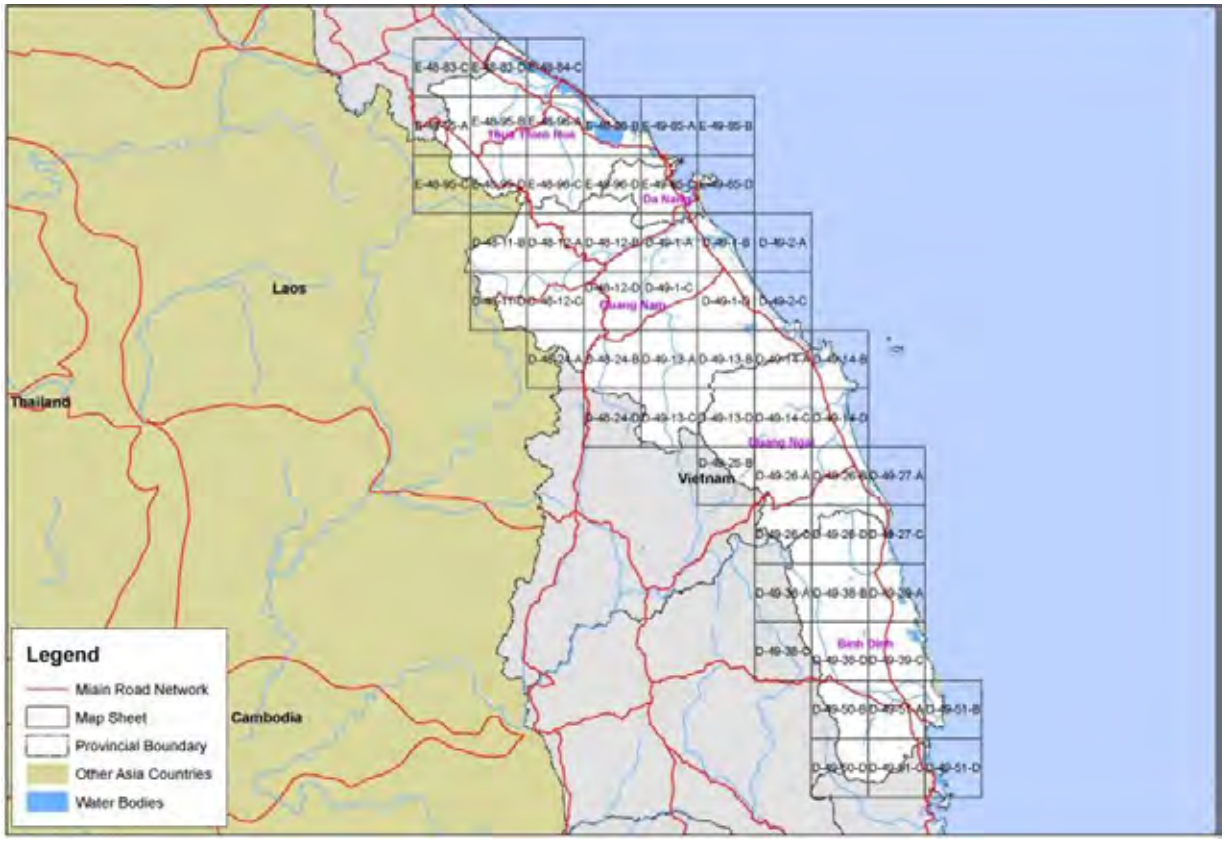
Explanation:

1.1 The Study Team obtained a topographical map of Danang City from MONRE at scales of 1:5,000, 1:10,000, and 1:50,000. Figure 1.1 shows a map index of 1:5,000- and 1:10,000-scale topographic map of Danang City. It is composed of 35 map sheets at a scale of 1:10,000. However for the central area of Danang City, the map sheets have a scale of 1:5,000 and cover smaller sections to enable detailed topographic data. Topographic data at scales of 1:5,000 and 1:10,000 used the coordinate systems of VN2000.

1.2 In DaCRISS, map sheets with a scale of 1:5,000 were used for detailed planning for urban districts and the 1:10,000 scale for urban planning for the whole city.

1.2 Topographic Map Index of Danang City's Surrounding Areas

Figure 1.2 Topographic Map Index of Danang City's Surrounding Areas



Source: MONRE.

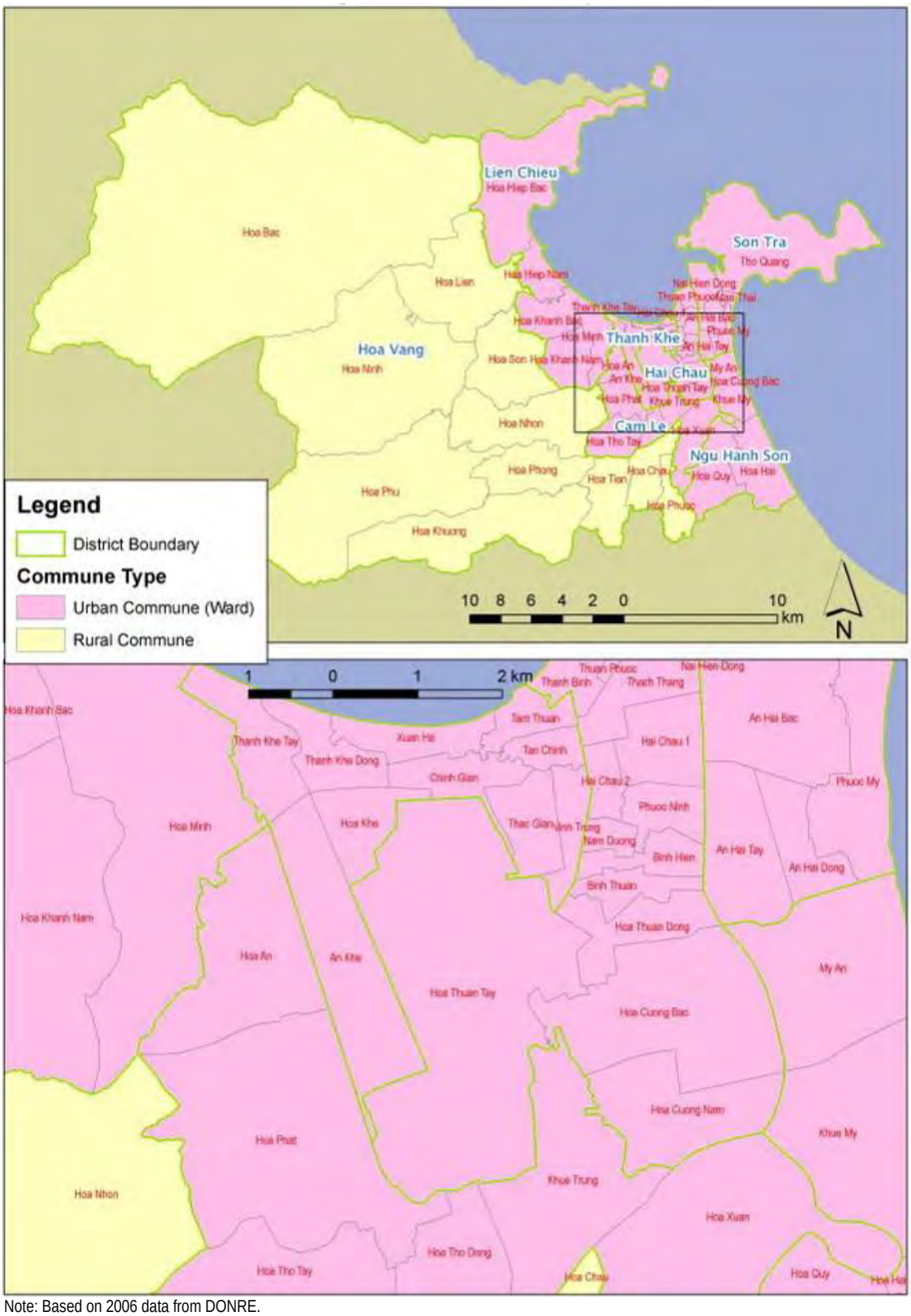
Explanation:

1.3 Besides Danang City, the study area of DaCRISS covers the five provinces of Thua Thien Hue, Danang, Quang Nam, Quang Ngai, and Binh Dinh. The map index in Figure 1.2 which has a scale of 1:50,000, shows the location of the study area vis-à-vis that of other Vietnamese provinces and Asian countries. It also shows the transportation network in the study area which plays an important role in linking it with other economic zones in Vietnam and Southeast Asia.

1.4 The map index has 62 sheets to show the topographic data of the entire study area. Topographic data at a scale of 1:50,000 used the coordinate system of UTM Zone 48. The map was used for regional development planning covering the DaCRISS study area.

2 ADMINISTRATIVE BOUNDARIES WITHIN DANANG CITY

Figure 2.1 Administrative Boundaries within Danang City



Note: Based on 2006 data from DONRE.

Explanation:

2.2 Figure 2.1 shows the administrative map of Danang City by commune. Danang is one of five independent but centrally controlled municipalities in Vietnam. It has six urban districts (Hai Chau, Thanh Khe, Lien Chieu, Cam Le, Son Tra, and Ngu Hanh Son), one rural district (Hoa Vang), and the island district of Hoang Sa. The total area of the city is 1,255.53 km^2.

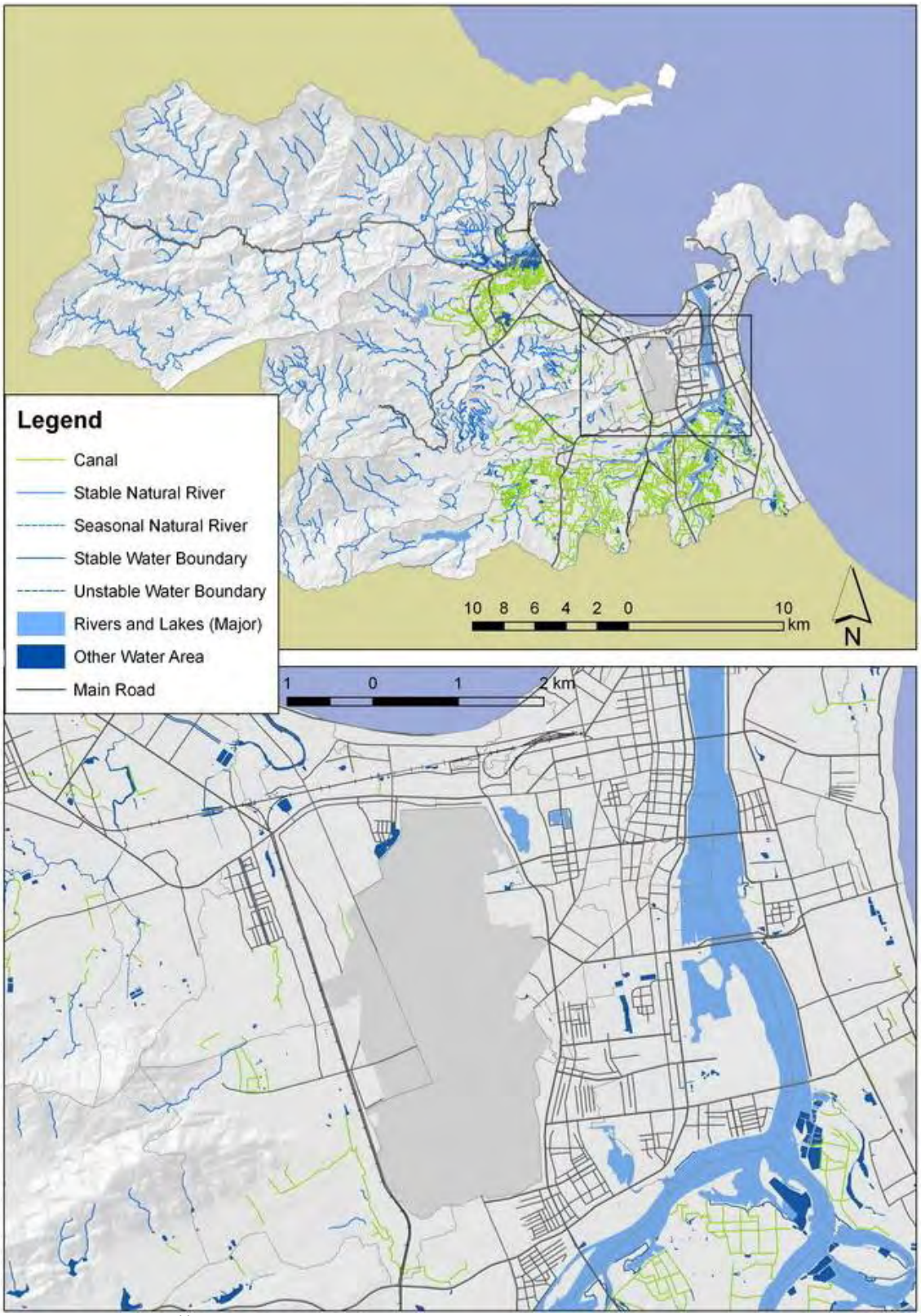
2.3 The map shows the names and boundaries of each commune, ward (with the exception of Hoang Sa District), and district. Urban and rural areas are differentiated by color: rose indicates urban area (45 wards) and yellow, rural area (11 communes). The city has the highest urbanization rate among provinces and municipalities in Vietnam, with 11 rural communes only, the fewest any province-level unit in Vietnam has.

2.4 The administrative map was developed from 2006 data supplied by DONRE. This map gives an overall picture of the administrative organization in Danang City at commune and district levels.

3 NATURAL CONDITIONS OF DANANG CITY

3.1 Water Network

Figure 3.1 Water Network Map of Danang City



Source: 1:10,000 Topographic Map, 2006, DONRE.

Explanation:

3.1 Figure 3.1 shows the map of the hydrological network in Danang City, including canals, as well as permanent and seasonal rivers. This map indicates that the river network in the city originates from the western and northwestern mountains of the city, in the boundary of Danang and Quang Nam provinces. Almost all rivers are short and sloping.

3.2 The main rivers and lakes in Danang City are colored light blue. Within the city's territories are four large rivers, three of which are in the northern downstream of Vu Gia–Thu Bon river basin, i.e., Vinh Dien, Yen, and Tuy Loan rivers. All of them run to Han River which drains into the Danang Gulf. The basin area of Cu De River (with north and south branches) north of the city is 472 km^2. In addition, some 42 lakes and reservoirs are distributed in the area, which are capable of storing 1.8 million m3 of water.[1]

3.3 The topographical separation of the city created two river basins, i.e., Cu De river basin in the north and Vu Gia–Thu Bon river basin in the south. Of the city's eight districts, six are located in the Vu Gia–Thu Bon river basin, accounting for 59.5% of its area. Therefore, this river basin plays a very important role in the city's development.

3.4 The database on the city's water network is organized as shown in Table 3.1.

Table 3.1 Database on Danang City's Water Network

Category	Name	Total Length (km)
Major River (under DOT management)*	Cu De	39
	Han	5.4
	Co Co	3.9
	Vinh Dien	11.3
	Qua Giang	4.0
	Lo Giang	2.3
	Cam Le	11.4
	Yen	6.1
	Hoa Nhon	5.4
	Lo Dong	14.7
	Tuy Loan	14.1
Canal		783.7
Main Lake	29/3 Park	-
	Bau Mac	-
	Bau Sau	-
	Bau Tram	-
	Bau Tron	-
	Dam Rong	-
	Dam Rong No.1	-
	Dam Rong No.2	-
	Hoa Cuong	-
	Hoc Khe	-
	Thac Gian	-
	Truoc Dong	-
	Vinh Trung	-
Reservoir	Dong Nghe	-
	Dong Treo	-
	Hoa Trung	-

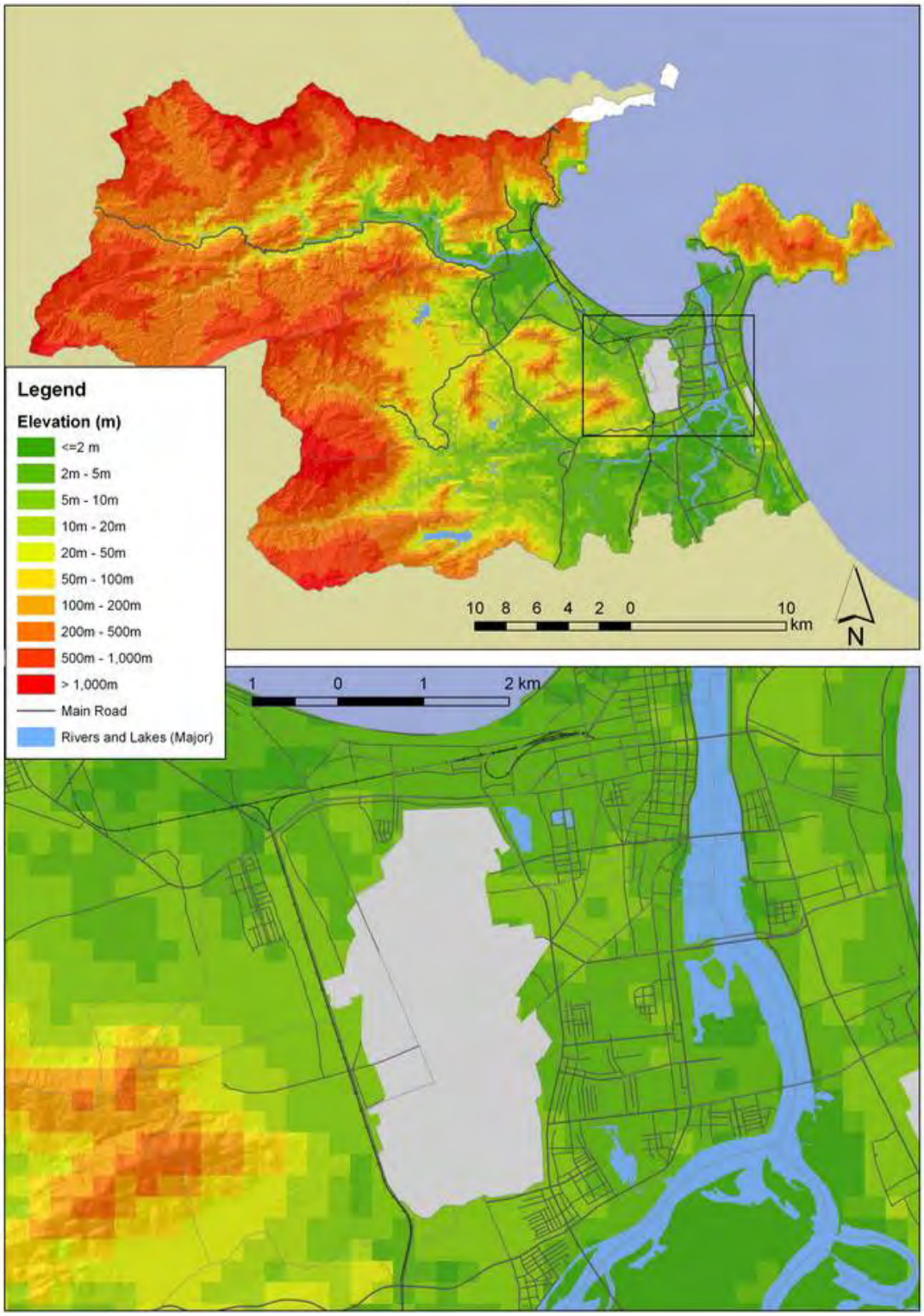
Source: DaCRISS Study Team.

[1] Source: "10 years environmental current status report" of DONRE.

3.2 Topography

1) Elevation

Figure 3.2 Elevation Map of Danang City



Source: 1:10,000 Topographic Map, 2006.

