RISK ASSESSMENT OF ARCHAEOLOGICAL HERITAGE AT TERRITORIAL SCALE THE CASE OF İZMİR METROPOLITAN AREA

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ABSTRACT

RISK ASSESSMENT OF ARCHAEOLOGICAL HERITAGE AT TERRITORIAL SCALE
THE CASE OF IZMIR METROPOLITAN AREA

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Archaeological heritage has been increasingly facing severe threats such as urbanization, infrastructure development, mass tourism, illicit digging, earthquakes, floods, and many others. As most of the risks deriving from natural and human factors affect large areas and aggregates of sites, archaeological heritage can be conserved only if it is managed at territorial scale based on priorities and through effective risk management strategies. Accordingly, a thorough assessment of factors contributing to the existence and levels of risks is the key for effective conservation and management of archaeological heritage. Hence, this thesis aims at developing a comprehensive methodology for risk assessment of archeological heritage at territorial scale.

Following a qualitative assessment approach, and referring to the concepts of other disciplinary fields, this study defines the analytical framework, essential data, main procedure, and analysis tools for risk assessment. The proposed risk assessment methodology, which utilizes the Geographical Information Systems, includes the stages of identifying, categorizing and mapping natural, institutional and individual-induced hazards, assessing vulnerabilities to these hazards through physical, institutional and social indicators; and evaluating levels of risks and generating risk maps through thematic mapping.

Besides, following the proposed methodology, a system is developed for the Assessment of Risks at Territorial Scale (ARTS) for archaeological heritage located in the Izmir Metropolitan Area, Turkey. Through this system, the levels of vulnerabilities and risks are identified and risk maps of archaeological sites are prepared. Successively, addressing present decision-making mechanisms in Turkey, integration of the system into existing archaeological heritage management system is proposed. As risk assessment is based on collecting and processing extensive amount of quantitative, qualitative and spatial data, the methodology can be developed further parallel to the researches and development of databases regarding natural and human-induced hazards and factors affecting vulnerabilities of archaeological assets.

Keywords: Archaeological Heritage, Natural and Human-induced Hazards, Vulnerability and Risk Assessment, Risk Management, Izmir.

ÖZ

ARKEOLOJİK KÜLTÜR MİRASININ BÖLGESEL ÖLÇEKTE RİSK DEĞERLENDİRMESİ
İZMİR METROPOLİTAN ALAN ÖRNEĞİ

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Arkeolojik değerler her gecen gün artan bir şekilde kentleşme, altyapı gelişimi, kitle turizmi, kacak kazı, deprem, sel ve benzeri tehditlere maruz kalmaktadır. İnsan ve doğa kaynaklı risklerin çoğunun bölgesel olarak çok sayıda arkeolojik alanı etkilemesi nedeniyle, arkeolojik alanların korunabilmesi arkeolojik mirasın bölgesel ölçekte öncelikler belirlenerek yönetilmesine ve risklere yönelik stratejilerin geliştirilmesine bağlıdır. Dolayısıyla, risklerin oluşumuna etki eden faktörlerin ve risk seviyelerinin kapsamlı olarak değerlendirilmesi, arkeolojik alanların etkili bir şekilde korunması ve yönetimi acısından önem taşımaktadır. Bu sebeple, bu tezde arkeolojik alanları tehdit eden risklerin bölgesel ölçekte değerlendirilmesi için kapsamlı bir yöntem geliştirilmesi amaçlanmıştır.

Kalitatif bir değerlendirme yaklaşımı izleyen bu çalışma, diğer disiplinlerde kullanılan kavramlara da referans vererek risk değerlendirmesi için gerekli analitik çerçeveyi, verileri, ana prosedürleri ve analiz araçlarını tanımlamaktadır. Geliştirilen risk değerlendirme yöntemi, Coğrafi Bilgi Sistemleri (CBS) de

kullanılarak doğal, kurumsal ve insan kaynaklı tehlikelerin tespiti, sınıflandırılması ve haritalandırılması; arkeolojik alanların bu tehlikelere karşı hasar görebilirliğinin fiziksel, kurumsal ve sosyal göstergeler ile değerlendirilmesi; son olarak risk seviyelerinin değerlendirilmesi ve tematik haritalandırma ile risk haritalarının hazırlanması basamaklarını içermektedir.

