DEVELOPING A GEOGRAPHIC INFORMATION SYSTEM FOR
THE GALLIPOLI CAMPAIGN

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Approval of the Graduate School of Natural and Applied Sciences

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ABSTRACT

DEVELOPING A GEOGRAPHIC INFORMATION SYSTEM FOR THE GALLIPOLI CAMPAIGN

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Geographical Information System (GIS) is a very powerful technique which is used in solving different problems in various fields dealing with spatial information. It can also be used for analyzing wars and campaign. Today's modern armies use GIS effectively for different purposes such as determining strategic points and planning attack and defense. GIS can also be used for past wars, and historical GIS includes these kinds of applications. In this study, GIS have been used for analyzing Gallipoli Campaign in the First World War. This campaign started in February on 1915 and Allied troops left the Gallipoli Peninsula on 9th January 1916. Gallipoli Campaign have very important role in Turkish and World history. This study includes two different parts about Gallipoli Campaign. In the first part, selected battles of the campaign are analyzed with different GIS functions. Selected battles are Naval, Ariburnu, Conkbayiri, and 2nd Kirte Battles, and they are selected

based on the availability of graphic and attribute data. In the second part, relationship between martyrs and locations are studied. Distributions of the number of soldiers for different criteria, such as province, district, soldier rank, death location and age are shown on maps and pie charts.

Keywords: The Gallipoli Campaign, Geographic Information Systems (GIS), Martyr Information System, Military geography

ÖZ

ÇANAKKALE SAVASLARI IÇIN BIR COGRAFI BILGI SISTEMI GELISTIRILMESI

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Yüksek Lisans, Jeodezi ve Cografi Bilgi Teknolojileri E.A.B.D.

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Cografi Bilgi Sistemleri (CBS), mekan bilgisi içeren çesitli alanlardaki farkli problemlerin çözümü için kullanilan çok güçlü bir tekniktir. CBS savaslarin ve çarpismalarin degerlendirilmesi için de kullanilabilir. Günümüzün modern ordulari CBS'yi stratejik noktalarin belirlenmesi ve saldiri ve savunma plani yapmak gibi farkli amaçlar için etkili bir sekilde kullanmaktadir. Bunun yaninda CBS geçmis savaslar için de kullanilabilir ve tarihsel CBS bu tür uygulamalari içermektedir. Bu çalismada, Çanakkale Savaslari'nin degerlendirilmesi için CBS kullanilmistir. Bu savaslar Subat 1915'de baslamis ve 9 Ocak 1916'da Itilaf kuvvetleri Gelibolu Yarimadasi'ndan ayrilana kadar sürmüstür. Bu çalisma iki kisimdan olusmaktadir. Ilk kisimda, seçilen savaslar için degisik CBS fonksiyonlariyla analizler yapilmistir. Deniz Savasi, Ariburnu Çikarmasi, 2. Kirte ve Conkbayiri Savaslari seçilmistir. Bu savaslarin seçilmesinin nedeni onlar hakkinda çok sayida grafik ve öznitelik

bilgisinin bulunmasidir. Ikinci bölümde sehitler ve mekanlar arasindaki iliski çalisilmistir. Sehit sayisinin dagilimi, geldikleri il, ilçe, rütbe, ölüm yeri, yas gibi farkli kriterler için belirlenmistir.

Anahtar Kelimeler: Çanakkale Savaslari, Cografi Bilgi Sistemleri (CBS), Sehit Bilgi Sistemi, Askeri cografya

To My Family

ACKNOWLEDGMENTS

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CHAPTER 1

INTRODUCTION

Wars affected human life negatively throughout the world history, whether they are limited to two small communities or extensive enough to include a number of countries. The standards of living are inversely affected not only during but also after the wars. People can not continue with their daily activities easily during battles, and numbers of people who are affected from battles are related with the size of battlefield.

The First and Second World Wars have especially critical significance, in which the battles are made on nearly every corner of the world. Thousands of people lost their lives and again thousands of people had to migrate. In addition, psychological problems of people increased.

The Ottoman Empire, followed by the Republic of Turkey after 1923, fought against Allied Forces in the First World War, and had battles in many fronts during the period of 1914-1918. One of the most important battles of the First World War was the Gallipoli Campaign. The Gallipoli Campaign started in February, 1915 with the naval bombardment of Allied forces and continued until Allied troops left the Gallipoli Peninsula in February, 1916.

After 90 years, there are still many aspects which require viewing about the Gallipoli Campaign (Tuncoku, 2005). The reason of selecting the Gallipoli Campaign for this study was that this campaign was one of the most

important turning points of Turkish and World history. Even after its 90th commemoration, it still preserves its significance.

In this study, Gallipoli Campaign is studied with a different approach, using Geographic Information Systems (GIS), which is a very powerful technique used in solving different problems in various fields. There are numbers of publications containing information and data about the Gallipoli Campaign. Thus, enormous amount of data can be gathered, organized, put into databases, and analyzed with this new approach using Geographic Information Systems. There were plenty of important battles during Gallipoli Campaign. In this study, four important battles are selected to be analyzed. These battles and why they are selected are explained in the following chapters.

In the light of the above-mentioned facts, the aims of this study can be given as follows:

- To develop a Geographic Information System for the Gallipoli Campaign.

- To prepare a basic study on Gallipoli Campaign using Geographic Information System and to show capabilities of GIS for similar applications.

- To build Martyr Information System

In the scope of this study, the followings are performed;

- Visibility and proximity between structures and resources, and troops on the Gallipoli Peninsula are studied using GIS analyses.

- Matching locations, people and time during the selected battles.

- Building a database for the Gallipoli martyrs.

- Determining the distributions of martyrs with different criteria.

- Building an interface to facilitate reaching martyr information easier.

This study is explained in five chapters. In this chapter, aim and scope of the study are given. In the next chapter (Chapter 2), literature about Gallipoli Campaign and Geographic Information Systems (GIS) are given. At the beginning of Chapter 2, importance of Gallipoli Campaign for Turkish national and for international history is explained. The concept of Historical GIS and different Historical GIS applications are given.

The thesis continues with information about study area, data collection process and how the data are prepared for analysis in Chapter 3. Sources of data obtained are given. Problems about data and their solutions are tried to be explained. After that, process of building a database for martyr information is explained briefly.

In the fourth chapter, methods and main processes of GIS analyses are explained including the flowcharts of the study for graphical and non-graphic data. After linking database and locations, thematic maps, which were prepared for distribution of the martyrs, are given. Chapter four also includes the results of the analyses, pie charts and lists of martyrs classified with different criteria such as their ages. Developing an interface for finding martyr information is also given.

Finally, last chapter concludes this study by a summary and recommendations according to the results of the thesis.

CHAPTER 2

LITERATURE REVIEW

The Gallipoli Campaign is noted as one of the major battles of the First World War. Among the important assertions concerning the major results of the Gallipoli Campaign in Turkish history is that a large number of highly educated soldiers including civilians in Turkish Army lost their lives during these wars (Kafadar and Esenkaya, 2004). However, the exact number of martyred educated soldiers at Gallipoli could not be determined. Besides, it is a fact that medical school in Istanbul did not have any graduates in 1915, because all the students of the senior class were lost in Gallipoli Campaign. According to Çetiner (2001) about 250.000 soldiers lost their lives or were disabled only in Turkish force. Having this large number of loss of educated or illiterate soldiers certainly affected development of Turkey.

The terms, martyr and casualty have different meanings. Martyr means a person who lost his life fighting or due to his wounds, while casualties include the wounded, the ill, or disabled or lost during the war. The number of Turkish soldiers who were martyred during the war is close to 60.000 according to the records of Turkish Ministry of Defense (1998).

The number of casualties is given as 210 to 218 thousand in Turkish General Staff (2002). This campaign affected the results of 1st World War. Gallipoli Campaign accelerated the Russian Revolution, by worsening the political and economical conditions in the Tsarist Russia (Aybars, 2004). Another significant effect of Gallipoli Campaign was on the duration and the

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geography of the First World War. Gallipoli Campaign was a really serious blow to the British Naval Forces, which was once known as the "Magnificent Armada" (Karal, 1996). In addition, Gallipoli Campaign is the first major operation which contained air, land and naval forces all together in a campaign (James, 1989).

In the light of the above-mentioned facts, significant results of the Gallipoli Campaign can be listed as follows (Tuncoku and Taskiran, 2000; Baydur, 1983; Tuncoku, 2005).

Significant results of the Gallipoli Campaign in terms of Turkish History;

- Although both sides registered vast number of casualties, however this was more for the Ottoman side. There were nearly 60.000 martyrs but the casualties were approximately 250.000. In other words the casualties in Gallipoli are much higher than the ones in the other fronts where Ottoman army fought and this gap in the Turkish Army could not be filled easily.

- Gallipoli victory had a serious positive effect on the moral and the prestige of the Ottoman Army which was defeated in the Balkan Wars shortly before the campaign.

- It is claimed that casualties in the Gallipoli Campaign are not only important in military aspects but also they are important in terms of the Atatürk's revolutions after the declaration of Turkish Republic. Because together with the illiterate or less educated soldiers, graduates or students of Mülkiye, Tibbiye and Harbiye in Istanbul, and also those of Sultanis from a number of cities lost their lives in these wars. It is claimed that this group would have been the supporters of the reform had they continued to live.

- Gallipoli Campaign was a serious spark for the Turkish National Independence movement and brought people together for a national cause.

- Victory in the Gallipoli Campaign was also important for the military and political career of Mustafa Kemal. His victories in the Gallipoli Campaign made him better known by the Turkish Nation and these victories were the most significant references in his leadership in the Turkish National Independence Movement.

Significant results of the Gallipoli Campaign in terms of International Politics;

- Turkish victory in the Gallipoli Front prevented the surrender of the German army in the Eastern Front. This is the very reason that the First World War was prolonged for two more years. Material and moral losses of France and Britain have caused a relief for the Germany in the Western front.

- Because of the reason that the Dardanelles could not be passed by the Allied Forces, the necessary aids for the Russia were not supplied so the pressures on the Tsarist regime were aggravated. This heavy burden accelerated the formation of 1917 Revolution.

- The closure of the Turkish Straits throughout the Gallipoli Campaign had also a negative effect on world trade.

- Failure of the Allied Forces in the Gallipoli Front affected the Balkan States. Bulgaria joined the German Block and Rumania, Greece and Italy continued their neutrality.

- Gallipoli Campaign was also a serious blow for the undefeatable British Armada.

- The experiences of the colonial soldiers coming from different countries of Commonwealth, such as Australia and New Zealand, to the Gallipoli front gave them the understanding of their own nationalism, as being an Australian or a New Zealander rather than being British.

There are lots of studies about Gallipoli Campaign in Turkey, Australia, New Zealand and England. Those studies usually include similar viewpoints. Military records, diaries and memoirs of soldiers and journalists are the main resources of Gallipoli Campaign studies.

In Turkey, poems, stories and brief essays constitute the great deal of publications about Gallipoli Campaign. Other studies related with Gallipoli Campaign are historical accounts written by the commanders or political leaders and comprehensive academic studies conducted by the Office of Military History and Strategic Studies of Turkish General Staff. (Tuncoku, 2005). Some of these studies include maps and sketches. One of them is about Conkbayiri Battles. Conk (1959), who was one of the commanders of various Turkish troops during the Gallipoli Campaign, wrote his experiences and memoirs in a book. His book includes also sketches which show location and movement of troops. In addition, different books also contain sketches and maps such as Perk (1939) and Aker (1935). Different sources contain information about ammunition of Turkish Army. Sahin (2003) includes information about ration and supply of Turkish Army. Apart from the above mentioned ones, a different study is prepared by Turkish Historical Society and Forsnet (2001) in CD format. This study includes information about the Gallipoli Campaign from the beginning of the battles to the evacuation of the Gallipoli Peninsula by the Allied forces. Furthermore, animations, photos and additional visual materials were used in this study.

Geographic Information Systems (GIS) is a technique used in various fields where spatial information is necessary from earth sciences to political or medical sciences. Aronoff (1991) defined GIS as: "A GIS is a computer-based system that provides the following four sets of capabilities to handle georeferenced data: 1. input; 2. data management (data storage and retrieval); 3. manipulation and analysis; and 4. output."

Geographic Information Systems can also be used for analyzing different dimensions of the battles. Today's modern armies use GIS effectively for different purposes such as determining strategic points and planning attacks and defenses (Yomralioglu, 2000).

Terrain has very important role on human life during peace and war. Knowledge of the battlefield terrain has a vital role during all phases and levels of military planning (Web 1). Terrain analysis can be performed easily using GIS etchniques. Visibility, proximity and other surface maps can be derived easily using a GIS software. There are different terrain analyses methods. Richman (1999) explains terrain analyses methods for Armies. Turkish Army uses also GIS analyses for military applications. General Command of Mapping developed several projects, such as SAHADASU (Digical Map Supported Military Applications Software Project) to increase the battle efficiency of Turkish Army (Ünal and Türker, 2002). Satyanarayana and Yogendran (Web 2) explain some GIS application for military operations. The use of GIS in electronic battlefields can be found in ESRI (Web 3).

Development of science and technology enables us to evaluate historical events through a different perspective, since they are sources or topics of the scientific research.

GIS can also be used for the battles in the world history. Historical GIS includes such applications. Gregory (2002) states that, "Historical GIS is also

a term that is becoming increasingly used to describe approaches to historical research involving the use of GIS ."

Answer to the question "Why use a historical GIS?" is given in "GREAT BRITAIN historical GIS project" web site (Web 4) as "At one level GIS offers an effective mapping tool to historians and historical geographers. For more sophisticated users it offers far more: an integrated analytical tool capable of handling attribute data through space and time with complex visualisation tools to explore data and display the results of analysis." In Queen Mary and Westfield College at University of London, Historical GIS cources are given in summer semesters (Gregory 1998). In this college, different applications of Historical GIS are published in Historical GIS News. A different application of Historical GIS is to prepare Electronic Historical Atlas of Britain (White, 1998). According to American Battlefield Protection Program web site (Web 4), GIS analyses are also used for determining battlefield integrity by The National Park Service's Cultural Resources Geographic Information Systems. This service studies different applications like finding America's Hidden Battlefields and Mapping Historic Battlefields (Web 5).

So far, there are no studies with GIS about Gallipoli Campaign on any other Campaign in Turkish history, so in this work such a research is attempted.

In this thesis, a different viewpoint by using the graphic and non-graphic information of Gallipoli Campaign through GIS is developed. As mentioned before, the reason of selecting the Gallipoli Campaign is; the Gallipoli Campaign is one of the most important turning points of Turkish and World history and even after 90 years it still preserves its significance.

CHAPTER 3

DATA COLLECTION AND PROCESSING

In this chapter, a brief information about the study area is given. Then, data collection and their preparation processes for the analyses are explained; including information about the problems of data, assumptions made and how the problems of data are solved. Necessary corrections and assumptions made about the martyrs' information are explained. Standardization of martyr data and building martyr database steps are also included.

3.1. Study Area

Gallipoli Campaign took place in 1915 on both sides of Dardanelles strait which joins Marmara and Aegean Seas, Gallipoli Peninsula and Kumkale on the land and also in the strait itself. The study area is shown in Figure 3.1 with its location in Turkey. In this scale, study area lies between 26.164 - 26.502 E Longitudes and 40.377 - 40.044 N Latitudes and also between 429032.895 - 457555.020 Eastings and 4469666.545 - 4432964.976 Northings in WGS 1984, which is in UTM Zone 35N.

Only the European side of the Dardanelles has been analyzed in this study, because accurate data were available only for this side. The Anatolian side of the Dardanelles is not included on Sevki Pasa Maps, which are the main source of information and explained later in detail. In addition, 1/25.000

scaled topographic maps of the Anatolian side could not be obtained from General Command of Mapping.
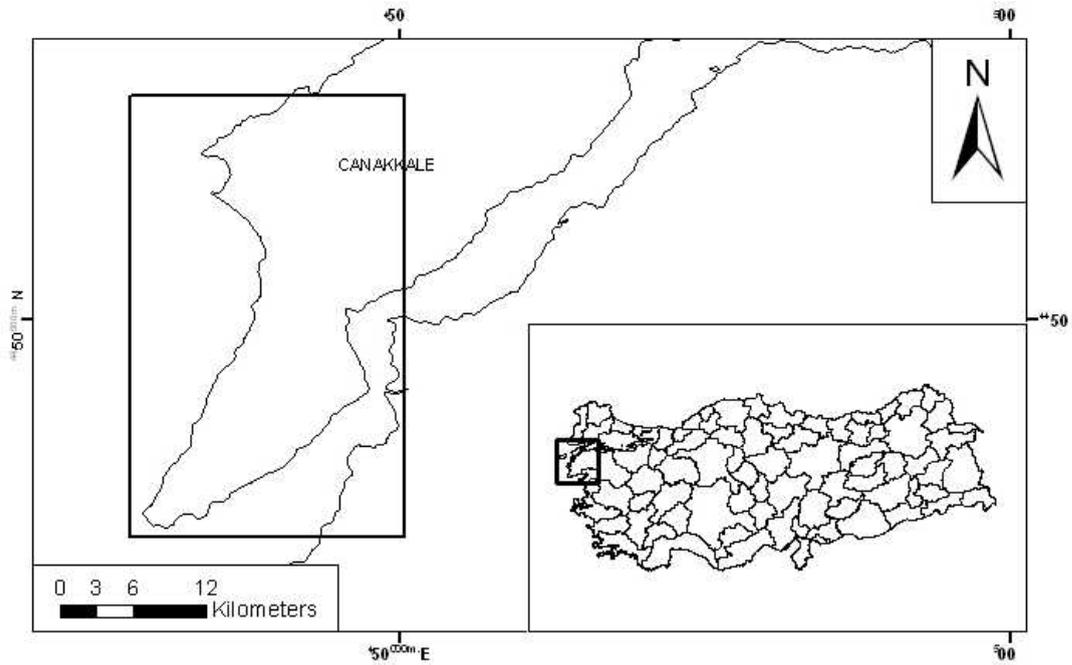
Figure 3.1. The study area

3.2. Data Collection

As explained in Chapter 1, Çanakkale Campaign are very important for Turkish and also for World History. Therefore, there are a large number of studies and work conducted about them. Most of them are classical historical studies, which describe the battles in words with the help of some sketches. The aim of this study is studying this important war in the light of GIS techniques. Therefore, a thorough search is tried to be made for available data.

The data are collected from different institutions and researchers in Turkey. These sources are as follows:

➢ National Library, Ankara

- Turkish General Staff, Military History and Strategic Studies Center (Genelkurmay Baskanligi, Askeri Tarih ve Stratejik Etütler Baskanligi, ATASE), Ankara
- General Command of Mapping, Ankara
- Naval Museum of Istanbul and Naval Museum Archive, Istanbul
- Military Museum of Turkey, Istanbul
- Polatli Military School of Artillery and Missile, and Artillery and Missile Museum, Ankara
- Çanakkale Naval Museum, Çanakkale
- The Atatürk and Gallipoli Campaign Research Center at Çanakkale Onsekiz Mart University, Çanakkale
- Remains of Çanakkale Central Hospital, Çanakkale

Many different types of data are collected from these sources, and they can be classified into two groups:

- Graphical data
- Non-graphic data

This classification is important for GIS analyses, since the processes are different for different types of data.

3.2.1. Graphical Data

All the information about graphical data is summarized in Table 3.1. In addition, the total list and all related information about the graphical data are provided in Appendix A.

The map showing all the regions belonging to the Ottoman Empire is obtained from the General Command of Mapping (Figure A1). Although this map was necessary for martyr information, it was not used in the study because of data inconsistency. For example martyr information obtained from

Ministry of Defense and location names on this map could not be matched with each other suitably. In addition, to be able to use different maps in a GIS work, they should all be converted to the same projection, and projection of this particular map could not be obtained from General Command of Mapping.

Many soldiers, who came from different parts of the Ottoman Empire, took part at Çanakkale Campaign and martyred during the battles. According to Ministry of Defense records, the number of martyrs who came from the places out of today's boundaries of Turkey is about 1116. In addition, records about 612 martyrs do not include origin information, which means provinces where soldiers came from are unknown. Therefore, analyses and queries of the study related to the martyrs are limited to the soldiers who came from the locations in the today's boundary of Turkish Republic.

1/50.000 scaled paper map, named Anafarta-i Saghir, is taken from National Library in Ankara. It is scanned with 200 dpi and saved in JPEG format for further use and given in Figure A2.

One of the most important maps of the study is 1/5.000 scaled Gallipoli Peninsula maps, which are provided by ATASE as scanned map sheets in TIFF format. These map sheets are called Sevki Pasa Maps.

According to Özkale and Senler (1980), these maps were started to be prepared in 1914 with a team under the management of Mehmet Sevki Pasa known as the founder of modern mapping in Turkey. In 1915, after the evacuation of the Allied forces from Gallipoli Peninsula, renewal of these maps was completed to guide the historians for writing the history of battles. Thus, in addition to topographic situation of the peninsula all the fortifications of both sides were shown with details on this large scale map before they were subjected to change with the effects of weather conditions and other effects.

Table 3.1.Graphical data used in this study

DATA NAME	SCALE	YEAR	FORMAT	CONTENT	SOURCE
Sevki Pasa Maps	1/5.000	1914	Paper format	Topographic data in 43 map sheets	ATASE
Topographic maps	1/25.000	2001	ArcGIS coverage	boundaries, elevation, hydrology, industry, physical, population, track, vegetation in 7 map sheets	General Command of Mapping
Anafarta-i Saghir	1/50.000	1920	Paper format	Topographic data	National Library
Osmanli Imparatorlugu Sinirlari'nin Genislemesi	1/12.000.000		Paper format	Ottoman Empire Boundaries	General Command of Mapping
DEM data	1/250.000		DTED format		GGIT Data Source
Turkilgeo	1/1.000.000		ArcGIS coverage	Province map of Turkey	GGIT Data Source
Turkey district	1/1.000.000		ArcGIS shapefile	District map of Turkey	GGIT Data Source
Information related to locations of troops and their belongings on both sides	No scale or not dependable scale	1993	Paper format	6 different sketches	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 1.Kitap (Turkish General Staff, 1993)
Information related to locations of troops and their belongings on both sides	No scale or not dependable scale	1978	Paper format	11 different sketches	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 2.Kitap (Turkish General Staff, 1978)
Information related to locations of troops and their belongings on both sides	No scale or not dependable scale	2002	Paper format	18 different sketches	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 1., 2. ve 3. Kitaplarin Özetlenmis Tarihi (Turkish General Staff, 2002)

Sevki Pasa Maps consist of 43 sheets of 1/5000 scale. Their situation in the peninsula is given in Figure 3.2, and one example for a single map sheet in

Figure A3. In this figure, location of these map sheets is shown on 1/50.000 scaled paper map named Anafarta-i Saghir. There are two original copies of Sevki Pasa Maps, one being held in ATASE, Turkey, and the other in Australian War Memorial (AVM), Australia.

To obtain today's situation, 1/25 000 scaled recent digital topographical map sheets are obtained from General Command of Mapping (GCM) in Arcview coverage format. Seven map sheets of Gallipoli Peninsula are taken from GCM as shown in Figure 3.3. One of these map sheets is given in detail in Figure A4. However, H16d3 named map sheet showing the tip of the peninsula could not be obtained because of military restrictions. The 1/25.000 scale map is accepted as the base map for this study. All the other maps and sketches are georeferenced using this map.

Another digital map used in this study is 1/1.000.000 scaled province map of Turkey. This map, which is obtained from Department of Geodetical and Geographical Information Technologies (GGIT) at Middle East Technical University in ArcGIS coverage format, is used for preparing thematic maps.

Digital Elevation Model (DEM) of Gallipoli Peninsula was also obtained from GGIT. 1/250.000 scaled DEM data were used for surface analyses at the beginning of the study. Then, more accurate elevation model is prepared by using contour data of digital topographical map obtained from GCM.

Large numbers of sketches are also used in the study. These sketches are obtained from a variety of sources, such as the books published by Turkish General Staff (1978, 1993, 2002). Different references have the same sketches. Unfortunately, size and other features of some of the sketches change in different books. In such situations, more reliable sketches are found by comparing with each other and checking the source information.
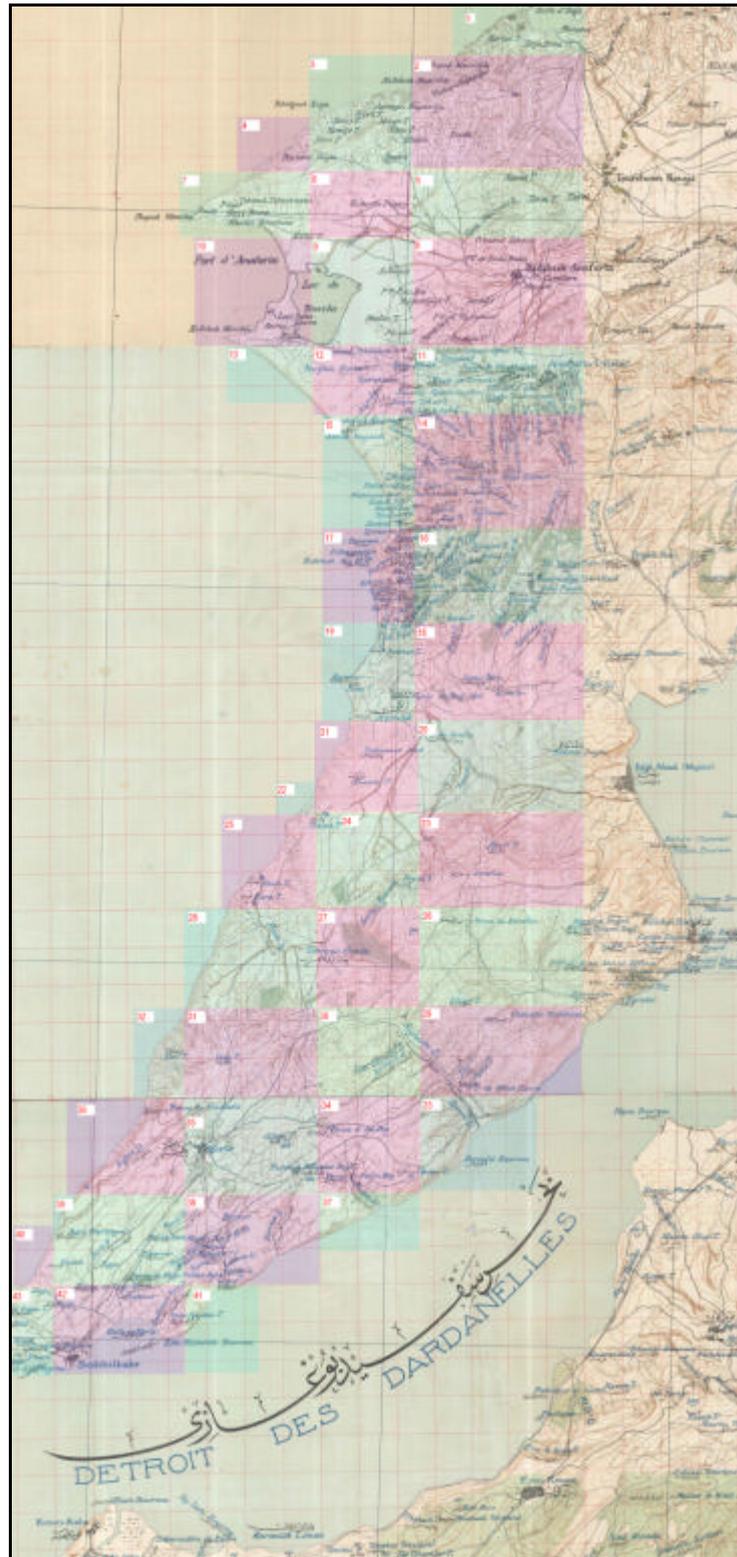
Figure 3.2.   Locations of 43 sheets of 1/5000 scale Sevki Pasa Maps on Gallipoli Peninsula.
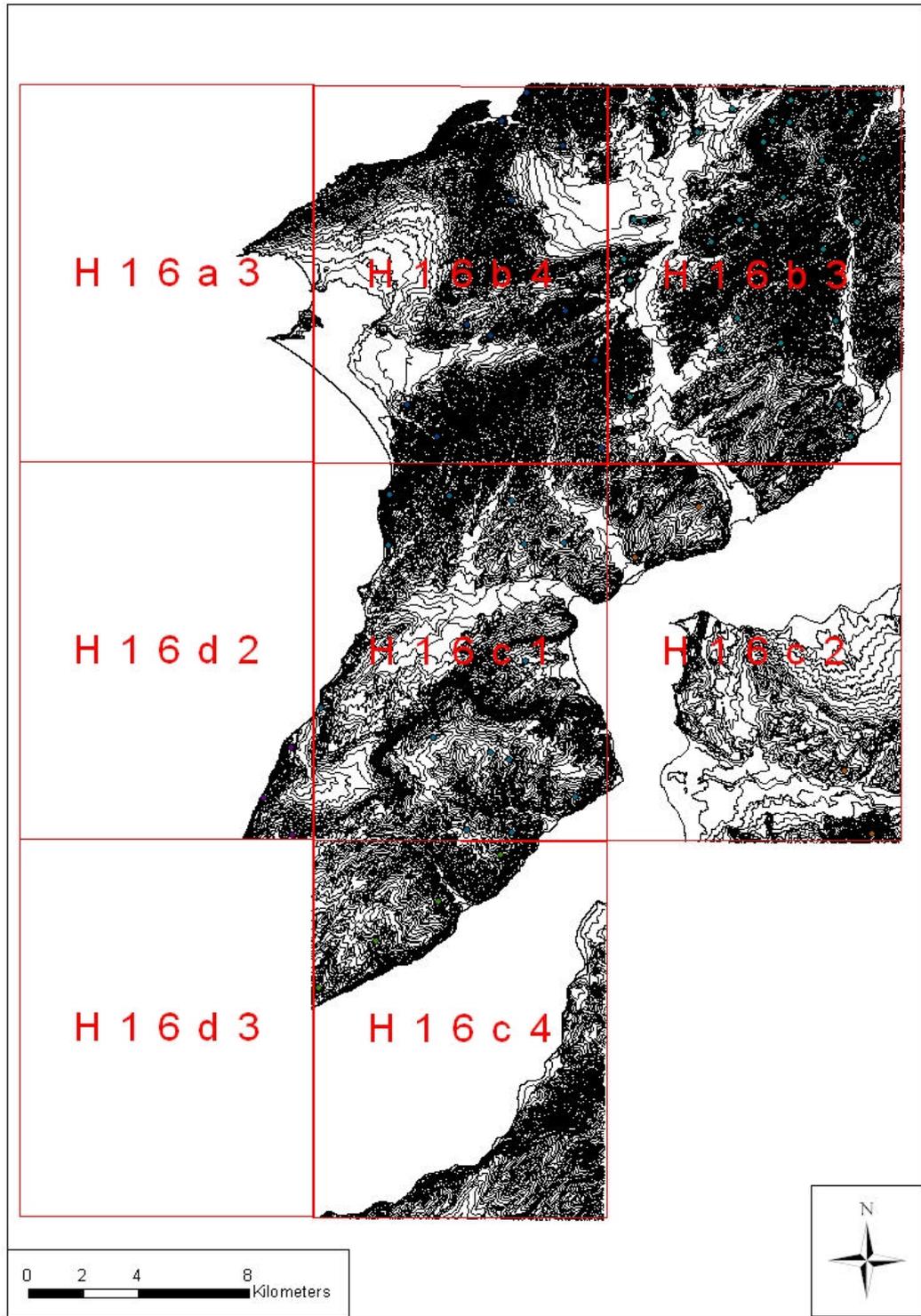
Figure 3.3. Seven map sheets of Gallipoli Peninsula are taken from GCM

3.2.2. Non-Graphic Data

There are some data obtained in tabular form, their information is summarized in Table 3.2. These are commander names, martyrs information, information about artilleries and range of artilleries.