Explanation:

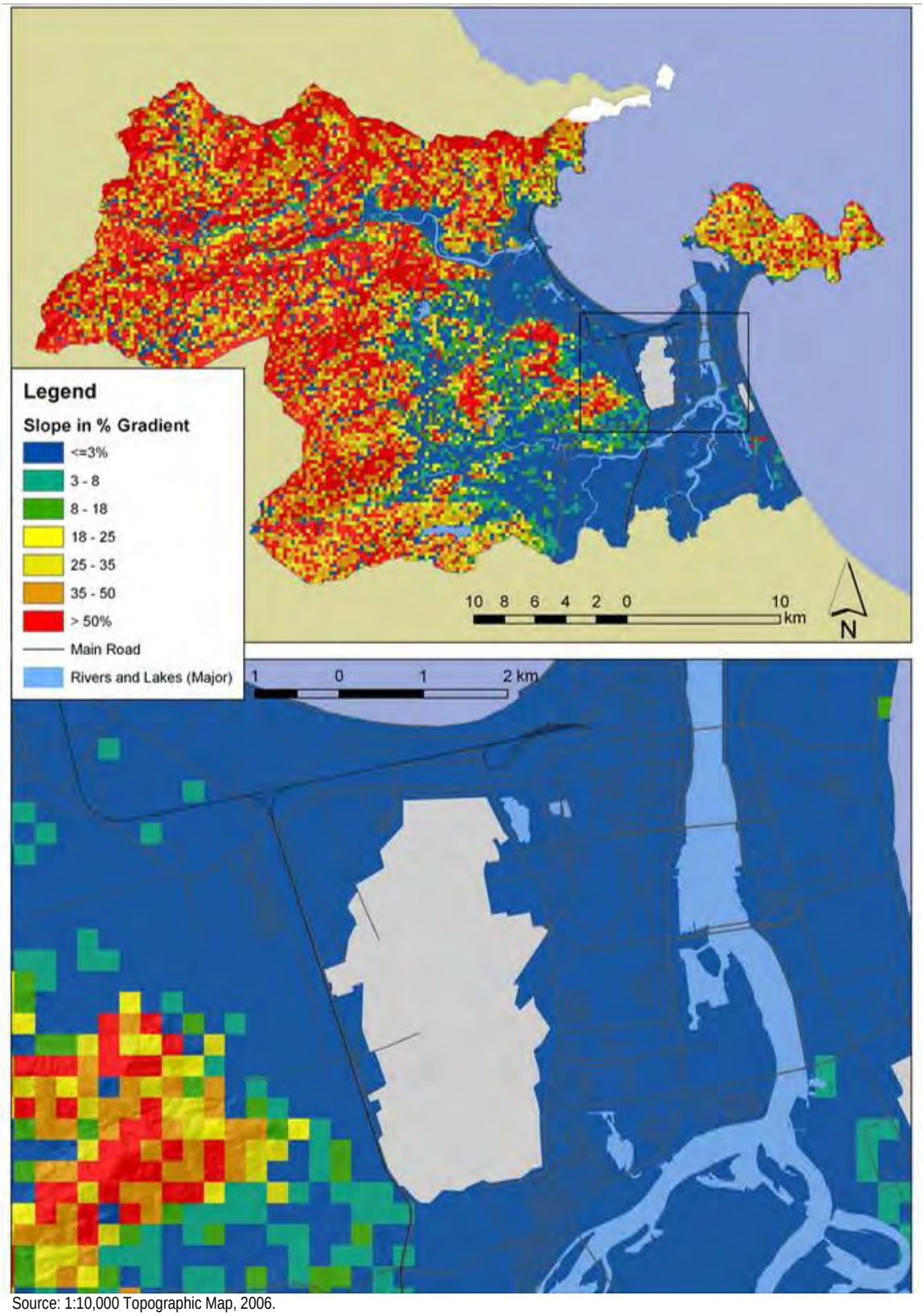
3.5 The elevation map of Danang City was constructed based on the contour lines and elevation points data of the 2006 topographic map at a scale of 1:10,000. Terrain elevation was classified into 10 groups, i.e. less than 2 m, 2–5 m, 5–10 m, 10–20 m, 20–50 m, 50–100 m, 100–200 m, 200–500 m, 500–1,000 m, and more than 1,000 m. Figure 3.2 gives each group different colors.

3.6 The lowest part of the city with an altitude of less than 2 m is distributed in the floodplains of Cu De and Vu Gia–Thu Bon river basin and includes the rivers of Cam Le, Vinh Dien, and Co Co. The highest terrain with an altitude of more than 1,000 m is distributed in the western and northwestern parts of the city, in the boundaries separating Danang, Quang Nam, and Thua Thien Hue provinces.

3.7 The elevation map visualizes the morphological pattern of the city. Based on this map, it can be seen that Danang's topography gradually slopes from west to east. It is also varied and complex, consisting of high mountains, low hills, and low-lying coastal plains and river deltas. Mountainous areas account for about three-fourths of the city's area and mostly range from 700 to 1,500 m in height. The Ba Na–Nui Chua area is the highest point with an elevation of 1,487 m above sea level, followed by Son Tra peninsula with an elevation of 693 m above sea level. Phuoc Tuong and Bach Ma are the other major mountain ranges in the area. Meanwhile, the plains with an average elevation of 5 m above sea level occupies a fourth of the city area and are located along the main river and in the coastal zone.

2) Slope

Figure 3.3 Slope Map of Danang City



Source: 1:10,000 Topographic Map, 2006.

Explanation:

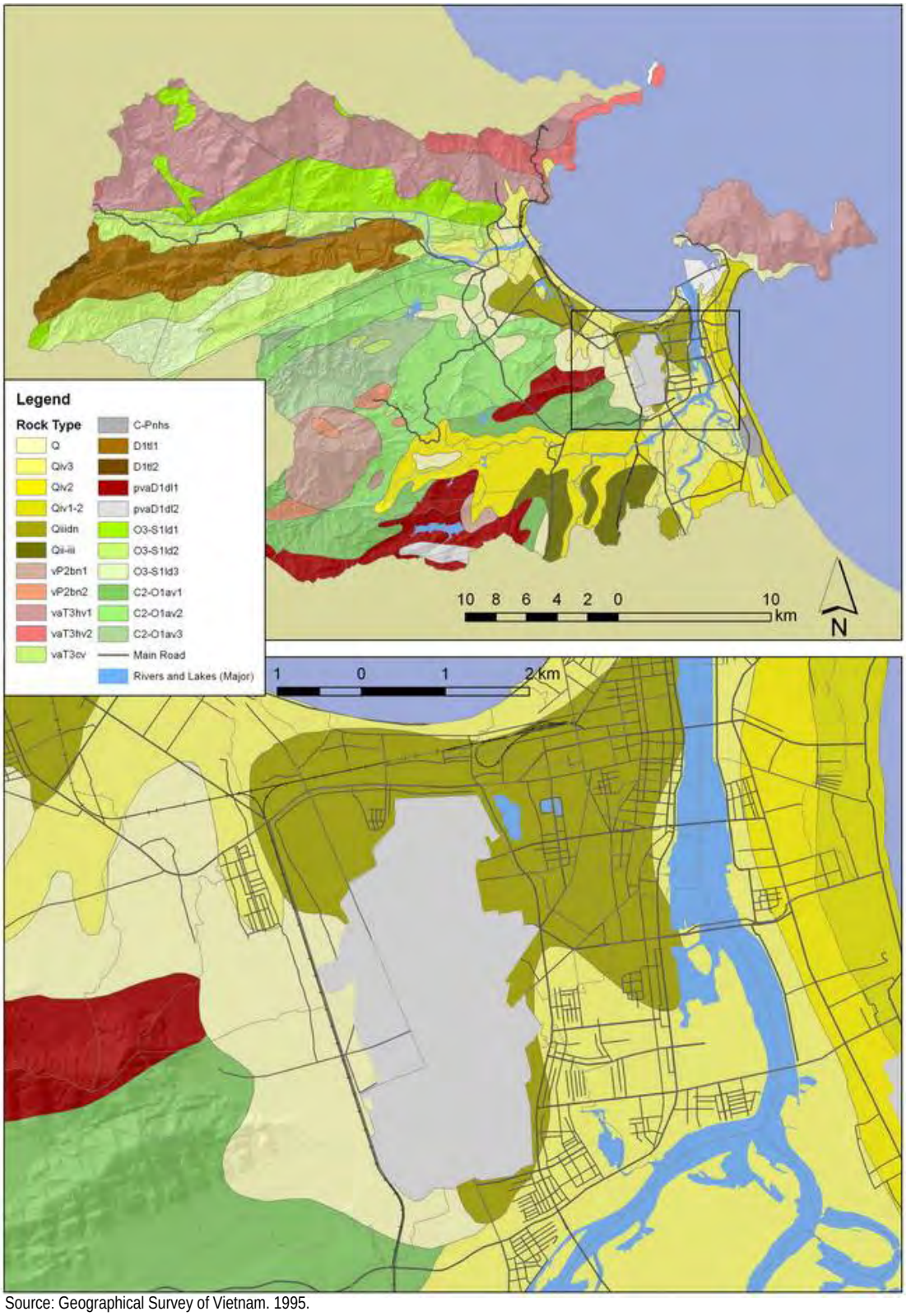
3.8 Based on contour data, slope distribution was calculated to generate important indicators on the development suitability of land in Danang City. To develop a slope map, a 250-meter grid cell was applied. Slope degrees are classified into seven categories (in percent (%) gradient), according to international standards, i.e., less than 3%, 3–8%, 8–18%, 18–25%, 25–35%, 35–50%, and more than 50%. The distribution of slope indicates that flatlands dominate the eastern part of the city along the coast and the Han River.

3.9 Based on the slope map, 36% or 342 km^2 of Danang City lies in flat areas having a slope of less than 3%, while 27% or 257 km^2 lies in steep areas having a slope of more than 50%.

3.10 The slope map is an important data source on water resources, as well as transportation, environment, and socio-economic development.

3.3 Geology

Figure 3.4 Geologic Map of Danang City



Source: Geographical Survey of Vietnam. 1995.

Explanation:

3.11 The geologic map is built from data of the Department of Geology and Minerals of Vietnam. Geologic classification is based on the classification of the rock types in different thicknesses. The database on the geologic classification of Danang is organized as shown in Table 3.2.

Table 3.2 Database on Geologic Classification of Danang City

Geology	Area, km^2 (Share to Total)	Name	Contents	Thickness	Type by		
					Sedimentary Rock		Volcanic/ Plutonic
Q	40.8 (4%)	Undivided Quaternary	Pebble, Granule, Sand, Clay	3–10 m thick	Alluvium (22%)		Unknown
Q_{iv}^3	74.9 (8%)	Upper Holocene	Pebble, Granule, Sand, Silt, Plant Remains, Peat, Shell, Clay	5–25 m thick			
Q_{iv}^2	74.9 (8%)	Middle Holocene	Sand, Granule, Grit	10–20 m thick			
Q_{iv}^{1-2}	14.0 (1%)	Nam O Formation	White Quartz Sand	3–6 m thick			
Q_{iii}^{dn}	33.0 (3%)	Da Nang Formation	Yellow Quarts Sand	8–10 m thick	Diluvium (6%)		Unknown
Q_{ii-iii}	22.9 (2%)	Middle-upper Pleistocene	Grey Colored Sand, Clay	4–10 m thick			
$\gamma P_2 bn_2$	7.6 (1%)	Ba Na Complex: Phase 2	Two-mica Granite, Alaskite Granite	-	Tertiary (4%)	Paleo-cene	Granite
$\gamma P_2 bn_1$	33.1 (3%)	Ba Na Complex: Phase 1	Biotite Granite, Two-mica Granite	-			
$\gamma aT_3 hv_2$	20.3 (2%)	Hai Van Complex: Phase 2	Biotite Granite	-	Mesozoic (19%)	Triassic	Granite
$\gamma aT_3 hv_1$	156.4 (16%)	Hai Van Complex: Phase 2	Biotite Granite, Two-mica Granite	-			
$vaT_3 cv$	2.2 (0%)	Cha Val Complex	Gabbro, Melanocratic Coarse-, Medium-Grained Gabbro Pyroxenite	-			
C-P nhs	2.7 (0%)	Ngu Hanh Son Formation	Marble Intercalated with Quartz-sericite shale, Sandstone	500 m thick	Paleozoic (49%)	Permian (0%)	Unknown
$D_1 tl_2$	1.0 (0%)	Tan Lam Formation: Upper Subformation	Silty Sandstone, Sandstone, Siliceous Shale, Carbonate-bearing Shale, Siltstone	Over 700 m thick		Devonian (12%)	Unknown
$D_1 tl_1$	67.9 (7%)	Tan Lam Formation: Lower Subformation	Conglomerate, Gritstone, Sandstone, Siltstone, Shale	600–700 m thick			
$\rho\gamma aD_1 dl_2$	4.4 (0%)	Dai Loc Complex: Vein Phase	Granite Aplite	-			Granite
$\rho\gamma aD_1 dl_1$	42.6 (4%)	Dai Loc Complex: Phase 1	Biotite Granite, Two-mica Gneissoid Granite	-			
O_3-$S_1 ld_3$	21.5 (2%)	Long Dai Formation: Upper Subformation	Silty Sandstone, Shale, Lenses of Limestone, Marl	Over 650 m thick		Ordovicia-Silurian (17%)	Unknown
O_3-$S_1 ld_2$	83.1 (9%)	Long Dai Formation: Middle Subformation	Sandstone, Quartzitic Sandstone, Siltstone, Dacite, Rhyolite	900–1000 m thick			
O_3-$S_1 ld_1$	53.1 (6%)	Long Dai Formation: Lower Subformation	Conglomerate, Gritstone, Sericite Schist, Silty Sandstone, Quartzitic Sandstone, Shale	900–1000m thick			Schist
C_2-$O_1 av_3$	38.7 (4%)	A Vuong Formation: Upper Subformation	Sandstone, Silty Sandstone, Shale, Sericite Schist, Lenses of Limestone	Over 700 m thick		Cambria-Ordovician (20%)	Schist
C_2-$O_1 av_2$	102.1 (11%)	A Vuong Formation: Middle Subformation	Quartzitic Sandstone, Biotite Quartzite, Quartz-sercite Schist	1000 m thick			
C_2-$O_1 av_1$	52.6 (6%)	A Vuong Formation: Lower Subformation	Sericite-chlorite Schist, Biotite Schist, Marbleized Limestone	1100 m thick			
Total	950						Granite: 20% Schist: 27%

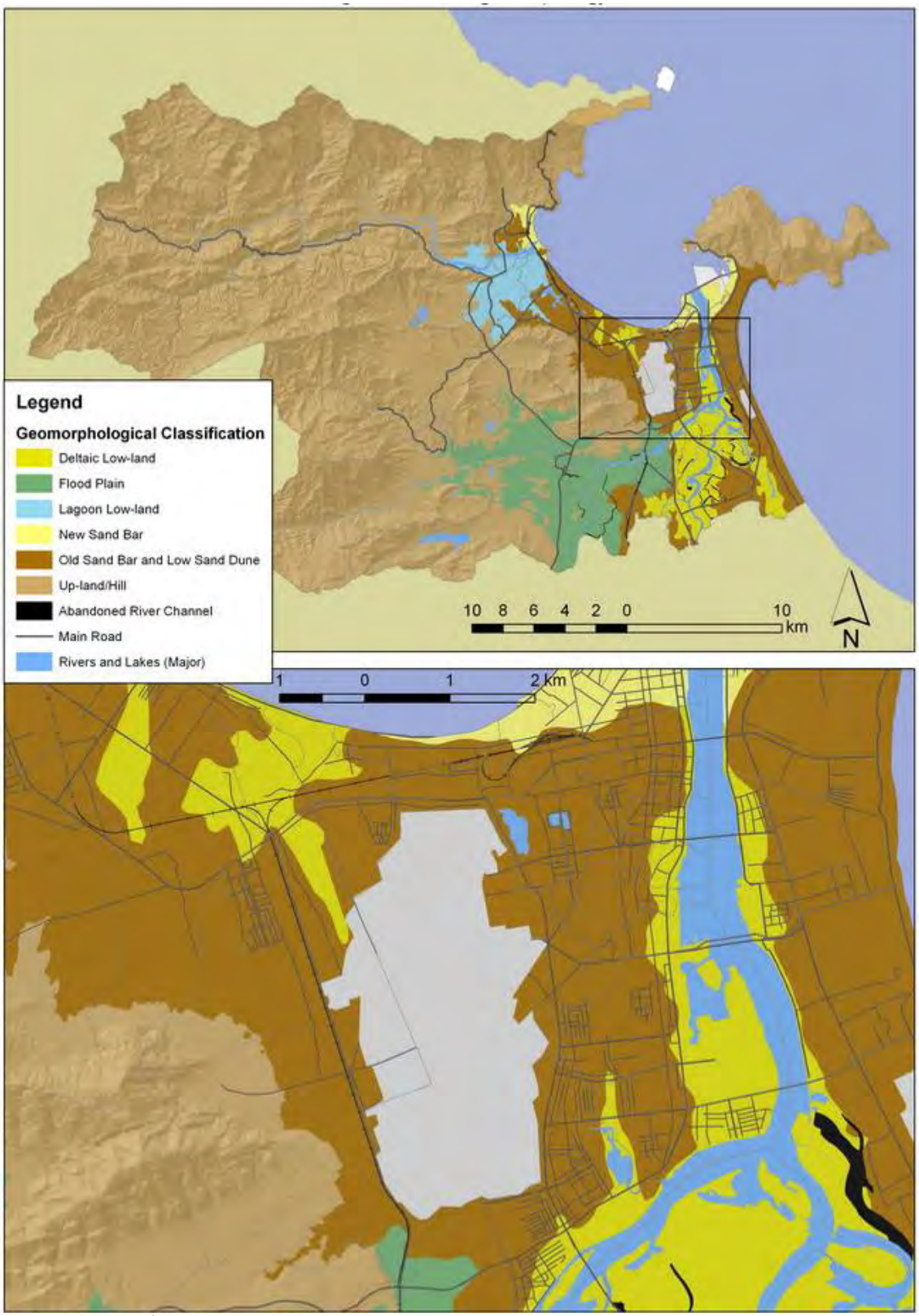
Note: From the geological and mineral resources map of Vietnam at 1:200,000 scale, Geological Survey of Viet Nam, Hanoi, 1995, and classified by the DaCRISS Study Team.

3.12 Based on GIS, 22% of Danang City's land is alluvium, concentrating around the downstream areas of rivers and is suitable for development in terms of geologic terms. In contrast, the mountainous areas were formed during the Paleozoic (covering about 49% of the city's area) and Mesozoic eras (about 19%).

3.13 The geological map was one of the references used in building the map on land development suitability for Danang City.

1) Micro-geomorphology

Figure 3.5 Micro-geomorphological Map of Danang City



Source: DaCRISS Study Team, 2009.

Explanation:

3.14 The micro-geomorphology of alluvial lowlands was interpreted from the city's topographical characteristics and detailed contour lines together with satellite imageries. Results of interpretation were classified into seven types, as follows: (i) deltaic lowland, (ii) floodplain, (iii) lagoon lowland, (iv) new sandbar, (v) old sandbar and low sand dune, (vi) abandoned river channel, and (vii) upland/hill. The aim of classifying the micro-geomorphology of the city's alluvial lowlands is to distinguish micro-topographies that can indicate the area's vulnerability to flood inundations.

3.15 Based on the micro-geomorphological map of the city, uplands/hills are the most common type, accounting for about 76% of total city area. This landform covers mountains and hilly, upland areas. The second most common type is old sandbars and low sand dunes: Danang City's main urban area, including the airport, is built on a sandbar, and agricultural land use is limited in this area due to poor soil condition.

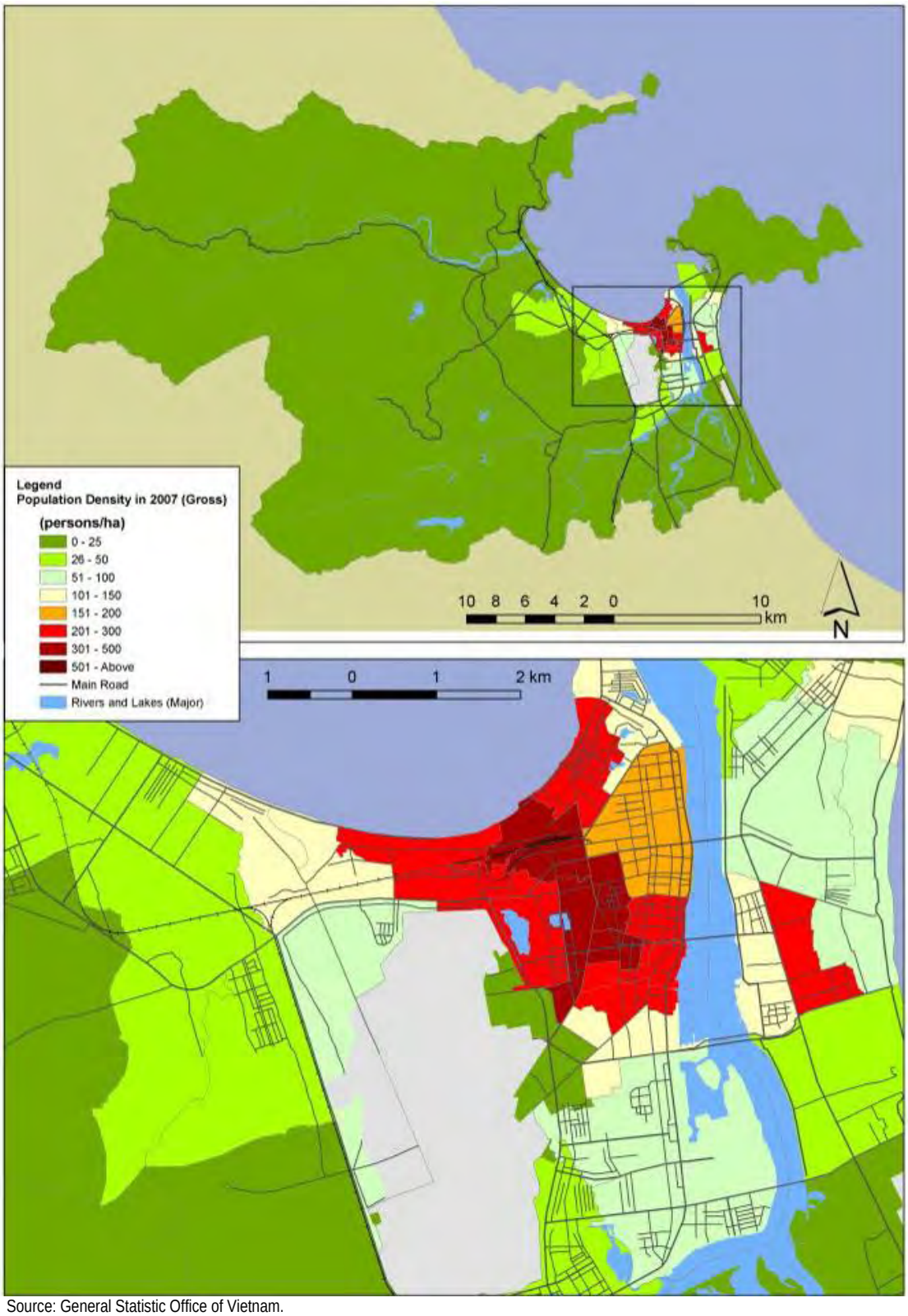
3.16 The micro-geomorphology type with the least coverage is abandoned river channel. This landform is formed in the lower reaches of Cam Le River, Vinh Dien River, and Co Co River. This area is relatively low lying and mainly marshy wetland which is susceptible to deep flood inundations.