Ayrıca, önerilen yöntem kullanılarak İzmir Büyükşehir Belediyesi sınırları içinde yer alan arkeolojik kültür mirasına yönelik Bölgesel Ölçekte Risk Değerlendirme Sistemi geliştirilmiştir. Geliştirilen sistem ile arkeolojik alanların hasar görebilirlik ve risk seviyeleri tespit edilerek risk haritaları hazırlanmıştır. Son olarak, Türkiye'deki arkeolojik alanlara ilişkin karar alma mekanizmaları değerlendirilerek önerilen risk değerlendirme yönteminin mevcut arkeolojik alan yönetim sistemine entegrasyonu için öneriler geliştirilmiştir. Risk değerlendirmesi, önemli miktarda nitel, nicel ve mekânsal verinin toplanması ve işlenmesine bağlıdır. Bu sebeple, doğal ve insan kaynaklı tehlikelere ve arkeolojik alanların hasar görebilirliklerini etkileyen faktörlere ilişkin araştırılmaların yapılması ve veri tabanlarının zenginleştirilmesine bağlı olarak önerilen yöntem geliştirilebilir.

Anahtar Kelimeler: Arkeolojik Miras, Doğal ve İnsan Kaynaklı Tehlikeler, Hasar Görebilirlik ve Risk değerlendirmesi, Risk yönetimi, İzmir

To my dear husband Ersin

and our daughter Eylul Bahar,

with love

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ABBREVIATIONS

AFAD	Afet ve Acil Durum Yonetimi Baskanligi
C.E.	Council of Europe
GIS	Geographical Information Systems
ICOMOS	International Centre for the Study of the Preservation and Restoration of Cultural Property
ICCROM	International Council on Monuments and Sites
KTVKBK	Kultur ve Tabiat Varliklarini Koruma Bolge Kurulu
KUDEB	Koruma, Uygulama ve Denetim Burosu
MoCT	Ministry of Culture and Tourism
NGO	Non-Governmental Organization
RCC	Regional Council of Conservation for Cultural Assets
TAY	Archaeological Settlements of Turkey Project
UNDP	United Nations Development Program
UNEP/MAP	United Nations Environment Programme Mediterranean Action Plan
UNESCO	United Nations Educational. Scientific and Cultural Organization

CHAPTER 1

INTRODUCTION

> Cultural heritage is always at risk. It is at risk from the depredations of war. It is at risk in the face of nature's occasional eruptions and irruptions. It is at risk from political and economic pressures. It is at risk from the daily forces of slow decay, attrition and neglect. It is even at risk from the hand of the over-zealous conservator! [1]
>
> Herb Stovel

It is widely accepted that learning about the origins and development of human societies is of ultimate significance to humanity. Archaeological heritage[2], which constitutes the record of past civilizations, is extremely significant for the humankind in understanding past societies, and identifying its cultural and social roots. Its conservation and management is hence crucial for the benefit of present and future generations[3]. However, it is reported by the ICOMOS International Committee for Archaeological Heritage Management (ICAHM) that much of the World's archaeological heritage is at risk[4]. ICOMOS Heritage at Risk Reports also reinforce this with two-thirds of the records stating threats to archaeological heritage.

The causes of destruction are various that range from urbanization, infrastructure development, physical resource extraction, mass tourism to deliberate destruction, vandalism, civil unrest, and many others. To cite only one of many

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[1] Stovel 1998: 17

[2] Archaeological heritage is defined in the European Convention on the Protection of the Archaeological Heritage (revised), as "a source of European collective memory and as an instrument for historical and scientific study. All remains and objects and any other traces of humankind from past times are considered elements of the archaeological heritage. The notion of archaeological heritage includes structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water". Council of Europe 1992

[3] ICOMOS 1990

[4] ICOMOS Committee on Archaeological Heritage Management (ICAHM) 2002

examples: in 2001, the Bamiyan Buddhas in Afghanistan was destroyed due to armed conflict and vandalism[5].

Besides, natural events and processes have accelerating impacts on archaeological heritage. As stated by UNISDR in its "*2009 Global Assessment Report on Disaster Risk Reduction, Risk and Poverty in a Changing Climate"*, every year, there is an apparent increase in the number of disasters around the world[6]. Rapid urban growth, unplanned developments in disaster prone areas and poor governance add to the vulnerability of settlements, and raise the impacts of hazards[7]. Therefore, natural events like earthquakes, floods, landslides turn into big disasters, which lead to loss of lives, livelihoods, as well as irreplaceable losses of cultural and natural properties including archaeological heritage around the World. The recent examples of disasters that have occurred over the last few years show the enormous level of losses of cultural heritage[8]. For instance, recently, in 2011, Great East Japan Earthquake, followed by multiple disasters including tsunami, fire, flooding, and nuclear accident, resulted in loss of lives, livelihoods, and damages to cultural assets[9].