Table 3.2. Non-graphic data used in the study

Type of data	Publish year	Content	Reference
Name of Commanders	1993	Commanders' name according to battles and date	The book "On Yillik Harbin Kadrosu 1912-1922 " (Görgülü, 1993)
Artillery information	2002	Locations and calibres of some artilleries	1. Dünya Harbi'nde Türk Harbi, Çanakkale Cephesi Harekati Özetlenmis Tarihi, Çizelge 1, 371, (Turkish General Staff, 2002)
Range information of Artilleries	1993	Locations and calibres of some artilleries	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 1. Kitap (Haziran 1914 – 25 Nisan 1915), Ekler, Çizelge 6, (Turkish General Staff, 1993)
Martyr information	1998	Martyr information since Ottoman-Russia War	Sehitlerimiz (Ministry of Defense, 1998)

Different sources contain commander names for the battles, and Görgülü (1993) classified them according to the battles. During the battles, sometimes commanders were wounded or were appointed to different duties. Therefore, commanders of troops changed at different times. These changes were also given in Görgülü (1993).

List of artilleries were obtained from Turkish General Staff (2002). Data about some of the artilleries include range information, as listed in Turkish General Staff (1993), and given Appendix B.

Data related to martyrs were obtained from the Ministry of Defense. These data were given in books as paper format at the beginning of the study. But

later, all the martyr data were obtained in MS Excel format from the same source.

3.2.3. Data processing

The 1/50.000 scaled paper map, taken from the National Library, consisted of two parts. The first part of this map shows the east side of Gallipoli Peninsula including Anatolian coast, and was produced in September 1920. The second part shows western side of the peninsula, and was produced in November 1920. These maps are topographical maps and location names are generally written in French. Some of the location names are written both in French and Turkish (with Ottoman script). These annotations caused understanding problems in some parts of the map like Ariburnu region. Fonts written in French and Turkish on the map for that region are mixed with each other. Therefore, details on the map could not be seen clearly. Due to such problems, Ariburnu region was not used for applications at the beginning of the study. Later, these problems were overcome once Sevki Pasa Maps were obtained. The information from these maps is combined with those of Sevki Pasa Maps, which have larger scale and contained more detail.

As mentioned before, 1/5.000 scaled Gallipoli Peninsula maps are called Sevki Pasa Maps. Trenches, wells, lines of fire, location of artilleries, bridges, and wire fences, waterway of Allied forces, trees, dikes, graveyards, observation posts, railways, roads and streams are all shown in these maps. Annotations and legend sheet of these maps are given in Turkish with old Ottoman script, and they are translated into contemporary Turkish for matching locations with places on base map. Different units like farms which do not exist today, are seen in these map sheets. These locations are very important. Because, according to records, there are soldiers, who were martyred at some of these locations like Triyandafil Farm. These maps are also used to complete the information in the missing sheet of southern part of

the Gallipoli Peninsula, for the 1/25.000 scale map. Sevki Pasa Maps are the most accurate maps used in this study.

Before digitizing, Sevki Pasa Maps are referenced by using 1/25.000 scale map sheets and a GIS software. Referencing is made by using hill tops, coast lines (especially sharp turns) and other important locations on maps. Projection systems of all these maps are determined as WGS 1984 in UTM_Zone_35N.

The scanned Sevki Pasa Map sheets are then used for digitizing all the necessary information about the troop locations, their artilleries, etc., since 1/25.000 scale map sheets have only elevation and hydrology information which are approximately same as on Sevki Pasa Maps.

1/25 000 scaled digital topographical maps, which are used as base map for this study, had some problems such as missing contour elevations or contours which are not digitized. For example in Figure 3.4, it is seen that 80 meter elevation contour in H16b3 map sheet is missing.

Another problem stem from the fact that contours which show the same elevation on adjacent map sheets do not follow each other properly. For example, in Figure 3.5, a discontinued contour (65 m) and erroneously connected contours (65 m and 70 m) are shown. These problems could cause wrong results in the analysis steps. Therefore, they are all corrected before the analyses.

After all the corrections, a complete contour map of the area was obtained and Triangulated Irregular Network (TIN) elevation model was produced using it, which was then used for surface analyses. TIN model shows an area in three dimensional forms for surface representation. In other words, Burrough (1993) says that "Triangulated Irregular Network (TIN) is a system for digital elevation modeling that avoids the redundancies of the altitude

matrix and which at the same time would also be more efficient for many types of computation (such as slope) than systems that are based only on digitized contours." Figure 3.6 shows TIN model of the peninsula.
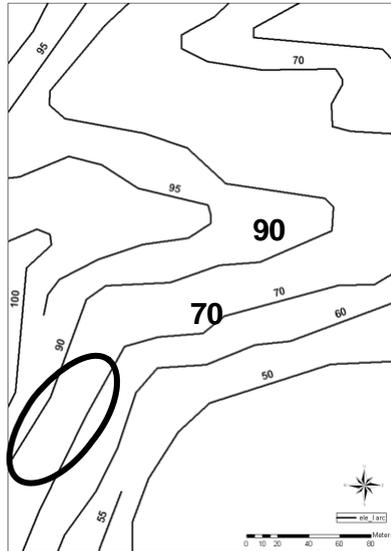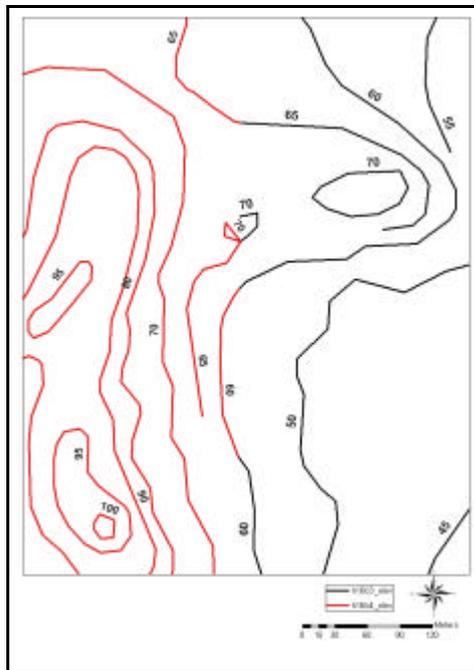

Figure 3.4. Missing contour on H16b3 map sheet

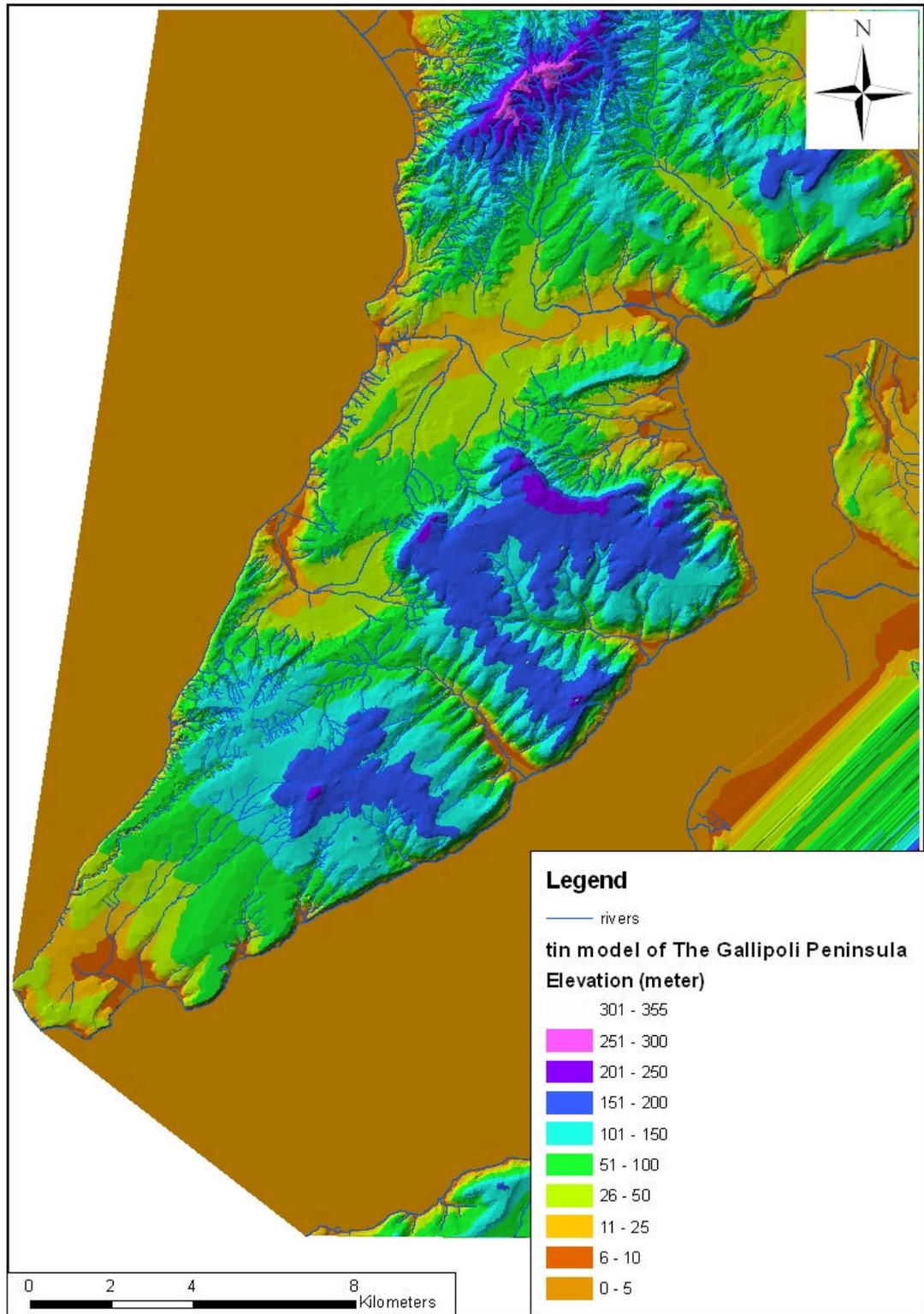Figure 3.5. Connection problems on H16b3 map sheet

Figure 3.6. TIN model of the Gallipoli Peninsula

As mentioned before, there were a large number of sketches obtained from different sources such as publications of Turkish General Staff (1978, 1993, 2002). These sketches are used for determining location of troops and military equipment such as artilleries. Some of these sketches are more detailed showing locations and troop movements at different times of the day. Those are used for selected battles and dates. Selected battles are Naval Battles (18th March 1915), Ariburnu Landing (25th April 1915), 2nd Kirte Battle (6th – 8th May 1915) and Conkbayiri Battle (6th – 10th August 1915). The data for the selected battles are obtained through a number of sketches which show Naval Battles between 12 and 18 o'clock on 18th March 1915, condition between 24 and 27th April 1915 in Ariburnu. Some other sketches are related to Kirte and Conkbayiri regions. These sketches are digitized and registered for further analyses. Sharp turns of rivers, important hills, coast lines and other important locations on the maps were used for georeferencing.

There are some data obtained in form of tables, such as commander names, information about artilleries, range of artilleries and martyrs information. Commander names are taken from Görgülü (1993). In this book, commander names are classified according to dates and battles. This classification made it possible to obtain commander names for selected campaign. During troop-commander name matching process, names are checked on tables and sketches.

Information about the artilleries is taken from publications of Turkish General Staff (1993, 2002), including the approximate ranges of artilleries, which were determined with approximate calculations. Additionally, Polatli Military School of Artillery and Missile, and Artillery and Missile Museum were visited with the aim of obtaining exact range information. Unfortunately, sufficient information could not be gathered there since the artilleries used in Çanakkale Campaign were very old types.

All the tabular and other types of information related to the digitized graphic data are entered manually as their attribute data in the digital medium.

After all these processes, a number of layers are produced for further usage, as listed below.

- Area of Tents of Allied force
- Artilleries of Turkish force
- Artilleries of Allied force
- Barbed wire of Turkish force
- Barbed wire of Allied force
- Bridges
- Bunkers of Allied force
- Covert roads of Turkish force
- Covert roads of Allied force
- Ditches
- Fire line of Turkish force
- Fire line of Allied force
- Graveyards
- Important locations
- Machine guns on precipice
- Observation post of Turkish force
- Observation post of Allied force
- Rails
- Roads of Turkish force
- Roads of Allied force
- Shelters of Turkish force
- Shelters of Allied force
- Single bunker of Allied force
- Telegraph line
- Transportation ditches with trenches

- Transportation roads of Turkish force
- Transportation roads of Allied force
- Trenches of Turkish force
- Trenches of Allied force
- Troops according to date for selected battles
- Vegetation
- Water canal
- Water pump 1
- Water pump 2
- Water reservoir 1
- Water reservoir 2
- Well

In Figure 3.7, layers of water tanks and observation posts of Allied forces for Ariburnu region are shown as an example. All the other layers are given in Appendix C.

3.2.4. Editing and building the database

Martyr information is obtained from a five-volume book titled "SEHITLERIMIZ" prepared by the Ministry of Defense in 1998. These volumes contain martyr information from 1877-1878 Ottoman – Russian War up to 1998 internal security operations in Turkish Republic. These records contain different information about martyrs such as:
- Number (Starting from 1 and continuing. The order given by the Ministry of Defense according to first city, then districts, following soldier names)
- Name of the war (such as Ottoman – Russian, First World War, The Balkan War etc.)
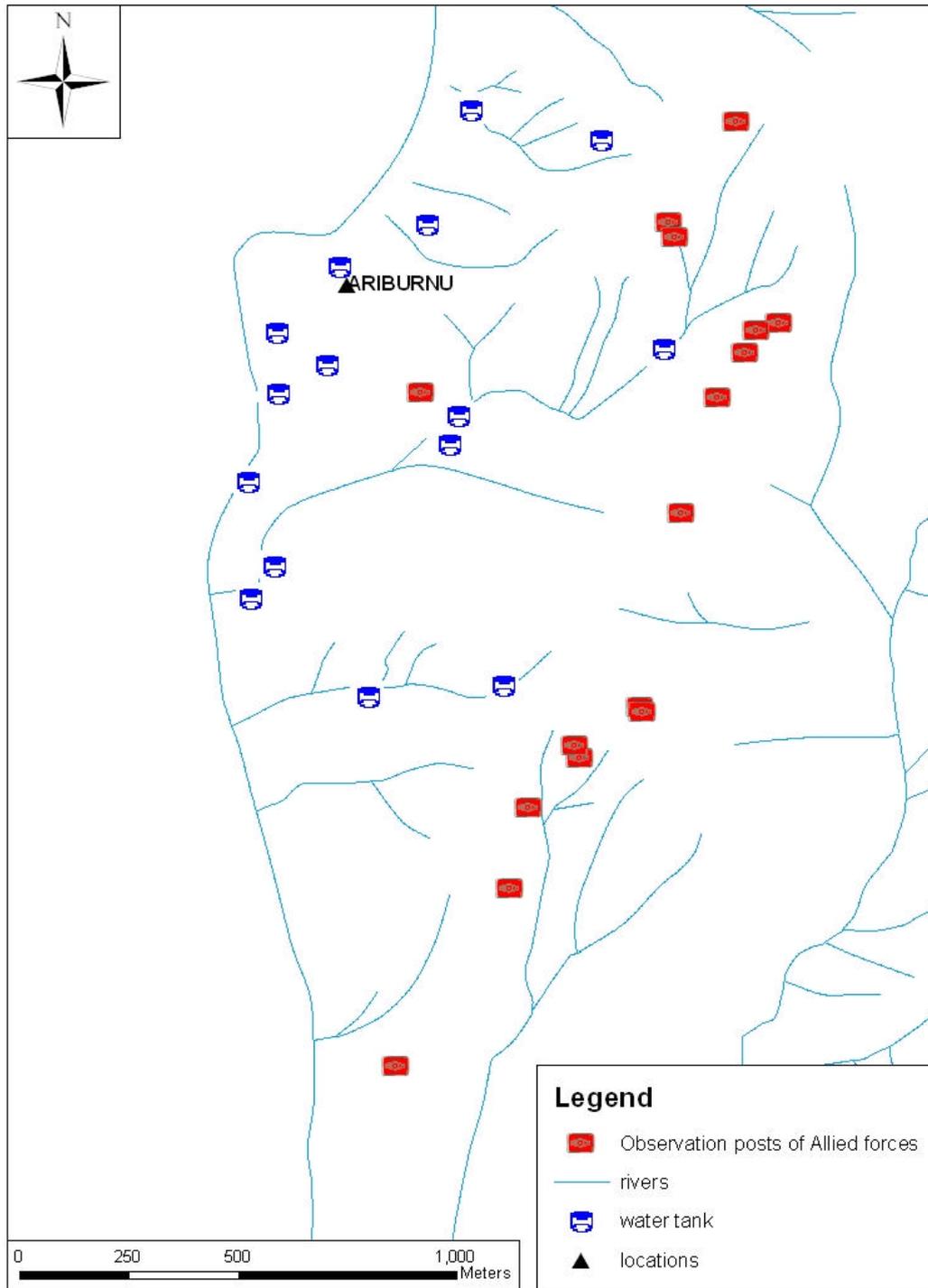
Figure 3.7. Water tanks and observation posts of Allied forces for Ariburnu region

- Front (Front names in the wars, such as Iraq, Romania, Galicia, Trablusgarp, and Çanakkale .)
- Troop information (Service, Army, Army corps, Division, Regiment, Battalion, Company)
- Nickname
- Father Name
- Name
- Year of birth (Birth information about the soldiers contain only their birth years and they were given in the old calendar. They are transformed to the Gregorian calendar by adding 584.
- District where soldier came from
- Sub-district where soldier came from
- Village where soldier came from
- Military arms of service
- Rank
- Date of death
- Location of death
- Name of recruiting office
- Name of special forces

The martyr information is classified according to provinces. Surnames were non existent in 1915, instead nicknames, father names and first names are used for identifying a person.

At the beginning of the study, these records were taken in paper format. By the time when the records were obtained in digital form in MS Excel format, about 2500 records had been entered manually, and in addition, it was necessary to select Gallipoli records from the whole martyr information manually one by one. All these problems consumed a great amount of time. After the records were obtained in digital form, the processing became

easier, such that using Autofilter function in MS Excel, Gallipoli records were selected at once.

In 1998, there were 75 provinces in Turkey. But, now there are 81 provinces. However, martyrs who came from new provinces of Igdir, Yalova, Karabük, Kilis, Osmaniye and Düzce are included in the records of their previous provinces.

Some problems were also encountered in martyr data. For example, some dates were unrealistic such as 29th or 30th of February in 1915. Such mistakes are corrected as assumed and shown in Table 3.3.

Table 3.3. Correction of date records

Date	Number of Occurrences	Assumed Date
29 February 1915	229	28 February 1915
30 February 1915	114	28 February 1915
30 February 1916	3	28 February 1916
30 February 1917	2	28 February 1917
31 April 1915	4	30 April 1915
31 June 915	6	30 June 915
31 June 1915	109	30 June 1915
31 June 1916	1	30 June 1916
31 September 1915	10	30 September 1915
31 September 1917	1	30 September 1917
31 November 1914	1	30 November 1914
31 November 1915	18	30 November 1915
31 November 1916	1	30 November 1916

Another problem was the inconsistency in the spelling of certain names. For example, there are four different spellings for a farm name, as Triyandafil, Tiryandafil, Teryandafil, Triyanda Fil. According to records, there are 771 soldiers, who lost their lives in Triyandafil Farm. Therefore, spellings of locations hold importance. Similarly, all the locations are standardized, such as only "Kirte" instead of Kirte Harbi or "Kirte Harbi'nde", as such differences cause problems during querying process in GIS analyses.

Martyr records do not include unique identification numbers. Therefore, a unique number was assigned to each person in a systematic way (MARTYR_ID) such as 9010032. Here 901 shows Adana province. Each record has 3 digits for provincial identification. Last two digits indicate the identification code, and the first digit is used for degree equalization. The next 4 digits show the order of a martyr from that province. 0032 means that this martyr is 32nd in the order among the soldiers from Adana.

As mentioned before, different places are visited for collecting data. Military Museum of Turkey in Istanbul, Naval Museum of Istanbul, ATASE in Ankara, Naval Museum of Çanakkale, Gallipoli Peninsula Historical National Park and Cemeteries are some of the searched data sources. Many other resources could not be visited because of time limitations and in some of the visited ones, data could not be obtained. For example, in Turkish Naval Museum, according to Chart and Map Catalogue, there are a large number of maps in Naval Museum Archive. However, permission to have access to such data could not be obtained without long processing time.

With a field trip on Gallipoli Peninsula, coordinates of important locations, cemeteries and memorials are determined by Global Positioning System (GPS) measurements as shown in Figure 3.8. These coordinates are then used for inserting these locations on the maps and georeferencing of the maps and sketches.
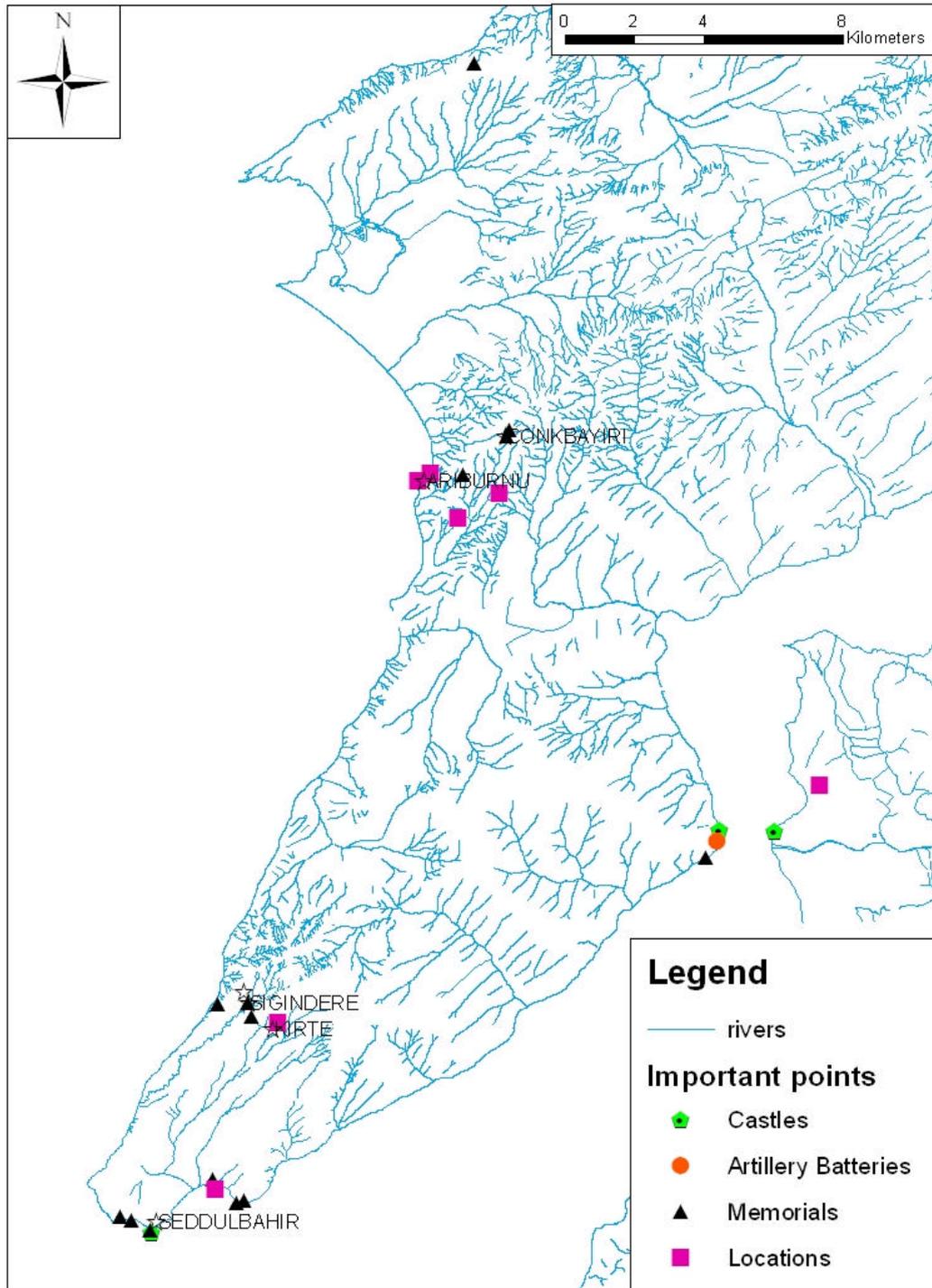
Figure 3.8. Important locations, cemeteries and memorials are determined by GPS measurements

CHAPTER 4

METHOD AND ANALYSIS

In this chapter, different types of GIS analyses, performed in this study on the graphical and/or non-graphical data, are explained. Processing steps of graphical and martyr data are also included. The battles chosen for the study and the types of different GIS analyses on them are also covered.

4.1. Battles Selected for the Analyses

During the Çanakkale Campaign, there are about 20 battles which took place in the eleven months, the most important 11 of them are shown in Figure 4.1. As it is shown in the figure, some of the battles brought large casualties to both sides, whereas in some they are unfortunately very high on the Turkish side compared to the Allied side. For example, among these battles Conkbayiri is the one with highest casualties on both sides. Sigindere and Ariburnu Battles follow Conkbayiri in number for Turkish losses where the losses of Allied forces are much less.

In this study, GIS analyses are performed on some selected important battles and dates. These are Naval, Ariburnu, Second Kirte and Conkbayiri Battles. These battles are selected due to the large number of casualties as well as availability of more data.
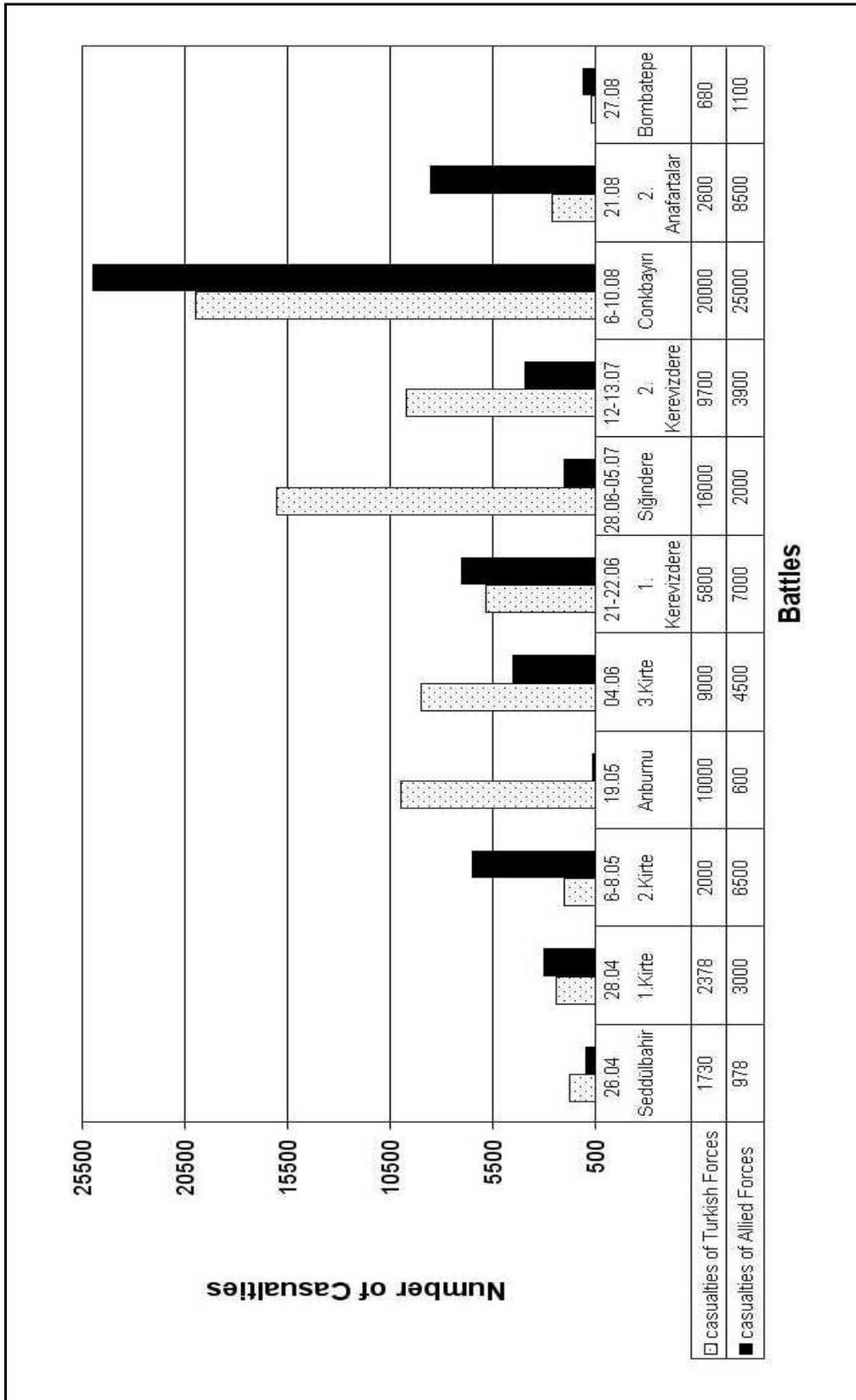
Figure 4.1. The battles and their casualties in Gallipoli Campaign

4.2. GIS analyses used in this study

GIS techniques provide different types of analysis and querying. These analyses can be collected under three categories.

- Non-Spatial Analyses
- Spatial Analyses
- Combined Spatial and Non-Spatial Analyses

4.2.1. Non-Spatial Analyses

Non-spatial analyses include analyses on attribute data. All types of queries related to tabular data can be made through non-spatial analyses. In this study, especially martyr data are used for non-spatial analysis. Then the information on troops, their commanders and the artilleries are searched. Some of the non-spatial analyses are listed below;

- Querying soldiers coming from a certain location:

As explained in previous chapter martyr database has location information therefore, martyrs who came from a certain province or village can be queried.

- Querying a location on the Gallipoli Peninsula and all soldiers who lost their lives at that location:

Using martyr database, giving a certain location in the Gallipoli Peninsula all the martyrs who lost their lives there can be determined.

- Querying names of the troops and the names of their commanders:

Names of the troops for both sides and commander names of Turkish troops can be queried.

- Querying location of artilleries, range and battery name:

Locations of artilleries, ranges and battery names can be searched.

All these analyses are very fast since they do not refer to graphical data.

4.2.2. Spatial Analyses

All the analyses made on graphical data are spatial analyses, where no usage of non-graphic data is performed. Surface analyses related to the topography of the area are one type of spatial analyses. Visibility, proximity and slope analyses are the spatial analyses used in this study, and they are explained in the following pages.

In this study, visibility, proximity and slope analyses are used for determining areas for different purposes such as finding visibility of troops or preparing mobility maps. Main processing steps of graphical data is shown in Figure 4.2. Prepared layers were explained in the previous chapter. In addition to them, contours of Gallipoli Peninsula are obtained after completing the 1/25000 scaled map sheets in digital format.

Troops, observation posts and artilleries are used for visibility analyses. Proximity analyses are performed on the layers prepared before, to be combined with surface model. Surface analysis is made by using the TIN model of Gallipoli Peninsula.