4 SOCIO-ECONOMIC CONDITIONS

4.1 Population

1) Gross Population Density

Figure 4.1 Gross Population Density



Source: General Statistic Office of Vietnam.

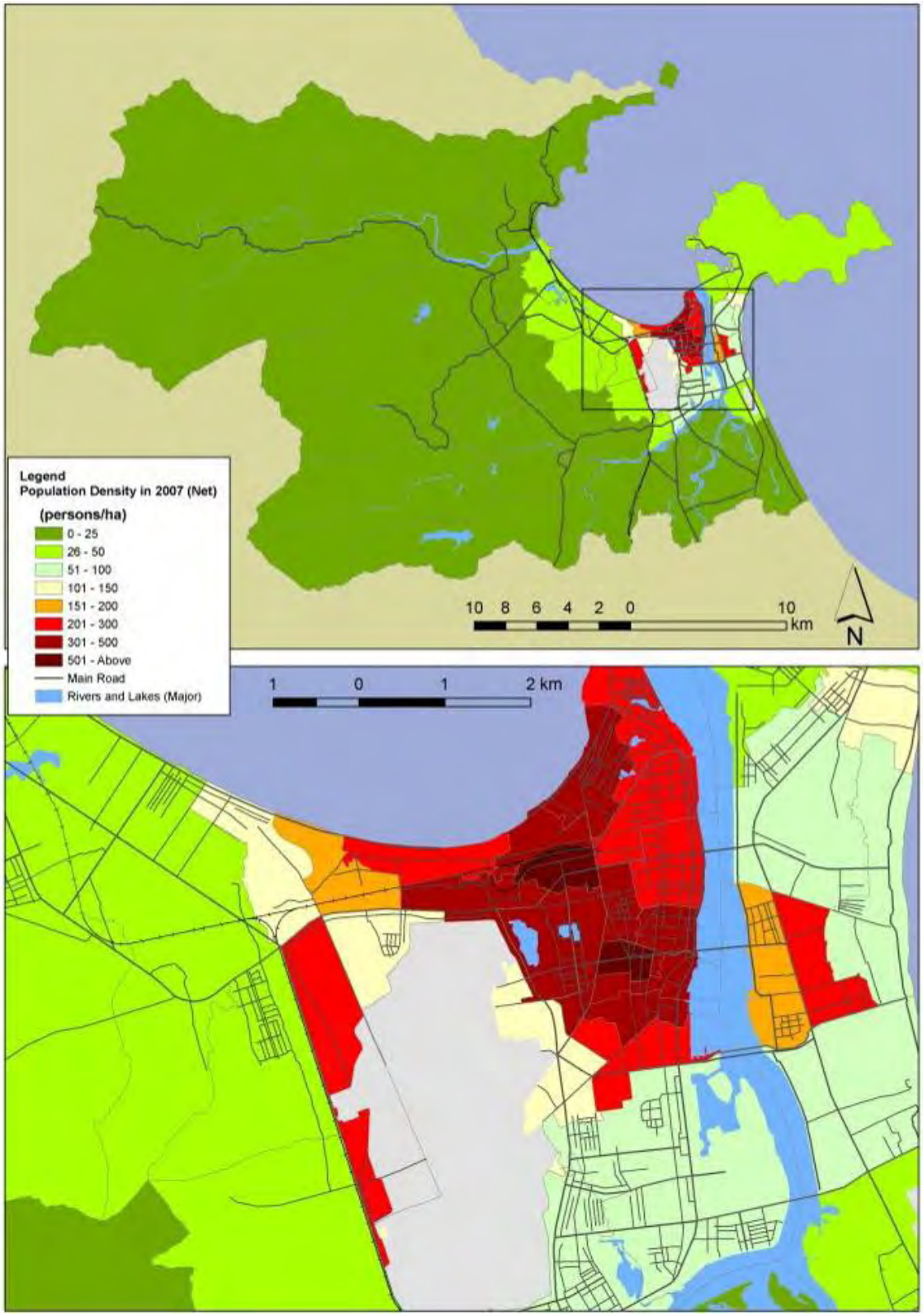
Explanation:

4.1 This is the map of Danang's 2007 gross population density by commune, based on survey data of the General Statistics Office of Vietnam. As of 2007, Danang City had a population of 806,757 and a population density of around 6.29 persons/ha, which is only one-fifth of the average population density of Hanoi (37.4 persons/ha) and Ho Chi Minh City (31.75 persons/ha).

4.2 In this map, the data on population density (person/ha) was divided into eight groups, with corresponding value intervals: 0–25, 26–50, 51–100, 101–150, 151–200, 201–300, 301–500, and more than 501. This classification was the basis for comparing the difference between the gross population density map and the net population density map (following this map). In 2007, the inner-city districts of Hai Chau and Thanh Khe were the most populous areas, five wards of which had high population densities of about 301–500 persons/ha. These wards were Nam Duong, Tan Chinh, Hai Chau 2, Tam Thuan, and Vinh Trung. In contrast, population densities in suburban areas, such as Hoa Vang district (especially in the communes of Hoa Ninh, Hoa Phu, and Hoa Khuong), some peripheral areas of Lien Chieu and Cam Le districts, as well as in Tho Quang ward (Son Tra district) were quite low at less than 25 persons/ha.

2) Net Population Density

Figure 4.2 Net Population Density



Source: General Statistic Office of Vietnam.

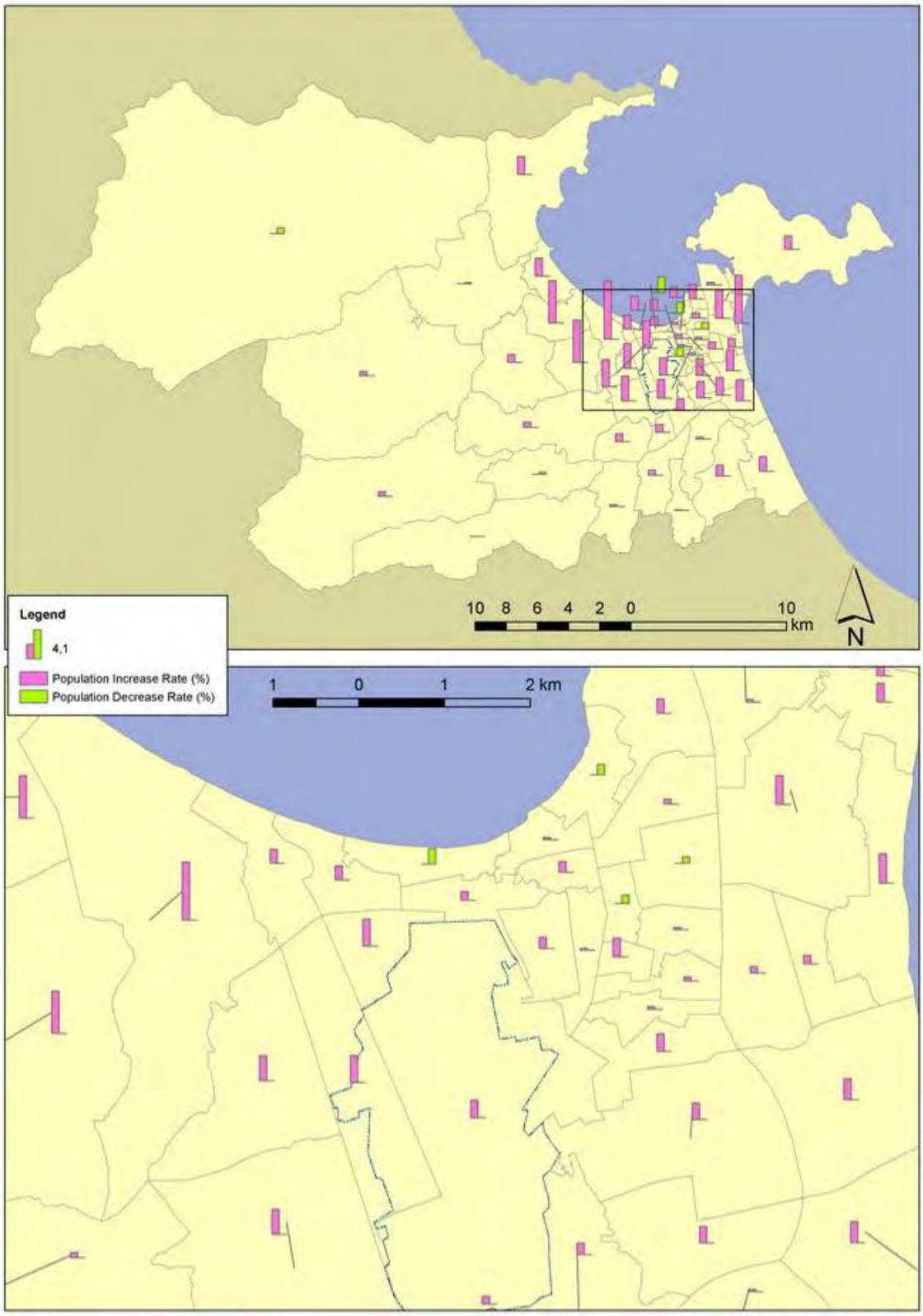
Explanation:

4.3 Net population density is defined as population per unit of land which are urban areas and other areas suitable for various types of development. The area is calculated based on a suitability analysis which excludes areas vulnerable to erosion, rivers and lakes, forest land, transportation land, cemeteries, military land, and areas that need special protection such as natural habitats, coral reefs, etc. In this map, the data classification system and the color setting for each data group are similar to the previous map on gross population density.

4.4 Based on the net population density map, in 2007, the urban area had high population densities, especially in the two wards of Nam Duong and Tan Chinh (more than 501 persons/ha). In suburban areas, population density was less than 50 persons/ha. The reason for this situation is that the urban area is the economic, political, and cultural center of Danang City. In addition, this area has favorable natural conditions and developed infrastructures; therefore, it attracts a significant number of residents. In general, population distribution is uneven, resulting in overcrowding in urban areas and creating adverse impacts on the environment.

3) Population Growth Rate (2000–2007)

Figure 4.3 Population Growth Rate (2000–2007)



Source: General Statistic Office of Vietnam.

Explanation:

4.5 In this map, bar charts were used to show the population growth rate of Danang City in the period from 2000 to 2007. According to the statistical yearbook done by the General Statistic Office of Vietnam (GSO), the population growth rates in Danang City's communes in this period varied. Some communes had negative population growth (it means that the population decreased), while others registered population increases. Therefore, the double bar chart is a useful tool to draw this distinction. Pink bar charts show negative population growth rate and green bar charts show population growth rate.

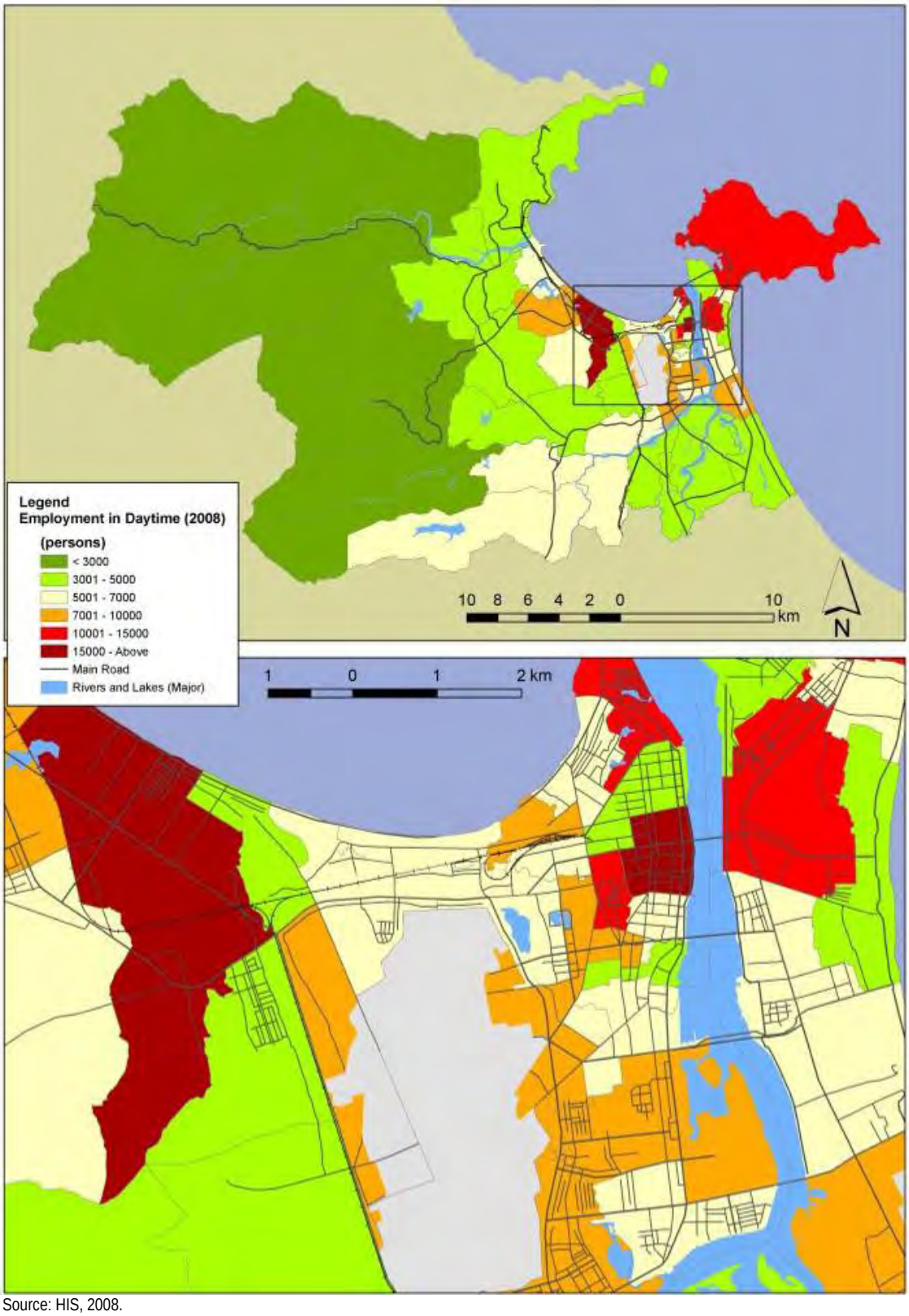
4.6 The average population growth rate from 2000 to 2007 in Danang City was only 1.70%. However, this does not include migrants to urban areas. Of the 56 communes of Danang City, Xuan Ha had the lowest growth rate (-2.2%). Besides Xuan Ha, there were six other communes (i.e., Thanh Binh, Hai Chau II, Hai Chau I, Hoa Bac, Hoa Phong, and Hoa Lien) which experienced decreased population growth rates. The highest growth rate (around 8.3%) occurred in Hoa Minh commune. There were 24 communes which had growth rates higher than the average of Danang City.

4.7 In general, during the 2000–2007 period, the population in Danang City increased at a moderate pace. Population growth was low in the central districts, such as Hai Chau and Thanh Khe, but high in outlying urban areas such as Lien Chieu district.

4.2 Employment

1) Daytime Employment

Figure 4.4 Daytime Employment



Source: HIS, 2008.

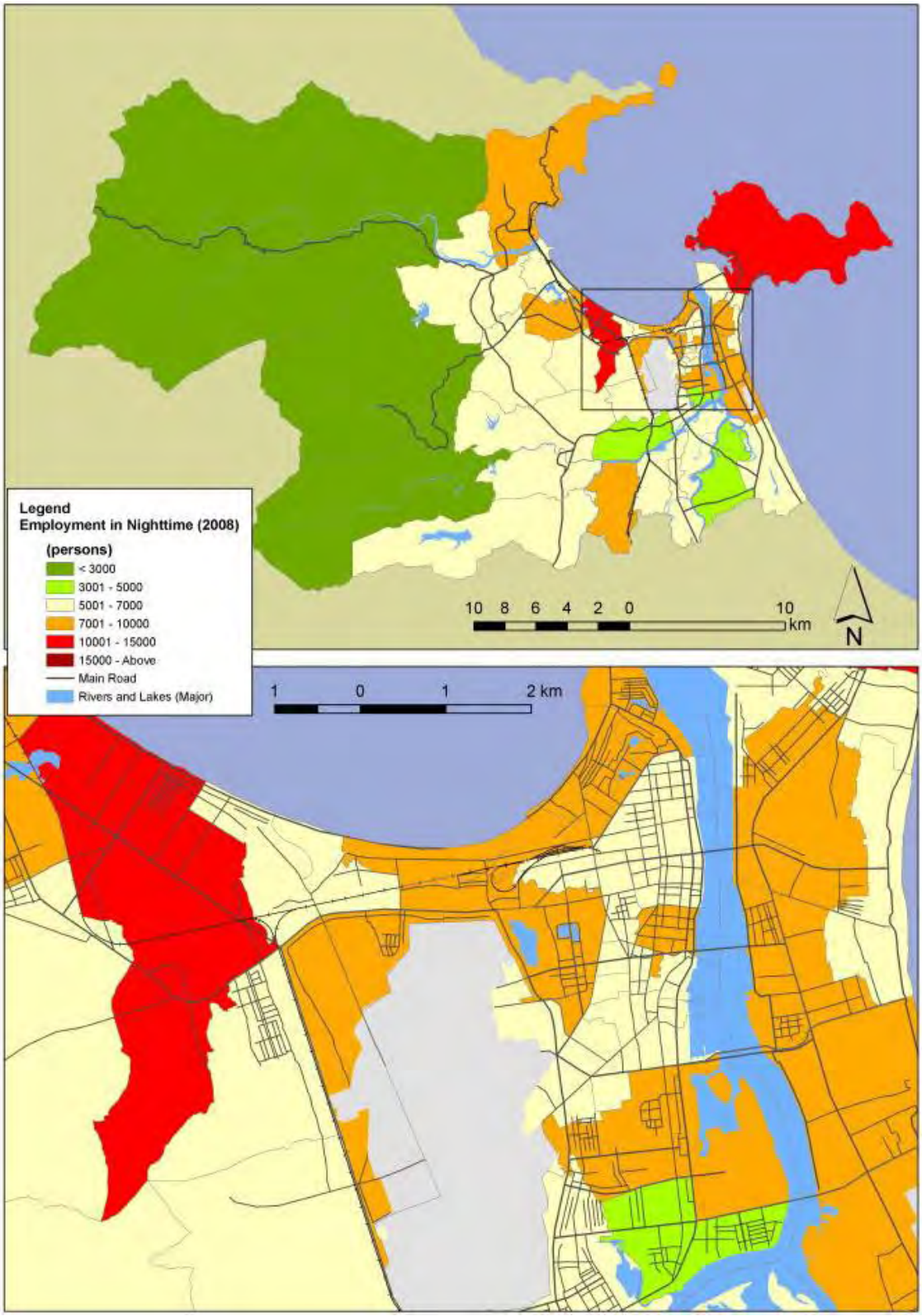
Explanation:

4.8 At the beginning of DaCRISS, in August 2008, the Study Team carried out a Household Interview Survey (HIS) which covered the whole of Danang City with a total number of 5,000 household respondents. The survey extracted vital information from household heads and their members (as well as any incidental guests) to be used as a basis for planning. A series of maps on the socio-economic conditions of the survey area were constructed from the results of this survey.

4.9 One such map is the distribution of daytime employees in Danang City. The total number of daytime employees stood at 369,488 which included the workers in the primary, secondary, and tertiary sectors. As shown in this map, the communes that had the highest number of daytime workers are Hoa Minh ward (26,175) and Hai Chau 1 (20,091). Hoa Phu commune (Hoa Vang district) had the lowest number of daytime workers at 1,809. In conclusion, any place near industrial zones or central business districts always attracts many laborers in both daytime and nighttime. But in rural areas, the number of workers (mainly in primary sector) is very few.