In addition to these momentary incidents with severe consequences, slow and progressive natural events such as precipitation, wind, temperature and relative humidity have significant adverse effects on vulnerable archaeological properties, as indicated in the reports prepared by UNESCO and the Advisory Bodies to the

[5] Similarly, the Temple of the Tooth Relic in Kandy in Sri Lanka was destroyed after terrorist attack in 1998. UNESCO / WHC 2007
[6] UNISDR 2009
[7] Bandarin 2010: 3
[8] Bam, a World Heritage Site in Islamic Republic of Iran, was damaged due to earthquake in 2003. Another World Heritage Site, Parambanan Temple Compounds in Indonesia was hit by earthquake in 2006. Some of the recent examples of disasters in the World include 2004 Niigata-Chuetsu Earthquake, 2004 earthquake and tsunami in Sumatra, Hurricane Katrina in 2005, big water hazard in Myanmar in 2008, 2008 Sichuan Earthquake, 2009 debris flow disaster in Taiwan, 2010 flood in China, 2011 East Japan great earthquake and tsunami, great debris flow disaster in Kii peninsula in 2011. See: UNESCO / WHC 2007
[9] Japan ICOMOS National Committee 2011

World Heritage Committee[10]. Another issue that gained significance in the last years is global climate change, which is also exposing archaeological heritage to increasing risks[11].

As a response to increasing losses of heritage values, awareness of natural and man-caused risks has grown, especially after 1990's, through international efforts[12]. Particularly, the State of Conservation reports for World Heritage properties prepared by UNESCO World Heritage Center have publicized threats to the World Heritage, identifying properties in need of extraordinary measures and addressing international cooperation to guarantee their survival. Besides, due to increasing concerns, in 1992, the International Council on Monuments and Sites (ICCROM) initiated the *Blue Shield* Movement in order to reorient conservation attitudes and practices toward a preventive approach. An Inter-Agency Task Force involving ICCROM, UNESCO, ICOMOS, ICOM and many others was established in order to coordinate activities related to emergencies. The ICCROM Blue Shield Movement and Inter-Agency Task Force Meetings have been effective in raising interest in risk-preparedness among cultural heritage professionals[13]. Eventually, risk preparedness and management emerged as an important policy area. Initiatives of international nongovernmental and intergovernmental organizations continued with the publication of "*Manual for Risk-Preparedness for World Cultural Heritage"* in 1998[14]. Moreover, as one of the publications of a series of World Heritage Resource Manuals, a joint undertaking by the Advisory Bodies of ICCROM, ICOMOS, and IUCN, and the UNESCO World Heritage Center, the Manual titled *"Managing Disaster Risks for World Heritage"* was published in 2010, providing a methodology for identifying, assessing, and reducing risks. These publications aim to help State

[10] For more information see: UNESCO 2013a
[11] UNESCO / WHC 2007
[12] Stubbs, 2009: 115
[13] As a result of the efforts of the Inter-Agency Task Force, the International Committee of the Blue Shield (ICBS) was established in 1996. For more information see: Stovel 1998: 2
[14] "Risk Preparedness: A Management Manual for World Cultural Heritage" was prepared by ICOMOS with the support of UNESCO's World Heritage Committee, and edited and published by ICCROM. Stovel 1998

Parties build their capacities for effectively managing cultural and natural World Heritage properties.

In fact, these Manuals provide guidance for all cultural properties, and should not be limited to the World Heritage. Besides, a proactive conservation and management approach that takes into account a wide range of risks is essential not only at site-scale but at all levels of heritage management (e.g. national, territorial, local). Moreover, with respect to archaeological heritage, managing risks to archaeological heritage necessitates a special approach, as kinds and intensity of threats (e.g. illicit digging, development projects, agricultural activities, etc.) as well as vulnerability factors (e.g. being below ground or excavated) are specific to this heritage. From its identification to protection and conservation, deficiencies in all phases of management increase its vulnerability to all kinds of hazards.

Within the complexity of issues, effective management of archeological heritage is challenging, especially for countries that possess an extensive amount of archaeological assets facing extensive urbanization and development pressures, as in the case of Turkey. Richness, intensity and variety of archaeological assets are reflected in many of the Anatolian settlements, which have been formed through historical continuity with varying contents and layers since the early ages onwards[15]. However, within the dynamics of change, this richness can be conserved only through holistic and proactive risk management approaches at all levels of management. Thereupon, territories that possess aggregates of archaeological assets constitute the context of this thesis.