To perform spatial analyses in GIS, an areal extent is determined for each selected battle using all the related maps and sketches to be used for that battle. This way the analyses became easier since worked on a smaller area than the whole peninsula.
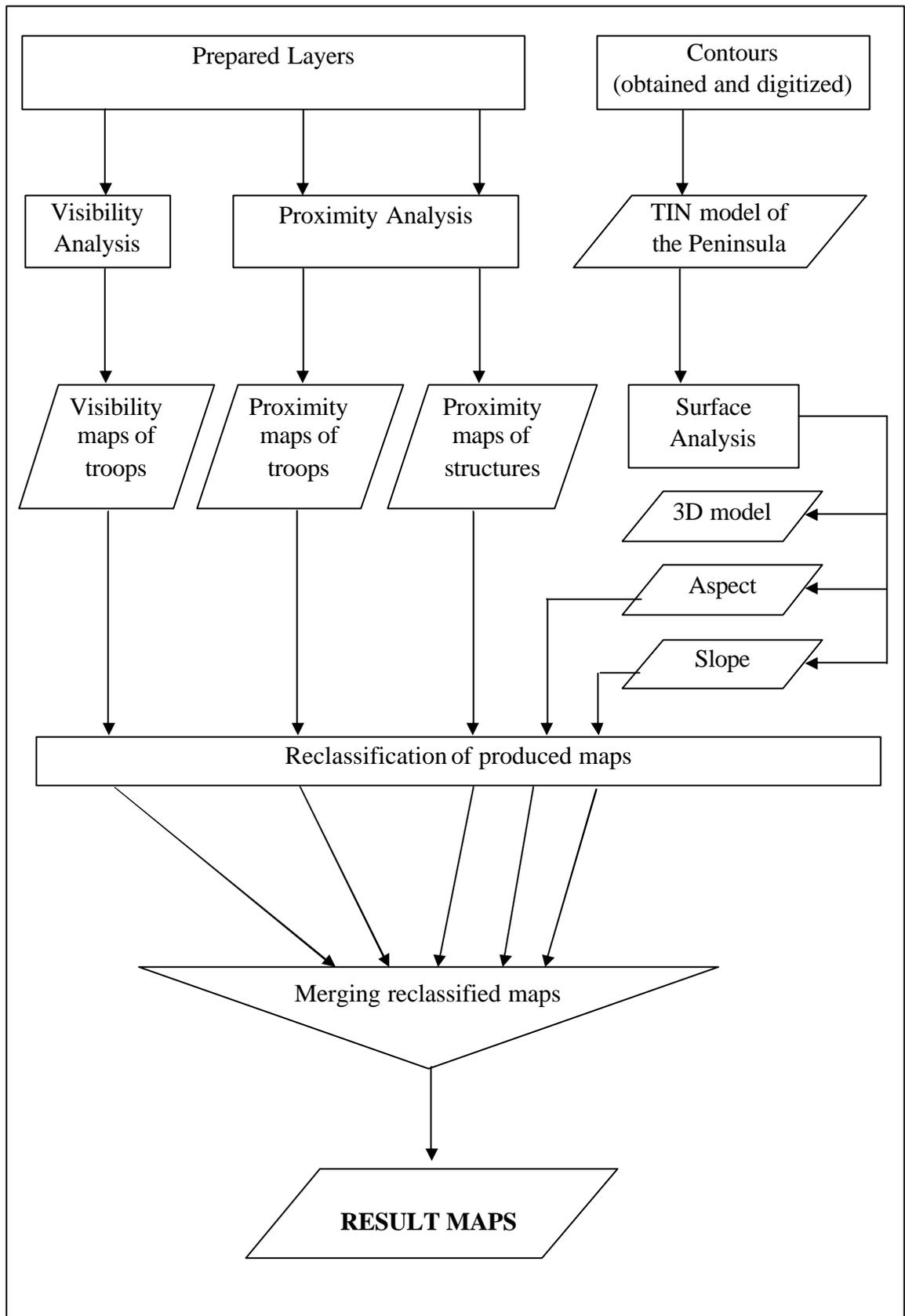
Figure 4.2. Processing Steps of Graphical Data

4.2.2.1. Determining visible areas

Visibility analyses are performed for troops and observation posts of both sides, and also for artilleries of Turkish troops in Naval Battles. In an ideal situation troops should not be seen by enemy forces. Therefore, locations of visible troops from enemy forces are assumed to be at wrong places, because, movement and attack preparation activities can easily be seen by the other side. Cover protection from enemy fires is very important during the battles.

All the visibility maps were obtained by using Viewshed tool of ArcGIS software and are prepared for determined extent for each battle.

During the process of determining visible area as percentage, firstly, area of extent is determined in square kilometer and also in number of pixels in raster format using a GIS software. They are given below for each battle;

- 318.7 km^2 (188598 pixels) for Ariburnu Battles
- 193.3 km^2 (79411 pixels) for Second Kirte Battles
- 158.2 km^2 (98996 pixels) for Conkbayiri Battles.

The total area of the Gallipoli Peninsula is about 500 km^2.

The numbers of pixels in the visible areas are determined using the attribute tables of the visibility maps. In these tables, a value "0" indicates a pixel being in invisible area, all the others indicate that a pixel is in visible area. Percentages of visible areas are then determined by using the formula given below.

$$\text{Visible area}(\%) = \frac{\text{TNOFP} - \text{NOFPZ}}{\text{TNOFP}} * 100$$

Where; TNOFP: Total number of pixels in the extent of a battle

NOFPZ: Number of pixels which have value "0" for the same extent

Visible areas for Turkish Forces on August 8 during the Conkbayiri Battles are shown in Figure 4.3.
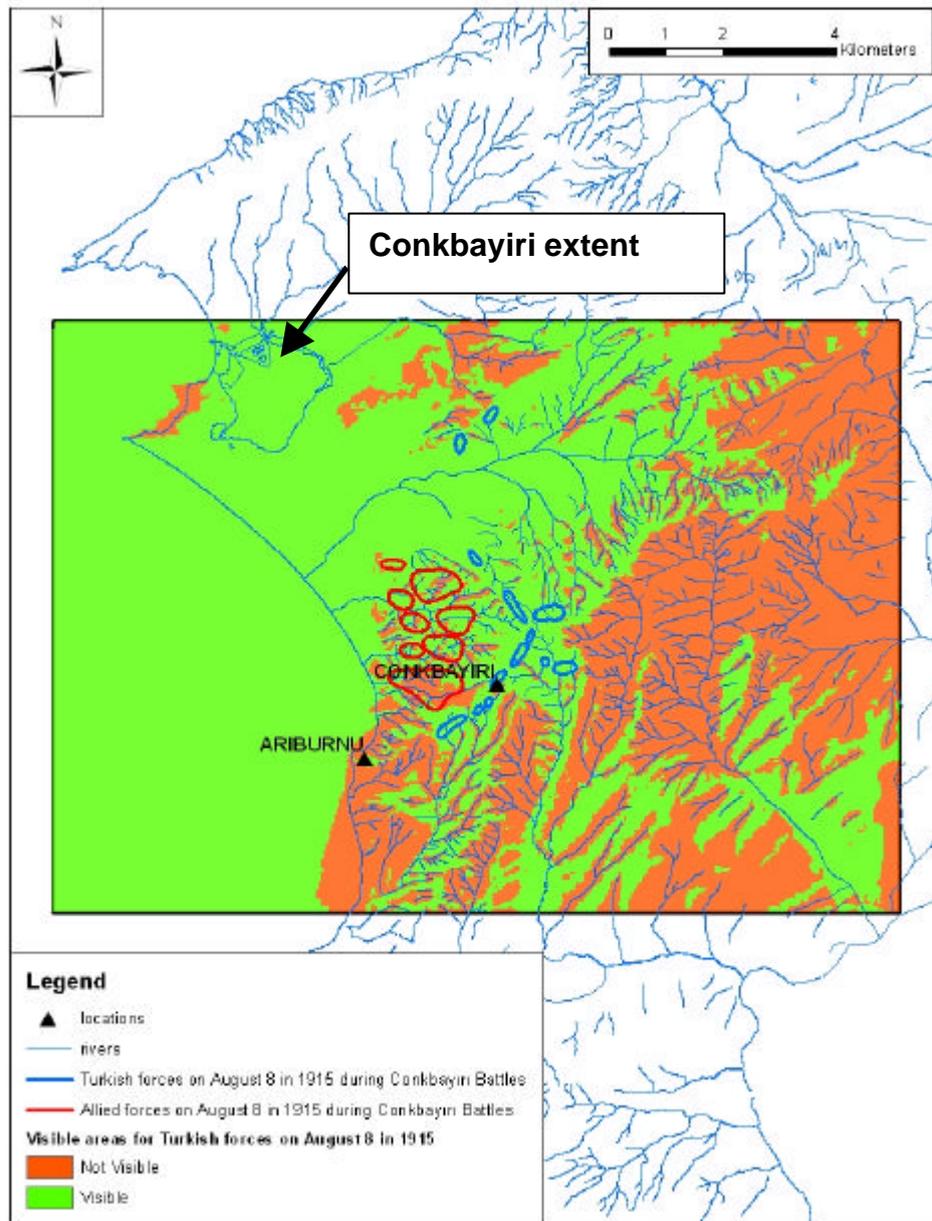

Figure 4.3. Visible areas for Turkish forces on August 8 during the
Conkbayiri Battles

According to the figure, locations of the Allied forces are not correct. As explained before, casualties were very high in this battle and it may be the reason for high casualties of Allied forces. Because, Turkish troops could see movements of the enemy forces. This analysis is also performed for Allied forces on August 8 during the Conkbayiri Battles. Figure 4.4 shows their visible areas for this battle. As it is shown in the figure, some of Turkish troops can be seen by Allied troops, which may indicate the reason for high casualties on Turkish side this time.

Prepared visibility maps for all the selected battles are listed in Table 4.1. In this table, visible areas are given as percentage and also as total area. In the table, in "Layer" column each layer gives the result of one visibility analysis performed for a certain battle, at a certain date and time and for one side. For example, "c_0708_tr_m" layer shows visibility situations from the locations of Turkish troops in the morning on August 7 during Conkbayiri Battles. As it is seen in the table, amount of visible areas for Allied forces increases from 113.5 km^2 to 146.3 km^2 while they were moving during the two days of Ariburnu Battles. It is possible to reach a similar result about the locations of the troops of both sides for different battles. Some of these are explained below:

- Amount of visible areas for Turkish troops during Ariburnu Battles decreased day by day. Therefore, movement of the Turkish troops is erroneous according to visibility situation. On the other hand, Allied forces could see larger areas with time during these battles. Thus, it is possible to claim that Allied forces moved to better locations with better visions and increased the amount of visible areas. This may be the reason for higher casualties of Turkish forces compared with those of Allied forces in this battle.
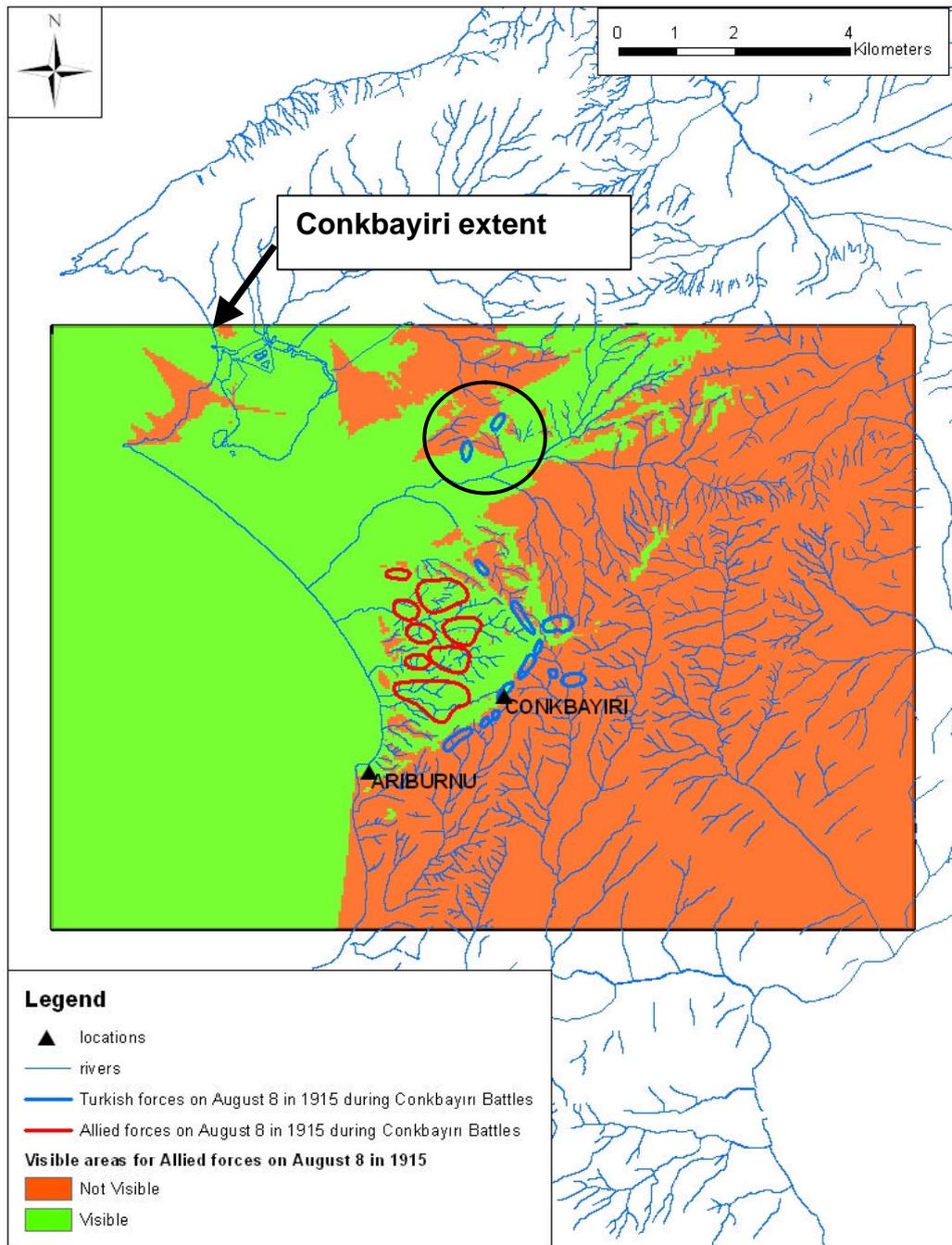
38

Figure 4.4. Visible areas for Allied Forces on August 8 during the
Conkbayiri Battles

Table 4.1. Visibility maps for battles according to date and time

Battle	Extent area (Sq km)	Layer	Visible area (%)	Visible area (sq km)
Ariburnu	318.7	a_2504_tr_m	58.7	187.1
		a_2504_tr_a	56.6	180.4
		a_2604_tr	58.4	186.1
		a_2704_tr	51.7	164.8
		a_2504_al_m	35.6	113.5
		a_2504_al_a	44.0	140.2
		a_2604_al	45.9	146.3
		a_2704_al	45.9	146.3
Second Kirte	193.3	k_0605_tr	56.2	108.6
		k_0705_tr	59.1	114.2
		k_0805_tr	26.3	50.8
		k_0605_al	21.8	42.1
		k_0705_al	17.2	33.2
		k_0805_al	17.3	33.4
Conkbayiri	158.2	c_0608_tr_e	61.2	96.8
		c_0708_tr_m	62.5	98.9
		c_0708_tr_e	66.5	105.2
		c_0808_tr_m	65.1	103.0
		c_0908_tr_e	69.1	109.3
		c_0608_al_e	46.3	73.2
		c_0708_al_m	47.3	74.8
		c_0708_al_e	46.8	74.0
		c_0808_al_m	47.3	74.8
		c_0908_al_e	53.0	83.8

- During Second Kirte Battles, visibility areas for both sides decreased by time. But, movement of Turkish forces affected visibility negatively and amount of visible areas decreased from 108.6 km^2 to 50.8 km^2. For this battle visibility seems to have exerted a minor effect since the loss in Allied forces is much higher than in Turkish forces during this battle. There should be some other factors causing these results.

- During Conkbayiri Battles, both sides could see larger areas as time passes. In this battle the casualties are very high on both sides, and the reasons may not be only the visibility.

When locations of troops are overlayed on visibility maps the situation is seen more clearly. Such a detailed overlay study is performed for Second Kirte Battles. As it is seen in Table 4.2, the locations chosen by the commanders of Allied forces are erroneous, because they can be seen by the Turkish side. This table may explain the good location of Turkish forces and bad for enemy side and also their high casualties. Except French 2nd Division on May 8, all Allied troops could be seen by Turkish troops during Second Kirte Battles.

In addition to troop locations, visibility analyses are also performed for observation posts and artilleries. As mentioned before, observation posts of both sides were derived from Sevki Pasa Maps with digitizing process. Both sides have observation posts located at different places, the ones which are in the extents of the studied battles are used. The list of visibility maps for observation posts of studied battles are given in Table 4.3. In the table, "Layer" column explains observation post information. For example, "k_op_tr" layer shows observation posts of Turkish troops during Second Kirte Battles.

Table 4.2. Allied troops which can be seen by enemy during Second Kirte
      Battles

Battle	Date	Allied troops which can be seen by Turkish Forces
Second Kirte	06.05.1915	Australia 88th Brigade
		New Zealand Brigade
		Indian Brigade
		French 1st Division
		French 2nd Division
	07.05.1915	Australia 88th Brigade
		New Zealand Brigade
		Indian Brigade
		French 1st Division
		French 2nd Division
	08.05.1915	Australia 88th Brigade
		New Zealand Brigade
		Indian Brigade
		French 1st Division

Table 4.3. Visibility maps for observation posts according to date and time

Battle	Extent area (Sq km)	Layer	Visible area (%)	Visible area (sq km)
Ariburnu	318.7	ar_op_tr	34.5	110.0
		ar_op_al	42.8	136.4
Second Kirte	193.3	k_op_tr	2.2	42.53
Conkbayiri	158.2	c_op_al	32.1	50.8

Figure 4.5 shows visible areas from the single observation post of Turkish Force during the Second Kirte Battles.

Another visibility map is prepared for artilleries during the Naval Battle. Figure 4.6 shows the visible areas for artilleries of Turkish force. Two examples of visibility analysis results are given in Appendix D.
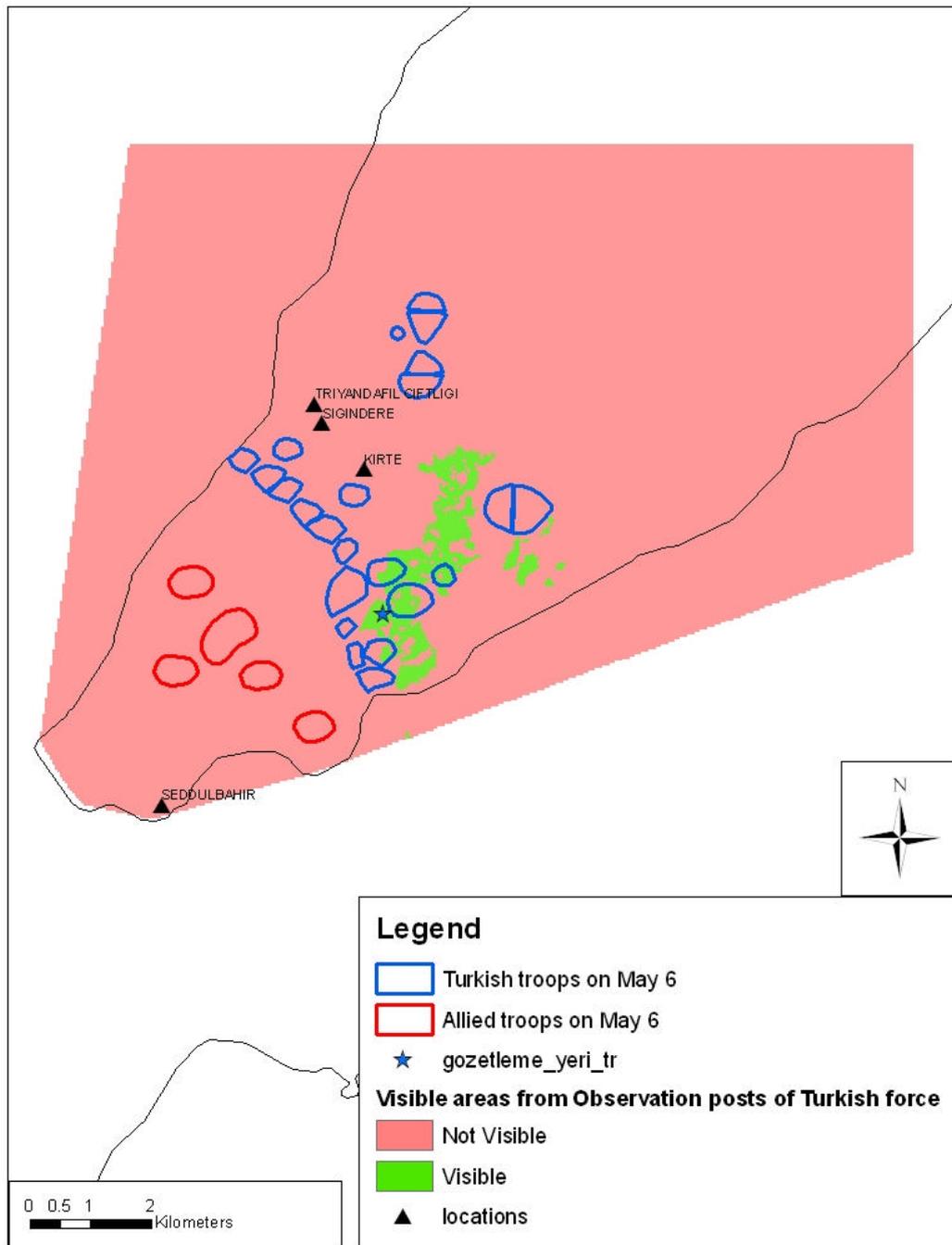
Figure 4.5. Visible areas from observation post of Turkish Force on during the Second Kirte Battles.
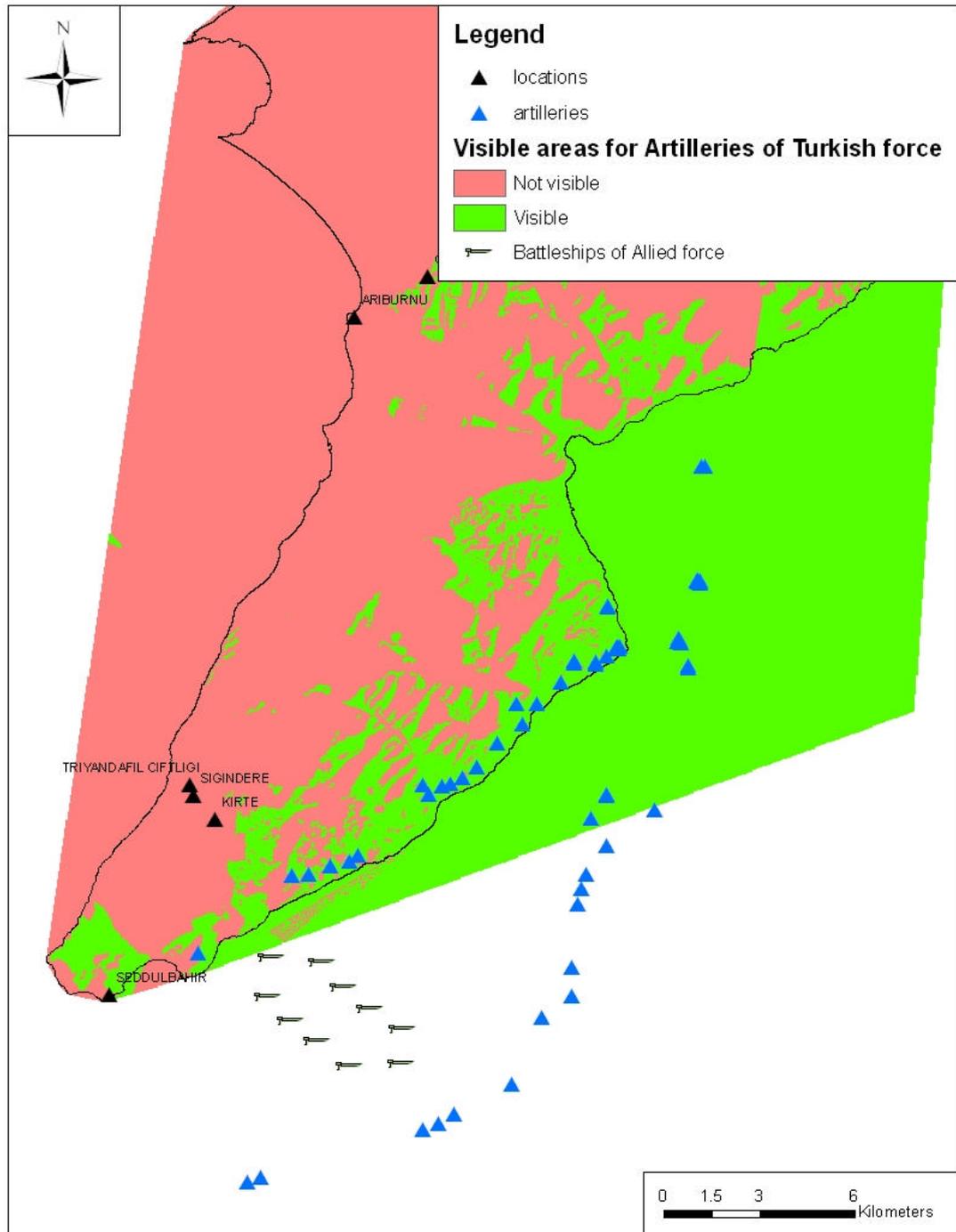
Figure 4.6. Visible areas from artilleries of Turkish Force on during the Naval Battles

4.2.2.2. Proximity analysis

This analysis was carried out for troops, natural sources, roads and other fortifications on the battlefield. During proximity analyses, buffer zones are determined as 500 m, 1000 m, 1500 m and 2000 m. These zones are determined according to walking distances or closeness to enemy troops to achieve meaningful results. During the processes, it is assumed that soldiers must be closer to water resources for their needs. In Figure 4.7, buffer zones of water reservoirs are shown as an example for one data layer, which was performed for Second Kirte Battles. Some of the examples of proximity analyses are given in Appendix E.

Results of proximity analysis were classified into two groups as; positive proximity and negative proximity. Closeness to natural resources is assumed to have positive effects, while proximity to enemy forces has negative effects. List of the layers with their effects are given in Table 4.4 considering Turkish troops. All of the maps derived with proximity analyses are converted to raster format to combine with derived maps from other analyses. These layers are then used in the following processes in combination with the results of slope analysis.

These positive and negative proximity effects are classified into five groups to perform overlay analyses. Positive effect areas are divided into five zones, the best zone having value "5", and the least positive zone having "1". A similar classification is made for negative effect areas, where "1" shows the closest area to the enemy sie.

Proximity analyses are also performed to find the area which lies in the artillery ranges. In Figure 4.8, buffer zones of artilleries according to ranges which are obtained from Turkish General Staff (1993) are shown.
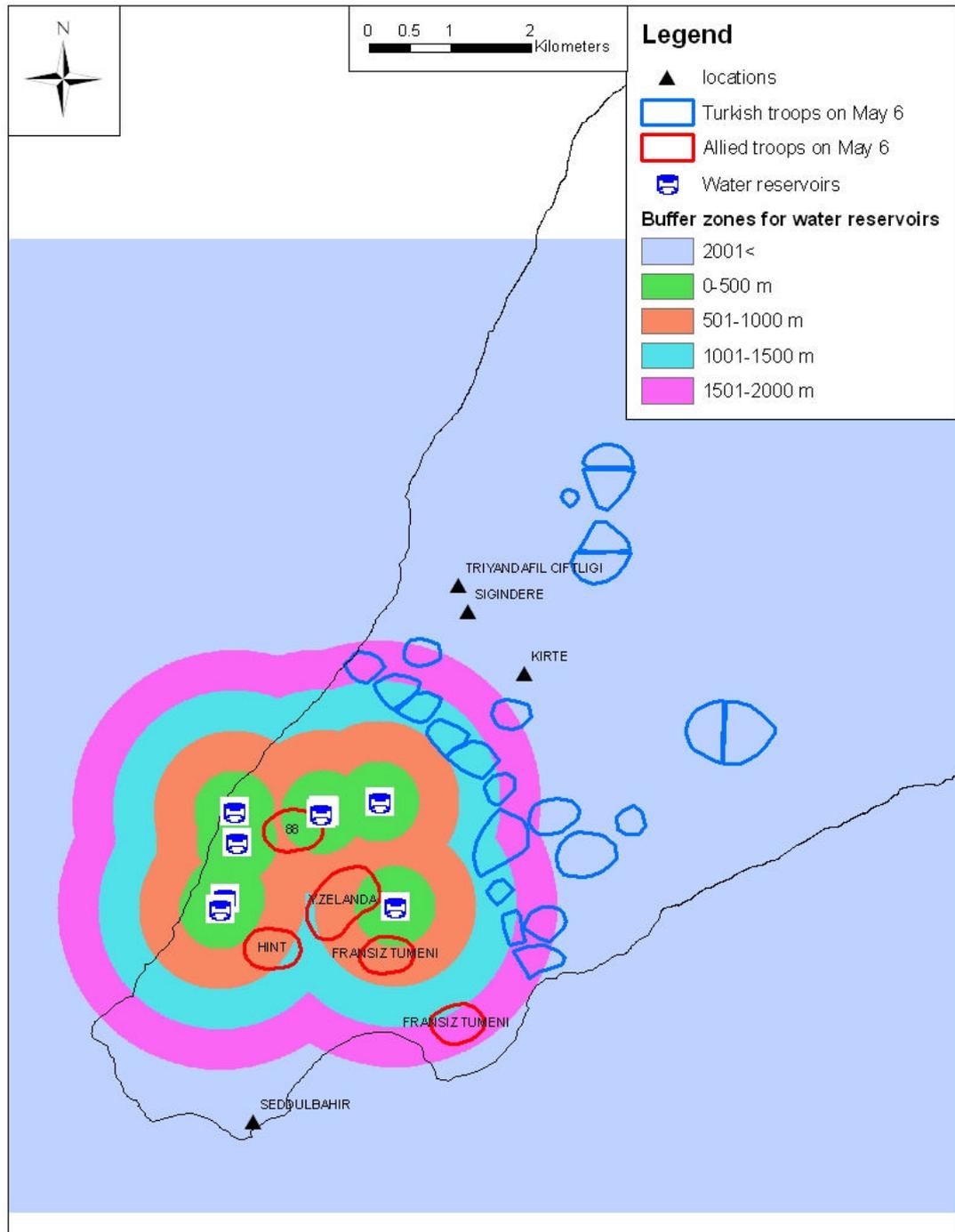
Figure 4.7. Buffer zones for water reservoirs for Kirte region

In this figure, ranges of artilleries are not realistic because all of the battleships of Allied force are in the ranges of artilleries of Turkish force. Therefore, smaller buffer zones which are enough to hit battleships of the enemy are determined during the Naval Battles (Figure 4.9). As seen in the

figure, 6000 meter range seems to be enough to hit the battleships of Allied forces.