2) Nighttime Employment

Figure 4.5 Nighttime Employment



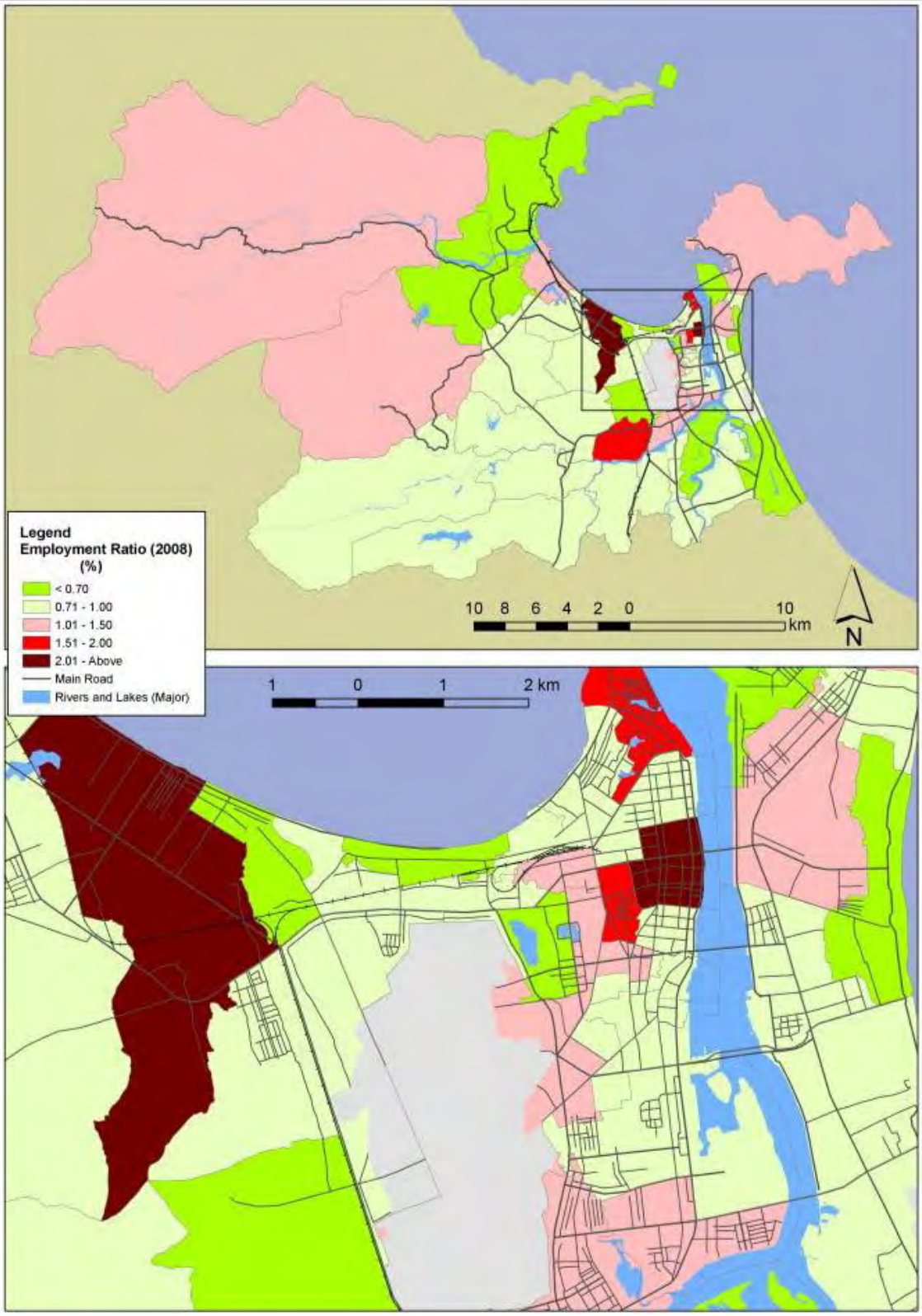
Source: HIS, 2008.

Explanation:

4.10 Nighttime employment indicates the residence of the workers. The ratio was basically high in near existing residential areas, also high in Tho Quang and Hoa Minh communes. Basically, they are spread in proportionate to the population.

3) Employment Ratio

Figure 4.6 Employment Ratio



Source: HIS, 2008.

Explanation:

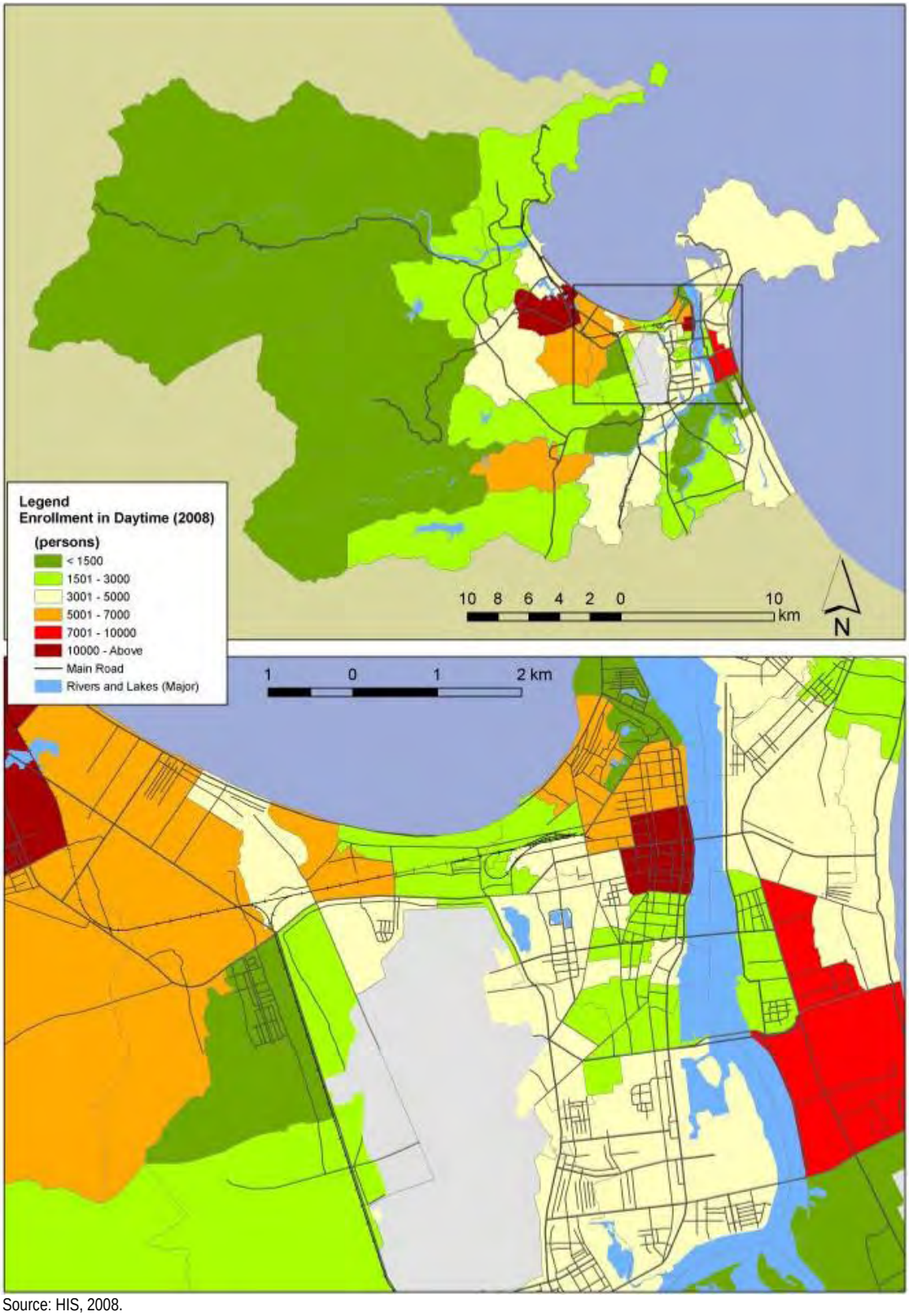
4.11 This is a map showing daytime to nighttime employment ratios. The data on employment ratio (%), which were classified into five groups: less than 0.70, 0.71–1.00, 1.01–1.50, 1.51–2.00, and more than 2.00, was extracted from the results of the 2008 HIS.

4.12 Daytime to nighttime employment ratios were especially high in areas with industrial zones and CBDs. Hoa Minh and Hai Chau had higher daytime to nighttime employment ratios than the other communes in Danang City, while Thanh Khe Tay, Thac Gian, and Hoa Lien had the lowest values.

4.3 School Enrollment

1) Daytime School Enrollment

Figure 4.7 Daytime School Enrollment



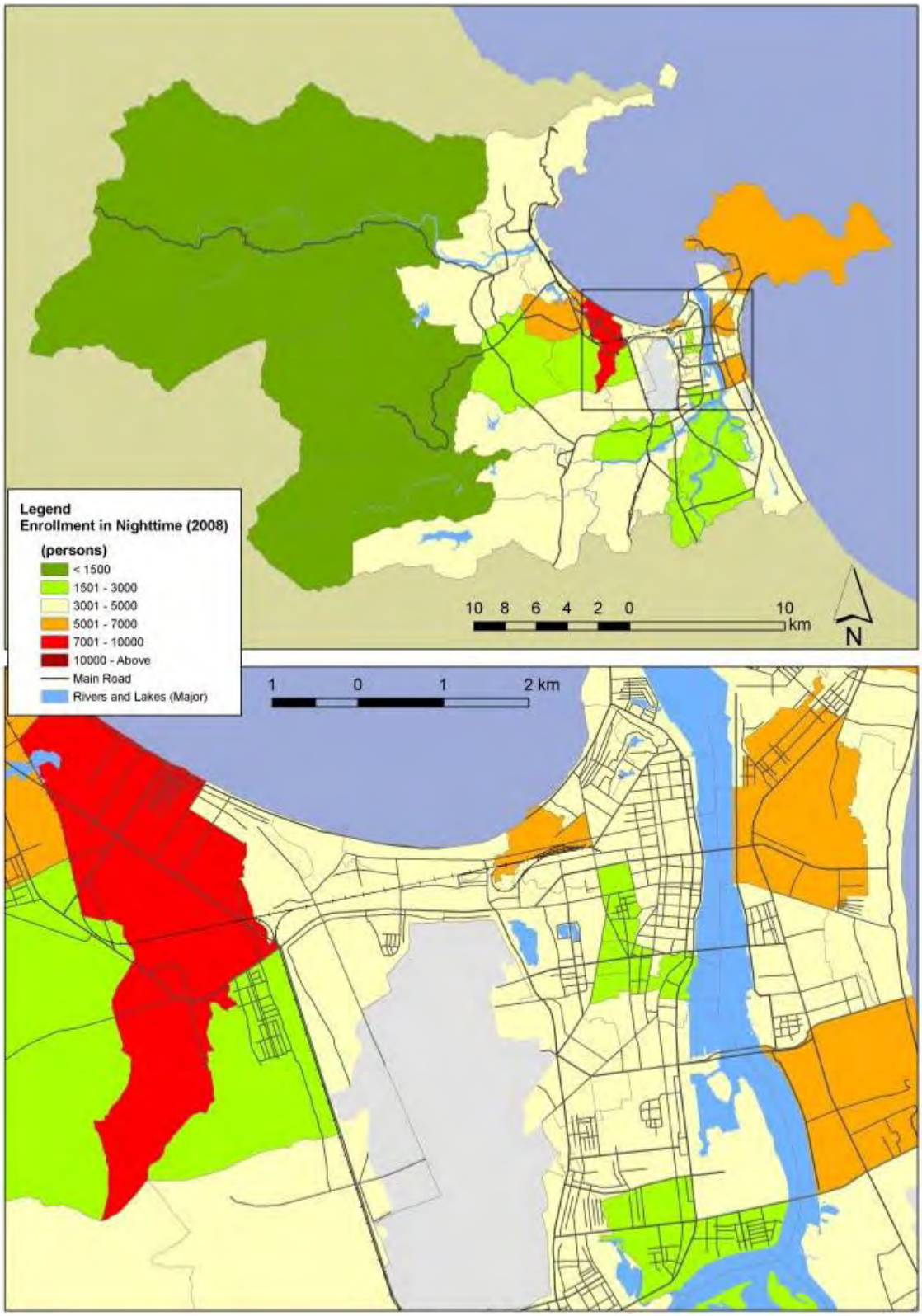
Source: HIS, 2008.

Explanation:

4.13 The Danang City people's committee has been investing huge money in education. As a result, student enrollment at different education levels in the city is higher than the average for Vietnam. Danang is also one of the largest education and training centers in Vietnam with a number of reputable universities and colleges located here. This boosts the enrollment rate of the city, making it comparable to the standards of cities in developed countries. In general, schools, universities, and colleges are located in the central districts of Hai Chau and Thanh Khe, making the enrollment rates here higher than in other districts. Meanwhile, rural Hoa Vang district had the lowest number of enrolled students.

2) Nighttime Enrollment

Figure 4.8 Nighttime Enrollment



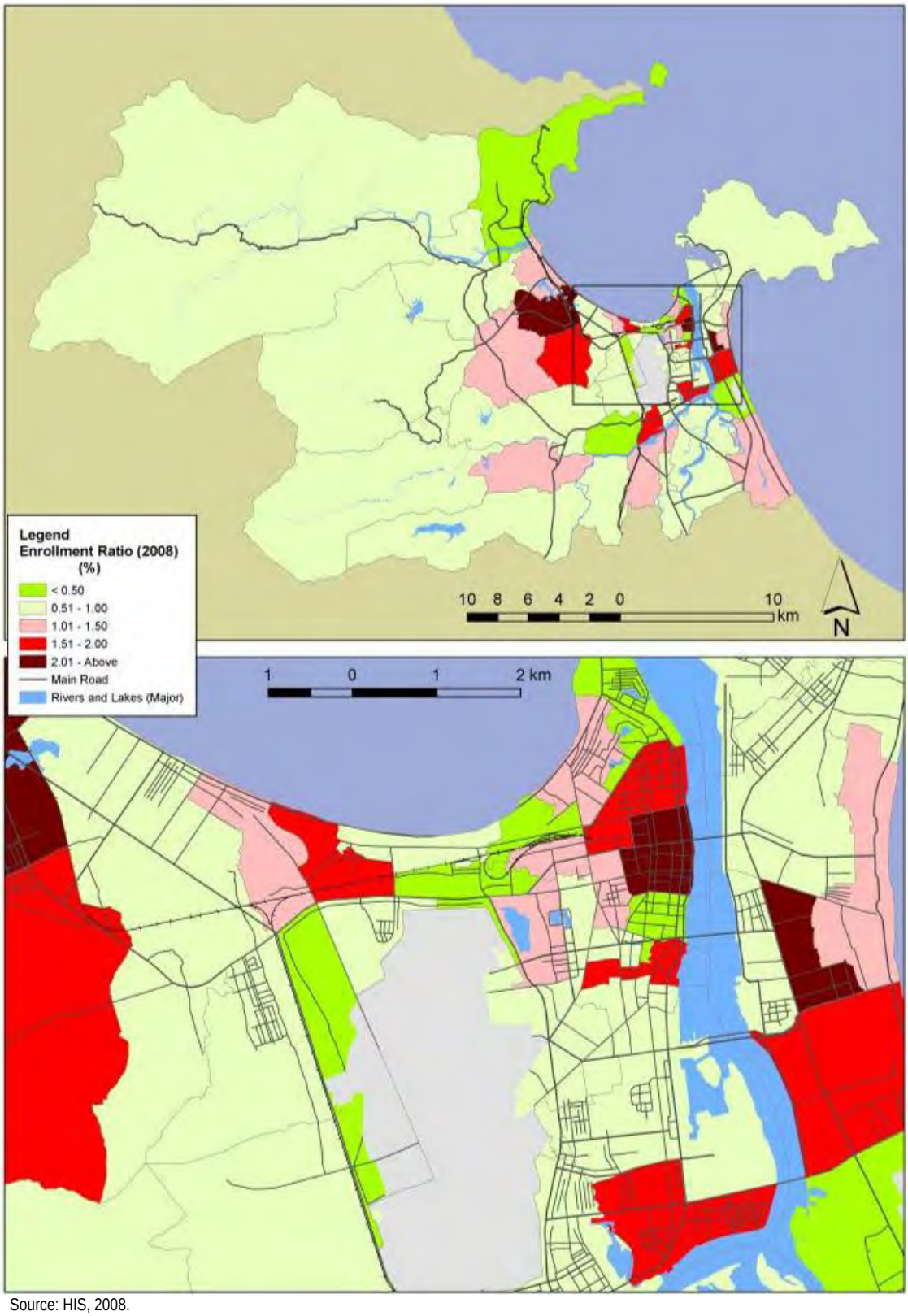
Source: HIS, 2008.

Explanation:

4.14 Nighttime enrollment indicates the residence of the students. The ratio was basically high in near existing residential areas, also high in Hoa Minh commune. Basically, they are spread in proportionate to the population.

3) Enrollment Ratio

Figure 4.9 Enrollment Ratio



Source: HIS, 2008.

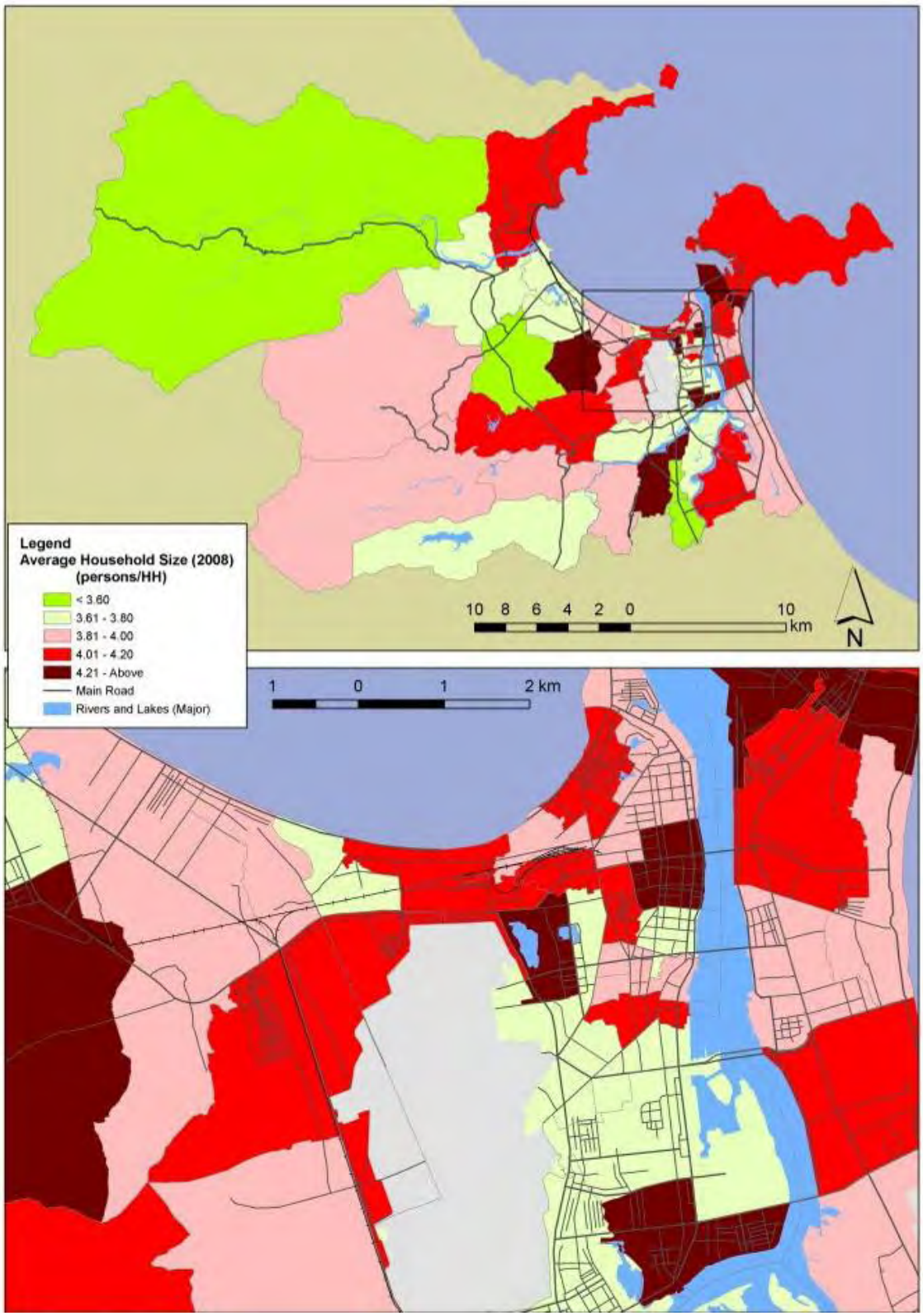
Explanation:

4.15 This map shows the percentage of enrolled students to the total population of each commune. The higher the number, the more students there are in the commune. Basically Hai Chau and Thanh Khe communes had a high percentage, whereas rural areas had low percentages.

4.4 Household Data

1) Average Household Sizes

Figure 4.10 Average Household Sizes



Source: HIS, 2008.