1.1.Definition of the Problem

Until recently, the focus of attention in the conservation field has been on conservative interventions after deterioration or some sort of damage has already

[15] Altinoz 2002: 4

occurred to the cultural property. However, various experiences and recent losses of cultural heritage in the world because of destructive natural and human-caused hazards have shown that there is need for a preventive approach in the field. It has been accepted that disasters are not solely 'natural' in their dynamics; instead, they happen because of various interlocking factors, many of which are very much within human control, and preventing or at least minimizing the effects of various hazards are possible[16]. Hence, reactive and curative practice has lately started to be replaced with a proactive and preventive approach in the cultural heritage conservation field.

A proactive approach is critical not only in dealing with the risks of disasters and natural processes of decay, but for managing all kinds of risks including the tremendous development pressures in and around heritage sites. Especially in developing countries, and particularly in settlement areas, development is the major threat to cultural assets and, it is mostly very late to intervene after development schemes have already been developed and approved. In order to ensure the minimum impact on heritage values, a proactive approach is essential for preventing irreversible changes, while addressing the present and future needs.

Moreover, success in the field of conservation depends on improving the effectiveness of conservation actions. It is crucial to set measures of priority and to make informed decisions regarding the conservation of cultural heritage for the effectiveness of the required actions, considering the scarcity of funds available as opposed to the vast number (and variety) of the components of this irreplaceable heritage. In order to be able to set priorities, it is also essential to take into account various natural and man-induced hazards threatening cultural heritage.

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[16] Bandarin 2010: 3

Hence, effective management of **archaeological heritage** necessitates understanding factors (hazards) threatening conservation and physical, legal, administrative, managerial, and social aspects (vulnerability) that increase the likelihood of loss of values and destruction. As togetherness of hazards and vulnerabilities create risks to heritage values, it is vital to comprehend all internal and external dynamics that pose risks to heritage in order to develop effective management strategies. Accordingly, **information** about risks and contributing factors is extremely important for effective **archaeological heritage conservation and management**.

Management of archaeological assets is carried out by **decision-makers** (mostly public institutions) operating within a system of roles and responsibilities at national, territorial and local levels and within the framework of established legislations. Conservation of archaeological assets directly depends on the decisions and regulations imposed by the decision-maker through the tools and **decision-making processes** of registering, planning, allocating funds for conservation, research, excavation, and opening to visitation. There are strategic tools such as legislation, policies, and planning that guide high-level management decisions as well as practical tools such as daily maintenance and monitoring at site level. Preventive approach is essential in **all levels of decision-making**. Being greatly critical for the conservation of values, these **decision-making processes at national, territorial, local and site levels**, has to be built upon **informed judgment about values as well as risks** threatening those values.

It is also important to highlight that as most of the risks deriving from natural and human factors **affect large areas where an aggregate of sites exist rather than a single site, risks can be effectively managed only if they are assessed and managed at all levels of decision-making.** Here, **territorial scale strategies** become particularly important for territories with aggregates of assets, as site – scale management cannot be effective in dealing with larger scale problems. When decisions are not built upon information about common problems and threats to many sites, the management becomes ineffective, and lead to losing values. These problems are common to most of the heritage-rich territories as in the case of Turkey.

Turkey is one of those countries that houses a significant number of unique examples of archeological heritage. However, archaeological assets in Anatolia are facing increasing threats due to rapid urbanization and development as well as impacts of natural events and processes. Many sites are located within the context of rapidly urbanizing and developing cities, and subject to impacts of development. The result is the rapid destruction and loss of archaeological assets in these areas instead of their conservation. Assessing the existing management system in Turkey reveals that deficiencies in the current administrative system of archaeological heritage management increase the vulnerability of assets to natural and human-induced hazards. Particularly, there are not policies, procedures and administrative system that enable proactively dealing with risks, and hence decisions are not based on priorities identified through rational analyses[17]. Besides, the current system lacks a territorial management approach, and only facilitates site-scale management for a few selected sites that are either currently excavated or open to the public. Thereupon, territorial scale management supported by information about kinds of dangers within the territory, level of vulnerabilities of each site, and sites at risk of various hazards is critical.