Table 4.4. Proximity maps and effects for Turkish troops

Layers with positive effects	Layers with negative effects
Artilleries of Turkish force	Area of Tents of Allied force
Barbed wire of Turkish force	Artilleries of Allied force
Bridges	Barbed wire of Allied force
Covert roads of Turkish force	Covert roads of Allied force
Ditches	Fire line of Allied force
Fire line of Turkish force	Observation post of Allied force
Graveyards	Roads of Allied force
Important locations	Shelters of Allied force
Observation post of Turkish force	Single bunker of Allied force
Rails	Transportation roads of Allied force
Roads of Turkish force	Trenches of Allied force
Shelters of Turkish force	Water canal (Allied force)
Telegraph line	Water pump 1 (Allied force)
Transportation ditches with trenches	Water pump 2 (Allied force)
Transportation roads of Turkish force	Water reservoir 1 (Allied force)
Trenches of Turkish force	Water reservoir 2 (Allied force)
Vegetation (type 1)	
Vegetation (type 2)	
Vegetation (type 3)	
Vegetation (type 4)	
Well	

4.2.2.3. Slope analysis

Slope is very important for military operations, since they affect movements of troops. Steep slopes are not appropriate for military vehicles and soldiers on foot. In this study, slope map is derived from contours and elevation points for the Gallipoli Peninsula and is shown in Figure 4.10. As it is seen in the figure, slope is more important for Ariburnu region compared to the regions of other selected battles. There are lots of steep slopes in Ariburnu region.
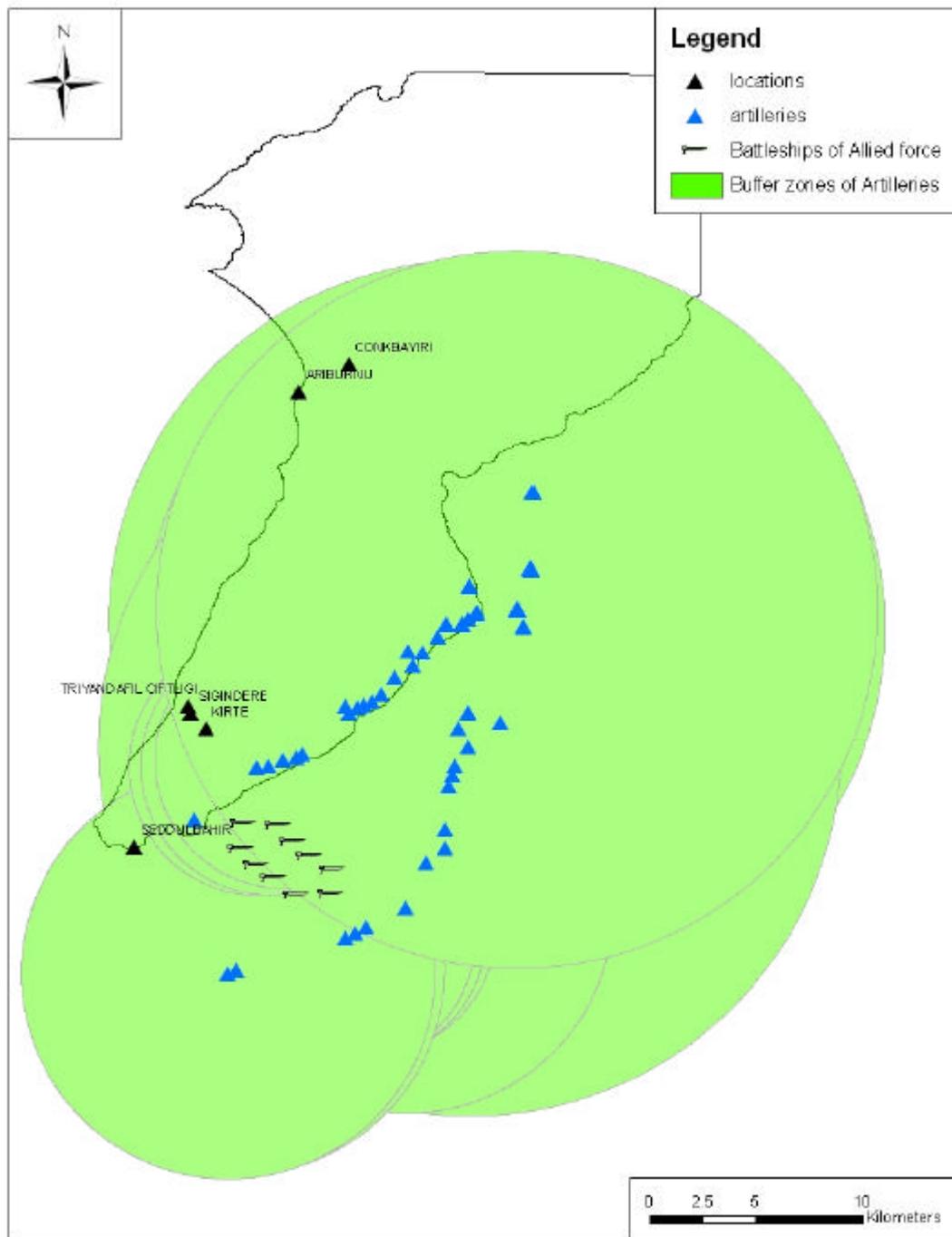
Figure 4.8. Buffer zones of artilleries of Turkish force during the Naval Battles
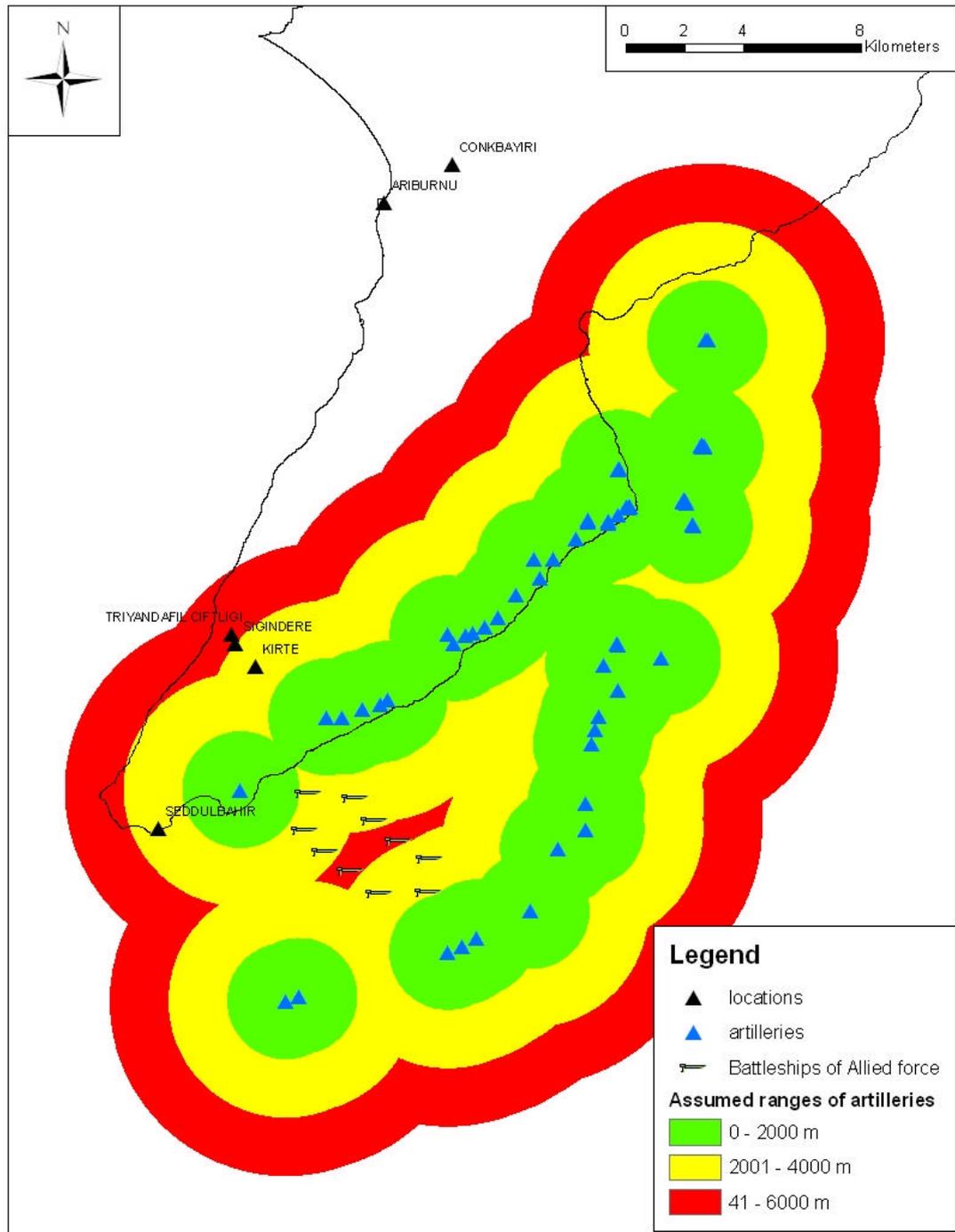
Figure 4.9. Assumed buffer zones of artilleries of Turkish force

Slope map is reclassified according to the percent slope values of the pixels. Figure 4.11 shows reclassified slope map for Kirte region. There are not very steep slopes in this region when compared with Ariburnu region. Region

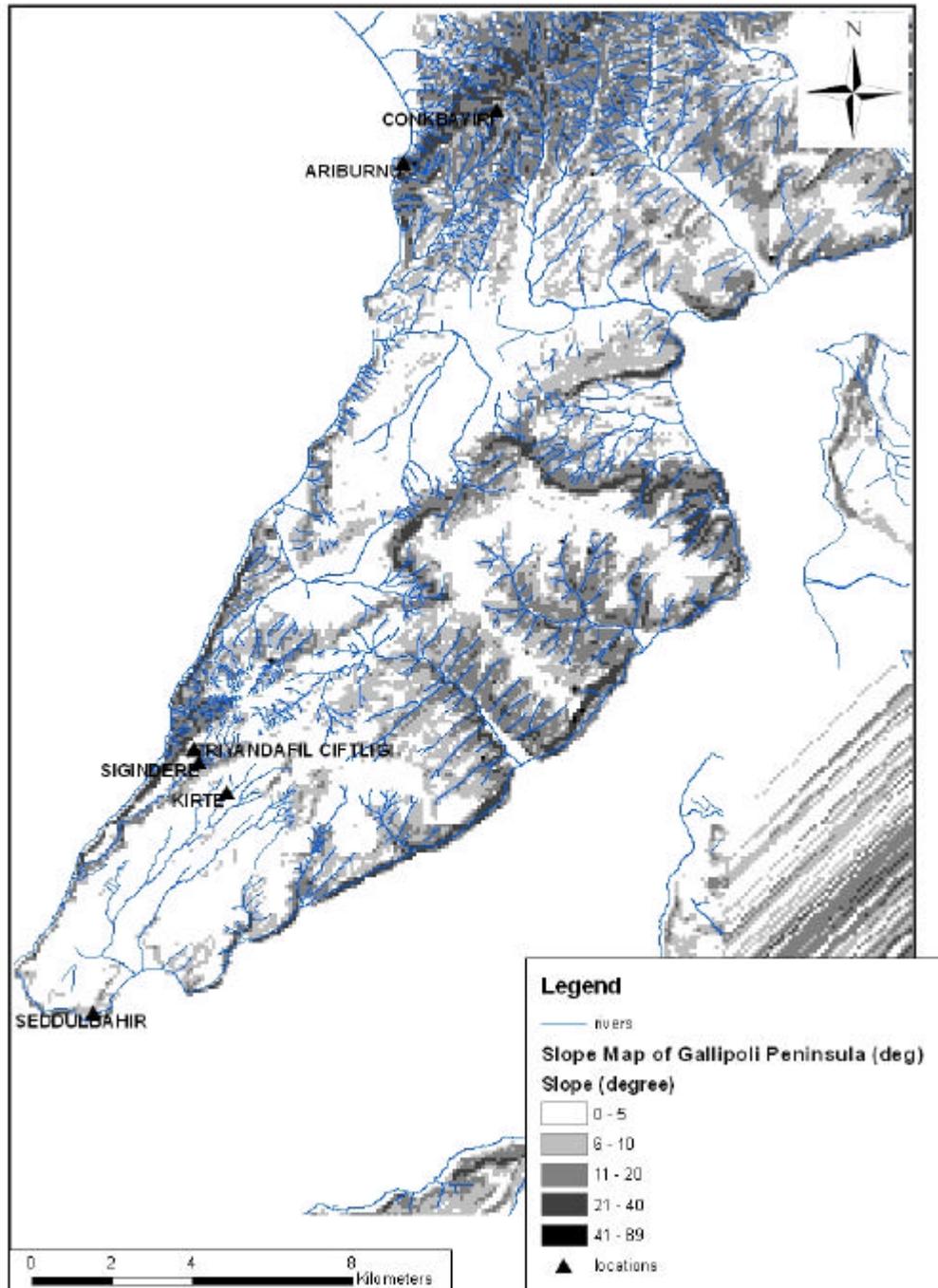value "0" which corresponds to areas with higher slopes (above 40%) shows unsuitable areas for military activities.

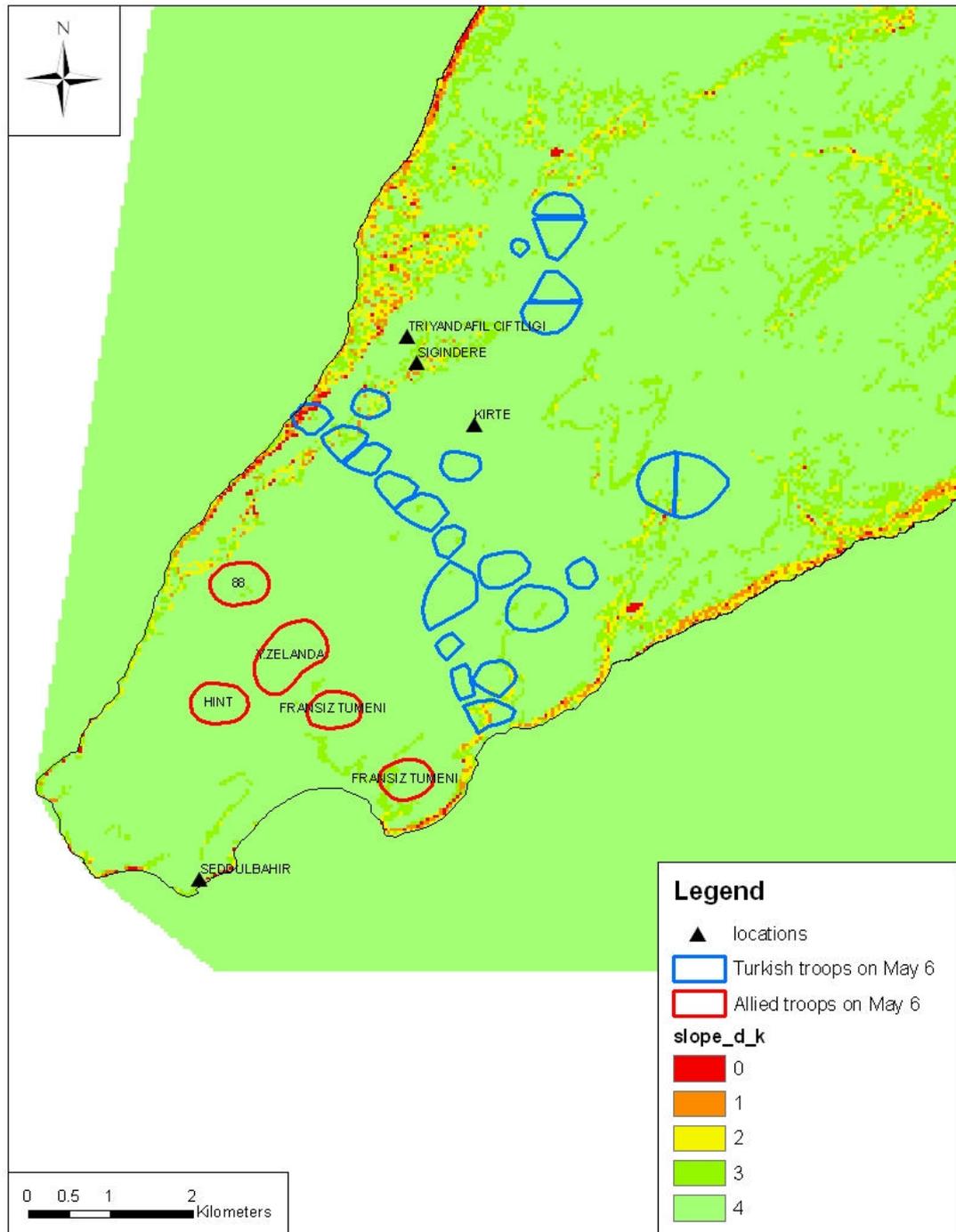

Figure 4.10. Slope map of the Gallipoli Peninsula

Figure 4.11. Reclassified slope map of Kirte region in Gallipoli Peninsula

4.2.2.4. Combining derived maps

Proximity maps for objects in the area (water resources, trenches etc.), slope map, proximity of troops and visibility maps are combined using overlay analyses in raster format in GIS software. Figure 4.12 shows the combination of all layers which have positive effects (water resources, vegetation etc.) in Kirte region for Turkish forces. If the weight increases it shows that the location becomes more suitable for the troops. The areas shown dark blue is the most suitable areas according to proximity analyses for Turkish troops. As it is seen in the figure, 21st Regiment, 1st Battalion of 127th Regiment, 1st Battalion of 32nd Regiment, 45th Regiment, 19th Regiment and 1st and 3rd Battalion of 56th Regiment are the Turkish troops which were in the best locations.

Similarly, negatively affecting factors are combined for each selected battle. In Figure 4.13, total negative effects of prepared layers for Kirte region is shown for Turkish troops. In this figure, high values show unsuitable sites for Turkish troops. As seen in the figure, Bursa Gendarmerie Battalion is in the worst location according to negative effects.

Combination of positive and negative effects for Kirte region is given in Figure 4.14. As seen in the figure, location of Turkish troops is usually in suitable areas. These maps are derived from subtraction of negative effects from positive effects.

Slope map is reclassified into two groups instead of five, to eliminate very steep areas. It is assumed that values of unsuitable areas are "0" for further GIS operations since slope map is multiplied with other raster layers. Therefore, all areas with steep slopes (above 40%) are eliminated. Figure 4.15 shows reclassified slope map for Kirte region. It is seen that some of the troops are located on unsuitable sites.

Figure 4.12. Total positive effects of prepared layers for Kirte region.

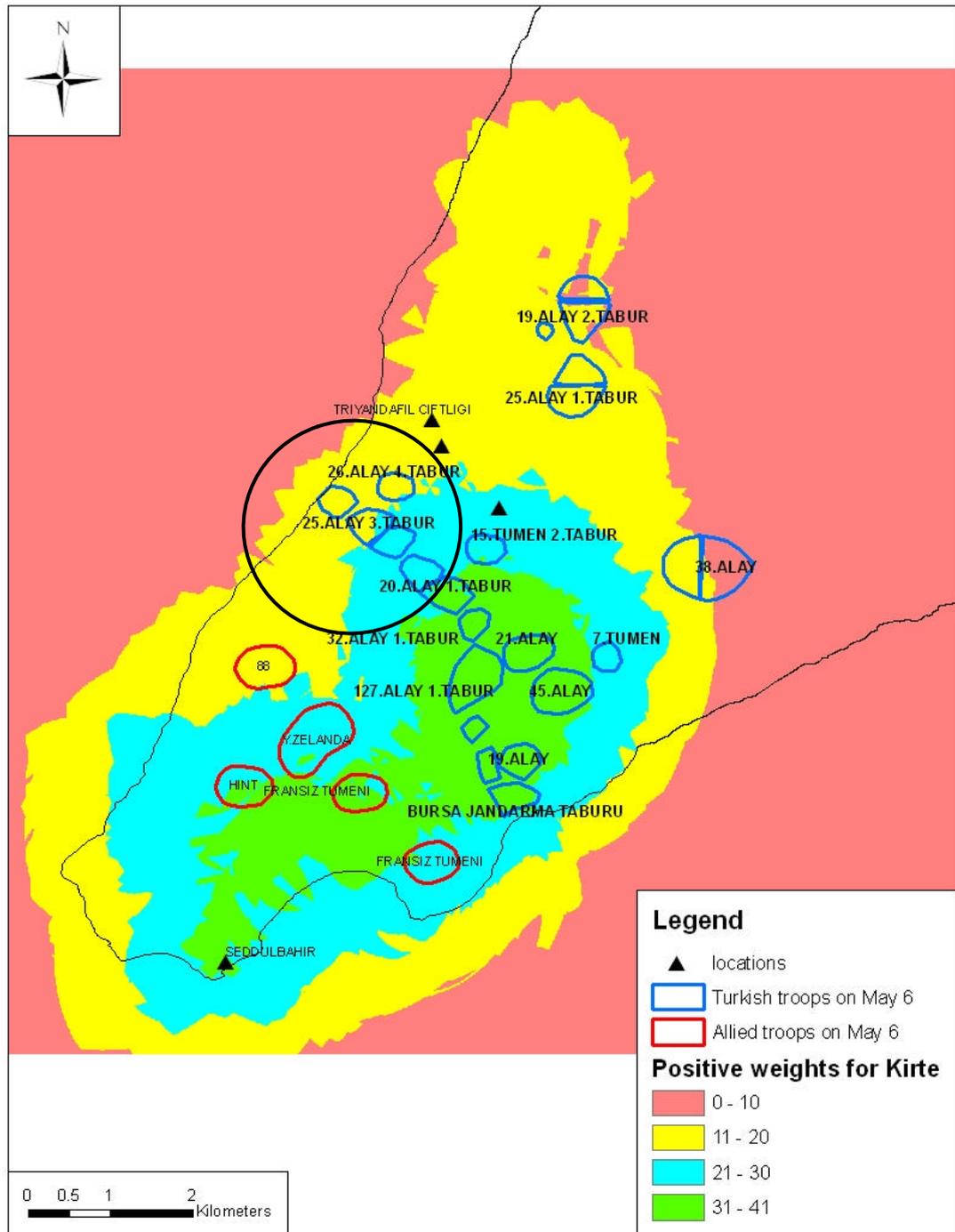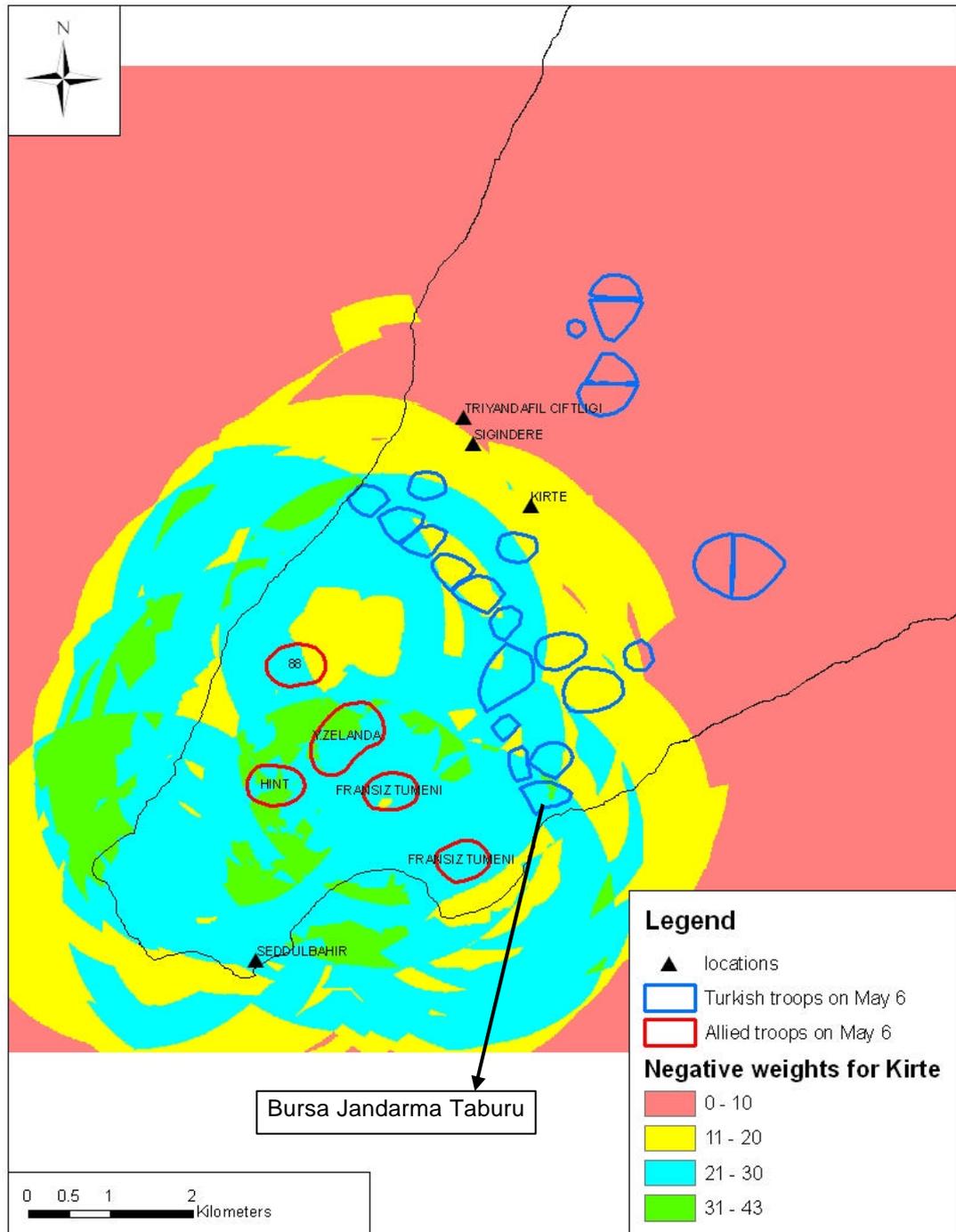Figure 4.13. Total negative effects of prepared layers for Kirte region
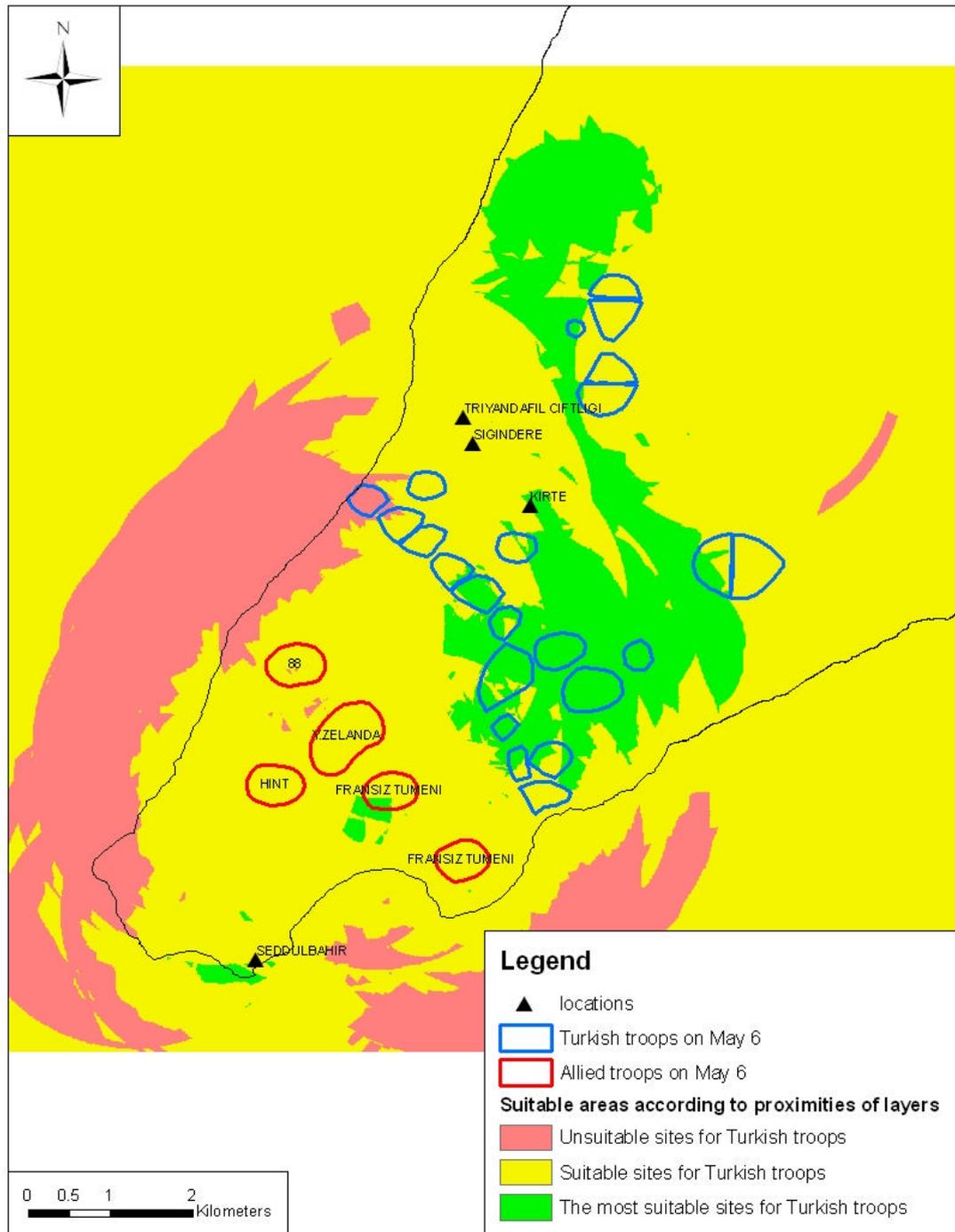
Figure 4.14. Total effects of prepared la yers for Kirte region
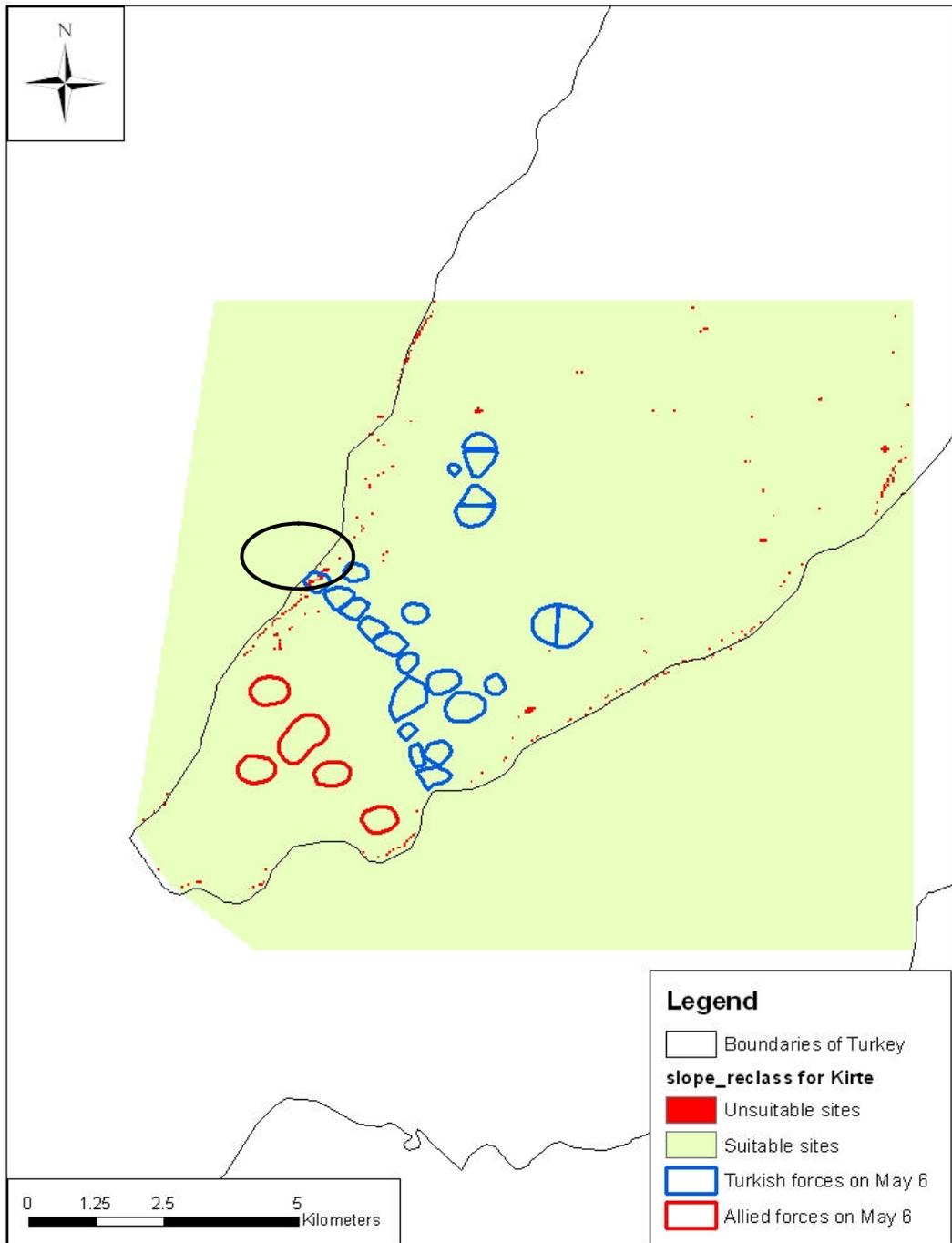
Figure 4.15. Reclassified slope map for Kirte region