Explanation:

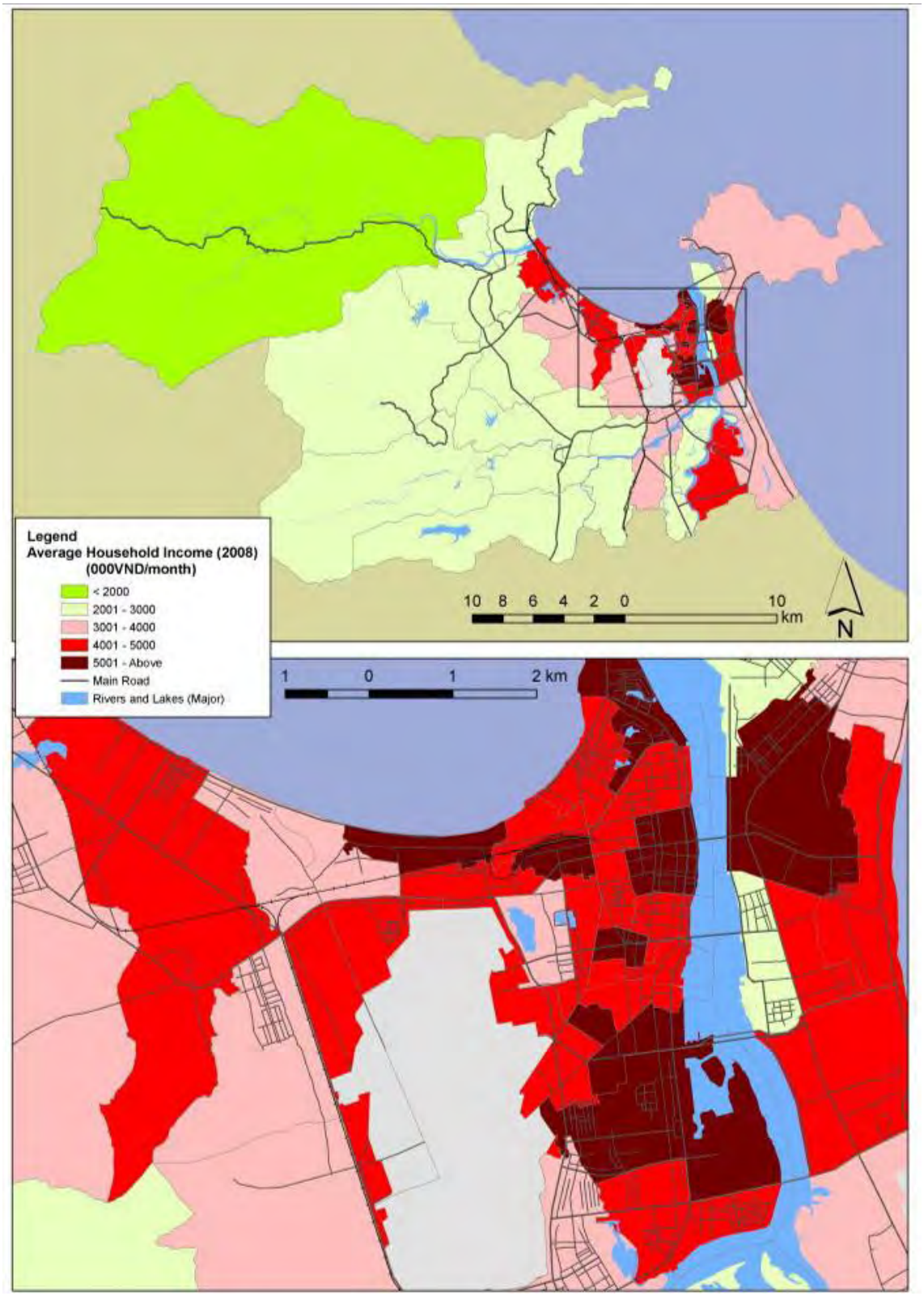
4.16 The Vietnam General Statistics Office's Survey of Households in 2006 reported that the average household size in Vietnam at that time was 4.24 persons. The DaCRISS HIS conducted in 2008, however, reported a lower estimate of around 3.95. This suggests that in 2008, there were about 204,000 households in the province. The difference in estimates may be due to the efforts made in the HIS to enumerate migrants to and from Danang, which would tend to reduce the average household sizes.

4.17 The map of household sizes was made based on the DaCRISS HIS results. Based on this map, only about 30% of households had five members or more, 34% had four, 20% had three, 12% had two, and only 4% had one household member. In the future, household sizes are expected to decline with increasing migration and changing social conventions.

4.18 In addition, the map also shows that the average household size in Danang City's urban areas was bigger at 4.0 than that in rural areas at 3.8, which is extraordinary in Vietnam. The errors may come from the shortcomings of the surveyed data., The highest figure (around 4.57 persons) was recorded in Thac Gian ward, Thanh Khe district and the lowest (3.31 persons) was in Hoa Bac commune, Hoa Vang district.

2) Average Household Incomes

Figure 4.11 Average Household Incomes



Source: HIS, 2008.

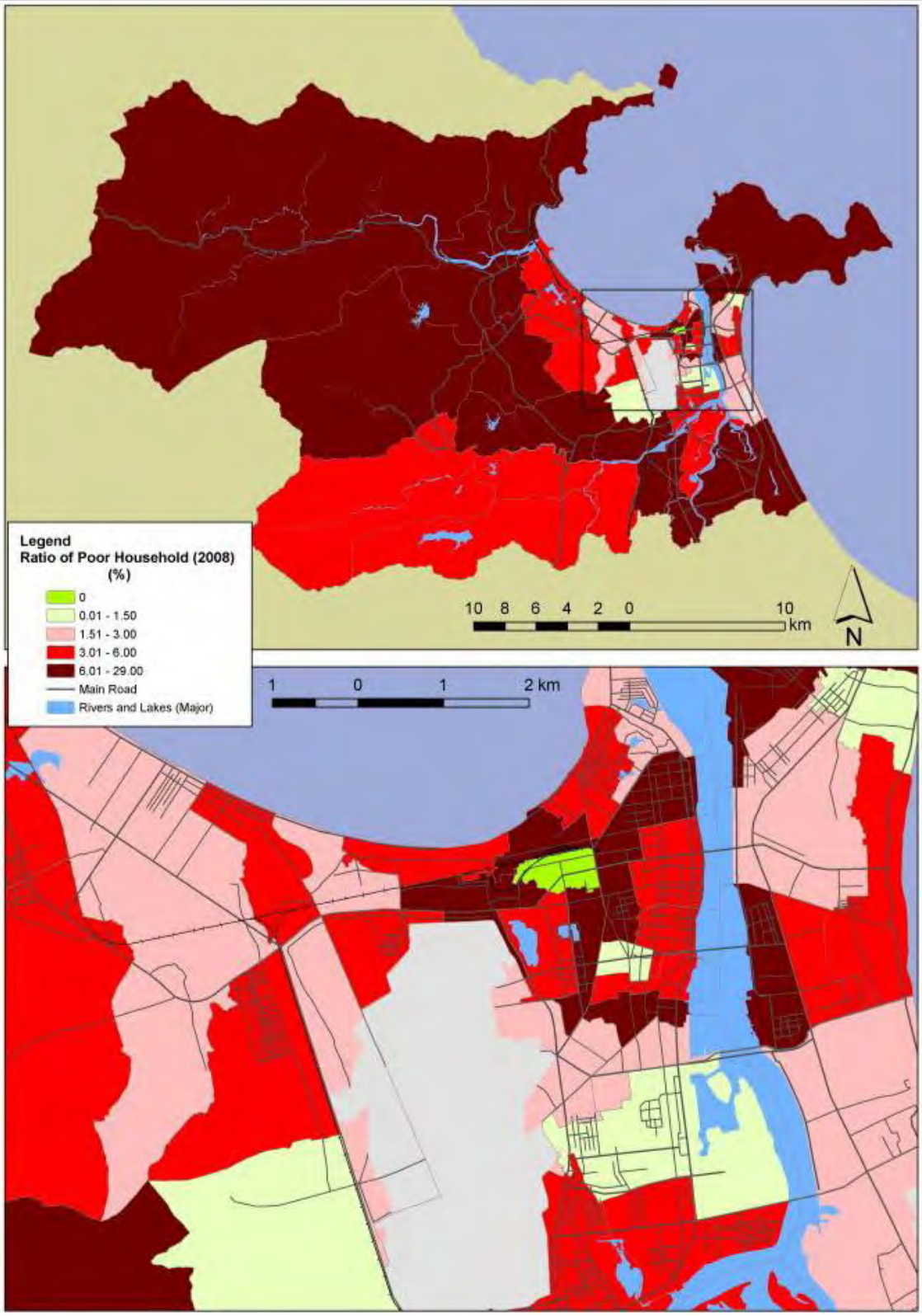
Explanation:

4.19 Income distribution differed considerably across districts. Rural and peripheral areas (i.e., Hoa Vang, Lien Chieu, Cam Le, and Ngu Hanh Son districts) all showed relatively high proportions of households with low incomes (below VND3.5 million a month), while those in the urban core (i.e., Hai Chau and Thanh Khe districts) were significantly higher. Son Tra, on the other hand, showed a mixed pattern. The HIS data on household income levels showed a distinct structural break at the < VND3.5 million mark. This could be evidence of increasing income inequalities between an emergent middle class and other income groups.

4.20 Income peaked at VND2–3 million a month for most districts. More than 20% of the population in Hai Chau received an income of more than VND6 million a month as of 2008, showing that it hosts the better-off population in the city. While the city's average income is VND3.9 million a month, those of Hai Chau, Thanh Khe, Son Tra, Ngu Hanh Son, Cam Le, Lien Chieu, and Hoa Vang districts were VND 4.9, 4.5, 4.0, 4.1, 3.1, 3.8, and 2.5 million a month, respectively.

3) Share of Poor Households

Figure 4.12 Share of Poor Households



Source: HIS, 2008.

Explanation:

4.21 Overall, almost all communes in Danang City have poor households with the a yawning gap between the highest and the lowest values, as shown in this map. The HIS estimate of household poverty level in the city was lower, at 2.0%. While Cam Le had the highest poverty rate, Thanh Khe, Lien Chieu, and Hoa Vang also showed relatively high levels of poverty. In terms of absolute numbers of the poor, Thanh Khe stood out. This is one indication—despite rapidly rising incomes in urban areas—of persistent inequality.

Table 4.1 Poverty Levels in Danang City by District, 2008

District	Poor Households		Poverty Density (no. / km^2)[1]	Share in Total
	Number	Rate (%)		
Hai Chau	408	0.8	19	10
Thanh Khe	1,024	2.6	115	26
Son Tra	345	1.2	6	8
Ngu Hanh Son	199	1.5	5	5
Cam Le	897	5.1	27	22
Lien Chieu	608	2.8	7	15
Hoa Vang	602	2.1	1	15
Danang	4,123	2.0	4	100

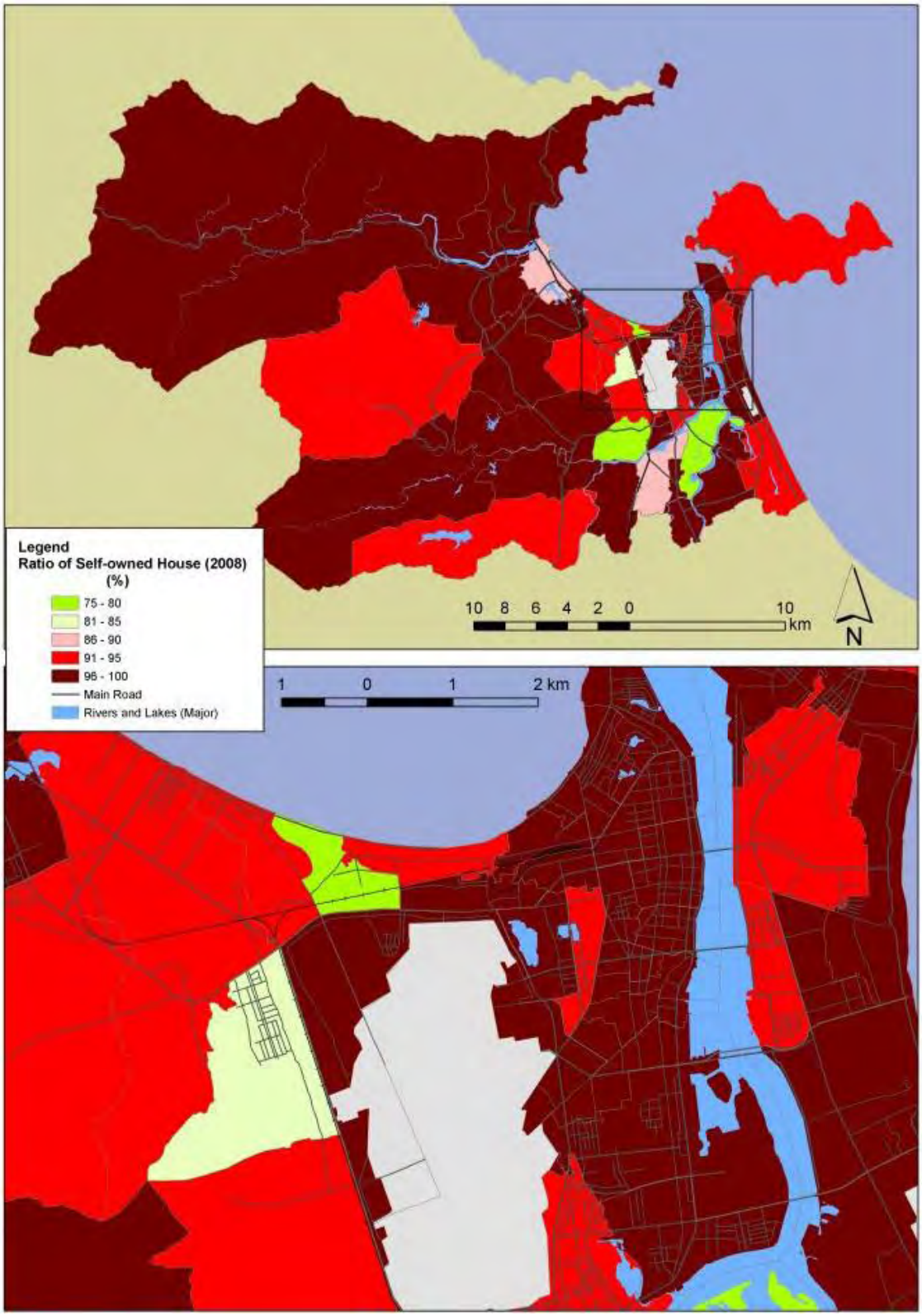
Source: DaCRISS HIS, 2008.

[1] Poverty density is the number of poor households in a unit area.

4.5 Properties

1) Share of Privately Owned Houses

Figure 4.13 Share of Privately Owned Houses



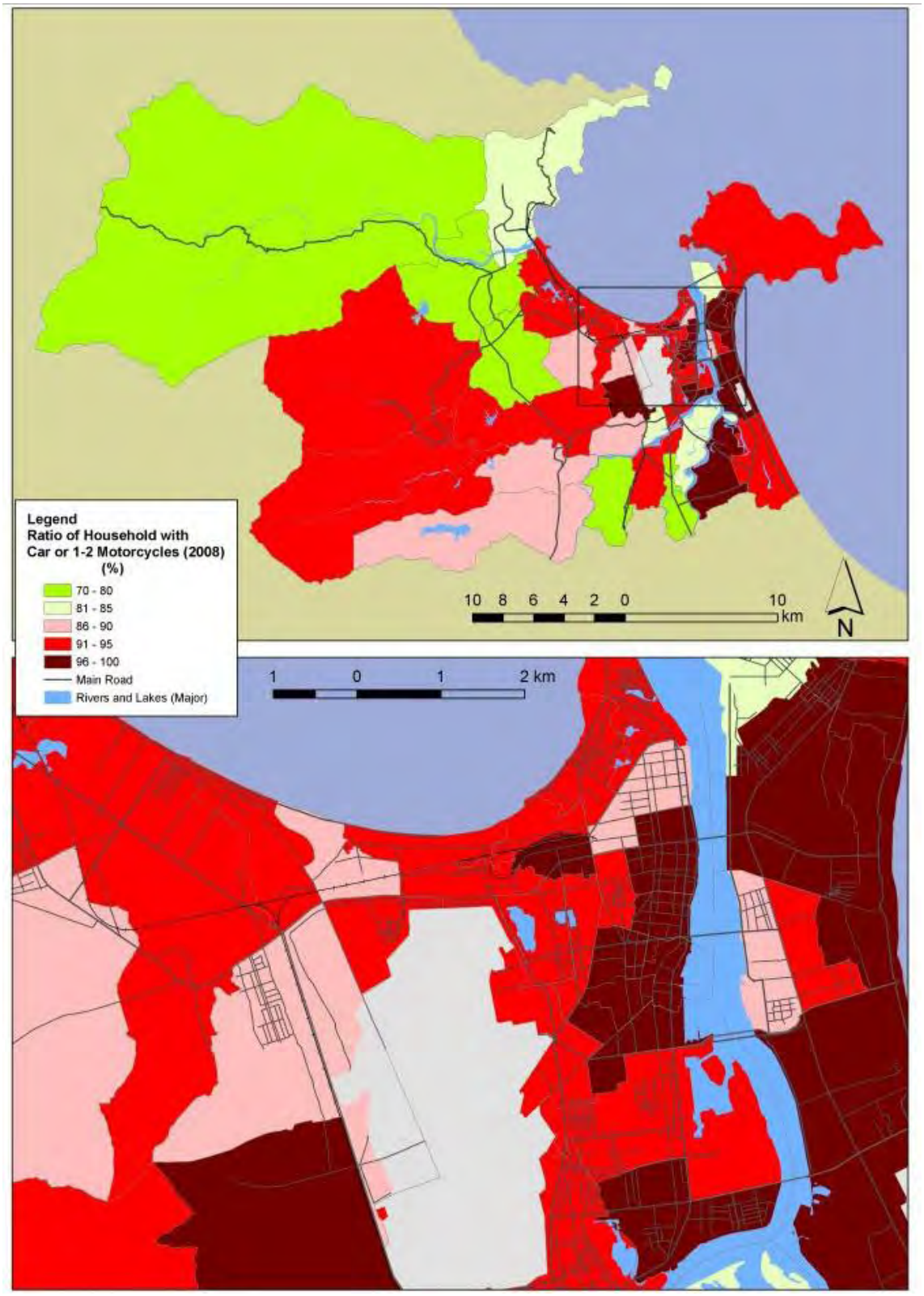
Source: HIS, 2008.

Explanation:

4.22 In 2008, the share of privately owned houses to total housing units in Danang City was 95%. HIS data on the percentage of such houses were classified into five groups: 75–80%, 81–85%, 86–90%, 91–95%, and 96–100%. There were seven communes where 100% of the survey respondents owned their houses (i.e., Chinh Gian, Tan Chinh, Hoa Khe, My An, Hoa Bac, and Hoa Lien). Thanh Khe Dong had the lowest share of privately owned houses, followed by the communes of Hoa Tho Tay and Hoa Xuan.

2) Share of Households with Cars or Motorcycles

Figure 4.14 Share of Households with Cars or Motorcycles



Source: HIS, 2008.

Explanation:

4.23 HIS data on car or motorcycle ownership have a similar pattern, with rural and peripheral areas showing lower levels of durable-vehicle ownership, and inner-city areas showing higher levels of ownership. In 2008, the average rate of Danang City was 90.5%. Based on this map, some 35 communes in Danang City had vehiscle ownership rates higher than the city's average. Almost all of these communes are in the urban districts of Hai Chau and Thanh Khe.

Table 4.2 Vehicle Ownership among Households in Danang City by District, 2008

(%)

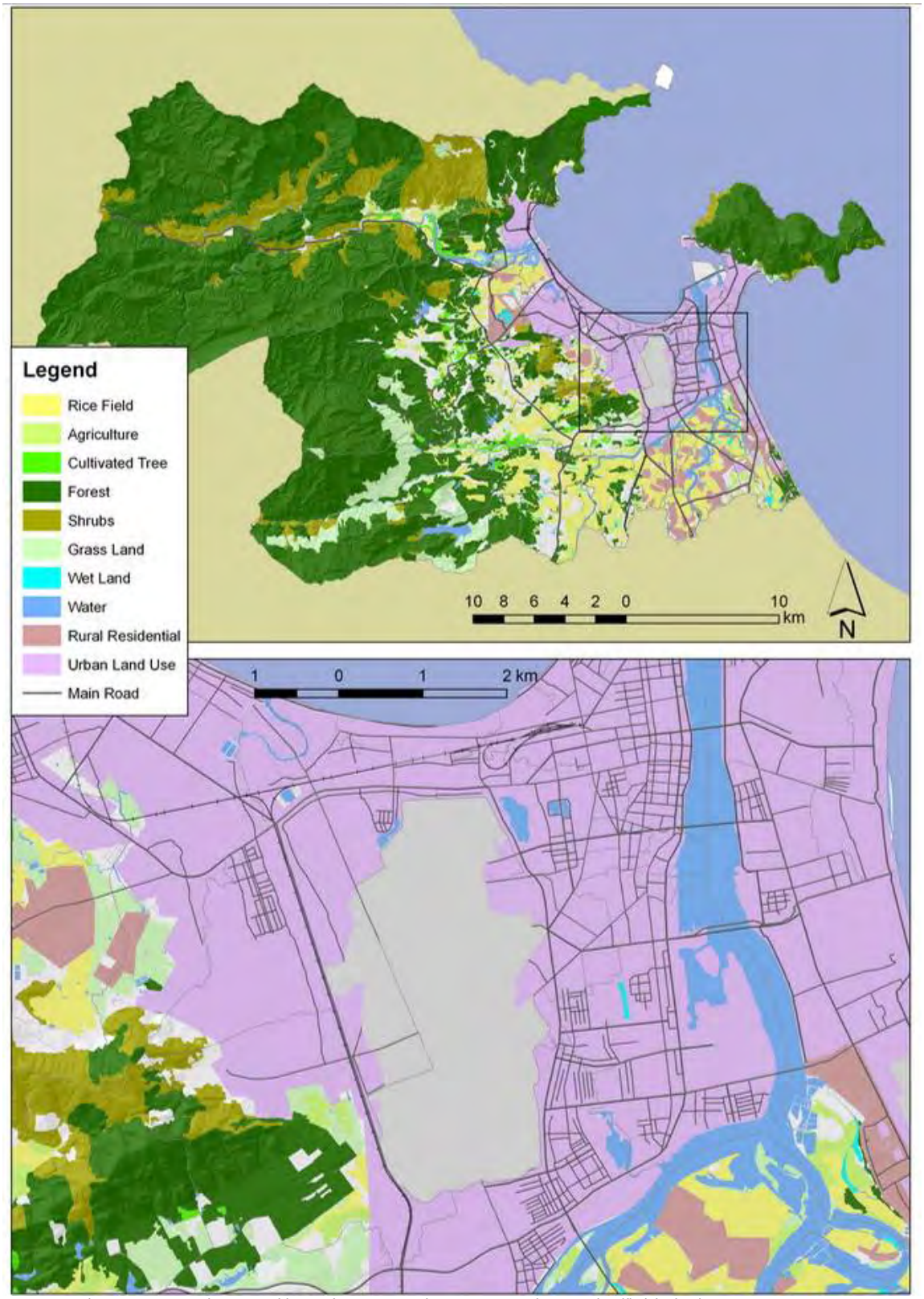
Item		Hai Chau	Thanh Khe	Son Tra	Ngu Hanh Son	Cam Le	Lien Chieu	Hoa Vang	Total
Vehicles (%)	None	3	3	2	0	4	4	8	4
	Bicycle	3	4	5	4	8	5	8	5
	Single MC	24	29	34	27	31	37	45	32
	Multi MC	67	61	59	69	56	52	38	58
	Car/Van	3	2	1	1	1	2	0	1
	Others	0	0	0	0	0	1	0	0
	Total	100	100	100	100	100	100	100	100

Source: DaCRISS HIS, 2008

5 EXISTING LAND USES

5.1 General Land Uses

Figure 5.1 General Land Uses in Danang City



Note: Based on a 1:10,000-scale topographic map from DONRE, the DaCRISS Study Team classified the land uses.