As mentioned earlier, information on risks is an important input for different levels of archaeological heritage management process. At all levels of decision-making, risk assessment should be the first step of a preventive and effective conservation and management process. Risk assessment enables an informed judgment about risks and possible losses. Determining risks not only provides a basis for setting priorities but also enables planning of essential precautions and interventions to prevent or at least minimize any possible negative impacts of such hazards on cultural heritage. A preventive approach helps extend the life of

[17] Interview with the Head of Excavations Department at the Ministry of Culture and Tourism, Turkey, December 2010.

cultural properties as well as offers a holistic focus on management of all assets. At territorial level, assessment of risks help understand distribution of sites at risk, for setting measures of priority, and for developing proactive management strategies to prevent or mitigate risks. While risk assessment at site level enables informed judgment about risks and help develop a risk management plan, as well as site-specific strategies and measures for mitigation, and management of risks to that site, risk assessment at territorial scale helps decision-makers develop strategic tools such as policies, strategies, and planning based on priorities to manage risks to the properties. **Seeing the big picture through a large-scale assessment also enables to assess risks of development as well as enables to better deal with most hazards that have impact on large areas rather than a single site.**

Carrying out risk assessment necessitates the collection, structuring and processing of raw data on dangers and vulnerabilities to make informed judgments about risks. **At territorial scale, this necessitates following up a methodology which enables to analyze complexities of hazards and vulnerabilities for multiple sites.** However, **the major problem is the lack of a definite methodology** as to collect, structure, analyze and evaluate the data to provide information on risks threatening archaeological heritage in a territory, thus, it necessitates to be processed through a well-defined methodology, which provides tools for problem analysis and evaluation.

Based on a preventive approach, a risk assessment approach for a site-level analysis and assessment was introduced in the World Heritage Resource Manual "Managing Disaster Risks for World Heritage. However, as mentioned by Jigyasu, "the work is still much at conceptual level and based on qualitative methods. More research needs to be undertaken to develop quantitative tools for risk assessment…" He also states that "(the methodology) needs to be tested on various types of heritage sites. Considering the complexity of heritage sites both in terms of their values and their qualifiers (authenticity and integrity), this is indeed a challenging but a very important task"[18].

Although practical applications and knowledge of risk assessment in the field of cultural heritage conservation is still limited, there are some substantial experiences. For instance, the Risk Map of Italy is the first systematic attempt of risk assessment of cultural heritage. This nation-wide project, initiated by the Central Restoration Institute (ICR) in the 1980s, is an example of a quantitative approach to risk assessment, based on a "risk model" constructed through a statistical approach[19]. This project develops two different approaches, depending on the scale of the analysis. At the first level, a territorial analysis aims to calculate the level of risk of each municipality, which is the analysis unit, so lacks a direct corroboration between each heritage site and the risk factors, and hence lacks a vulnerability analysis. At second level, risk level is calculated for each single heritage item, but the level of hazard is not calculated for each single site and instead the hazard level of the territory in which it is located is used for the calculation, while 'vulnerability' is considered as the physical condition of each site. Besides anthropic factors of risk are delimited to tourism impact, theft and population changes[20]. This project is important in revealing the potentials and significance of risk assessment for effective management of cultural heritage.

However, assessing risks threatening archaeological sites necessitates **a unique approach due to** complexities and characteristics specific to this heritage. Besides, assessing risks at territorial level is critical to develop effective strategies. However, a comprehensive methodology for risk assessment of archaeological heritage at territorial scale should be developed in a way that it can provide a direct corroboration between hazards and sites, that can take into

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[18] Jigyasu 2010
[19] Giammarusti n.d.: 105
[20] Outcomes of this project as explained by Stovel, enables "predicting preventive measures required most urgently, …, and time/cost effectiveness of available preventive measures". Stovel 1998: 70

account various natural and human-induced hazards including development, and that can integrate an approach for assessing vulnerabilities of multiple sites to evaluate their levels of risks.

1.2. Aim and Scope of the Study

It follows from the above discussion that risk assessment is the key for effective management of archaeological assets. Information about risks should be taken into account during the decision-making processes. Conservation of archaeological assets can be achieved if risk assessment is integrated into the all levels of management systems. In order to contribute to archaeological heritage management, **this study aims at providing a methodology for risk assessment of archaeological heritage at territorial scale** that enables informed judgment about risks, and risk assessment can become an integral part and parameter within the conservation and management processes.

While developing the methodology, parameters of risk and the choice of data to be used as well as how it will be structured, analyzed and evaluated to obtain information about risks are examined. Besides, objectives of the study are identified based on the needs of the current management processes in Turkey. Hence, the thesis deals with setting a risk assessment system and methodology for archaeological heritage at territorial scale, while defining its position within existing archaeological heritage management and the administrative system in Turkey.

Considering variety of hazards and the complexity of factors affecting vulnerability of archaeological heritage, and the necessity of information regarding risks from different disciplines to understand the presence and level of risks to achieve appropriate prevention and mitigation strategies, it is aimed to obtain a system in which all these different data can be correlated with each other.