After the processes explained before, three models are prepared to determine the most suitable locations for both sides. The models are using the positive and negative effects of the layers in different ways. Their detail

are given Appendix F. Figure 4.16 shows the first model for Turkish troops on May 6 during the Second Kirte Battles. In the figure, Turkish troops are seen to be located in suitable areas. Therefore, according to model 1, site selection for Turkish troops is correct.
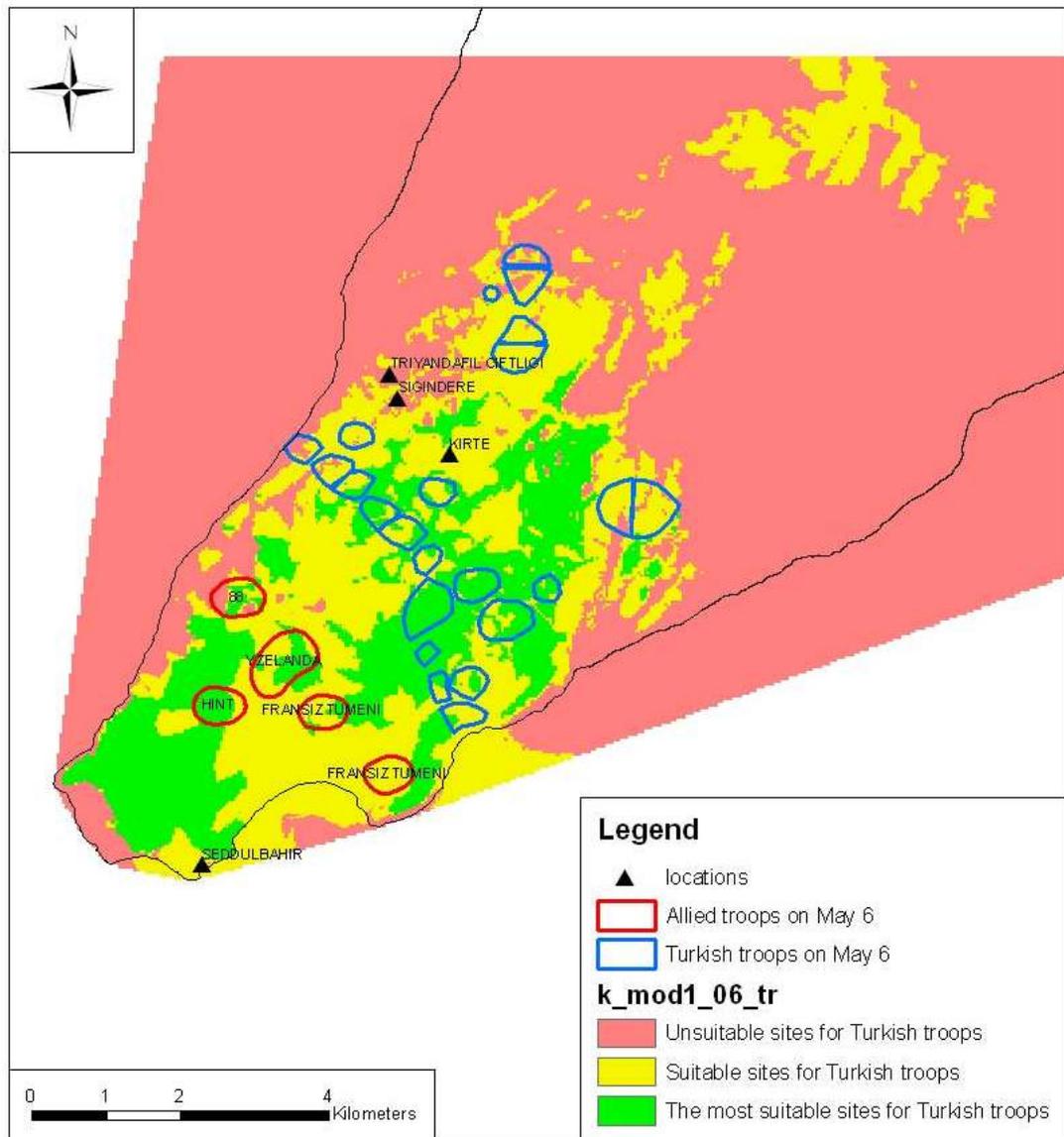
Figure 4.16. First model for Turkish troops on May 6 for Kirte region

Another model is shown in Figure 4.17. Locations of Turkish troops are also appropriate according to this figure.
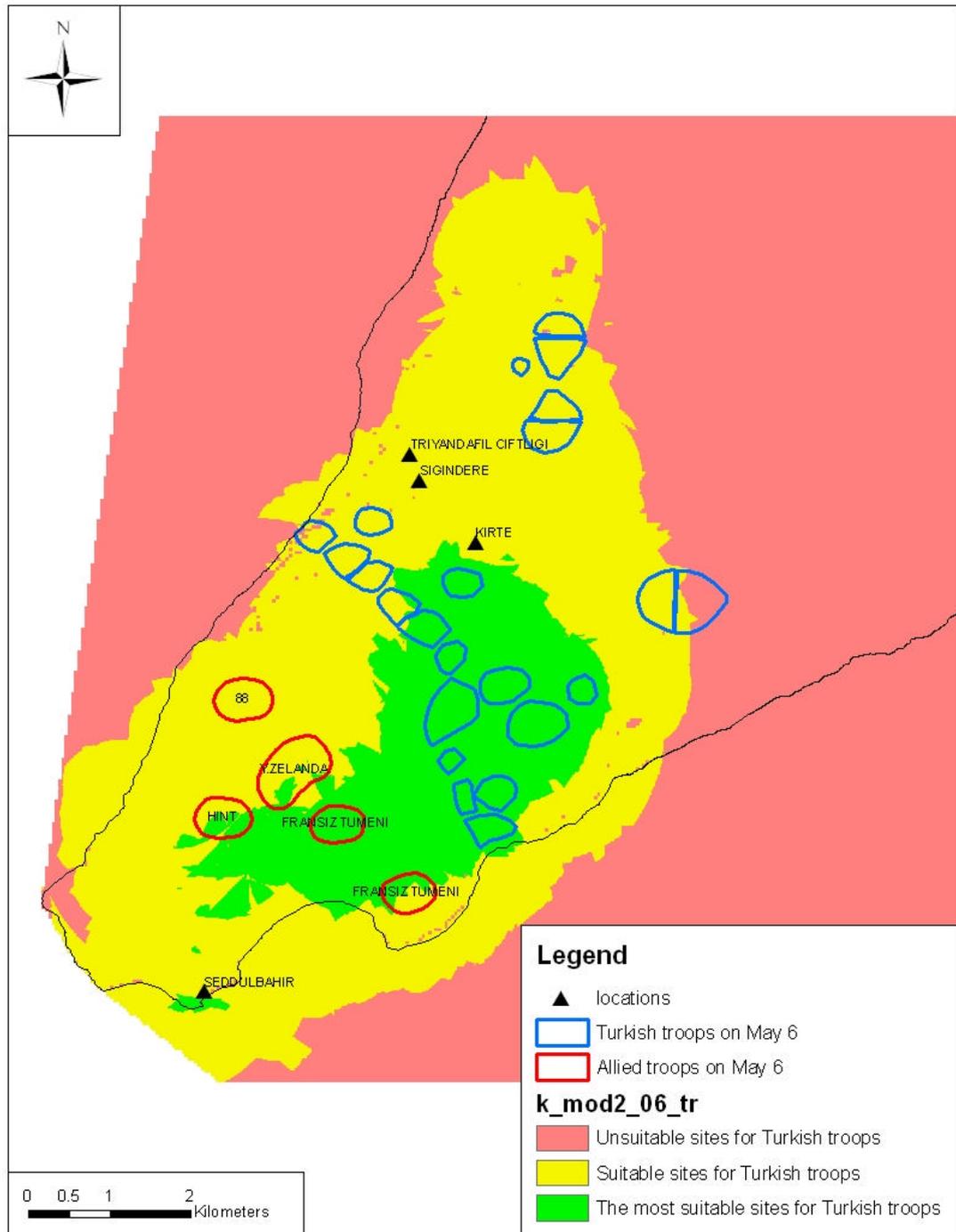
Figure 4.17. Second model for Turkish troops on May 6 for Kirte region

The third model is shown in Figure 4.18. Similarly, nearly all of Turkish troops are in suitable areas. Resulting map of the third model can be used as a

mobility map, because effects, which are used in this model, are general effects independent from locations of troops. Similar analyses are also performed for Allied forces. Some examples of results for Turkish or Allied forces with different models on different days are shown in Appendix F.
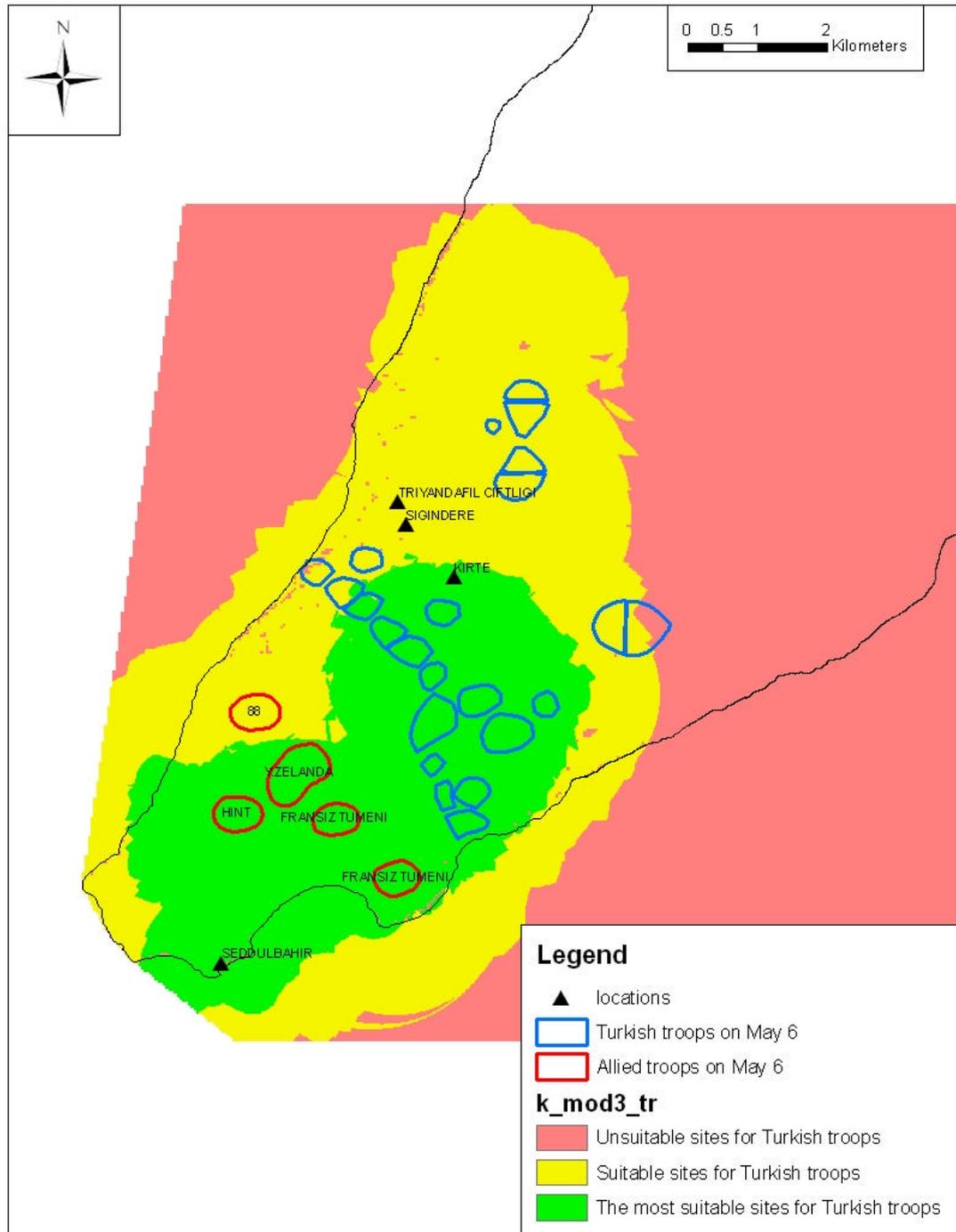
Figure 4.18. Third model for Turkish troops on May 6 for Kirte region

4.2.3. Combination of Spatial and Non-Spatial Analysis

Attribute and graphical data are analyzed together in this group of analyses. In this study, different combined analyses are performed. Determining visible areas for observation posts is a spatial analysis. Then, querying troops which can be seen by enemy forces is an example for non-spatial analyses, and these two types are combined to come to the conclusions. Analyzing martyr data and related graphical data (location of their death or places they came from) is also a combination analysis.

4.2.3.1. Processes of martyr Data

Martyr data are used for preparing different thematic maps and pie charts. For this purpose, the processes followed are shown in Figure 4.19. As it is shown in the figure, a martyr database is prepared first using the corrected and standardized martyr data. Then, an interface is prepared to make it easier to reach martyr information. Furthermore, distributions of martyrs are determined according to different criteria such as age, province and district they come from and recruiting office. To be able to do this, provinces and districts of Turkey, and locations on Gallipoli Peninsula are linked with martyr database.

4.2.3.1.1. Determining Distribution of martyrs

Distribution of martyrs who came from different cities of the Republic of Turkey is shown in Figure 4.20 According to the figure; Bursa is the city which has the highest number of Gallipoli martyrs.

The same information is given in pie chart form with actual numbers for the cities, which have more than 1000 martyrs, in Figure 4.21. As seen in the

figure, the first five cities with highest number of Gallipoli martyrs are Bursa, Balikesir, Konya, Kastamonu and Denizli.
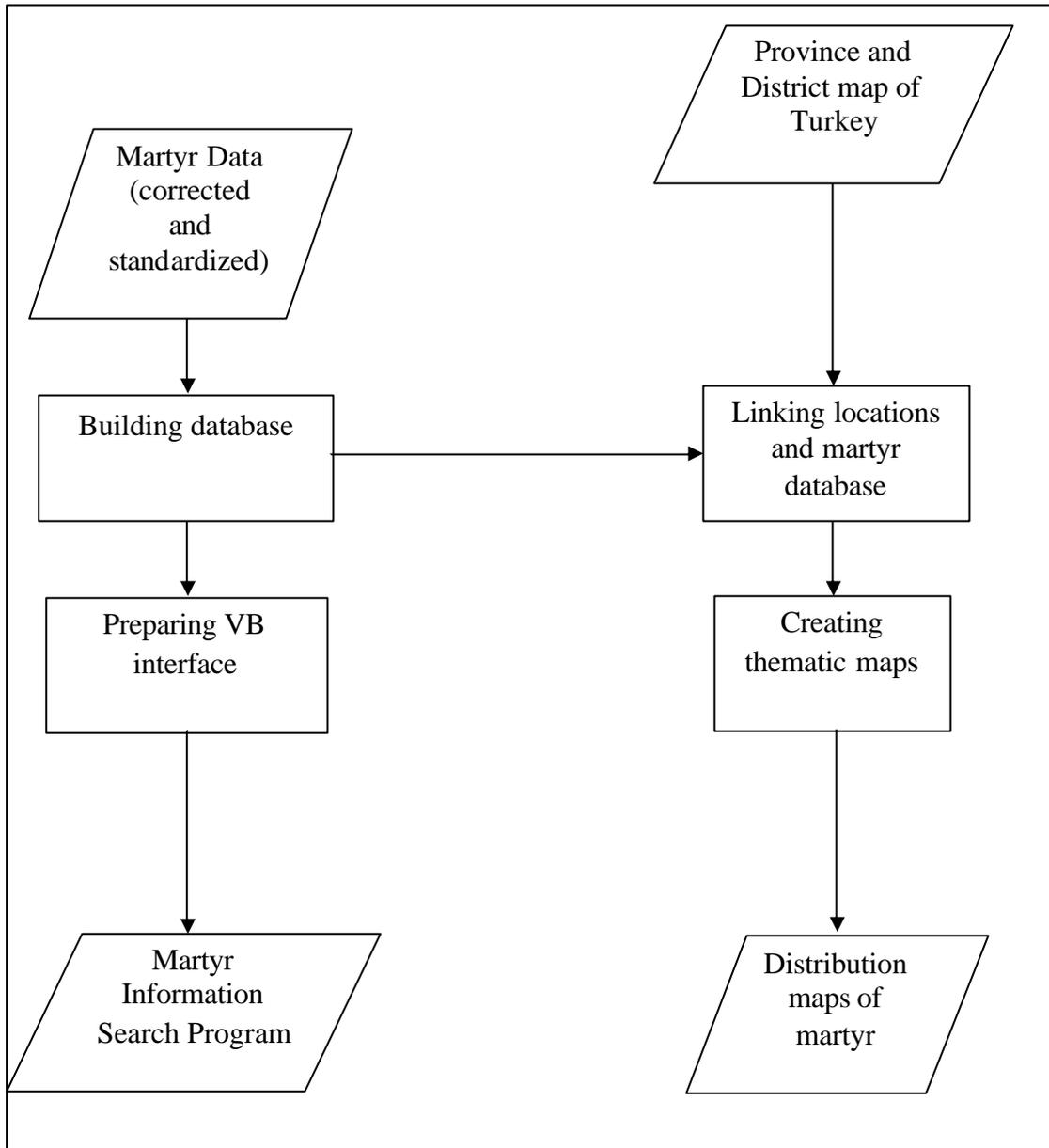
Figure 4.19. Processes of martyr data

Martyr information can be given with districts where the soldier came from, since the information is also available in the database. Therefore, distribution of martyrs with respect to districts is also determined (Figure 4.22). According to the figure, the highest number of soldiers martyred in the Gallipoli

Campaign came from Biga district of Çanakkale, although as total number in the city, Çanakkale comes as 8th city.
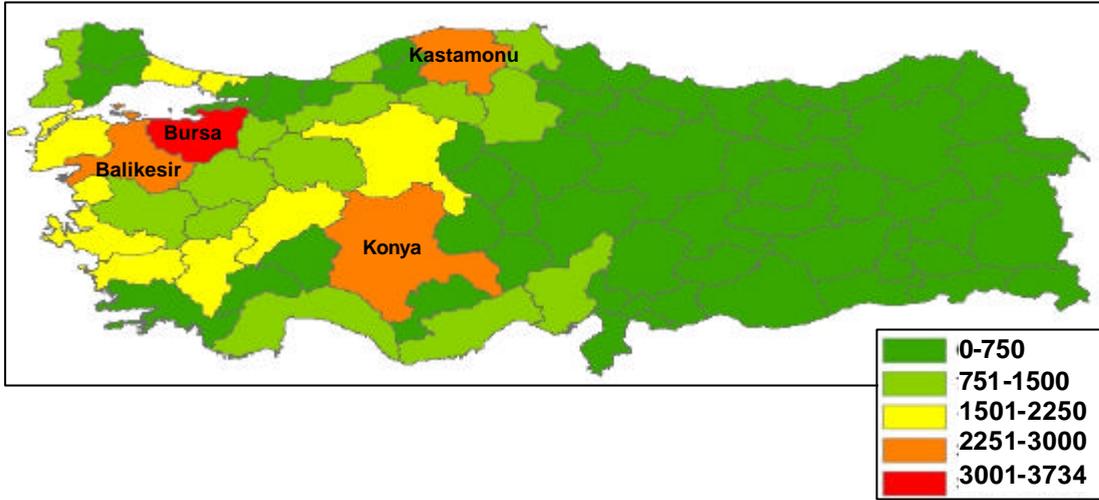
Figure 4.20. Distribution of Gallipoli martyrs according to cities they came from in Turkey
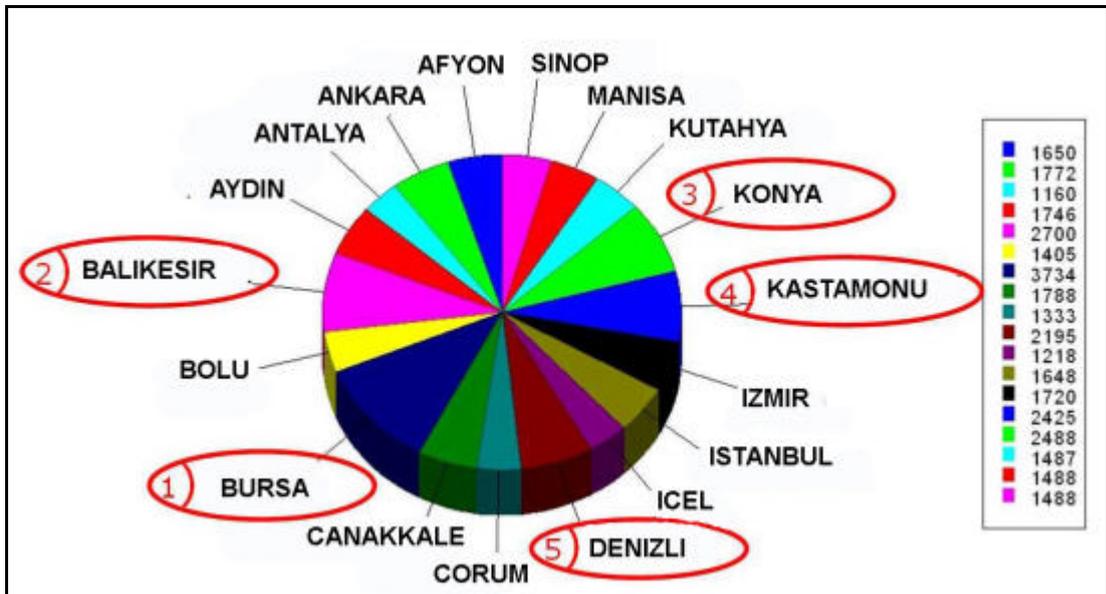
Figure 4.21. Distribution of Gallipoli martyrs according to provinces (above 1000 martyrs)
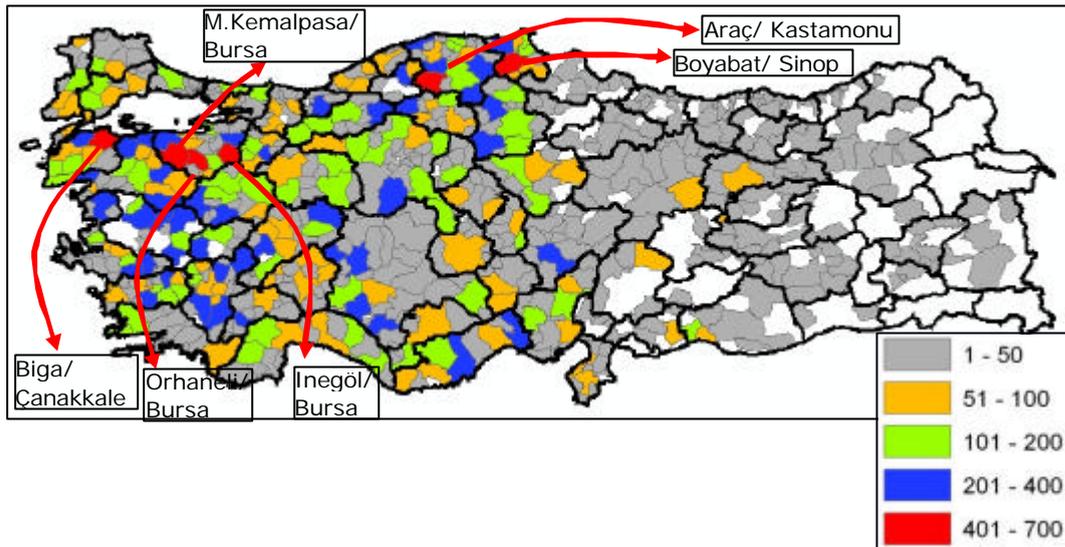
Figure 4.22. Distribution of number of martyrs for districts on Turkey

The distribution of Gallipoli martyrs according to the location of death is shown in Figure 4.23. As it is seen in the chart, the highest number of soldiers lost their lives in Seddülbahir according to Ministry of Defense records. Unfortunately the locations, where some of the soldiers were martyred are not known. So, they could not be included in the thematic maps.
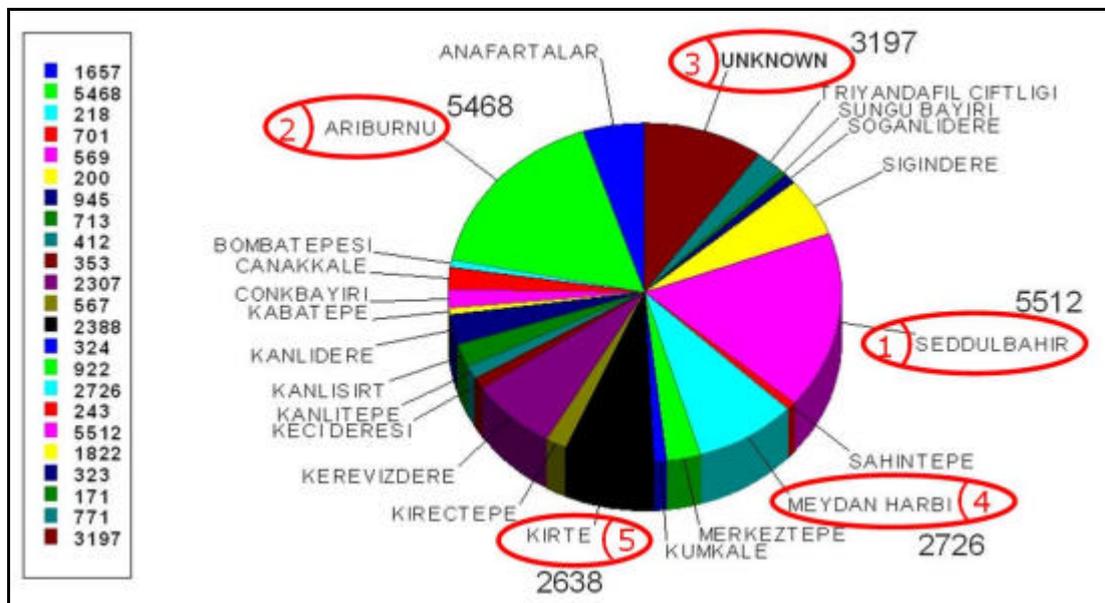
Figure 4.23. Distribution of Gallipoli martyrs according to locations of death

Another pie chart shows distribution of Gallipoli martyrs according to the age of soldiers as given in Figure 4.24. The soldiers in the age group of 23 to 29 make up the largest losses, among them there are 3190 soldiers of 28 years of age with highest number of death.
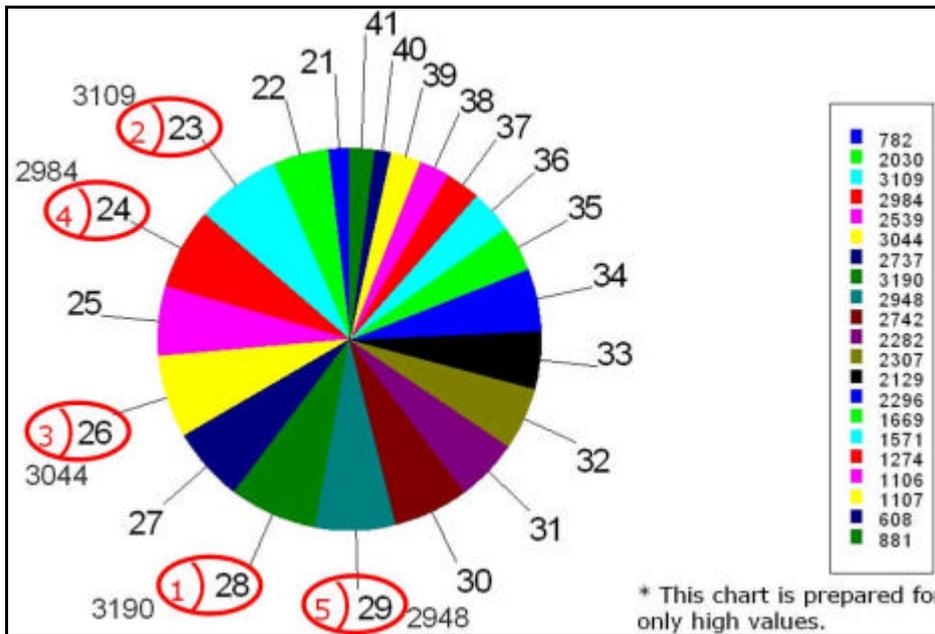
Figure 4.24. Distribution of Gallipoli martyr according to age of soldiers

As it is also seen in the chart there are martyrs almost at all ages including very young and also old ones who could be accepted above fighting age.

As shown in Figure 4.25, ages of Gallipoli martyrs change between 12 and 55. This distribution is prepared by using records of the Ministry of Defense.

As it is understood from the memoirs of the ANZAC soldiers, there were also women fighting in Turkish side (Tuncoku, 2005 and Saglam, 2003). But information about them is not in the book of Ministry of Defense among official soldiers.

Age distribution of Martyrs ordered by number		
OID	Age	Number
54	28	3190
49	23	3109
52	26	3044
50	24	2984
55	29	2948
56	30	2742
53	27	2737
51	25	2539
58	32	2307
60	34	2296
57	31	2282
59	33	2129
48	22	2030
61	35	1669
62	36	1571
63	37	1274
65	39	1107
64	38	1106
67	41	881
47	21	782
66	40	608
68	42	178
40	19	156
46	20	142
69	43	103
32	Age not known	97
71	45	58
70	44	57
39	18	47
72	46	44
38	17	9
35	14	8
73	47	5
74	48	4
34	13	3
36	15	3
37	16	3
75	49	2
78	55	2
33	12	1
76	51	1
77	53	1

Age distribution of Martyrs ordered by age		
OID	Age	Number
78	55	2
77	53	1
76	51	1
75	49	2
74	48	4
73	47	5
72	46	44
71	45	58
70	44	57
69	43	103
68	42	178
67	41	881
66	40	608
65	39	1107
64	38	1106
63	37	1274
62	36	1571
61	35	1669
60	34	2296
59	33	2129
58	32	2307
57	31	2282
56	30	2742
55	29	2948
54	28	3190
53	27	2737
52	26	3044
51	25	2539
50	24	2984
49	23	3109
48	22	2030
47	21	782
46	20	142
40	19	156
39	18	47
38	17	9
37	16	3
36	15	3
35	14	8
34	13	3
33	12	1
32	Age not known	97

Figure 4.25. Ages of Gallipoli martyrs

4.2.3.1.2. Building interface

In this study, an interface is prepared for reaching martyr information easily using the available data. If province, district, nickname or father name of a Gallipoli martyr, are entered to the system all the other information related to the martyr can be obtained. The province where selected martyr came from could also be seen in a map using this interface since graphical data are linked with the database. Both Turkish and English versions are prepared for the interface by using Visual Basic programming language.

With the prepared interface a search menu can be used for finding unknown information about a martyr. However, after an inquiry more than one record may be selected as a result as seen in Figure 4.26. Because, there are many martyrs for whom some of the information are the same. In this situation, more specific information is needed for the specific martyr. Otherwise, selected martyrs can be searched one by one to find the desired one. Figure 4.26 shows main menus of the interface and also the martyr information table.