Explanation

5.1 The 2006 land-use map was constructed from topographic data with a scale of 1:10,000. The DaCRISS Study Team classified the land uses shown in this map into two groups, i.e., non-urban and urban. The composition of land uses and their sources are described below.

Table 5.1 Land Uses in Danang City

Land Use			Data Source
Non-urban Land Use	River/Lake		1:10,000 Topographic Map
	Agriculture	Rice Field	1:10,000 Topographic Map
		Agriculture	1:10,000 Topographic Map
		Cultivated Tree	1:10,000 Topographic Map
	Forest		1:10,000 Topographic Map Protective Forest Area Map by DARD
	Green and Open Space	Shrubs	1:10,000 Topographic Map
		Grassland	1:10,000 Topographic Map
		Wetland	1:10,000 Topographic Map
		Rural Residential Area	Identified by DaCRISS Study Team
Urban Land Use			Identified by DaCRISS Study Team

Source: DaCRISS Study Team.

5.2 About 60% of the total city area comprises forests (60%), most of which are located in Hoa Vang District. It is, followed by green and open space (18%). The area for urban land uses (i.e., residential, commercial/business, institutional, industrial, etc.) consists of only 10% of the total land area.

Table 5.2 Share of Land Uses in Danang City

Land Use	Area (ha)	Structure of Land Use (%)
River / Lake	2,892	3
Agriculture	8,990	9
Forest	56,636	60
Green and Open Space	17,543	18
Urban Land Use	8,912	10
Total [1]	94,973	100

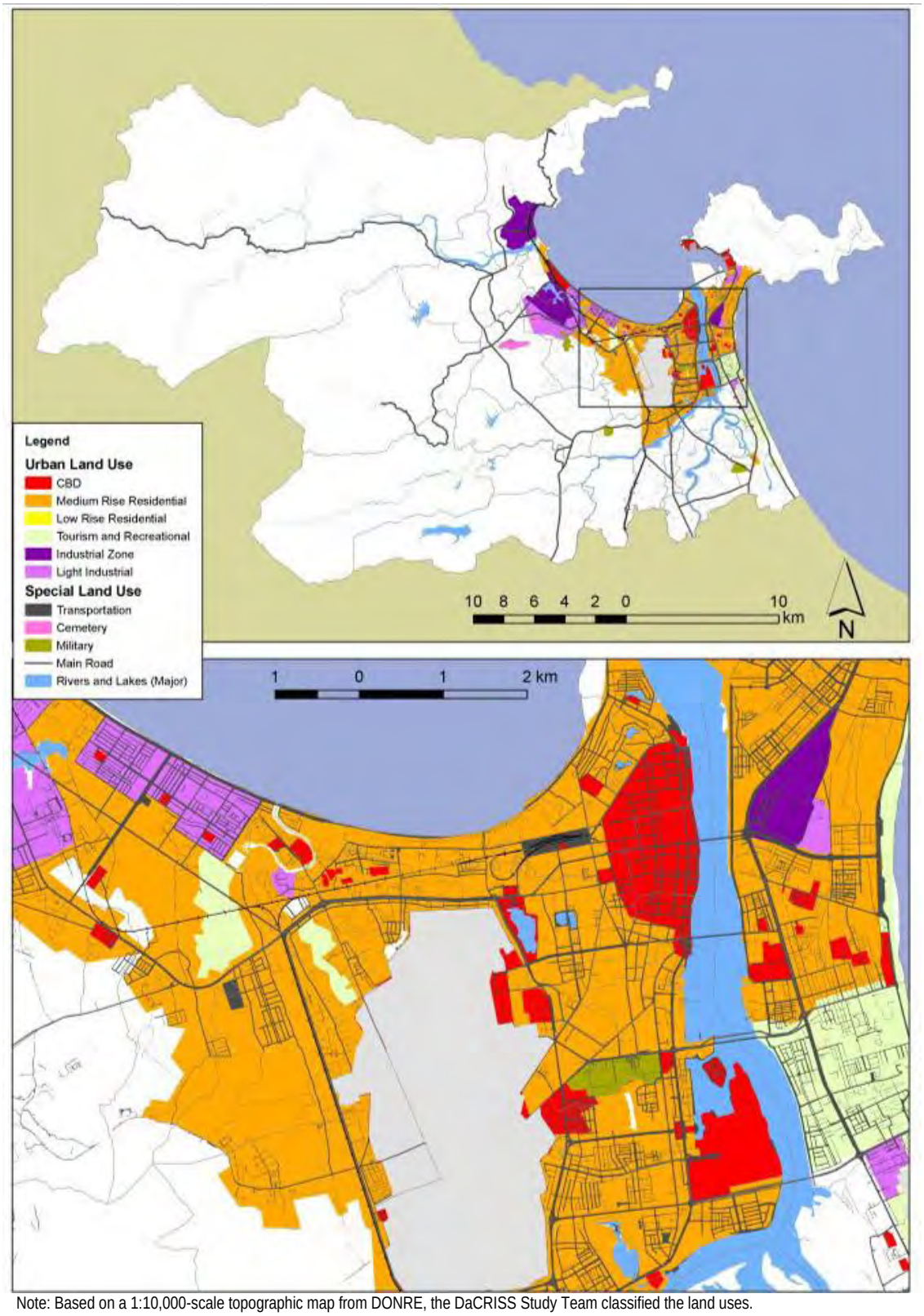
Source: DaCRISS Study Team.
[1] Excluding the Hoang Sa Islands.

5.3 In 2006, the largest use of city land in Danang was for non-urban purposes. While forests and green spaces have an important role in promoting ecological balance, with current rapid urbanization, land uses in Danang have changed, i.e., there is increasing urban land use and decreasing rural land use. Green spaces have diminished due to the spread of urban residential areas and infrastructure construction, among others. The consequences of this process have to be taken into account when planning for the city's land uses.

5.4 The existence of varied natural resources comprising forests, mountains and hills, greenery, and water bodies including rivers, lakes and seas, as well as beaches, can provide an ideal network of greenery and open space to enhance the city's uniqueness and identifiable image, as well as create a rich landscape that can provide an ideal space for tourism and recreation for both residents and visitors, if they are adequately maintained.

5.2 Urban Land Uses

Figure 5.2 Urban Land Uses in Danang City



Note: Based on a 1:10,000-scale topographic map from DONRE, the DaCRISS Study Team classified the land uses.

Explanation

5.5 The DaCRISS Study Team developed the urban land-use map of Danang (see Figure 5.2) based on the 2006 topographic map with a 1:10,000 scale. Urban land uses are classified as shown in the table below with data sources.

Table 5.3 Urban Land Uses in Danang City

Urban Land Use		Data Source
Urban Use	CBD	Identified by DaCRISS Study Team
	Medium-rise Residential Area	Identified by DaCRISS Study Team
	Mixed-use Residential Area	Identified by DaCRISS Study Team
	Tourism and Recreational Area	Identified by DaCRISS Study Team
	Industrial Zone	Identified by DaCRISS Study Team
	Light Industrial Area	Identified by DaCRISS Study Team
Cemetery Area		Future Land use Map by MOC
Military Area		Future Land use Map by DOC
Transportation	Airport	1:10,000 Topographic Map
	Port	1:10,000 Topographic Map
	Other Transportation	1:10,000 Topographic Map

Source: DaCRISS Study Team.

5.6 Of the total land area devoted to urban land uses, mixed and medium-scale residential areas account for around 40%, industrial zones, 20%, and tourism and recreational areas, 8%. At the moment, the city has 10 industrial zones, with the three largest ones being Lien Chieu, Hoa Khanh, and An Don.

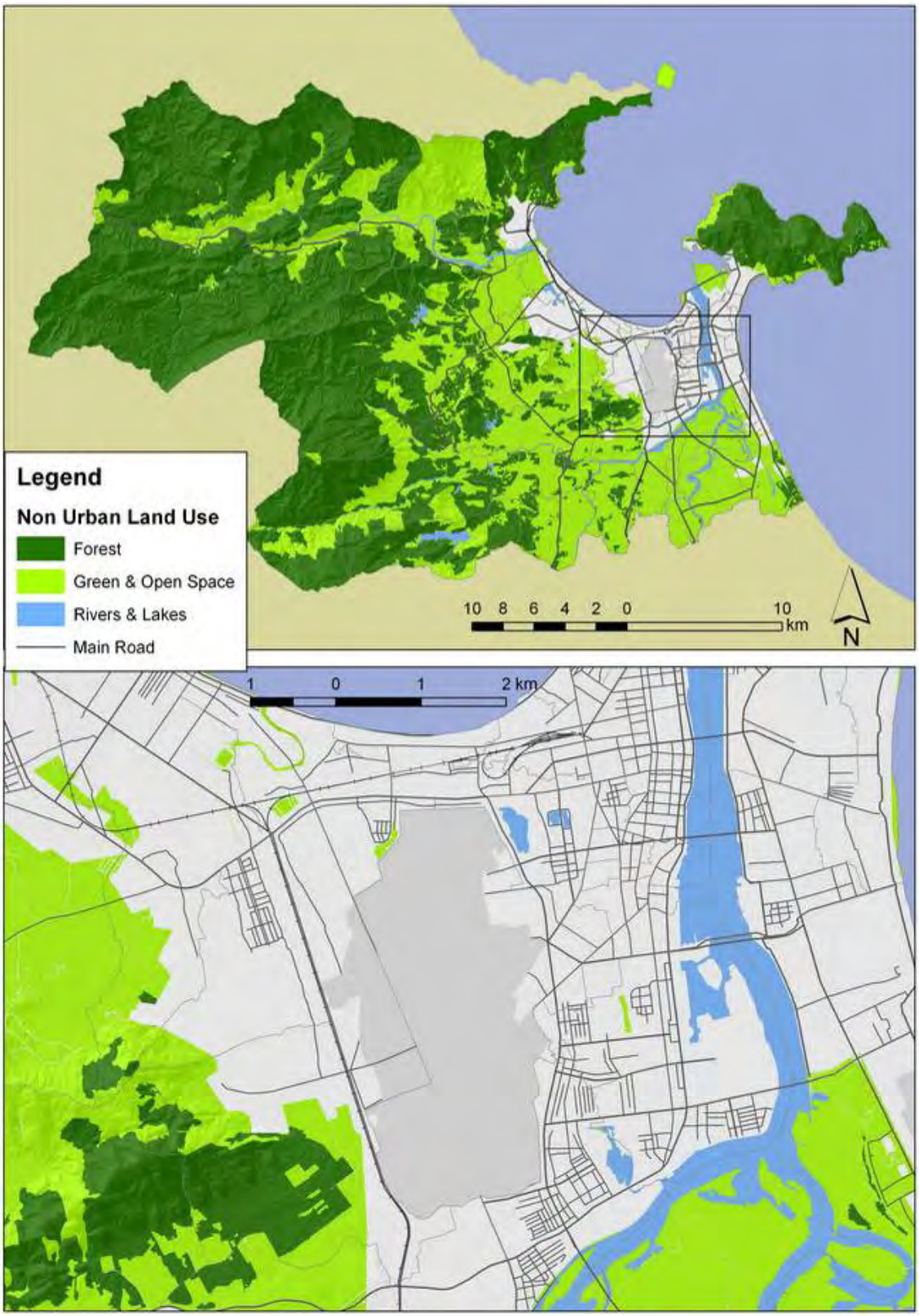
Table 5.4 Share of Urban Land Uses in Danang City

Urban Land Use		Area (ha)	% of Total Urban Land Use
Urban Use	CBD	602	6.7
	Medium Rise Residential Area	702	7.9
	Mixed Use Residential Area	2,796	31.4
	Tourism and Recreational Area	713	8.0
	Industrial Zone	983	11.0
	Light Industrial Area	729	8.2
Cemetery Area		86	1.0
Military Area		178	2.0
Transport	Airport / Ports	941	10.6
	Railway Station / Bus Terminal / Roads	1,182	13.3
Total of Urban Land Use		8912	100

Source: DaCRISS Study Team.

5.3 Land Uses in Natural Areas

Figure 5.3 Land Uses in Natural Areas in Danang City



Note: Based on a 1:10,000-scale topographic map from DONRE, the DaCRISS Study Team classified the land uses.

Explanation

5.7 Land uses in natural areas in Danang cover forests, green and open spaces, and water surfaces (see Figure 5.3).

(i) Forests in Danang City are concentrated in Son Tra Peninsula, western Hoa Vang District, and northern Lien Chieu District. Rich natural forests are especially concentrated in the westernmost area of Hoa Vang District bordering Quang Nam province. Forests in the Son Tra Peninsula and Lien Chieu District are mainly artificial or restoration forests;

(ii) Green and open space consists of shrub lands, grasslands, wetlands, rural residential and agricultural areas; and

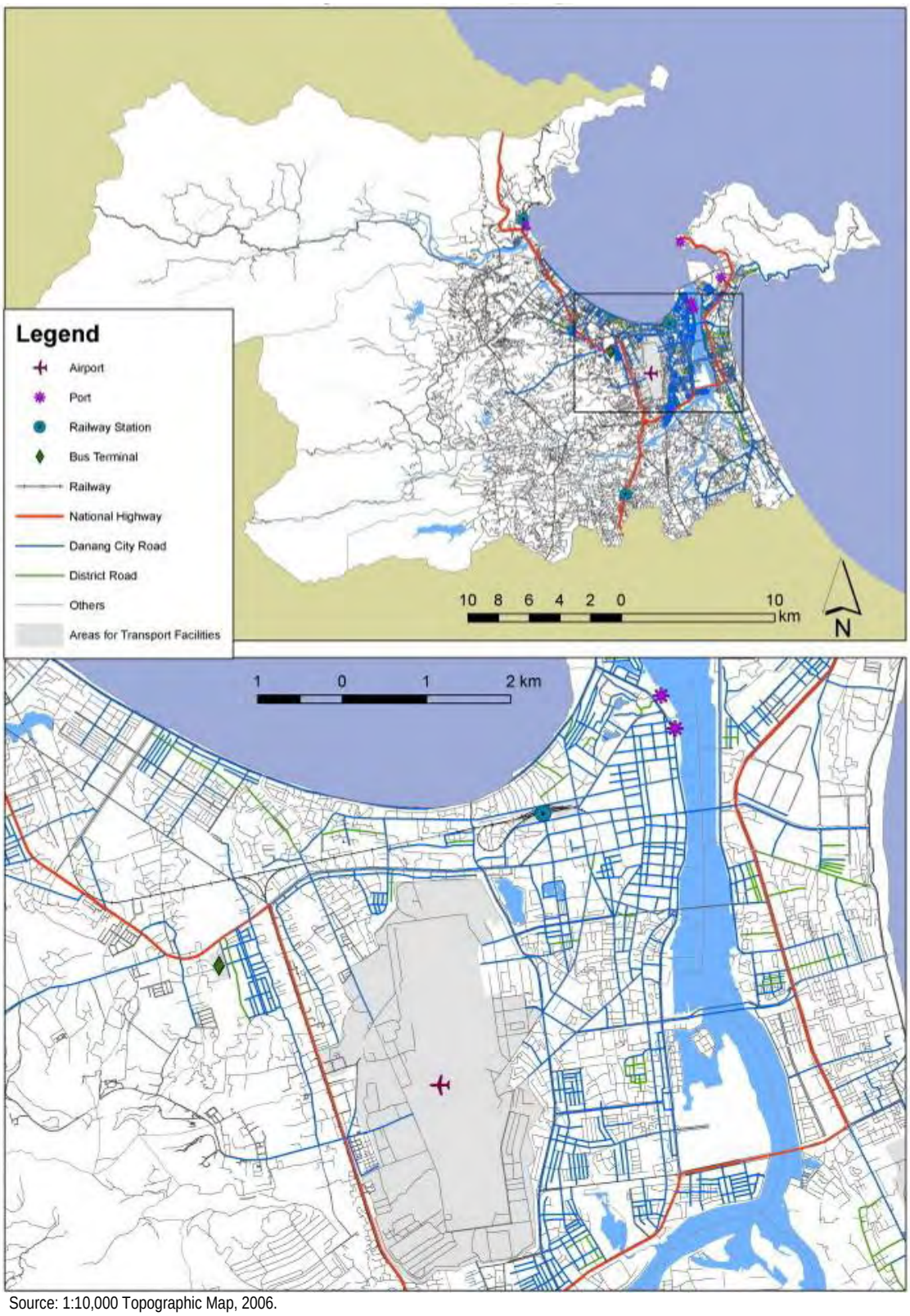
(iii) The water surface of the city shown in the map represents some major rivers and lakes.

6 URBAN TRANSPORTATION IN DANANG CITY

6.1 Transportation System

1) Overall Transportation System

Figure 6.1 Overall Transportation System in Danang City



Source: 1:10,000 Topographic Map, 2006.

Explanation:

6.1 Urban transportation in Danang City is primarily composed of roads and road transportation. On the other hand, its inter-city system is composed of all modes of transportation including roads, rail, air, and shipping which serve both passenger and cargo transportation, since the city was given the significant function of serving as the administrative and economic center in central Vietnam.

(a) **Roads:** The road network in Danang City is composed of national highways, provincial roads, and urban roads with a total length of 480 km.

(b) **Rail:** The North–South Line of Vietnam railways passes through Danang City with a 42-kilometer length. Within the city, there are five railway stations (i.e., stations of Da Nang, Thanh Khe, Kim Lien, Hai Van Nam, and Le Trach). Da Nang station is one of the major stations in the North–South Line.

(c) **Air:** The Danang International Airport is located west of the city center.

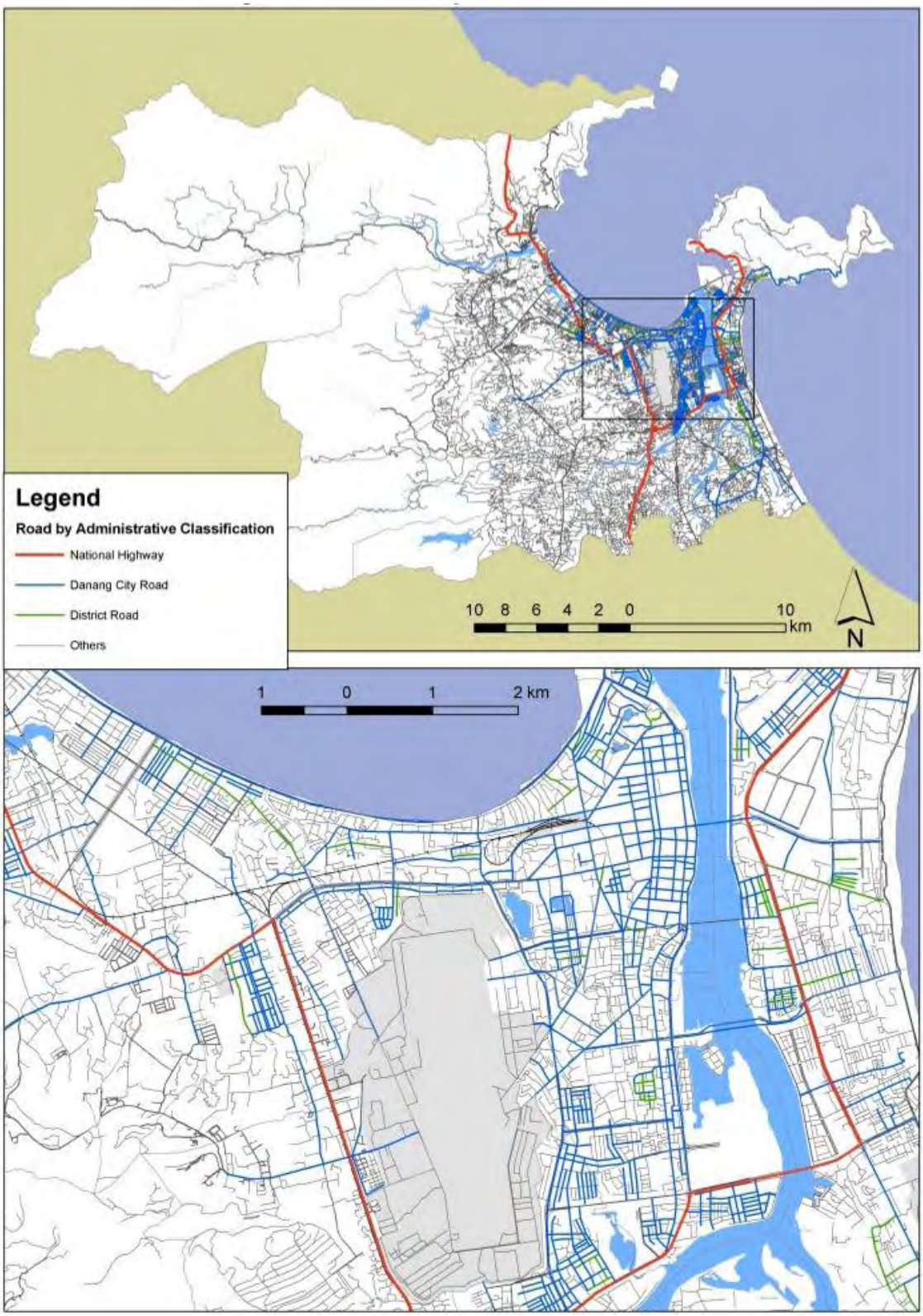
(d) **Ports and Shipping:** Danang Port is the only gateway sea port in the city and is composed of two terminals: Tien Sa and Song Han.