Hence, the proposed system is based on Geographic Information Systems (GIS), which offer a medium compatible with the complexity of the analysis, and enable manipulating complex, multi-faceted and dynamic spatial information and provide the necessary analysis tools for the assessment. In addition, today, widespread use of GIS in spatial planning will ease the integration of the assessment system in existing conservation and planning systems in practice. GIS also provides flexibility for continuous updating of data through monitoring processes. While carrying on this research, QGIS is used. Existing capabilities of QGIS enable to construct the proposed system.

The major contribution of this thesis is the construction of the framework and content of a risk assessment methodology for archeological heritage to support territorial scale management. Focusing on the territorial scale, the study does not aim to create and develop a system, which includes all types of information necessary for the decisions and proposals to achieve site-level risk management. The main objectives of the study can be defined as:

- To propose a methodology for assessment of risks to archeological heritage at territorial scale based on a theoretical background, addressing international theories, principles and experiences as well as the current decision-making process in Turkey,

- To identify and categorize comprehensively both natural and human-induced hazards threatening archaeological heritage,

- To define principles of risk assessment of archeological heritage within the framework of international policies,

- To examine hazards threatening archaeological heritage in Turkey and evaluate archaeological heritage management policies and capacities of Turkey through an overview of legislative and administrative framework,

- To develop a system for Assessment of Risks at Territorial Scale (ARTS) by utilizing GIS for archaeological heritage in Izmir Metropolitan Area which enable to identify natural, institutional and human-induced hazards, to assess level of vulnerabilities of archaeological assets and their level of risks,

- To propose a framework to integrate risk assessment process into archeological heritage management and planning processes to enable a preventive conservation approach, through evaluation on Turkey's administrative system and the ARTS- Izmir Metropolitan Area study.

Delimitations set for the research include the following theoretical and contextual discussions, and the geographical boundaries of the case selected:

- Subject: The study is delimited to the archeological sites excluding underwater, movable, and intangible heritage categories.

- Context: Archaeological heritage management policies of Turkey were examined within the framework of legislative and administrative context of the country.

- Scope and boundaries of ARTS – Izmir Metropolitan Area: For territorial scale assessment system, Izmir Metropolitan Municipality area is selected.

Specifically, as spatial data regarding geographical locations of archaeological sites and spatial-planning parameters are available through 1/25.000 scale Izmir Urban-Region Development Revision Plan (IKNIPR) including areas within the boundaries of the Izmir Metropolitan Municipality, the case study areas is delimited to the area of the Metropolitan Municipality, rather than the entire provincial area. Besides, to archaeological sites presented within the abovementioned plan, which covers 538.551,6 hectares area, are included in the case study research.

In addition, while the political and socio-economic factors affect conservation and management of archeological heritage, this study will be limited to the physical and institutional aspects of vulnerability of archeological assets, mentioning also social dimensions of vulnerability.

1.3. Methodology and Structure of the Thesis

As this study aims at developing a comprehensive methodology for assessing risks at territorial scale through dealing with complex information concerning various hazards and vulnerabilities of archaeological heritage, it necessitates referring to the studies, concepts and certain analysis tools of other disciplinary areas. Multiplicity of hazards, some of which falls within the interest of natural and applied sciences, impacts of development, physical, managerial, legal, administrative and social aspects of the abstract concepts of 'vulnerability' and 'risk' bring forth the necessity to understand, identify, categorize, analyze, and evaluate all parameters of risk, including 'hazard' and 'vulnerability', through an extensive qualitative and comparative research. Hence, this analytical study calls for the utilization of the problem analysis models, which are the tools designed according to the specific needs of the management sciences. Referring to rationality and terminology of the 'Logical Framework Approach', a management tool used for design, monitoring and evaluation of development programmes/projects, the proposed methodology facilitates the qualitative vulnerability assessment in the form of the evaluation matrix based on a series of connected prepositions reflecting the comparative judgments. Besides, carrying out a spatial analysis for the identification of hazards, assessment of vulnerability and evaluation of risks necessitate employing spatial analysis tools, which are provided by Geographical Information Systems (QGIS) with the capacity of processing all the data. It is also important to note that the subjects originating from other disciplinary fields are not considered in all details and aspects, but instead, the necessary and basic concepts related with the subject of thesis are tried to be extracted and adapted to the context and content of the research. Concerning these subjects, the sources that contribute to the description of the basic concepts and processes are referred.