Figure 4.26. Main preview of interface

There are three parts in the preview window of interface. In the first part (Figure 4.27), martyr data can be searched manually.
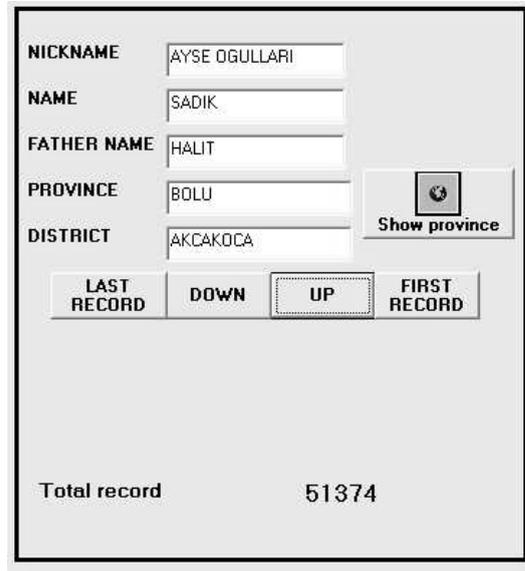
Figure 4.27. The first part of interface

In the second part of the interface, there is a search menu as seen in Figure 4.28, where the search criteria are shown. After the search process, number of records found is given in a box as shown in this figure under the title "Number of Found Records".
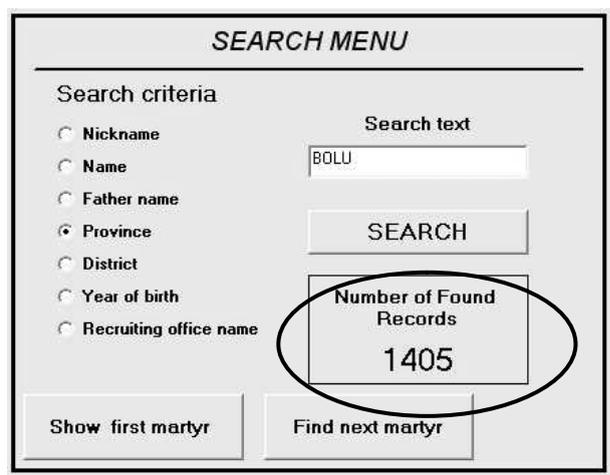
Figure 4.28. Search menu of interface

In the third part of preview window of the interface, the result of the inquiry is given as a table (Figure 4.29).

The martyr who is found by using search menu can be seen in the first part. "Show province" button makes it possible to see the province where a selected martyr came from on today's Turkey map. An example is given in Figure 4.30.

It is also possible with this interface to obtain printed outputs of selected martyr information by using print menu as shown in Figure 4.31.

This interface makes it easier to search, display and print information of Gallipoli martyrs.

INFORMATION ABOUT MARTYRS

SEHIT_ID	IL	NO	KL	U	JU	KA	AY	IR	JK	LAKAP	BABA_ADI	ADI	SINIF	RUTBE	J_MILCE	BUCAK	KOY	GN	AY	YIL	OLUM_YERI
9010001	ADANA	1K	0	6	0	47	2	6			ABDI	ABDI		DNBASI	1890			28	5	1915	KANLISIRT
9010002	ADANA	1K	0	6	0	48	1	3			GULSEN	ABDULAZIZ		ER	1889			5	3	1915	MEYDAN HARBI
9010008	ADANA	1K	0	6	0	48	3	10			MEHMET	ABDULLAH	PIYADE	ER	1889			23	5	1915	KARAYORUK DERESI
9010010	ADANA	1K	0	6	0	125	2	7			SULEYMAN	ABDULLAH	PIYADE	ER	1883			11	9	1915	MEKTEB-I HARBIYE HASTAHANESI
9010011	ADANA	1K	0	0	0	125	3	1			MEHMET	ABIDYAN			1884			13	8	1915	RAMI GAZILER HASTAHANESI
9010014	ADANA	1K	0	0	0	0	0	11			ALI	AHMET		ER	1886			25	6	1915	ARIBURNU
9010015	ADANA	1K	0	6	0	47	1	1			HACI SELIM	AHMET		ER	1883			10	11	1915	TOPCU MEKTEBI HASTAHANESI
9010016	ADANA	1K	0	0	0	21	2	3		KADI OGULLARI	HASAN	AHMET	MUHTELIF	ER	1891			7	4	1915	MEKTEB-I HARBIYE MECRUHIN HASTAHANESI
9010017	ADANA	1K	0	6	0	125	1	0			HASAN	AHMET	PIYADE		1876			5	5	1915	KIRMIZI SIRT
9010022	ADANA	1K	0	6	0	72	3	10		YANO	MEHMET	AHMET		ER	1879			16	2	1915	ARIBURNU
9010026	ADANA	1K	0	6	0	48	2	5			MUSA	AHMET		ER	1888			29	5	1915	AKBAS HASTAHANESI
9010029	ADANA	1K	0	6	0	125	3	19			YUSUF	AHMET	IHTIYAT	ER	1884			13	3	1915	HILAL-I AHMER KADIRGA HASTAHANESI
9010030	ADANA	1K	0	0	0	125	3	11			YUSUF	AHMET		ER	1891			19	3	1914	ARIBURNU
9010032	ADANA	1K	0	0	0	125	2	8			IBRAHIM	AHMET RASIM		BASCAVUS	1888			1	4	1915	
9010033	ADANA	1K	0	6	0	48	1	0			HASAN	AHMET TURAN		ER	1891			24	5	1915	MEYDAN HARBI
9010034	ADANA	1K	0	0	0	12	1	1			ABDI	ALI	PIYADE	ER	0			7	5	1915	CENUP GRUBU SEVK MECRUHIN HASTAHANESI
9010035	ADANA	1K	0	6	0	125	2	3			ABDULLAH	ALI		ER	1887			7	8	1915	MEKTEB-I HARBIYE HASTAHANESI
9010037	ADANA	1K	0	16	0	0	0	0			AYNALI HALIL	ALI			0			18	5	1915	
9010041	ADANA	1K	0	6	0	48	1	0			HASAN	ALI		ER	1884			22	5	1915	MEYDAN HARBI

Figure 4.29. The third part of interface

Figure 4.30. Preview of map screen

Figure 4.31. Print menu of interface

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Throughout this study various analyses were carried out within the framework of the topic. Aims of the study were to develop a Geographic Information System for the Gallipoli Campaign, to show capabilities of GIS to analyze battles, set an example for similar applications, and to build a Martyr Information System.

In this study, selected battles of Gallipoli Campaign are analyzed using GIS techniques, to show what can be done using these techniques. Also, the basis is prepared for further studies on the Gallipoli Campaign.

According to the results of visibility analysis which are explained in Chapter 4, visibility does not have much effect on some battles. Amount of visible areas in Ariburnu Battle for Turkish force decreased by time. On the other hand, Allied troops could see larger areas with time. It can be said that only visibility can not explain the results of Ariburnu Battle when compared with casualties in this battle.

For Second Kirte Battle, changes in the amount of visible areas for both sides and their casualties seem to be not related with each other. Similarly, visibility situation alone does not explain the large number of soldiers losing their lives for both sides in Conkbayiri Battles. Other factors must be used for determining the closest model to real situation.

According to proximity maps, locations of troops were far from each other during Second Kirte Battles. It can be said that, proximities of troops have less effect in Second Kirte Battles. During Ariburnu Battles, distances between troops of both sides are about 150 m. Therefore, proximities of troops were important in those battles. Closeness of troops in Conkbayiri Battles was also effective because minimum distance between troops of both sides was about 50 m. Proximities for natural sources, roads and other fortifications on the battlefield also affected results of models. It can be said that these proximities are more important for Second Kirte Battles.

The martyrs, who came from today's Turkish boundaries, were about 50.000. Their information in tables are linked with the cities where they came from and location of their deaths on the maps. Therefore, martyr information and their location information can be queried simultaneously.

Distributions of Gallipoli martyrs according to the information in database are determined, such as the cities or provinces they came from, where they lost their lives or their ages.

Martyr distribution on province map of Turkey shows that the provinces in western part of Turkey have higher number of martyrs than the eastern part. Therefore, it is possible to claim that western part of Turkey had a more important role on Gallipoli Campaign than the other parts. The same results can be derived when thematic map of the distribution of martyrs for districts are studied.

Seddülbahir is the location where the highest number of Turkish soldiers was martyred. The following important locations are Ariburnu and Kirte. Unfortunately, for a large number of soldiers the locations where they lost their lives are not known, and they could not be included in the study.

The distribution of martyrs according to age shows that the oldest age for the martyrs was 55 and the youngest age was 12. These ages are outside the interval which is accepted for military service today. In addition, soldiers who were between 23 and 29 years old constitute the largest group among martyrs. These ages are the most productive and efficient years of people, especially the educated ones. Most probably, effects of these casualties were seen on the first years of the Republic of Turkey.

A Martyr Information System is built for the Gallipoli martyrs. This system makes it possible to reach martyr information easily with a user-friendly interface instead of searching records in book pages.

This study is the first one in Turkey to analyze battles which occurred in the past using Geographic Information Systems. This way, Gallipoli Campaign was studied with a different approach apart from that utilized by researchers who studied in social sciences. This work can be extended with additional data and studies.

5.1. Recommendations

In this study, much time was spent for obtaining information from different locations and different people in Turkey. But, it was not possible to reach all of the sources. More detailed studies can be made if more sources, not only in Turkey but also world wide were found and used about Gallipoli Campaign.

During the study, Military History and Strategic Studies Center (ATASE) archive in Ankara and Naval Museum Archive in Istanbul were visited. Permissions were obtained to use ATASE archive, but according to rules of ATASE, two researchers were not allowed to study on the same source together in the archive at the same time and sources could not be photocopied. A large portion of their sources were written in old Ottoman

script. So, it is necessary to know how to read Ottoman script to be able to use the sources there. Therefore, sources in this archive were not used as efficiently as it was expected. In addition to this, approximately 45 days were spent for permission process.

Naval Museum Archive has a similar process in the usage of the archive. According to Map Catalogue of this archive, there are a lot of 1/25.000 scaled maps, but they could not be used due to the time limitations for the completion of the project. For further studies, all of these sources, especially graphical data must be used effectively.

This study requires information from different research areas such as history, strategy, sociology, etc. Similar studies can be made in a better way with the help of various experts, such as military strategist, sociologist, historian and archaeologist.

Prepared interface of this study to find martyr information can be developed further by a computer programmer in a more professional format, and then it can be used more effectively.

Martyr Information System can be enlarged by adding all the records of martyrs of different wars, mainly the Turkish Independence War. It would also be more useful if the martyr information system is put on internet.

Different thematic maps according to age distribution, death location etc. were produced for only Turkey. If these maps can be produced for whole Ottoman Empire boundaries, information about the martyrs coming from outside of Turkey's boundaries can also be seen.

If educational status of soldiers can be obtained, effects of casualties in Gallipoli Campaign on development of Turkey can be determined more

accurately, and this information can be useful for people dealing with social sciences.

Surface analysis can be made more accurately by using 1 meter interval contours of Sevki Pasa Maps, then, slope, visibility and other surface analyses can be more meaningful. Distance between trenches of Turkish and Allied forces sometimes decreased up to a few meters. In these situations, more accurate maps and graphic data are necessary to reach the best model which explains the real situation in 1915.

REFERENCES

Aker, S., (1935), Çanakkale Ariburnu Savaslari ve 27. Alay, Istanbul Askeri Matbaa, Istanbul

Aronoff, S., (1991), Geographic information systems: a management perspective, WDL Publications, Canada, 1991.

Aybars, E., (2004), Çanakkale Zaferinin Siyasi Sonuçlari, The Turkish Yearbook of Gallipoli Studies, Issue 2, March 2004, Çanakkale, 59-79.

Baydur, Y. H., (1983), Türk Inkilabi Tarihi, Cilt III, 1914 – 1918 Genel Savasi, Kisim: 2, Çanakkale vurusmalari ve onlarin tepki ve sonuçlari, Türk Tarih Kurumu Basimevi, Ankara.

Burrough, P. A., (1993), Principles of Geographical Information Systems for Land Resources Assessment, Oxford University Press, New York.

Conk, C., (1959), Çanakkale Conkbayiri Savaslari, Erkani Harbiye-i Umumiye Riyaseti Basimevi, Ankara.

Çetiner, S., (2001) Çanakkale Savasi üzerine bir inceleme, Cem Ofset, Istanbul.

Görgülü, I., (1993), On Yillik Harbin Kadrosu 1912-1922, Atatürk Kültür, Dil ve Tarih Yüksek Kurumu Türk Tarih Kurumu Yayinlari, XVI. Dizi – Sa. 69, Türk Tarih Kurumu Basimevi, Ankara.

Gregory, I. N., (1998), Historical GIS News, Spring 1998, University of London.

Gregory, I. N., (2002), A place in History – A Guide to Using GIS in Historical Research, Oxbow Books, Oxford, Available online at: http//hds.essex.ac.uk/g2gp/gis/index.asp/, last visited on 17.01.2005

James, R. R., (1989), Gallipoli, Papermac, Hong Kong.

Kafadar, O. and Esenkaya, A., (2004), Çanakkale Savaslarinda Kaybedilen Egitim Görmüs Nesiller Üzerine Düsünceler ve Öneriler, The Turkish Yearbook of Gallipoli Studies, Issue 2, March 2004, Çanakkale, 135-162.

Karal, E. Z., (1996), Osmanli Tarihi, IX. Cilt, Ikinci Mesrutiyet ve Birinci Dünya Savasi (1908-1918), Atatürk, Kültür, Dil ve Tarih Kurumu, Türk Tarih Kurumu Yayinlari, XIII. Dizi, Sa: 16, Türk Tarih Kurumu Basimevi, Ankara

Özkale, E. and Senler, M.R., (1980), Haritaci Mehmet Sevki Pasa ve Türk Haritacilik Tarihi (1919 yilina kadar), Harita Genel Müdürlügü.

Perk, K., (1939), Çanakkale Savaslari Tarihi, 1. Kisim, Büyük Harpten Evvelki Zamanlarda Çanakkale, Istanbul Askeri Matbaasi, Istanbul.

Richman, J., (1999), Modernized Integrated Database (MIDB) Team Lead Alpha, Reserve Production Center Denver / Joint Intelligence Center, Pacific., Terrain Analysis Methods for Army Reserve and Army National Guard Warfighters. Available from: http://gis.esri.com/library/userconf/proc00/professional/papers/PAP912/p912.htm., last visited on 22.04.2005.

Saglam, S., (2003), Yabancilarin Gözüyle Çanakkale Muharebeleri ve Türkler, Communiqués The Joint Turkish-Israeli Military History Conference II. Turkish General Staff Printing Office, Ankara, 1035-116.

Sahin, I. S., (2003), Çanakkale Muharebeleri'nde Türk Ordusunun Ikmal ve Iasesi. Communiqués The Joint Turkish-Israeli Military History Conference II (No presented Communiqués), Turkish General Staff Printing Office, Ankara, 85-101.

Tuncoku, A. M., (2005), Çanakkale 1915 Buzdaginin Alti, (The Body of The Iceberg Çanakkale 1915), TBMM Kültür, Sanat ve Yayin Kurulu Yayinlari, No: 107, TBMM Basimevi, Ankara

Tuncoku, A. M. and Taskiran, C., (2000), Chanakkale, Churchill and Anzacs, Turkish General Staff Printing Office, Ankara.

Turkish Historical Society and Forsnet, (2001), ÇANAKKALE 1915, CD-ROM, ISBN 975-6860-05-7

Turkish General Staff, (1978), Birinci Dünya Harbinde Türk Harbi V nci Cilt Çanakkale Cephesi Harekati 2nci Kitap (Haziran 1914- 25 Nisan 1915), Turkish General Staff Printing Office, Ankara.

Turkish General Staff, (1993), Birinci Dünya Harbinde Türk Harbi V nci Cilt Çanakkale Cephesi Harekati 1nci Kitap (Haziran 1914- 25 Nisan 1915), Turkish General Staff Printing Office, Ankara.

Turkish General Staff. (2002), Birinci Dünya Harbinde Türk Harbi V nci Cilt Çanakkale Cephesi Harekati 1 nci, 2 nci ve 3 ncü Kitaplarin Özetlenmis Tarihi (Haziran 1914- 9 Ocak 1916), Turkish General Staff Printing Office, Ankara.

Turkish Ministry of Defense, (1998), Sehitlerimiz, 5 Volumes, Kozan Offset, Ankara.

Ünal, G. and Türker, M., (2002), Terrain Analysis for Military Operations Using Geographic Information Systems, International Symposium on GIS, Union of Chambers of Turkish Engineers and Architects , Chamber of Survey and Cadastre Engineers, September 23-26, 2002, Istanbul, Turkey, 716 – 724.

Web 1, http://www.globalsecurity.org/military/ library/policy/army/fm/5-33/, Headquarters Department of US Army, (1990), FM 5-33 Terrain Analysis, last visited on 22.04.2005.

Web 2, http://www.gisdevelopment.net/application/military/overview/militaryf0002.htm and http://gislounge.com/ucon/ucmilitary.shtml/. Satyanarayana, P., Yogendran, S., IIC Technologies Private Limited. Military Applications of GIS, last visited on 22.04.2005.

Web 3, http://www.gis.com/specialty/defenseandintelligence/batt0298.pdf/, ESRI, (1998), The Role of Geographic Information Systems on the Electronic Battlefield, White Papers, last visited on 17.01.2005

Web 4, http://www.geog.port.ac.uk/gbhgis/, The Great Britain Hstorical GIS project. [online], last visited 2.04.2005

Web 5, http://www2.cr.nps.gov/abpp/, American Battlefield Protection Program web site, last visited on 22.04.2005

White, B., (1998), Historical GIS News, Spring 1998, University of London.

Yomralioglu, T. (2000), Cografi Bilgi Sistemleri: Temel kavramlar ve uygulamalar, Seçil Ofset, Istanbul.

APPENDIX A

GRAPHICAL DATA

In this part, information about raw graphical data was given with table and figures. These are listed below:

Table A1.   List of graphical data used in this study

Figure A1.   Boundaries of Ottoman Empire between 1299 and 1699

Figure A2.   1/50.000 scaled map obtained from National Library

Figure A3.   One map sheet of Sevki Pasa Maps (1/5000 scaled)

Figure A4.   One sheet of 1/25.000 scaled topographic map
(H16c1 map sheet)

Table A1.Graphical data used in this study

DATA NAME	SCALE	YEAR	FORMAT	CONTENT	SOURCE
Osmanli Imparatorlugu Sinirlari'nin Genislemesi	1/12.000.000		Paper format	Ottoman Empire Boundaries	General Command of Mapping
Anafarta-i Saghir	1/50.000	1920	Paper format	Topographic data	National Library
Sevki Pasa Maps	1/5.000	1914	Paper format	Topographic data	ATASE
Topographic maps	1/25.000	2001	ArcGIS coverage	boundaries, elevation, hydrology, industry, physical, population, track, vegetation	General Command of Mapping
Anafarta-i Saghir	1/50.000	1920	Paper format	Topographic data	National Library
2640	1/250.000		DTED format		
Turkilgeo	1/1.000.000		ArcGIS coverage	Province map of Turkey	
5 nci Ordu (25 Nisan 1915)		1993	Paper format	Sketch	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 1.Kitap
Planin Ana Hatlari, Ingiliz Fransiz Kuvvetlerinin Günlük Hedefleri		1993	Paper format	Sketch	
Çanakkale Müstahkem Mevkii Topçusunun Dögüs ve Dönüs Olanaklari		1993	Paper format	Sketch	
Çanakkale Müstahkem Mevkii Topçusu ve Mayin Hatlari (18 Mart 1915)		1993	Paper format	Sketch	
Çanakkale Bogazi'nda Topçu ve Mayin Hatlarinin Durumu (20 Eylül 1914)		1993	Paper format	Sketch	
Bogaz Giris Tabyalarindaki Toplarin Ates Alanlari ile Birlesik Filo'nun Bu Tabyalara Yönelik Harekat ve Ates Planlari (19 Subat 1915)		1993	Paper format	Sketch	

Table A1.Graphical data used in this study (continuing)

DATA NAME	SCALE	YEAR	FORMAT	CONTENT	SOURCE
Ariburnu ve Yakin Kiyilardaki Gözetleme Düzenleri	1/65.000	1978	Paper format	Sketch	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 2. Kitap
A.N.Z.A.C. (ANZAK) Kolordusunun Çikarma Plani	1/73.800	1978	Paper format	Sketch	
A.N.Z.A.C. (ANZAK) Kolordusunun Deniz Topçu Destegi ve Derinlikteki Türk Birliklerinin Ilk Müdahale Hareketleri	1/139.000	1978	Paper format	Sketch	
27 nci ve 57 nci Alaylarin 25 Nisan Ögleden Önceki Taarruzlari	1/50.000	1978	Paper format	Sketch	
19 ncu Tümen ve 27 nci Piyade Alayinin 25 Nisan Ögleden Sonraki Taarruzlari	1/50.000	1978	Paper format	Sketch	
5 nci Ordunun 24 Nisan 1915 Kuvvet Durumu ve Genel Savunma Düzeni		1978	Paper format	Sketch	
19 ncu Tümenin 25/26 Nisan Gece Taarruzu	1/70.000	1978	Paper format	Sketch	
19 ncu Tümenin 27 Nisan Taarruzu	1/32.500	1978	Paper format	Sketch	
Ingiliz ve Fransizlarin Kirte'ye Taarruzunda 6 Mayis Harekati	1/52.500	1978	Paper format	Sketch	
Ingiliz ve Fransizlarin Kirte'ye Taarruzlarinda 7 Mayis Harekati	1/51.500	1978	Paper format	Sketch	
Ingiliz ve Fransizlarin Kirte'ye Taarruzunda 8 Mayis Harekati	1/43.900	1978	Paper format	Sketch	

Table A1.Graphical data used in this study (continuing)

DATA NAME	SCALE	YEAR	FORMAT	CONTENT	SOURCE
Anzak Kolordusunun Çikarma Yeri ve Hedefleri	1/110.800	2002	Paper format	Sketch	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 1., 2. ve 3. Kitaplarin Özetlenmis Tarihi
Çanakkale Cephesi, 9 ncu Tümenin 24 Nisan'daki Genel Yerlesme Durumu	1/200.000	2002	Paper format	Sketch	
Anzaklarin Kanli Sirt Taarruzu ve Türk Karsi Taarruzlari (6 Agustos 1915)		2002	Paper format	Sketch	
6/7 ve 7 Agustos 1915'de Iki Tarafin Durumu ve Conk Bayiri (Kusatma) Taarruzu Plani		2002	Paper format	Sketch	
Conk Bayiri Harekatinda Taraflarin Durumu (7 Agustos Günü Sabahi Saat : 06 00)		2002	Paper format	Sketch	
Taraflarin Sabah Durumu ve Taarruz Plani (8 Agustos 1915)		2002	Paper format	Sketch	
Conk Bayiri Muharebeleri ve Taraflarin Sabah Durumlari (9 Agustos 1915)		2002	Paper format	Sketch	
Aksam Durumu (9 Agustos 1915)		2002	Paper format	Sketch	
Conk Bayirinda 10 Agustos 1915 Günü Sabahi Yapilan Türk Karsi Taarruzu		2002	Paper format	Sketch	
Çanakkale Cephesi, Seddülbahir Bölgesini Destekleyen Muhtelif Topçu Birlikleri	1/75.000	2002	Paper format	Sketch	
Çanakkale Müstahkem Mevkii Topçusu (18 Subat 1915)		2002	Paper format	Sketch	
Çanakkale Müstahkem Mevkii Topçusu ve Mayin Hatlari (18 Mart 1915)		2002	Paper format	Sketch	
Çanakkale Müstahkem Mevkii ve 3ncü Kolordu'nun Aldigi Düzenler (18 Mart 1915 Sabahi)		2002	Paper format	Sketch	

Table A1.Graphical data used in this study (continuing)

DATA NAME	SCALE	YEAR	FORMAT	CONTENT	SOURCE
Çanakkale Bogaz Muharebesi (18 Mart 1915)		2002	Paper format	Sketch	1. Dünya Harbi'nde Türk Harbi V. Cilt Çanakkale Cephesi Harekati 1., 2. ve 3. Kitaplarin Özetlenmis Tarihi
Çanakkale Bogazi Muharebesi (18 Mart 1915 Saat: 12.06 – 12.30)		2002	Paper format	Sketch	
Çanakkale Bogazi Muharebesi (18 Mart 1915 Saat: 12.30 – 14.00)	1/50.000	2002	Paper format	Sketch	
Çanakkale Bogazi Muharebesi (18 Mart 1915 Saat: 14.00 – 16.30)		2002	Paper format	Sketch	
Çanakkale Bogazi Muharebesi (18 Mart 1915 Saat: 16.30 – 18.30)		2002	Paper format	Sketch	

Figure A1. Boundaries of Ottoman Empire between 1299 and 1699

Figure A2. 1/50.000 scaled map obtained from National Library

Figure A3. One map sheet of Sevki Pasa Maps (1/5000 scaled)

Figure A4. One sheet of 1/25.000 scaled topographic map (H16c1 map
         sheet)

APPENDIX B

NON-GRAPHIC DATA

Figure B shows the approximate ranges of artilleries of Turkish force obtained from Turkish General Staff (1993).

Figure B. Ranges of artilleries which is scanned in JPEG format

APPENDIX C

LAYERS PREPARED FROM PAPER MAPS OR SKETCHES

List of prepared layers were given in the text. Some of these layers were shown in the following pages. These figures are;