(e) **Inland Waterway:** According to the DOT, there are 13 waterway routes at present in Danang with a total length of 162.7 km, 101.9 km of which is navigable

6.2 Road Network and Facilities

1) Road Network by Administrative Classification

Figure 6.2 Road Network in Danang City by Administrative Classification



Source: DOT, 2008.

Explanation:

6.2 In this map, the road network is classified into four groups: national highways, city roads (provincial roads), district roads, and other roads. As of 2008, the road network in Danang City was composed of national highways (69 km), provincial roads (100 km), and urban roads (311 km, including district and other roads) with a total length of about 480 km.

6.3 National highways (NHs) 1A and 14B run through the city, providing road connections to Hanoi in the north and Ho Chi Minh City in the south, as well as the Central Highlands and Laos to the west.

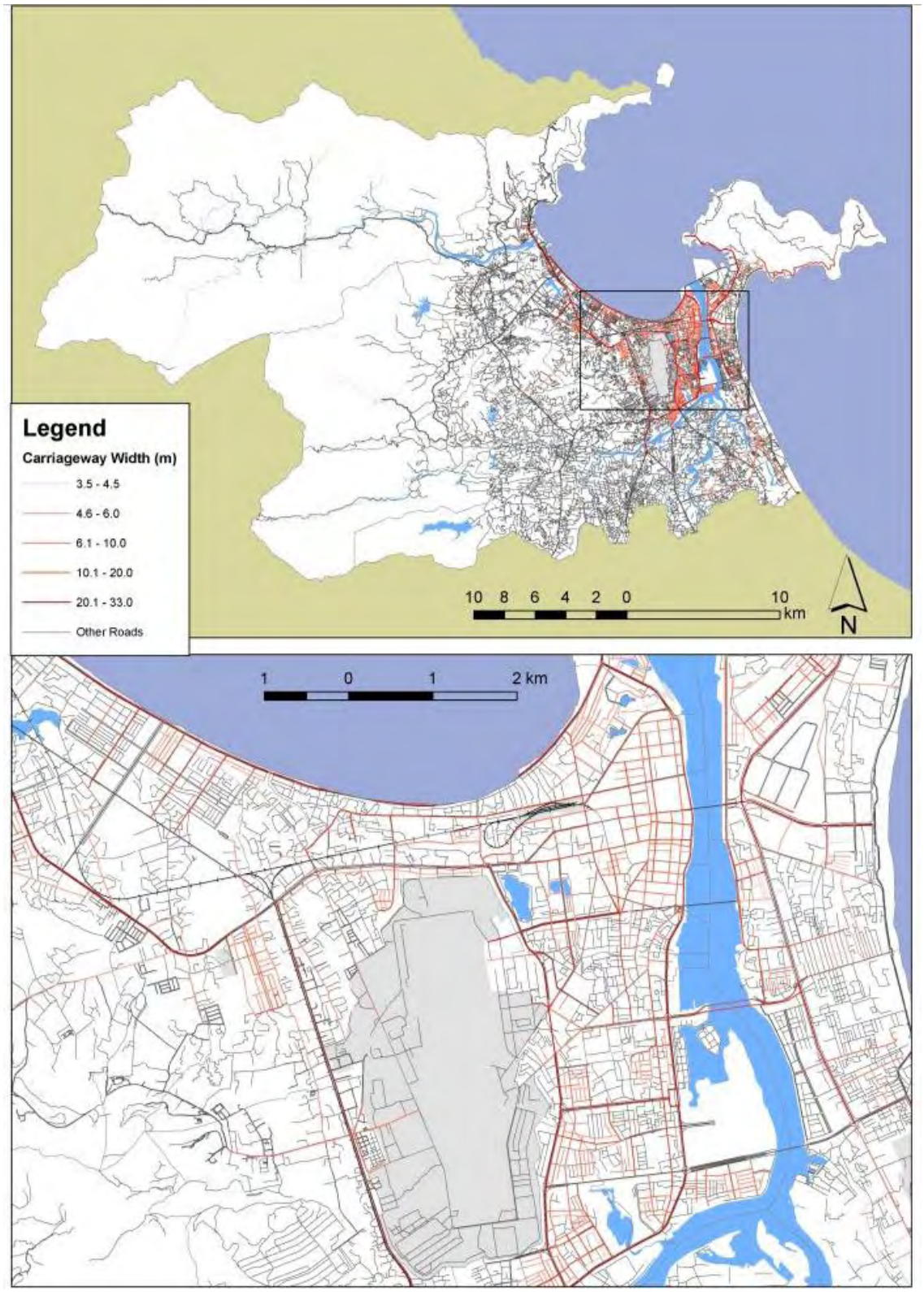
6.4 Provincial roads connect mainly between urban districts and mountainous Hoa Vang district as well as Quang Nam province.

6.5 The urban road network in the city center, particularly Hai Chau and Thanh Khe districts, is dense and shows a grid pattern. The city's overall network, however, is characterized largely by radial national highways.

6.6 National highways are developed and managed by national agencies, particularly the Vietnam Road Administration (VRA) under the Ministry of Transport (MOT). However, the management of some sections near to large cities is the responsibility of local governments. In the case of Danang City, NH14B is managed by Danang City as authorized by the MOT. The Danang Transport Maintenance and Management Company is assigned by the Department of Transport (DOT) of Danang to directly manage and regularly repair roads and waterways.

2) Road Network by Width

Figure 6.3 Road Network in Danang City by Carriageway Width



Source: DOT, 2008.

Explanation:

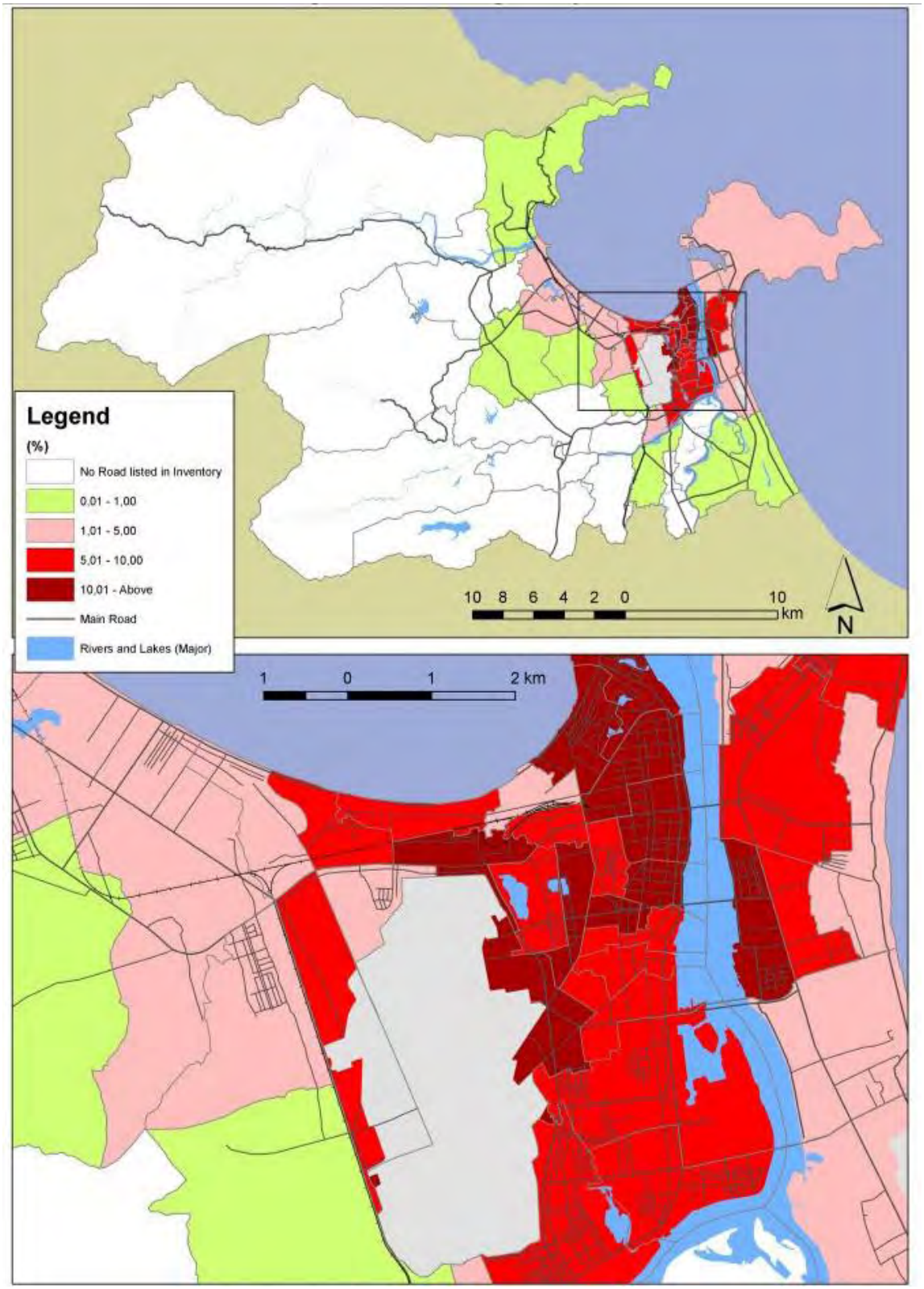
6.7 This map was developed in order to describe the roads according to their widths. The data used in this map was acquired from the Road Inventory (2008) of Danang's Department of Transport. Therefore, only roads listed in that inventory are shown and classified by color. The roads were classified into five groups according to carriageway width: 3.5–4.5, 4.6–6.0, 6.1–10.0, 10.1–20.0, and 20.1–33.0. As shown in this map, roads having widths of 6.1–10.0 m accounts for 30.4% of the total number of inventoried roads. Average width of roads in Danang is 8 m.

6.8 Roads with widths of 20.1–33.0 are mainly national highways. Arterial roads, including national highways and some major urban roads, have four or more lanes, with some having center medians. Most sections of provincial roads only have two lanes with neither center medians nor sidewalks.

6.9 Danang has made significant advances in urban transportation. Since the start of its urban renewal efforts, many old roads have been widened and extended. Some newly constructed roads have a role in adjusting transportation services and changing the urban appearance.

3) Road Coverage Ratio by Zone

Figure 6.4 Road Coverage Ratio in Danang City by Zone



Source: Calculated based on Road Inventory of DOT, 2008 and Net Area defined by DaCRISS Study Team.

Explanation

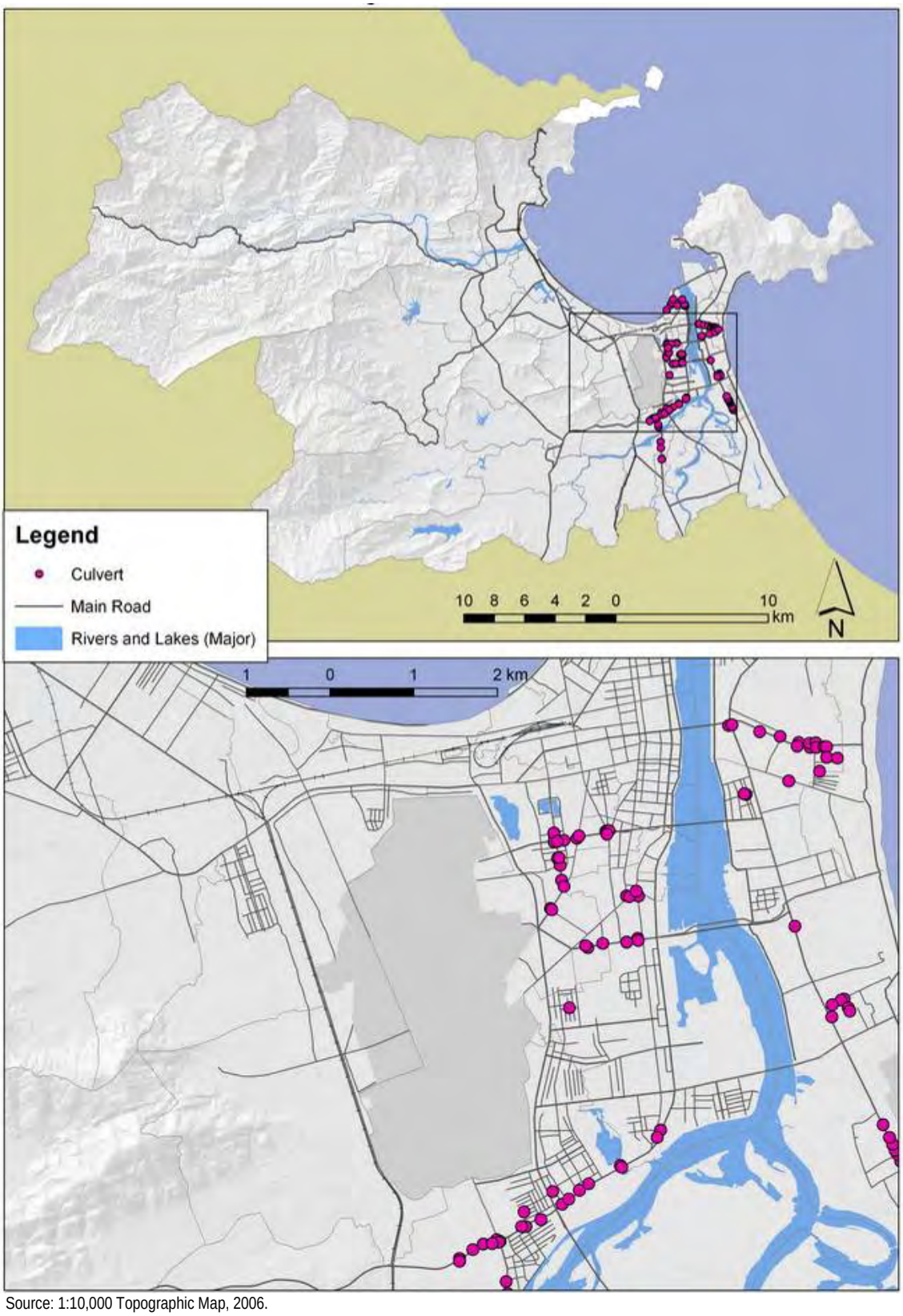
6.10 This map shows the road coverage ratio in Danang City, which is calculated based on the DOT's 2008 road inventory and net area defined by the DaCRISS Study Team.

6.11 Road coverage ratio in percent is classified into four groups: 0.01–1.00, 1.01–5.00, 5.01–10.00, and more than 10.01. In general, the distribution of the road network is uneven and insufficient.

6.12 The density of urban roads in the central districts of Hai Chau and Thanh Khe is 3.9–4.6 km/km^2. In other districts except Hoa Vang, it is 0.6–1.1 km/km^2. Therefore, the road coverage ratio is rather high (more than 10.01%) in some wards of the central districts, such as: Hoa Thuan Tay, An Hai Tay, Thuan Phuoc, Phuoc Ninh, Hai Chau 1, and Thach Thang. In contrast, the road coverage ratio in suburban communes is just 0.01%–1.00%.

4) Culvert Locations

Figure 6.5 Culvert Locations in Danang City



Source: 1:10,000 Topographic Map, 2006.

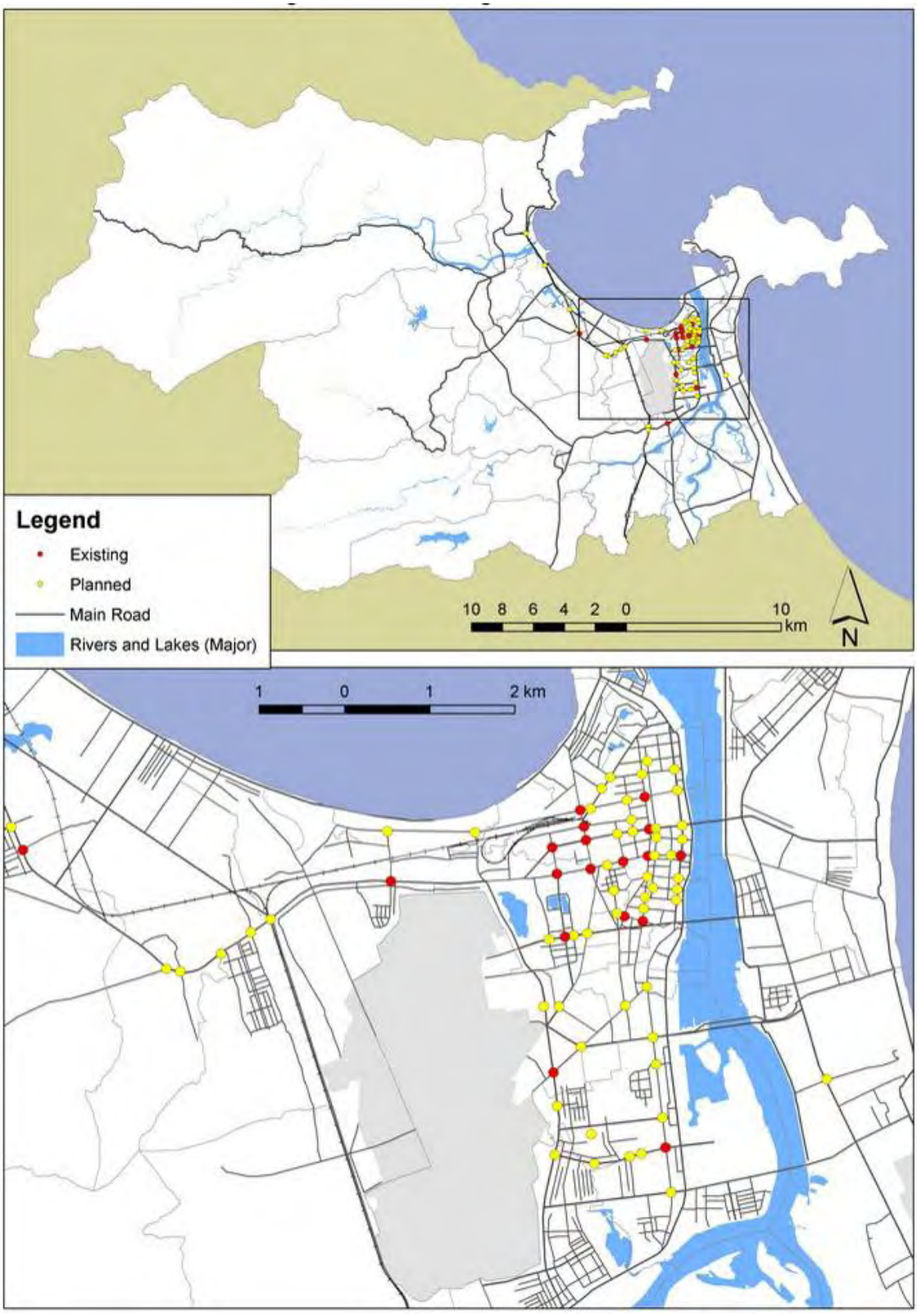
Explanation:

6.13 The map shows there are not so many culverts in Danang Based on the 2006 topographic map, there are only 100 culverts in the city and these are located mainly in the central area.. Culverts play a role in draining and diverting water during flooding. Roads where these are installed are Hung Vuong–Le Duan, Ham Nghi, Duy Tan, Ngo Quyen, Cach Mang Thang Tam, and Ong Ich Duong.

6.3 Road Traffic Management

1) Location of Signalized Intersections

Figure 6.6 Locations of Signalized Intersections in Danang City



Source: DOT, 2008.

Explanation:

6.14 There are nearly 2,700 road intersections in Danang at present. Of this number, 18 are controlled by traffic lights, 27 are operated as roundabouts, eight are controlled by traffic policemen, and about 2% have some sort of traffic control. The remaining intersections are not controlled at all.

6.15 Signalized intersections are mainly the major roads in the city center which include the main east–west roads of Hung Vuong, Le Duan, and Dien Bien Phu, as well as the main north–south roads of Ong Ich Khiem, Le Loi, etc.