Together with the conceptual base that is formed for building up the methodology for risk assessment of archeological heritage at territorial scale to support the archaeological heritage management processes, this research employs interpretive[21] and case study research[22] methods. The theoretical background of the study is grounded on both international context and theories and the administrative and legal conservation framework of Turkey, focusing on archaeological heritage conservation and management processes. Charters, Recommendations, Manuals, Guidelines developed by international non-governmental and intergovernmental organizations are reviewed. Besides, following research methods are utilized while collecting information regarding the context of Turkey:

- Literature research on issues threatening the conservation of archeological sites, legal and policy documents of Turkey,
- Collecting census data regarding various hazards affecting archaeological heritage,
- Analyzing data from Archaeological Settlements of Turkey (TAY) Project online database,
- Gathering data from public institutions regarding natural hazards,
- Collecting information from the Ministry of Culture and Tourism about the archaeological heritage inventory, and reported illicit digging incidents;
- Interview with the head of the Department of Archeological Excavations in December 2010,

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[21] Groat and Wang (2002, pp. 135-163) define interpretive research as "investigations into social physical phenomena within complex contexts, with a view toward explaining those phenomena in a narrative form and in a holistic fashion". Besides, they explain the nature of interpretation as follows: "the researcher attempts to collect as much evidence as possible concerning a complex social phenomenon and seeks to provide an account of that phenomenon. This requires searching for evidence, collecting and organizing that evidence, evaluating it, and constructing a narrative from the evidence that is holistic and believable".

[22] A case study in architectural research is "an empirical inquiry that investigates a phenomenon or setting" Groat and Wang 2002: 346

- Semi-structured interview with the Head of Clandestine Trade Section at the Ministry of Culture and Tourism in March 2013,

- Obtaining information about archaeological heritage inventorization of Turkey from the General Directorate of Cultural Properties and Museums, the Department of Conservation Councils, the Section of Identification and Registration,

- Obtaining the database on reported illicit digging incidents from the Section of Illegal Trafficking under the Department of Illegal Trafficking of the General Directorate of Cultural Properties and Museums, Ministry of Culture and Tourism,

- Semi-structured interview with the head of Department of Archaeological Site Museums (Oren Yerleri) of the General Directorate of Cultural Properties and Museums, Ministry of Culture and Tourism.

In addition, following the proposed methodology for the assessment of risks at territorial scale for effective management of archaeological heritage, a comprehensive system for **Assessment of Risks at Territorial Scale (ARTS)** is developed for archaeological heritage in Izmir Metropolitan Area within this dissertation research. The development of ARTS system aims at helping decision makers and heritage managers see ‘big picture’ regarding various risks threatening archeological heritage within a large administrative area, and contributing to the archaeological heritage management processes in this area. As risk assessment has to be a continuous process due to the changing dynamics affecting risks, the risk assessment system is designed in a way that it can be updated through continuous monitoring of risks, using the established indicators.

Izmir Metropolitan Area is selected for this research, as this area possesses rich and dense archaeological setting and is exposed to a wide range hazards including rapid urbanization and development pressures, earthquake, landslide, coastal processes, flooding as well as widespread unfavorable human activities such as agricultural use, land modifications and illicit digging (See Figure 1.1).

Following the proposed framework, first, natural and man-induced hazards threatening archaeological sites are identified using various data sources.

Figure 1.1. Location of Izmir

Moreover, as assessment of risks depends on data availability, the metropolitan area is selected due to the availability of spatial data in digital format. This research requires acquiring the relevant data from various sources, which is a challenging endeavor itself. After making a thorough analysis of the sources of information regarding hazards and vulnerabilities, the initial phase of the research includes systematic collection, and organization of extremely extensive amount of data on different types of natural and human-induced hazards, areas being affected by these hazards as well as on various information about archeological heritage.

For setting up a system and constructing a database at territorial level all the available information about multiple hazards and vulnerabilities of heritage are collected and assessed within a single system that enables the production and interpretation of information on risk through incorporating various research methods. Gathering and analyzing an extensive amount of information is made through both qualitative[23] and quantitative research methods[24] including literature review, archival research on historical records about past disasters, obtaining spatial planning maps from the Municipality, and inventory research from the database of the Ministry of Culture and Tourism to gather data regarding several characteristics of archaeological sites. In addition, publications, unpublished reports, interviews, site observations, field note-taking, and photographs as well as quantitative statistical data related to archaeological sites, natural hazards and illicit digging are used. Specifically, the following research methods are utilized:

- Obtaining 1/25.000 scale Urban-Region Development Plan (IKNIPR) from Izmir Metropolitan Municipality,
- Obtaining Map of Kadifekale Landslide Hazard Area from the Section of Urban Transformation of Izmir Metropolitan Municipality,
- Obtaining the Map of Urban Archaeological Sites in Historic Kemeralti Region and its surrounding from the Section of Historical Environment Conservation of Izmir Metropolitan Municipality,
- Obtaining Izmir Geological Map from Izmir Special Provincial Administration,
- Obtaining archeological heritage inventory (identification and registration forms) of Izmir from the Provincial Directorship of Izmir Culture and Tourism,
- Interview in Izmir Provincial Directorship of Disaster and Emergency Management (AFAD) in April 2013,

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[23] Groat and Wang (2002, p. 174) state that “qualitative research is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter”.