- Figure C1. Vegetation types and water sources
- Figure C2. Bridges, fire lines and trenches of both sides
- Figure C3. Roads, railways and bridges of both sides
- Figure C4. Telegraph line, transportation and covert roads, shelters and barbed wires of both sides
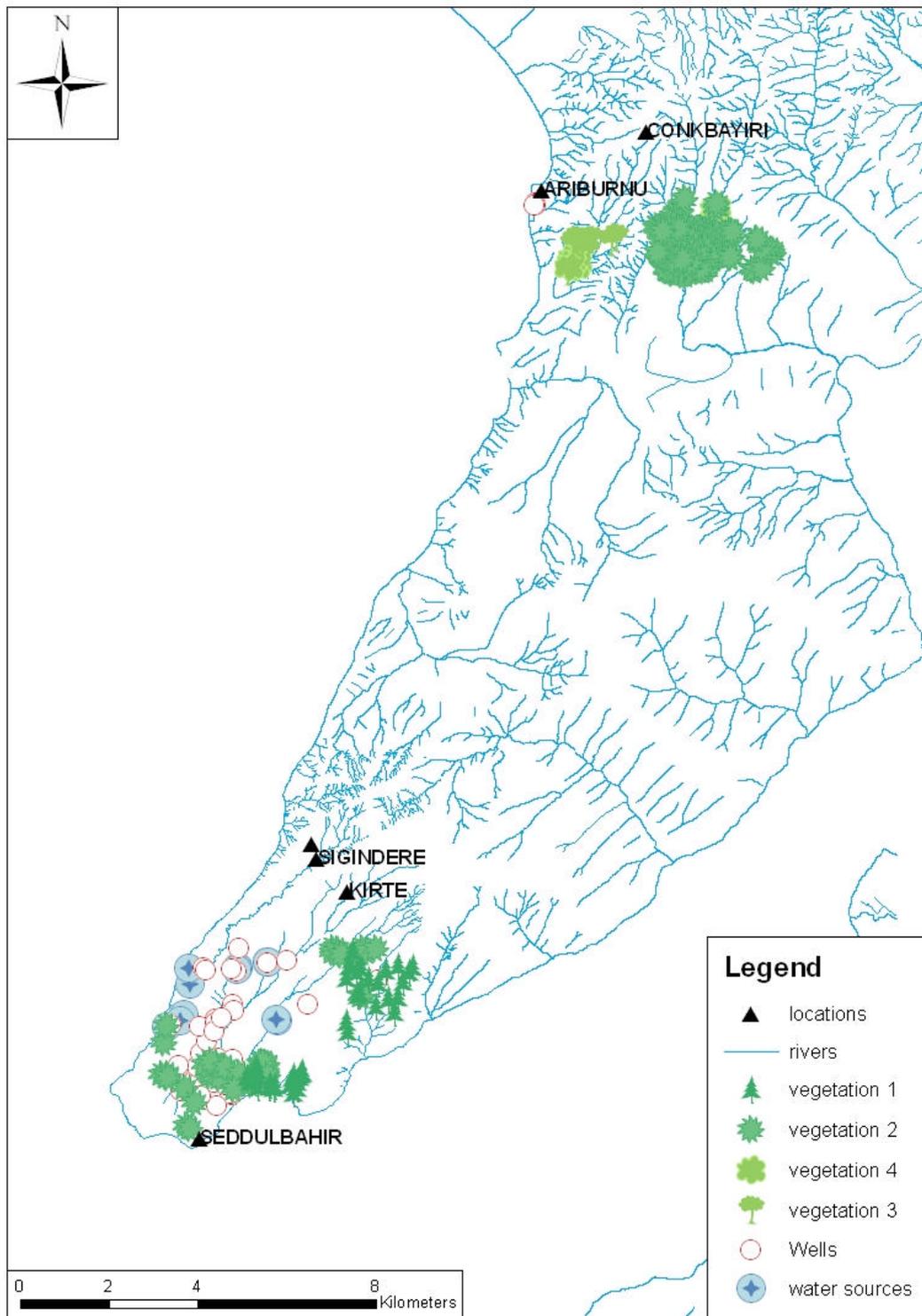
Figure C1. Vegetation types and water sources
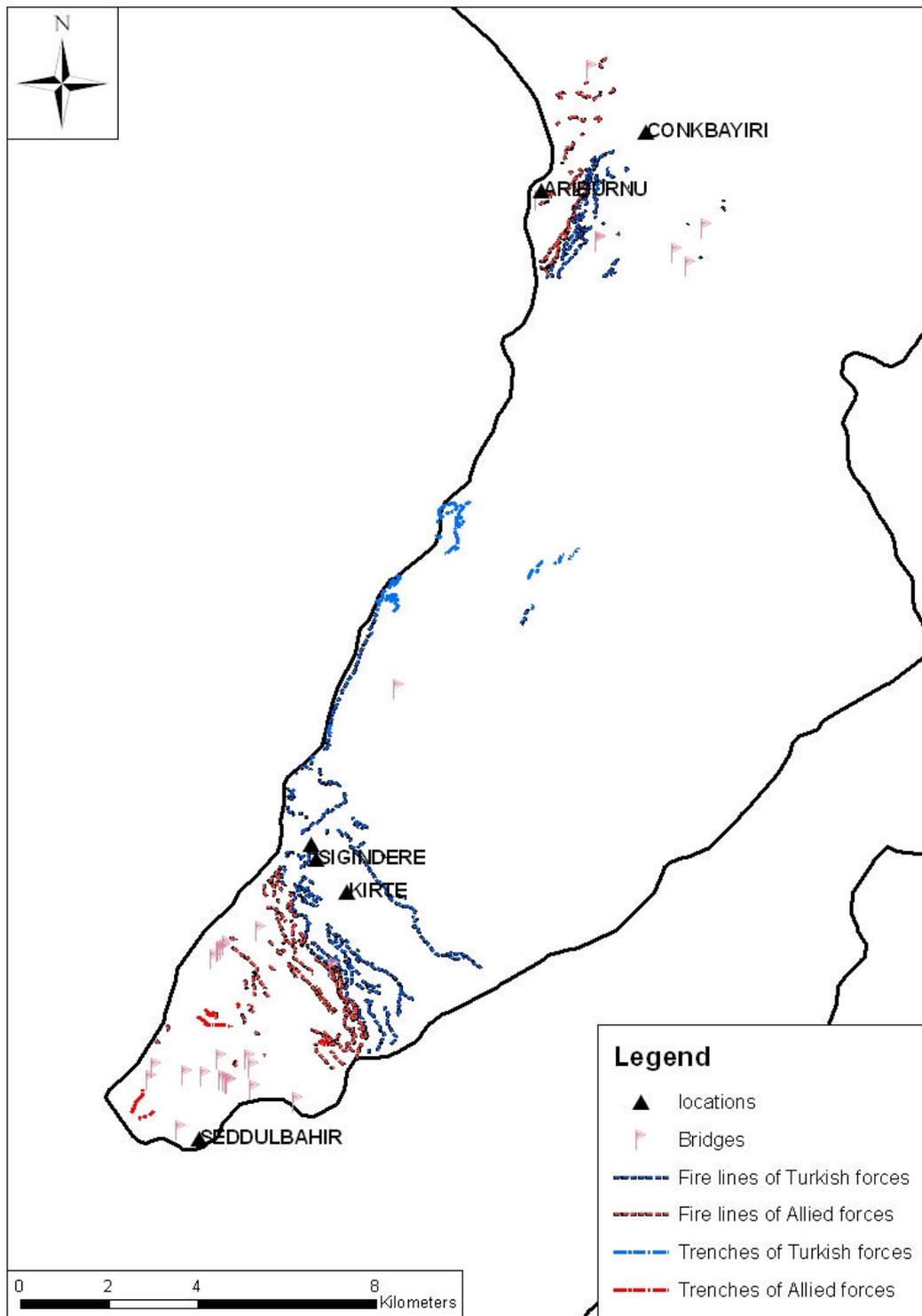
Figure C2. Bridges, fire lines and trenches of both sides
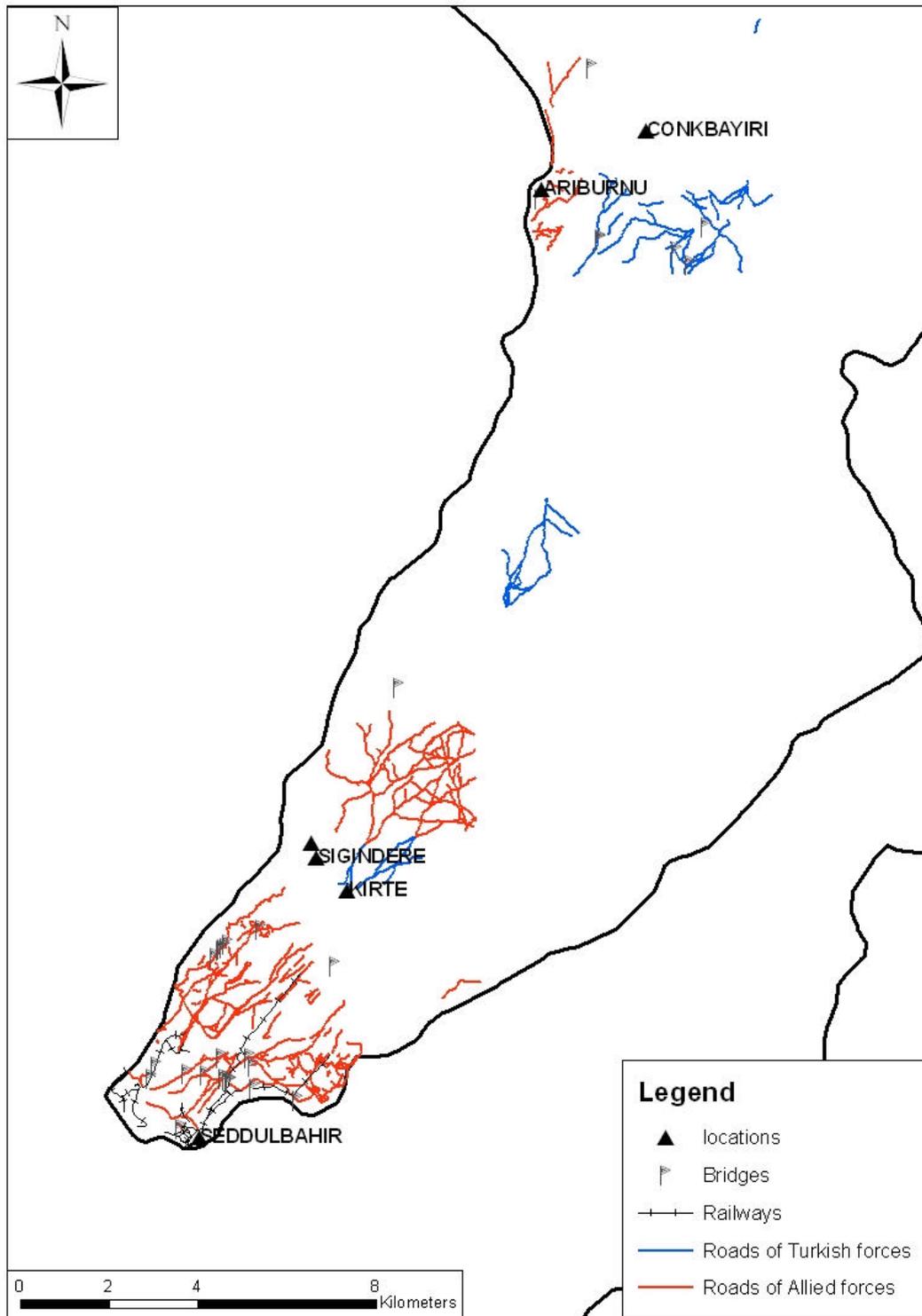
Figure C3. Roads, railways and bridges of both sides
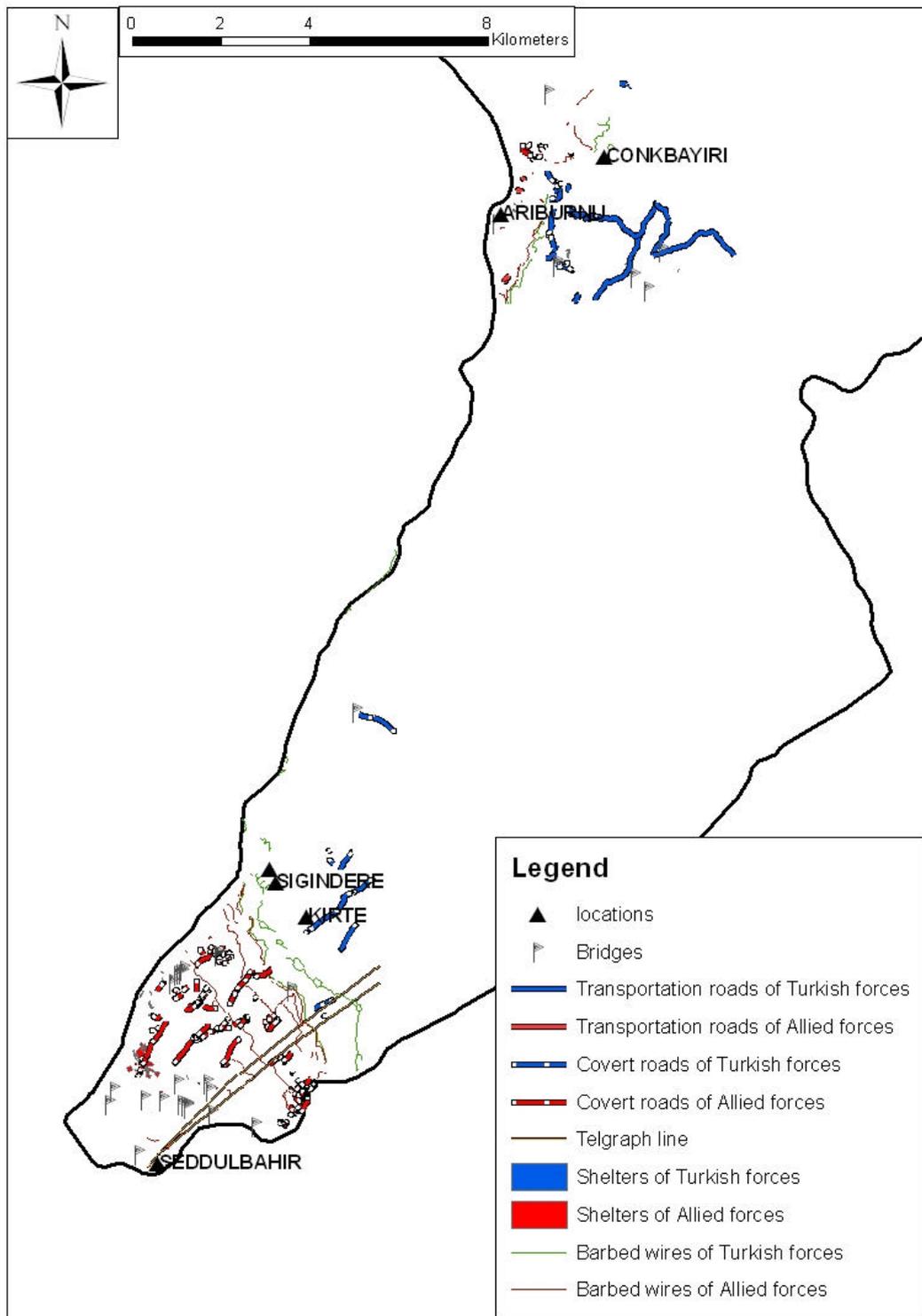
Figure C4. Telegraph line, transportation and covert roads, shelters and barbed wires of both sides

APPENDIX D

VISIBILITY MAPS

Some examples of visibility analyses were given in this part.
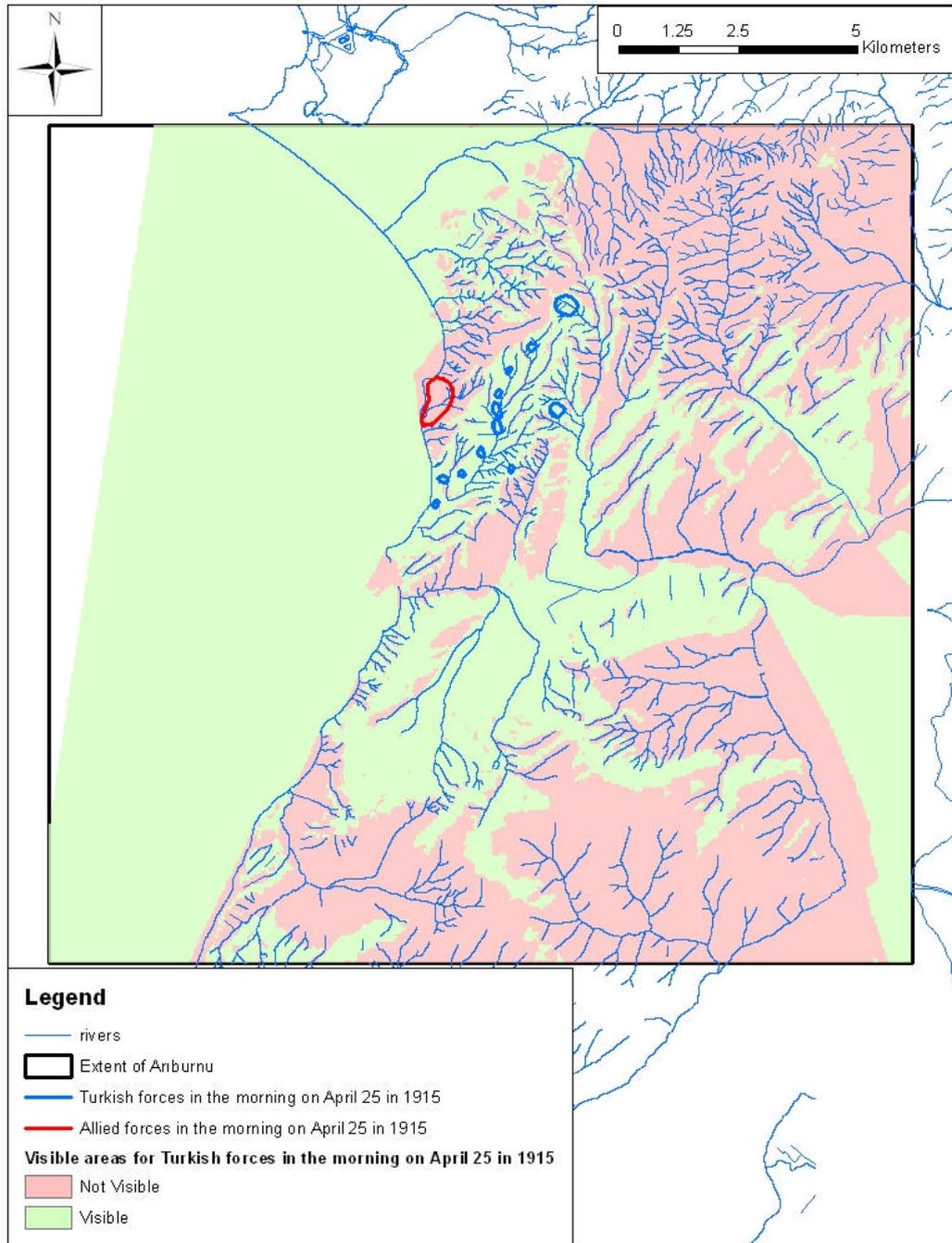
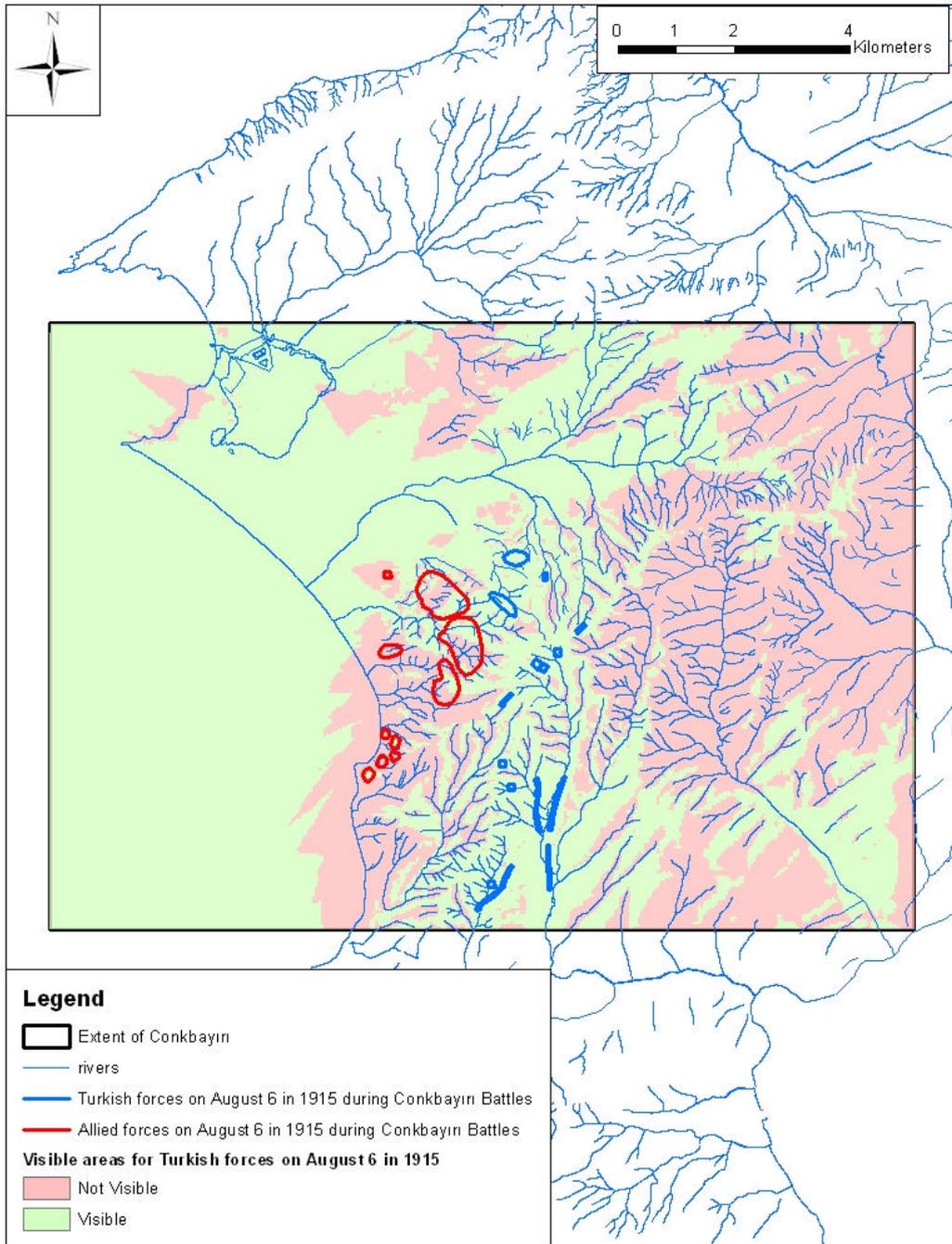Figure D1. Visible areas from Turkish Force in the morning of April 25 during Ariburnu Battles

Figure D2. Visible areas from Turkish Force on August 6 during
Conkbayiri Battles

APPENDIX E

PROXIMITY MAPS

Some proximity maps were given in the text. Additional proximity maps were shown in the following figures.
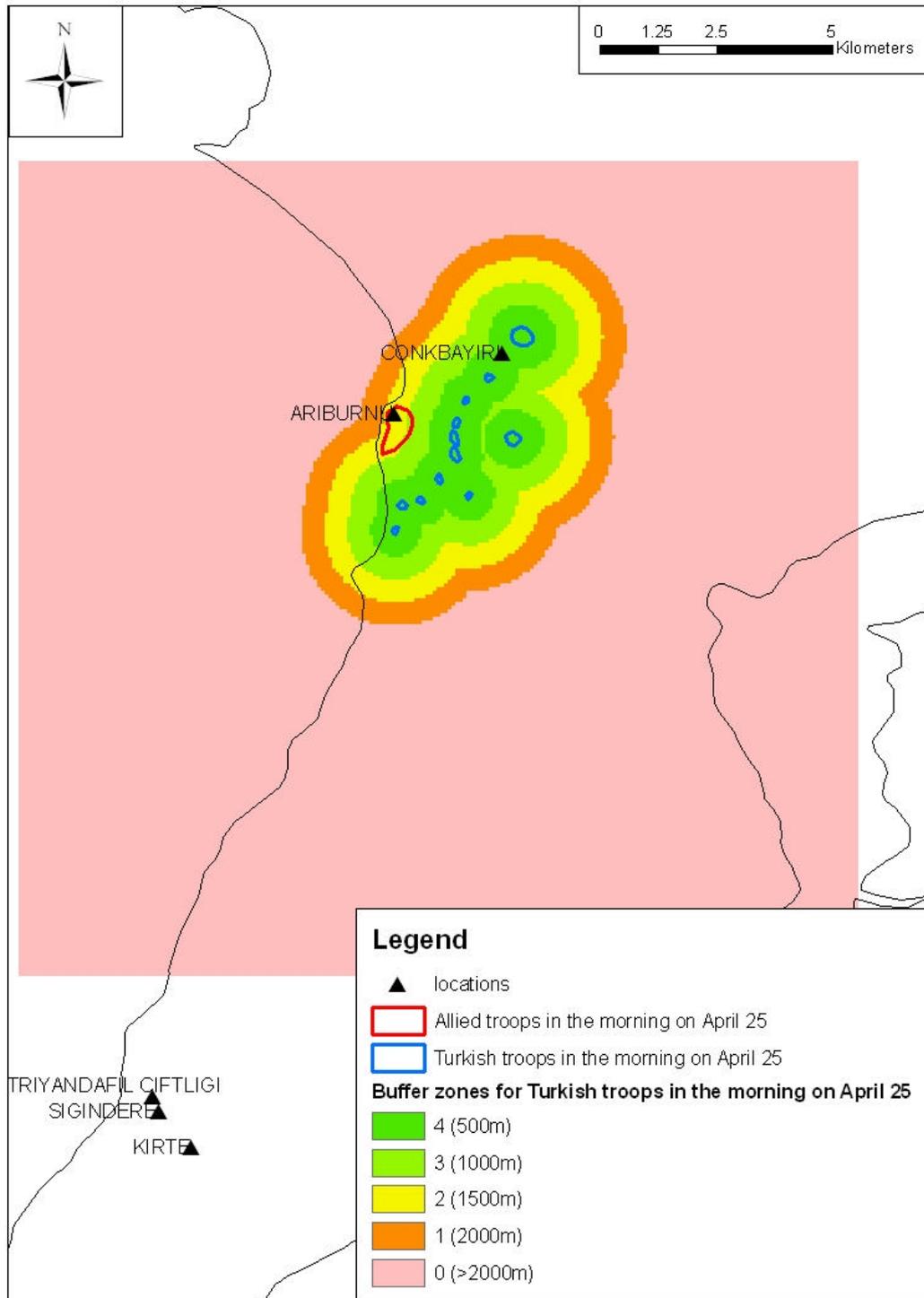
Figure E1. Buffer zones for Turkish Force in the morning of April 25 during Ariburnu Battles
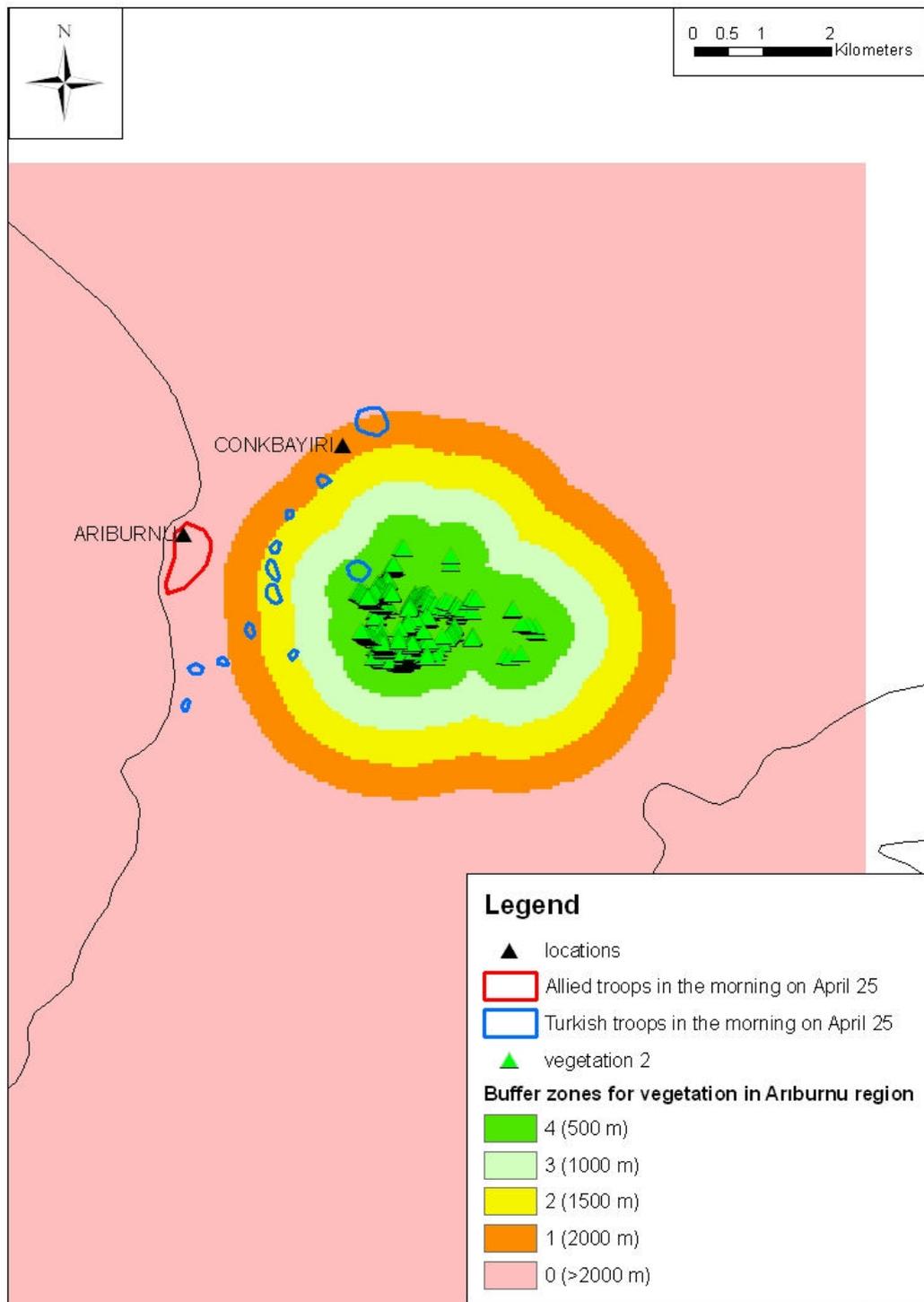
Figure E2. Buffer zones for vegetation layer in Ariburnu region

APPENDIX F

MODELS

Model parameters and some examples of models for different troops and dates were given in the following pages. These examples of models are listed below:

MODEL PARAMETERS:

MODEL 1: All effects are used for this model. Proximities of obstacles, natural resources, etc, closeness to troops, visibilities and slope were used in this model.

For Turkish troops: Positive effects + Closeness to Turkish troops - Closeness to Allied troops + Visibility situation for Turkish troops + Visibility situation from observation posts of Turkish force + Slope

For Allied troops: Negative effects - Closeness to Turkish troops + Closeness to Allied troops + Visibility situation for Allied troops + Visibility situation from observation posts of Allied force + Slope

MODEL 2: Invisible areas for Turkish troops are eliminated and slope is more important in this model.

For Turkish troops: (Positive effects + Closeness to Turkish troops - Closeness to Allied troops) * Visibility situation from observation posts of Turkish force * Slope

For Allied troops: (Negative effects - Closeness to Turkish troops + Closeness to Allied troops) * Visibility situation from observation posts of Allied force * Slope

MODEL 3: This model is prepared using main factors which do not depend on troop (proximity and visibility of troops are ignored.).

For Turkish troops: (Positive effects + Closeness to Turkish troops - Closeness to Allied troops) * Visibility situation from observation posts of Turkish force * Slope