Table 6.1 Number of Signalized Intersections in Danang City

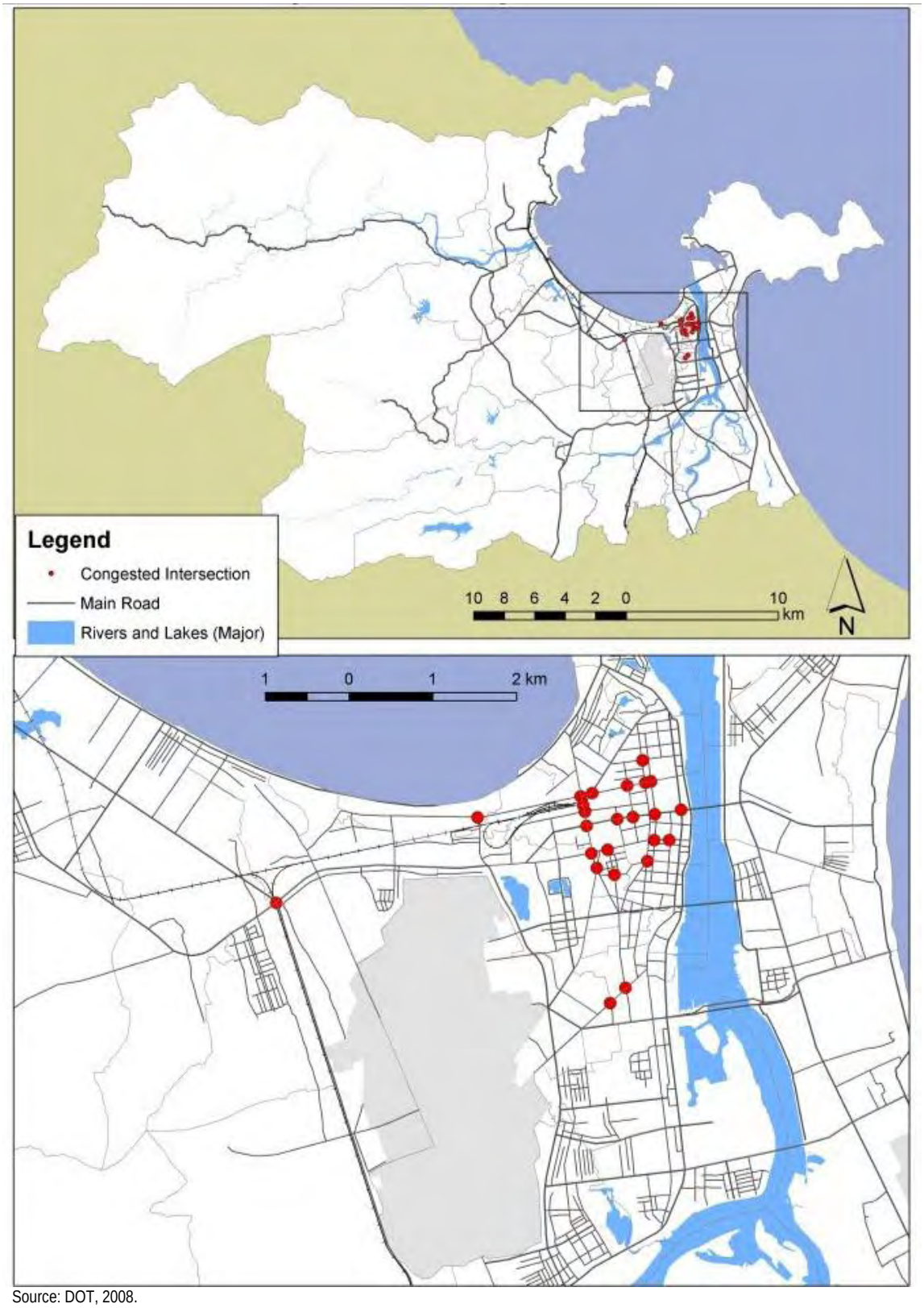
District	Number of Signalized Intersections	
	Existing	Planned
Hai Chau	9	38
Thanh Khe	5	8
Lien Chieu	0	8
Cam Le	1	4
Ngu Hanh Son	0	1
Son Tra	0	0
Hoa Vang	0	0
Total	15	59

Source: DOT, 2008.

6.4 Road Traffic Characteristics

1) Congested Intersections

Figure 6.7 Locations of Congested Intersections in Danang City



Source: DOT, 2008.

Explanation:

6.16 The locations of congested intersections were identified by the DOT and shown in this map. Although the definition of congestion is not clear, vehicle concentration can be observed only in the morning and afternoon peak hours. Traffic congestion on the mid-section of roads is very limited. Based on the experiences in Asian mega cities, traffic congestion in Danang is at a minimum and does not form long queues; vehicles merely slow down when crossing.

6.17 Congested Intersections in the center of Danang City comprise the following:

(i) Le Duan–Tran Phu;

(ii) Le Duan–Nguyen Chi Thanh;

(iii) Le Duan–Nguyen Thi Minh Khai;

(iv) Le Duan–Ngo Gia Tu;

(v) Ong Ich Khiem–Tran Cao Van–Quang Trung;

(vi) Ong Ich Khiem–Dong Da;

(vii) Ong Ich Khiem–Hai Phong;

(viii) Ong Ich Khiem–Le Duan;

(ix) Ong Ich Khiem–Hung Vuong;

(x) Ong Ich Khiem–Nguyen Hoang;

(xi) Hung Vuong–Yen Bai;

(xii) Hung Vuong–Nguyen Chi Thanh;

(xiii) Hung Vuong–Teieu Nu Vuong;

(xiv) Phan Chu Trinh–Hoag Dieu–Tran Quoc Toan;

(xv) Hoang Dieu–Trung Nu Vuong;

(xvi) Trung Nu Vuong–Le Dinh Tham;

(xvii) Dien Bien Phu–Ton Duc Thang–TruongChinh;

(xviii) Trieu Nu Vuong–Nguyen Trai;

(xix) Quang Trung–Nguyen Chi Thanh;

(xx) Quang Trung–Le Loi;

(xxi) Quang Trung–Nguye Thi Minh Khai;

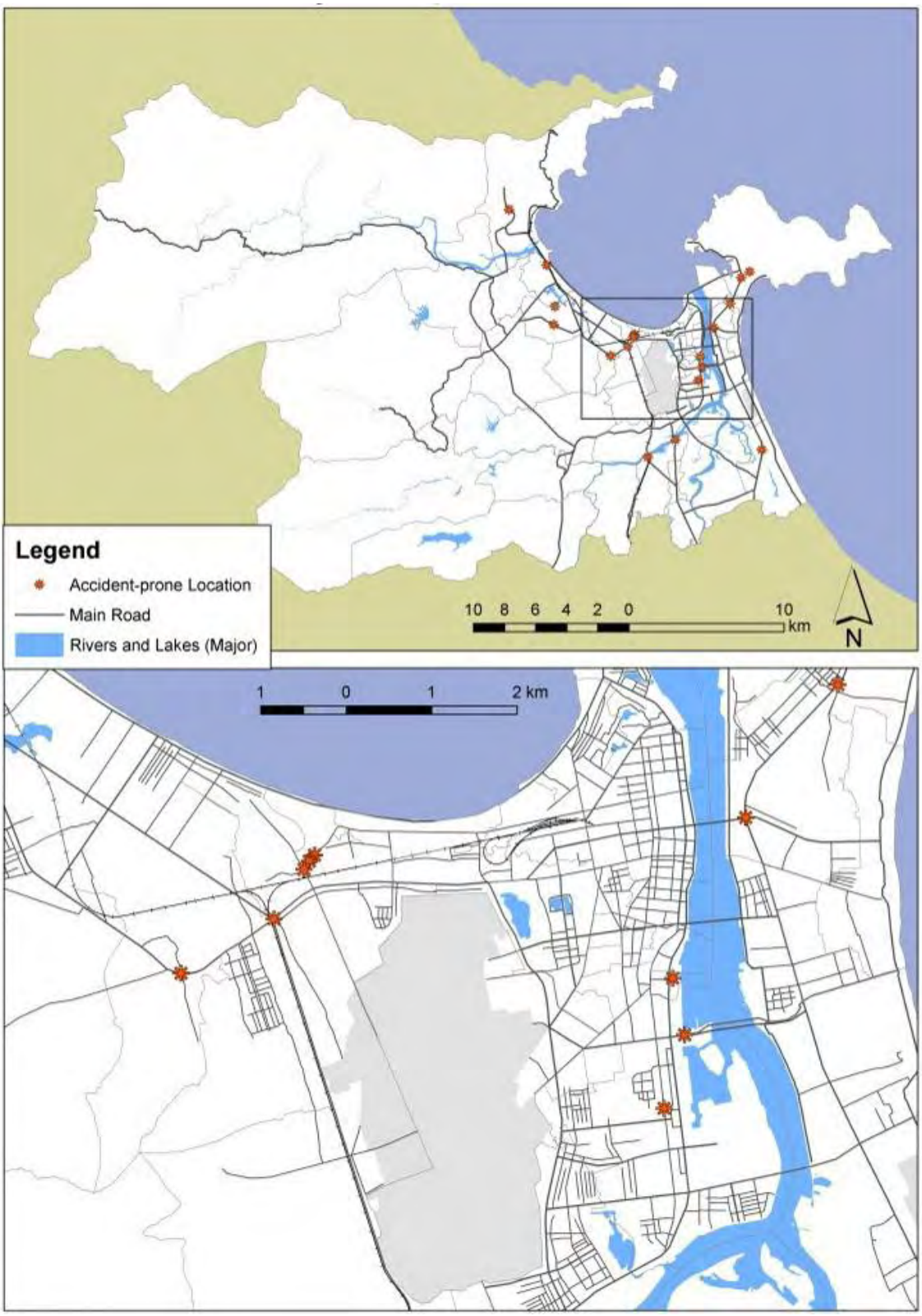
(xxii) Quang trung–Dong Da;

(xxiii) Le Loi–Ly Tu Trong; and

(xxiv) Tran Cao Van–Le Do.

2) Traffic Accident Locations

Figure 6.8 Traffic Accident Locations in Danang City



Source: DOT, 2008.

Explanation:

6.18 The map was built based on the 2005 statistical data of the DOT. The number of road traffic accidents has been increasing as the number of motorized vehicles increase.

Table 6.2 Traffic Accident Locations in Danang City

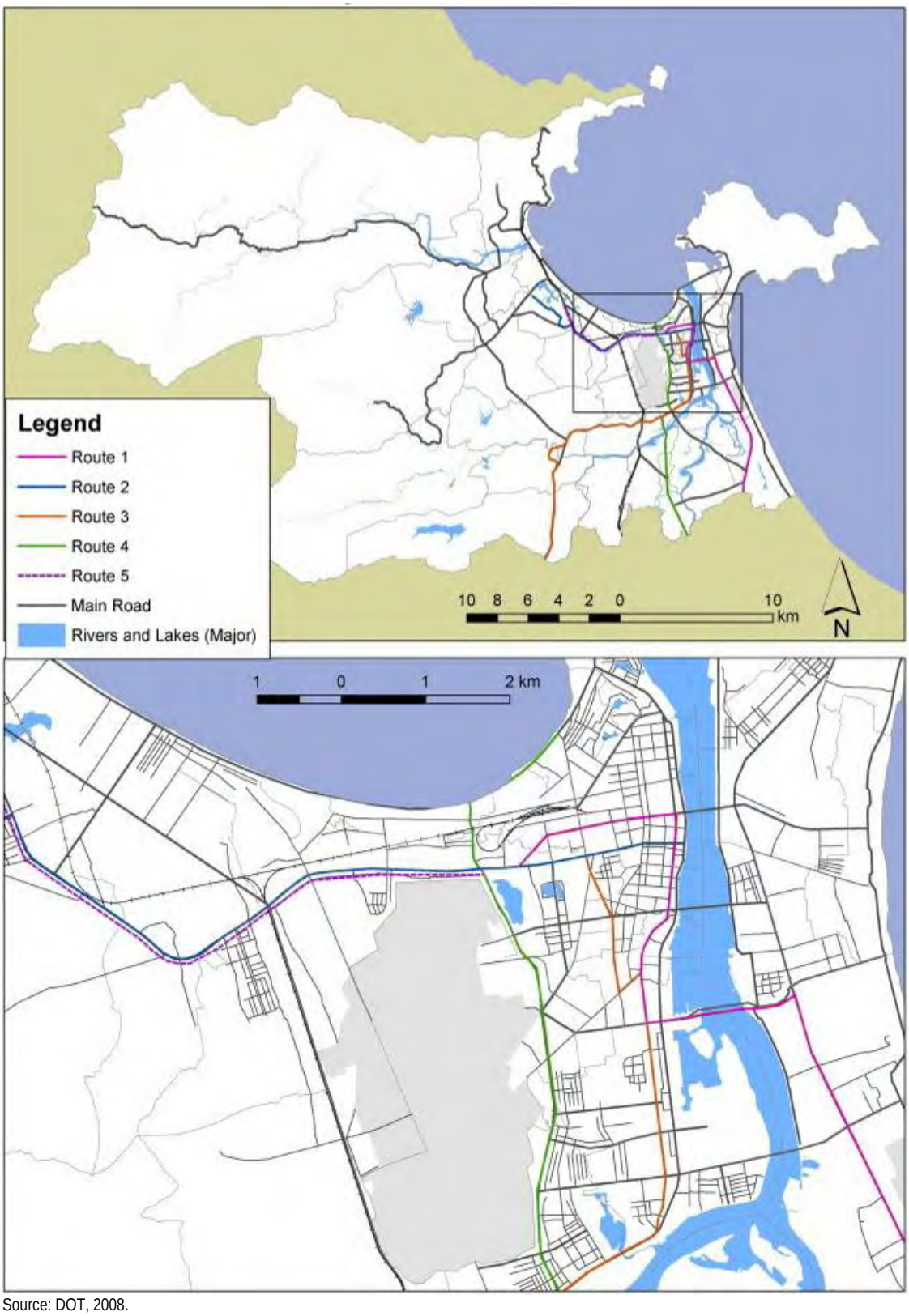
Location	Severity			Reason for Accident	District
	2 serious accidents (with fatality)	3 or more minor accidents with 1 serious accident	4 or more accidents with 1 fatality		
Huong Nho junction, Ngo Quyen rd. Man Thai ward	1 accident (1 death)	5 injured persons		roundabout	Son Tra
Ngo Quyen - Yet Kieu Rotary	1 accident (1 death)	3 collision with 5 injured persons		mixed traffic of pedestrians and vehicles on the same lane	
Tran Quang Khai			4 accidents	narrow road with sudden curve and no shoulder	
Ngo Quyen Rotary	1 accident (1 death)		4 collision	too big rotary	
Tran Thi Ly rd. (fr 2/9rd-Nguyen Van Troi turning to Tran Thi Ly bridge)	2 accidents (2 deaths)			speeding	Hai Chau
2/9 rd. (from Co Vien Cham to 2/9 - Nguyen Van Troi turning)	2 accidents (2 deaths)			speeding	
Nui Thanh (fr. Nui Thanh -Tieu La junction to Phan Dang Luu)	2 accidents (2 deaths)			speeding, lane changing	
Fr. The house no. 341 to 414 of Le Van Hien rd (of the year 2004)	2 accidents (2 deaths)			lane changing, pedestrians crossing carelessly	Ngu Hanh Son
Fr. The house no. 342 to 414 of Le Van Hien rd (first quarter of the year 2005	1 accident (1 death)			careless overtaking	
In front of the house no 746 in Cao Van rd.	1 death and 2 injured			speeding	Thanh Khe
In front of the house no 752 in Cao Van rd.	2 injured p			lane changing	
In front of the house no 768 in Cao Van rd.	1 death			Restricted vision	
Ton Duc Thang-To Hieu-Nguyen Huy Tuong junction			4 accidents	speeding; pedestrians crossing carelessly	Lien Chieu
Nguyen Luong Bang-Nguyen Tat Thanh junction	2 accidents			speeding	
Ba Tan station			4 accidents		
Hai Van mountain pass				roundabout road	
Au Co rd. (fr. Thanh Vinh-Hoa Khanh)		3 accidents		no lights	
Hoa Khanh industrial park		3 accidents		no guiding panel	
road under Cam Le bridge	3 accidents (5 deaths)			speeding	Hoa Vang
National road 1A, south of Do Bridge	5 accidents (8 deaths, 6 injured)			roads crossing roundabout	
Hue Junction	4 accidents (4 deaths, 2 injured)				

Source: DOT.

6.5 Public Transportation System

1) Bus Routes

Figure 6.9 Bus Routes in Danang City



Source: DOT, 2008.

Explanation:

6.19 Danang City has five bus routes currently in operation, three of which (No.1, No.3 and No.4) directly connect the city center with three different towns in Quang Nam province. Details of the bus routes are provided below.

(i) Route No.1 with a length of 32 km starts from the central bus terminal in Hoi An, Quang Nam, passes through the city center of Danang, and ends in Ngu Hanh Son District;

(ii) Route No.2 with a relatively short length of 14 km connects Han Market in Danang City and Hoa Khanh Industrial Zone in Lien Chieu district via NH1A;

(iii) Route No.3 with a length of 34 km connects the central bus terminal in Dai Loc district in Quang Nam, passes through Danang's center, Cam Le and Hoa Vang districts;

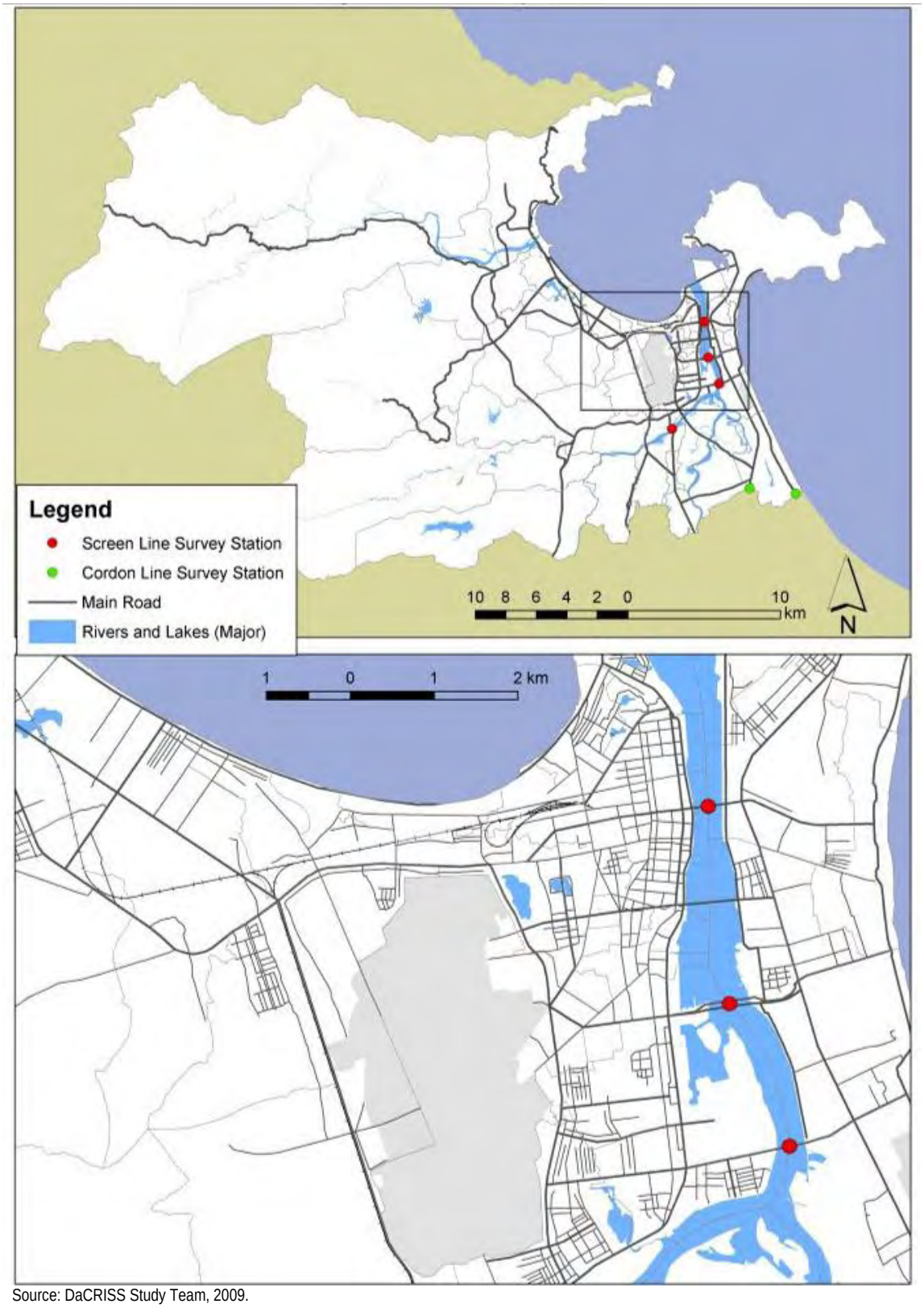
(iv) Route No.4 with a relatively longer length of 70 km connects the north of the city center and Tam Ky town, the provincial capital of Quang Nam, via NH1A; and

(v) Route No.5, an informal route with a length of 15 km, connects Kim Lien (Lien Chieu) and Bai Tho Supermarket (Thanh Khe).

6.6 Traffic Survey

1) Traffic Survey Locations

Figure 6.10 Traffic Survey Locations in Danang City



Source: DaCRISS Study Team, 2009.

Explanation:

6.20 The map shows the traffic survey points which were selected by DaCRISS in order to capture traffic movement between the city center and other areas, as shown in this map. Four survey stations of the screen line were set on the bridges along the Han River and two of the cordon screen line were set at Quang Nam province's boundary on the Son Tra–Dien Ngoc and Tran Dai Nghia routes.

6.21 Total vehicular traffic volume across this screen line was 276,302. The most dominant mode of transportation was motorcycle, sharing nearly 90% of the total. Bicycles, cars, and trucks accounted for about 3–5% each. The share of bus was only 0.7% of the total, although it included public and private buses such as tourist and company buses. Of the four survey stations, Han River Bridge had traffic volumes amounting to 136,205 vehicles.