For Allied troops: (Negative effects - Closeness to Turkish troops + Closeness to Allied troops) * Visibility situation from observation posts of Allied force * Slope
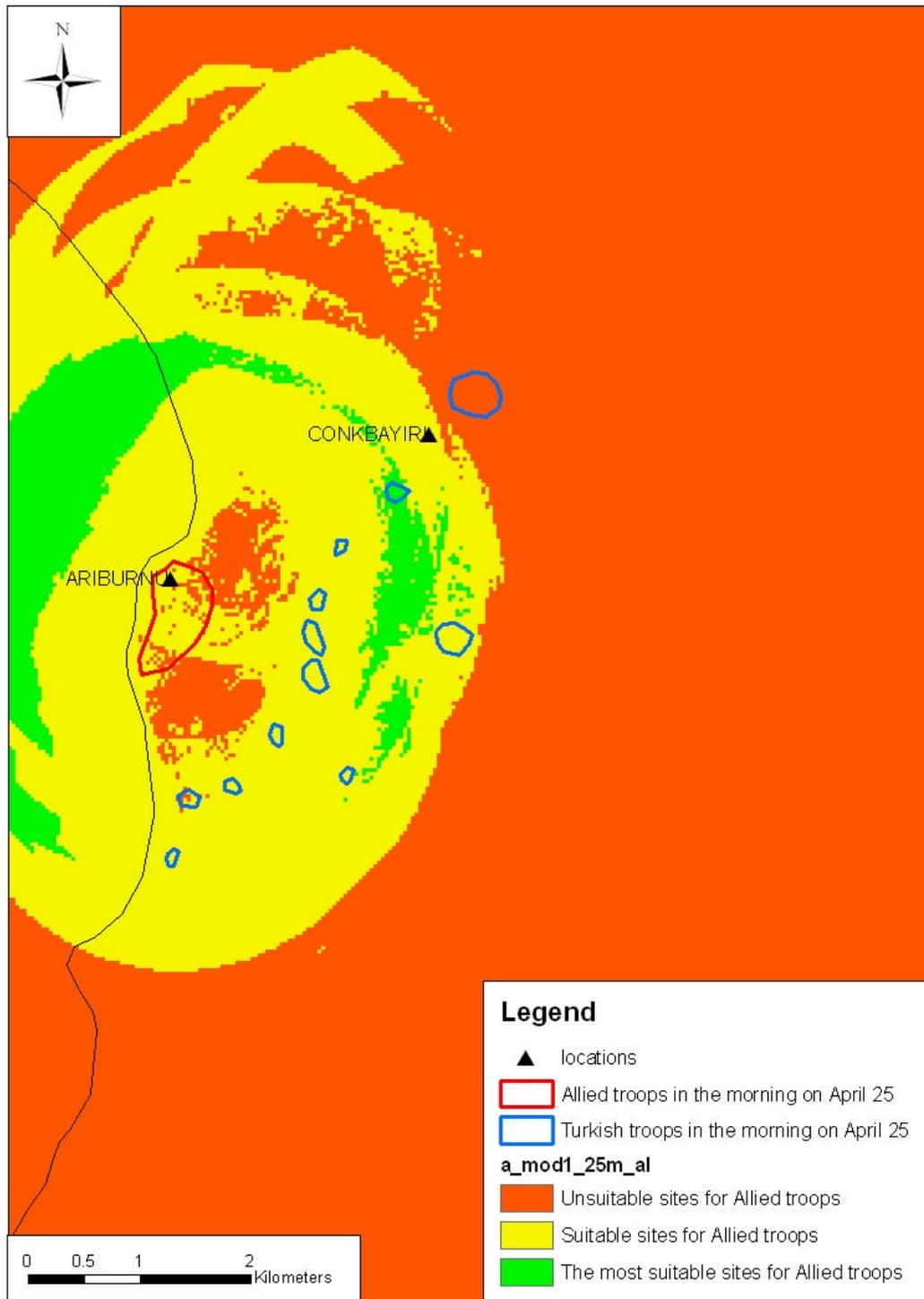
Figure F1. First model for Allied troops in the morning on April 25 during Ariburnu Battles
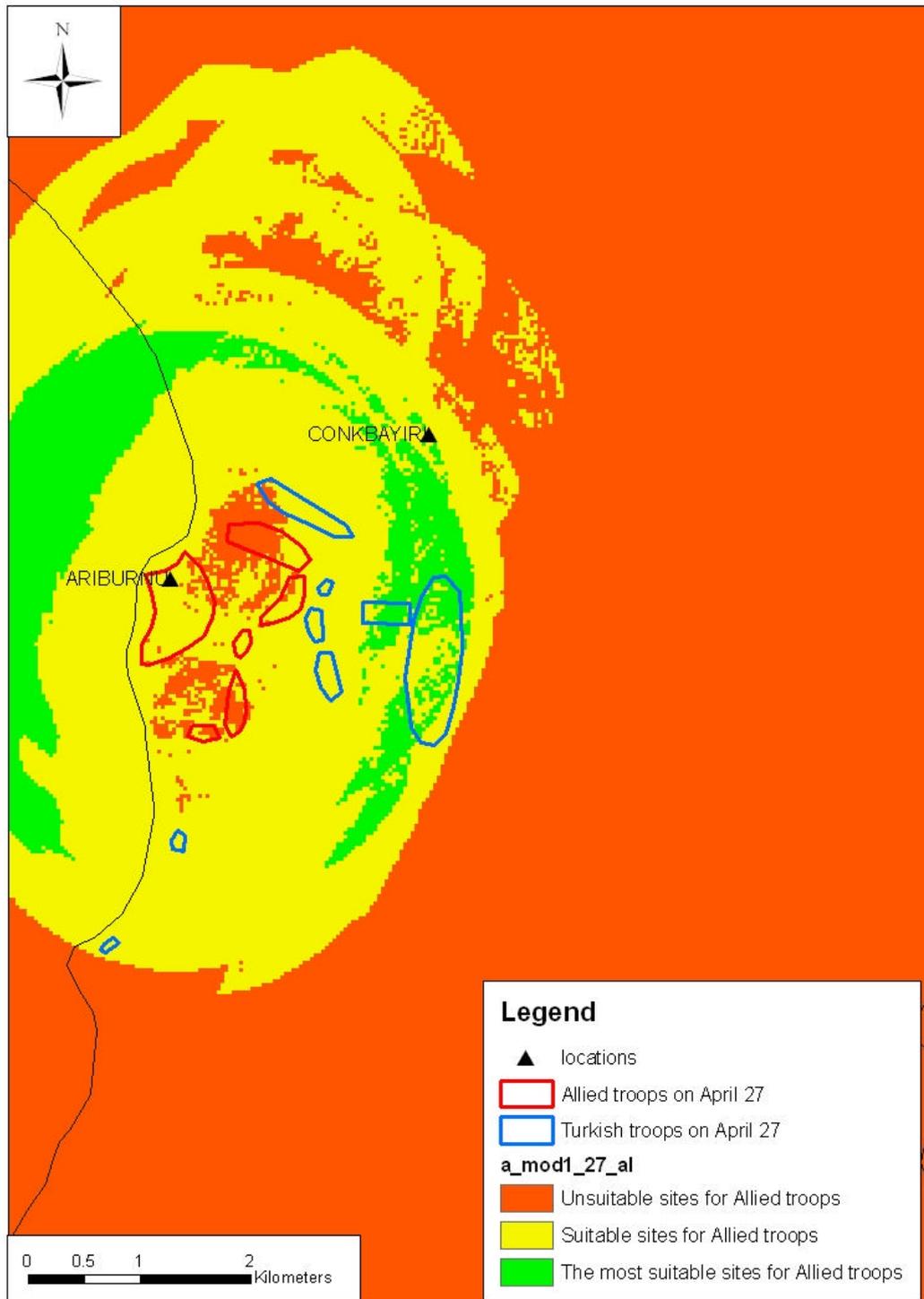
Figure F2. First model for Allied troops on April 27 during Ariburnu Battles
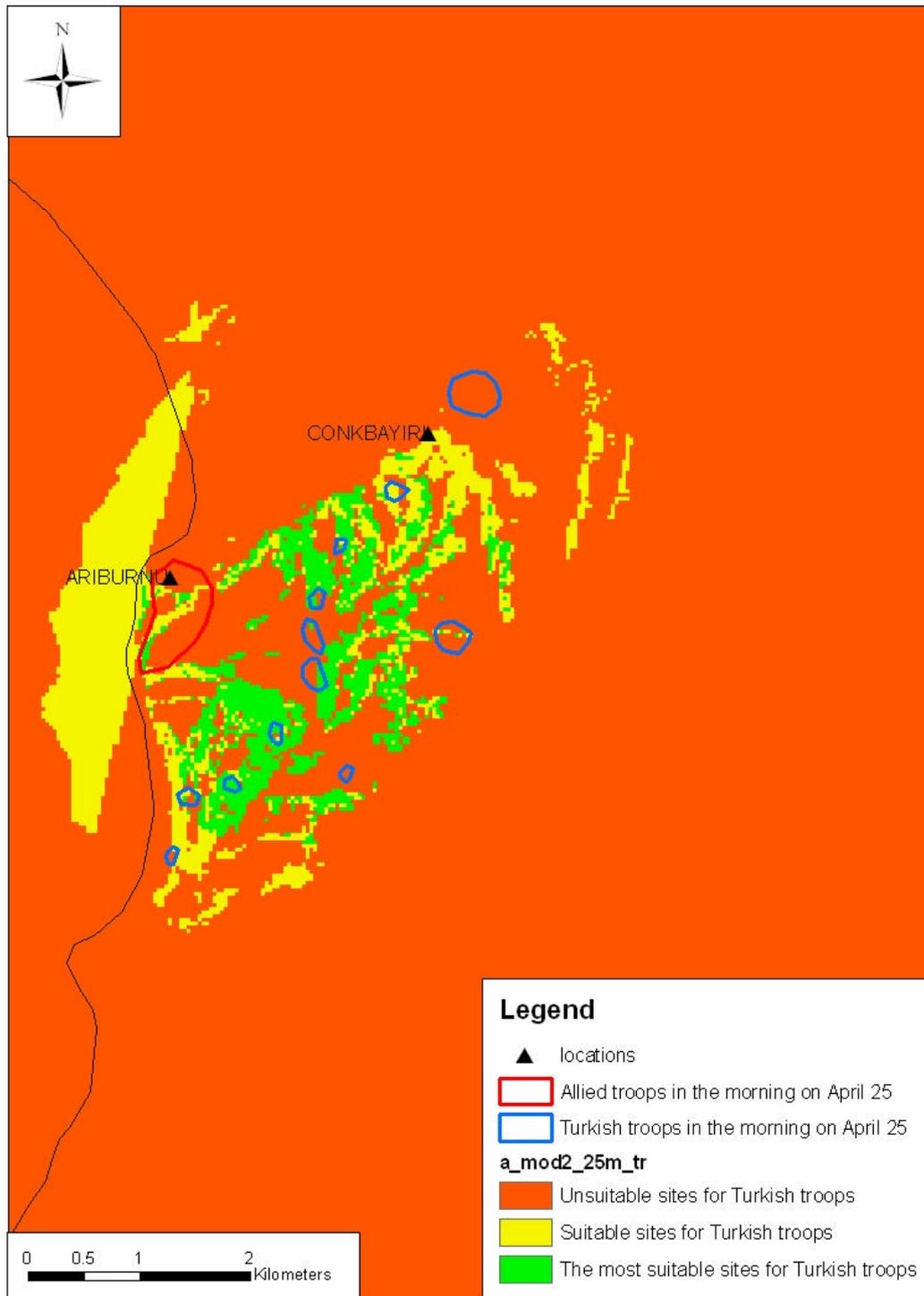
Figure F3. First model for Turkish troops in the morning on April 25 during
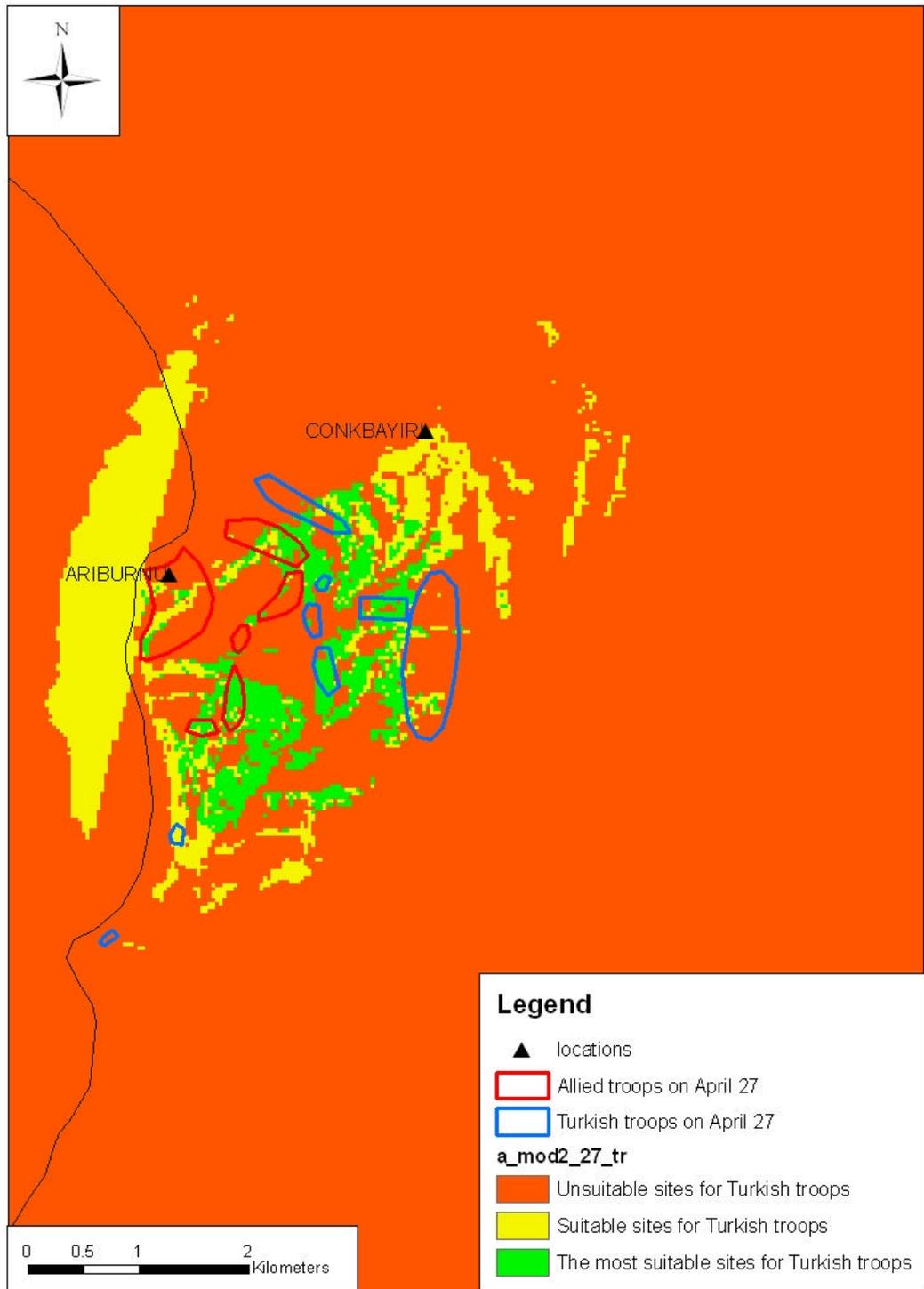Ariburnu Battles

Figure F4. First model for Turkish troops in the morning on April 27 during Ariburnu Battles
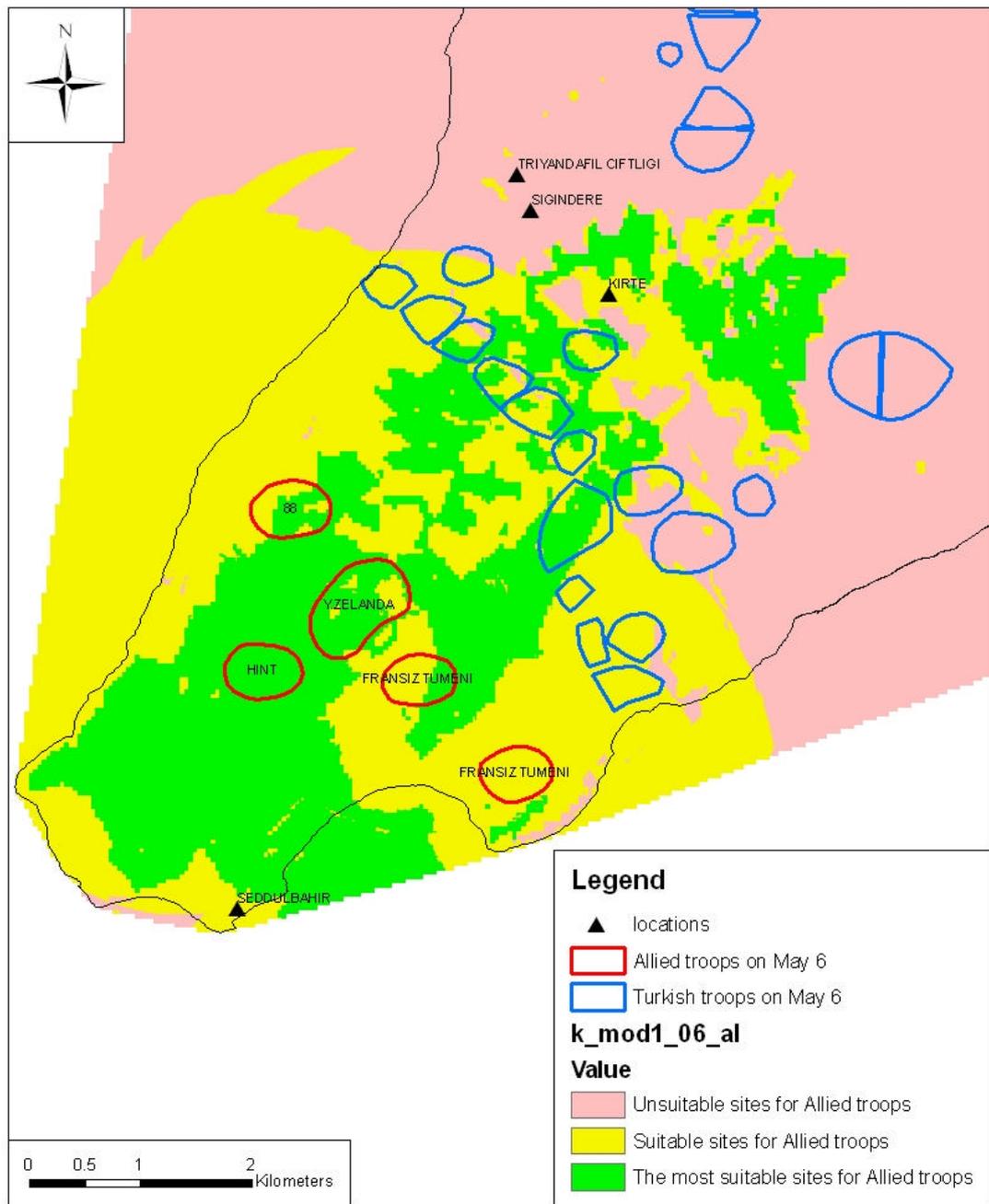
Figure F5. First model for Allied troops on May 6 during Second Kirte
Battles
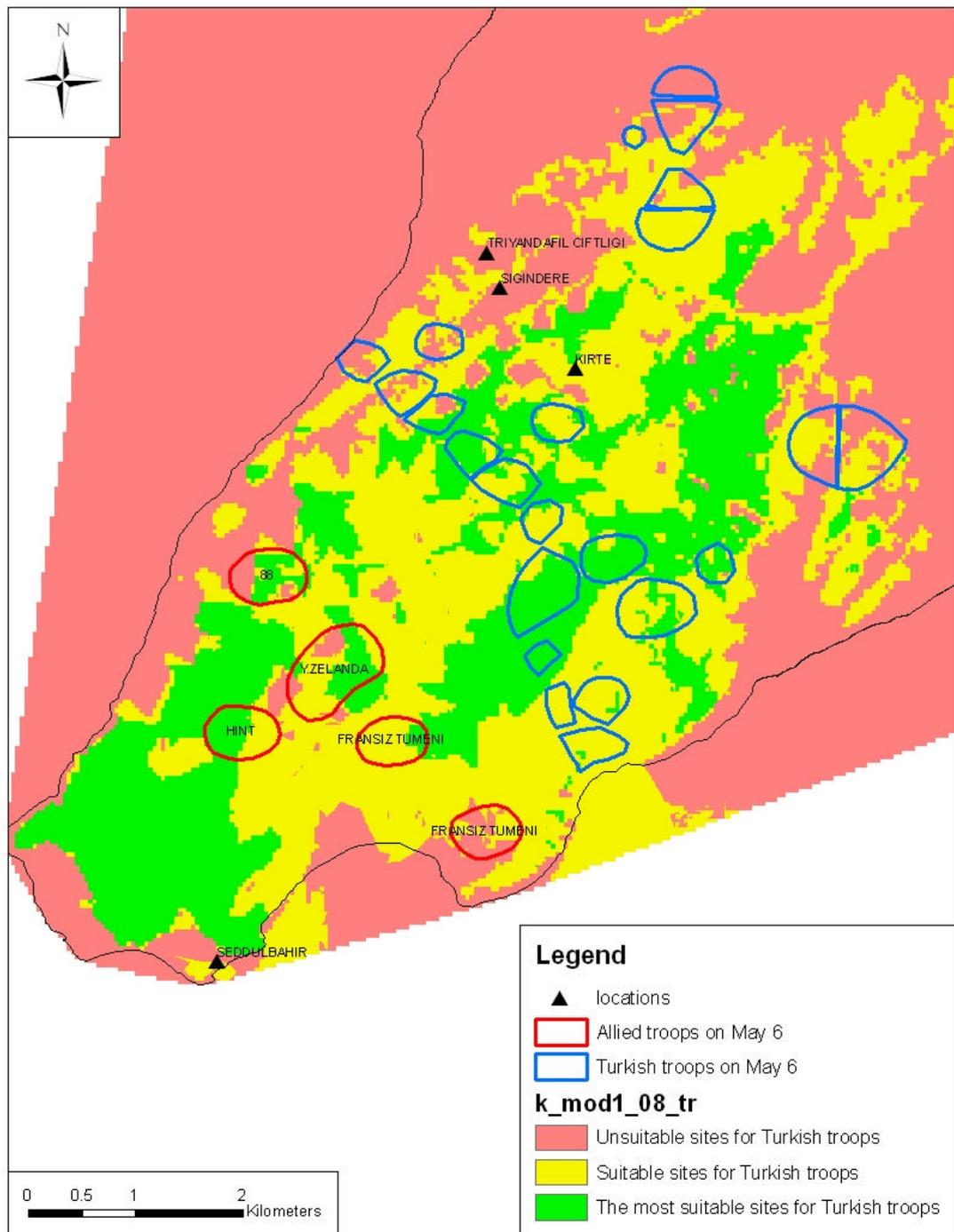
Figure F6.   First model for Allied troops on May 8 during Second Kirte
Battles

APPENDIX G

CODES OF INTERFACE

Codes of the interface build using Visual Basic programming language are given below.

This interface includes three forms.

- Find

This form is used to search martyr information manually or using search menu.

- Map

Location of city on Turkey is seen using this form.

- Print

Using this form, information of selected martyr can be printed out.

Code of "Find" form;

```
Private Sub cikis_Click()
Unload Me
End Sub

Private Sub cikis_button_Click()
Unload Me
End Sub

Private Sub Command1_Click()
Data1.Recordset.FindFirst "ADI='" & Text25 & "'"
Label8 = Data1.Recordset.AbsolutePosition + 1
End Sub

Private Sub Command10_Click()
Data1.Recordset.FindNext "ADI='" & Text25 & "'"
Label8 = Data1.Recordset.AbsolutePosition + 1
End Sub

Private Sub Command11_Click()
Load Form2
Form2.Show
Me.Hide
End Sub

Private Sub Command12_Click()
Command11.Caption = "ili göster"
End Sub

Private Sub Command2_Click()
Data1.Recordset.AddNew
Command3.Enabled = True
Command2.Enabled = False
End Sub

Private Sub Command3_Click()
Data1.Recordset.Update
Data1.Recordset.MoveLast
Command3.Enabled = False
Command2.Enabled = True
End Sub

Private Sub Command4_Click()
Data1.Recordset.MoveNext
If Data1.Recordset.EOF Then
Data1.Recordset.MoveLast
MsgBox "Son Kayit", vbOKOnly + vbInformation, "Son Kayit"
End If
Label8 = Data1.Recordset.AbsolutePosition + 1
End Sub

Private Sub Command5_Click()
Data1.Recordset.MovePrevious
If Data1.Recordset.BOF Then
```

```
Data1.Recordset.MoveFirst
MsgBox "Ilk Kayit", vbOKOnly + vbInformation, "Ilk Kayit"

End If
Label8 = Data1.Recordset.AbsolutePosition + 1
End Sub

Private Sub Command6_Click()
Data1.Recordset.MoveLast
Label8 = Data1.Recordset.AbsolutePosition + 1
End Sub

Private Sub Command7_Click()
Data1.Recordset.MoveFirst
Label8 = Data1.Recordset.AbsolutePosition + 1
End Sub

Private Sub Command8_Click()
'Form2.Show
End Sub

Private Sub Command9_Click()
On Error Resume Next
If Text25 = "" Then
MsgBox "Lütfen Aranan Metni Giriniz", vbOKOnly + vbCritical, "Uyari"
Else

If Option1 Then
Data1.RecordSource = "Select * from liste where ADI like '" & Text25 & "'"
Data1.Refresh
ElseIf Option2 Then
Data1.RecordSource = "Select * from liste where BABA_ADI like '" & Text25 & "'"
Data1.Refresh
ElseIf Option3 Then
Data1.RecordSource = "Select * from liste where IL like '" & Text25 & "'"
Data1.Refresh
ElseIf Option4 Then
Data1.RecordSource = "Select * from liste where ILCE like '" & Text25 & "'"
Data1.Refresh
ElseIf Option5 Then
Data1.RecordSource = "Select * from liste where LAKAP like '" & Text25 & "'"
Data1.Refresh
ElseIf Option6 Then
Data1.RecordSource = "Select * from liste where ASKERLIK_SUBESI like '" & Text25 & "'"
Data1.Refresh
ElseIf Option7 Then
Data1.RecordSource = "Select * from liste where DOGUM_YILI_M like " & Text25 & ""
Data1.Refresh

End If
End If
Data1.Recordset.MoveLast
Label13 = Data1.Recordset.RecordCount
Label8 = Data1.Recordset.AbsolutePosition + 1

If Label13 = "0" Then
MsgBox "NO RECORDS FOUND !!!    TRY AGAIN."
```

```
End If
End Sub

Private Sub Çikis_Click()
Unload Me
End Sub

Private Sub DBGrid2_MouseDown(Button As Integer, Shift As Integer, X As Single, Y As
                Single)
If Button = vbLeftButton Then
Label8 = Data1.Recordset.AbsolutePosition + 1
End If
End Sub

Private Sub English_Click()

Label1.Caption = "FATHER NAME"
Label2(0).Caption = "NAME"
Label3.Caption = "PROVINCE"
Label4.Caption = "DISTRICT"
Label5(1).Caption = "NICKNAME"
Label5(0).Caption = "Total record"
Label6.Caption = ""
Label7.Caption = "Selected records"
Label8.Caption = ""
Label9.Caption = "Number of Found Records"
Label10.Caption = "Search criteria"
Label11.Caption = "SEARCH MENU"
Label12.Caption = "Search text"

Option1.Caption = "Name"
Option2.Caption = "Father name"
Option3.Caption = "Province"
Option4.Caption = "District"
Option5.Caption = "Nickname"
Option6.Caption = "Recruiting office"
Option7.Caption = "Year of birth"
Command1.Caption = "Show first martyr "
Command2.Caption = "New"
Command3.Caption = "Save"
Command4.Caption = "UP"
Command5.Caption = "DOWN"
Command6.Caption = "LAST RECORD"
Command7.Caption = "FIRST RECORD"
Command8.Caption = "SEARCH MENU"
Command9.Caption = "SEARCH"
Command10.Caption = "Find next martyr"
Command11.Caption = "Show province"
yazdir.Caption = "Print"
cikis_button.Caption = "Exit"

DBGrid2.Caption = "INFORMATION ABOUT MARTYRS"

menu.Caption = "MENU"
Kaydet.Caption = "Save"
Yazdir.Caption = "Print"
Cikis.Caption = "Exit"
```

```
HAKKINDA.Caption = "About"
Hakkinda.Caption = "About Martyr Search Program"

Form4.Caption = "Print and Print preview"
Form4.Yazdirma.Caption = "Print menu"
Form4.Yazdir.Caption = "Print"
Form4.iptal.Caption = "Exit"
Form4.Label17.Caption = "GALLIPOLI MARTYR INFORMATION FORM"
Form4.Label1.Caption = "IDENTIFICATION"
Form4.SEHIT_ID(1).Caption = "MARTYR ID"
Form4.LAKAP(1).Caption = "NICKNAME"
Form4.AD(0).Caption = "NAME"
Form4.BABA_ADI.Caption = "FATHER NAME"
Form4.DOGUM_YILI.Caption = "YEAR OF B."
Form4.GELDIGI_IL.Caption = "PROVINCE"
Form4.GELDIGI_ILCE.Caption = "DISTRICT"
Form4.BABA_ADI.Caption = "FATHER NAME"
Form4.Label12.Caption = "BUCAK"
Form4.Label13.Caption = "VILLAGE"
Form4.Label2.Caption = "TROOP INFORMATION"
Form4.Label9.Caption = "CLASS"
Form4.Label10.Caption = "RANK"
Form4.KUVVET.Caption = "FORCE"
Form4.Label3.Caption = "ARMY"
Form4.Label4.Caption = "ARMY C."
Form4.Label5.Caption = "FIRKA"
Form4.Label6.Caption = "REGIMENT"
Form4.Label7.Caption = "BATT."
Form4.Label8.Caption = "COMPANY"

Form4.Label11.Caption = "OTHER INFORMATION"
Form4.Label14.Caption = "PLACE OF DEATH"
Form4.Label15.Caption = "DATE OF DEATH"
Form4.Label16.Caption = "RECRUITING O."

Form3.Caption = "About Search Program"
Form3.Label1.Caption = ""

Form2.Refresh
Form3.Refresh
Form4.Refresh
End Sub

Private Sub Turkish_Click()
Label1.Caption = "BABA ADI"
Label2(0).Caption = "ADI"
Label3.Caption = "GELDIGI IL"
Label4.Caption = "GELDIGI ILÇE"
Label5(1).Caption = "LAKAP"
Label5(0).Caption = "Toplam Kayit"
Label6.Caption = ""
Label7.Caption = "Seçilmis Kayit"
Label8.Caption = ""
Label9.Caption = "Bulunan Kayit Sayisi"
Label10.Caption = "Arama Kriterleri"
Label11.Caption = "ARAMA MENÜSÜ"
Label12.Caption = "Aranacak Metin"
```

```
Option1.Caption = "Ad"
Option2.Caption = "Baba Adi"
Option3.Caption = "Geldigi Il"
Option4.Caption = "Geldigi Ilçe"
Option5.Caption = "Lakap"
Option6.Caption = "Askerlik Subesi"
Option7.Caption = "Dogum yili"

Command1.Caption = "Aranan kritere uyan ilk kisiyi bul"
Command2.Caption = "Yeni"
Command3.Caption = "Kaydet"
Command4.Caption = "ILERI"
Command5.Caption = "GERI"
Command6.Caption = "SON KAYIT"
Command7.Caption = "ILK KAYIT"
Command8.Caption = "ARAMA MENÜSÜ"
Command9.Caption = "ARA"
Command10.Caption = "Sonraki kisiyi bul"
Command11.Caption = "Ili Göster"
Yazdir.Caption = "Yazdir"
cikis_button.Caption = "Çikis"

DBGrid2.Caption = "SEHITLERE AIT BILGILER"

menu.Caption = "MENÜ"
Kaydet.Caption = "Kaydet"
yazdir.Caption = "Yazdir"
Cikis.Caption = "Çikis"
HAKKINDA.Caption = "Hakkinda"
Hakkinda.Caption = "Kayit Bulma Programi Hakkinda"

Form2.Label2.Caption = "TÜRKIYE ILLER HARITASI"
Form2.Label1.Caption = "  PROVINCE      : " & sehir

Form4.Caption = "Önizleme ve Yazdirma"
Form4.Yazdirma.Caption = "Yazdirma menüsü"
Form4.Yazdir.Caption = "Yazdir"
Form4.iptal.Caption = "Çikis"
Form4.Label17.Caption = "ÇANAKKALE SEHITI BILGI EDINME FORMU"
Form4.Label1.Caption = "KIMLIK BILGILERI"
Form4.SEHIT_ID(1).Caption = "SEHIT ID"
Form4.LAKAP(1).Caption = "LAKAP"
Form4.AD(0).Caption = "AD"
Form4.BABA_ADI.Caption = "BABA ADI"
Form4.DOGUM_YILI.Caption = "DOGUM YILI"
Form4.GELDIGI_IL.Caption = "IL"
Form4.GELDIGI_ILCE.Caption = "ILÇE"
Form4.BABA_ADI.Caption = "BABA_ADI"
Form4.Label12.Caption = "BUCAK"
Form4.Label13.Caption = "KÖY"
Form4.Label2.Caption = "BIRLIK BILGILERI"
Form4.Label9.Caption = "SINIF"
Form4.Label10.Caption = "RÜTBE"
Form4.KUVVET.Caption = "KUVVET"
Form4.Label3.Caption = "ORDU"
Form4.Label4.Caption = "KOLORDU"
```

```vb
Form4.Label5.Caption = "FIRKA"
Form4.Label6.Caption = "ALAY"
Form4.Label7.Caption = "TABUR"
Form4.Label8.Caption = "BÖLÜK"

Form4.Label11.Caption = "DIGER BILGILER"
Form4.Label14.Caption = "ÖLÜM YERI"
Form4.Label15.Caption = "ÖLÜM TARIHI"
Form4.Label16.Caption = "ASKERLIK SUBESI"

Form3.Caption = "Kayit Bulma Programi Hakkinda"

Form2.Refresh
Form3.Refresh
Form4.Refresh
End Sub

Private Sub Form_KeyDown(KeyCode As Integer, Shift As Integer)
If KeyCode = 13 Then
Command9_Click
End If
End Sub

Private Sub Form_Load()

Data1.DatabaseName = App.Path + "\kayit10704_97.mdb"
Data1.RecordSource = "liste"
Data1.Refresh
Data1.Recordset.MoveLast
Label6 = Data1.Recordset.RecordCount
Label8 = Data1.Recordset.AbsolutePosition + 1
End Sub

Private Sub Hakkinda_Click()
Form3.Show
End Sub

Private Sub kaydet_Click()
Dim kaytxt As String

CommonDialog1.ShowSave
' MsgBox CommonDialog1.FileName

If CommonDialog1.FileName <> "" Then

kaytxt = ""
kaytxt = "AD.................:" & Text2.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "LAKAP..............:" & Text1.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "BABA ADI............:" & Text3.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "GELDIGI IL..........:" & Text4.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "GELDIGI ILÇE........:" & Text5.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "BUCAK..............:" & Text8.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "KÖY................:" & Text4.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "DOGUM YILI..........:" & Text7.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "RÜTBESI............:" & Text15.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "ÖLÜM YERI...........:" & Text19.Text & Chr(13) & Chr(10)
```

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```
kaytxt = kaytxt & "ÖLÜM TARIHI.........:" & Text20.Text & "/" & Text21.Text & "/" &
            Text22.Text & Chr(13) & Chr(10)
kaytxt = kaytxt & "ASKERLIK SUBESI.....:" & Text23.Text & Chr(13) & Chr(10)

Open CommonDialog1.FileName For Output As #1: Close #1
Open CommonDialog1.FileName For Append As #1
Print #1, kaytxt
Close #1
MsgBox "Kayitlar basari ile kaydedilmistir !"

 End If
End Sub

Private Sub Resim_kaydet_Click()
KeyCode = 44
End Sub

Private Sub Text25_KeyPress(KeyAscii As Integer)
Call karakter_control(KeyAscii)
End Sub

Private Sub yazdir_Click()
Load Form4
Form4.Show
Form4.Refresh
Me.Hide
End Sub

Private Sub Yazdir_Click()
Load Form4
Form4.Show
Me.Hide
End Sub
```

Code of "Map" form;

```
Private Sub Form_Load()
Dim sehir, syol As String

On Error GoTo hata

sehir = Form1.Text4

Image1.Picture = LoadPicture("")

Label1.Caption = "  PROVINCE     : " & sehir

syol = ".\iller_jpeg\" & sehir & ".jpg"

Image1.Picture = LoadPicture(syol)

Exit Sub
```

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hata:

Label1.Caption = "NO PROVINCE FOUND !!!"
Label2.Caption = " "
End Sub

Private Sub Form_Unload(Cancel As Integer)
Form1.Show
End Sub

Code of "Print" form;

Private Sub Form_Load()

```
Text1 = Form1.Text6
Text2 = Form1.Text4
Text3 = Form1.Text1
Text4 = Form1.Text2
Text5 = Form1.Text3
Text6 = Form1.Text7
Text8 = Form1.Text5
Text9 = Form1.Text8
Text10 = Form1.Text9
Text11 = Form1.Text10
Text12 = Form1.Text11
Text13 = Form1.Text12
Text14 = Form1.Text13
Text15 = Form1.Text14
Text16 = Form1.Text15
Text17 = Form1.Text16
Text18 = Form1.Text17
Text19 = Form1.Text18
Text20 = Form1.Text19
Text21 = Form1.Text20 & "/" & Form1.Text21 & "/" & Form1.Text22
Text22 = Form1.Text23
```

End Sub

Private Sub kapat_Click()
Unload Form4
Form1.Show
Form1.Enabled = True
End Sub

Private Sub Form_Unload(Cancel As Integer)

Form1.Show
End Sub

Private Sub iptal_Click()
Unload Me
'Form1.Show
'Form1.Show
'Form1.Enabled = True

```
End Sub

Private Sub Yazdir_Click()
Form1.Enabled = True
Unload Me
Form4.PrintForm
Form1.Show
End Sub
```