[24] Cardona argues that a holistic conception and estimation of risk should necessarily be based on both qualitative and quantitative methods. Both the establishment of relationships between subjective risk perceptions and the scientific objective measurement are vital and needed for a complete view of risk, especially considering the inevitable intervention in risk from the public policy perspective. Cardona 2003

- Interview with public officials in Izmir Second Regional Conservation Council,

- Interviews with the Excavation Directors of some selected archeological sites including Agora, Klazomenai, and Teos[25] in June-July 2012.

- Undertaking fieldworks in June-July 2012 at several registered archeological sites including Agora, Bayrakli, Teos, Klazomenai, Limantepe, and Yesilova Hoyuk and their surroundings to explore and document issues threatening archeological heritage.

1/25.000 scale Urban-Region Development Plan (IKNIPR) prepared by İzmir Metropolitan Municipality of İzmir in 2007 and revised in 2010 is one of the significant data sources. IKNIPR comprises of twenty-one out of twenty eight districts of İzmir. As mentioned earlier, due to the availability of data, these twenty-one districts are included in the case study, and IKNIPR is used to identify the geographical distribution of archaeological assets. In addition, GIS coordinates of some archeological sites are provided from Turkish Archeological Settlements Project (TAY) Office. As a result, in addition to archeological sites that are presented on the 1/25.000 scale Urban-Region Development Plan (IKNIPR), those that exist in the TAY database are included in the case study, all of which make 230 first degree, 23 second degree, 7 urban archaeological, 160 third degree archaeological sites, and 20 sites without registration status[26]. While the geographical location and degree of legal protection (registration) could be verified for all, the names of only 60 sites could be identified. Together with geographical locations (coordinates) of the sites, the status of legal protection (degree of registration), type of investigation (i.e., regional survey, excavation), presence of on-site management, etc. are collected from various databases including that of the Municipality, the Ministry of Culture and Tourism, and the

[25] Sites that are located in different geographical areas such as urban, rural, coastal and inland areas are selected for site observations and interviews.
[26] Numbers representing number of objects/polygons in GIS shape file format. So, a single site listed in the inventory may contain several polygons in the system if it is divided into and drawn as several parts on the map.

TAY. Other valuable information about sites without legal protection status as well as types of past destructions of certain archaeological sites has been acquired from the online archaeology database of the TAY Project. In addition, geological hazard (landslide, rockfalls) and flooding hazard areas as well as settlement and urban development areas; industrial, commercial, tourism development areas, transportation development (both existing and proposed) including road, subway, railway; major utility development including power lines, natural gas pipelines, dams; agricultural areas and forests are be obtained from IKNIPR.

The process of collecting and organizing data in different formats is a significant aspect of this research, as it aims to assemble, rationalize all a large amount of information at various sources about all factors affecting vulnerability of archaeological sites, and to set up a structured, complex data bank with the capacity of processing all the data (See Appendix A). Moreover, a territorial risk assessment obliges using the potential of geographical information systems (GIS)[27], due to the complexity of the assessment with many sites and various hazards of different origin. In other words, risk assessment of archaeological heritage at territorial scale has to be in the form of a spatial analysis, because of utilizing various data with geographical references (See Figure 1.2). Hence, spatial data that are obtained from 1/25.000 scale (2010) Urban-Region Development Revision Plan are transformed into GIS shape file format, and a digital base map is created which provides geographical definition of the analyzed territory and the description of administrative limits. Based on the proposed methodology, vulnerability assessment is conducted for all sites located within the boundaries of the study area. Risks to archeological sites are evaluated through utilizing analysis tools of QGIS. Finally, cartographic presentations of different type of hazards, vulnerabilities and risks are produced.

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[27] The Geographic Information Systems (GIS) is utilized for developing the Italian Risk Map. In this project, with the information available in the databases, GIS enables to overlap data on various kinds of hazards with areas having presence of cultural assets in question. Central Restoration Institute (ICR) 2003: 65

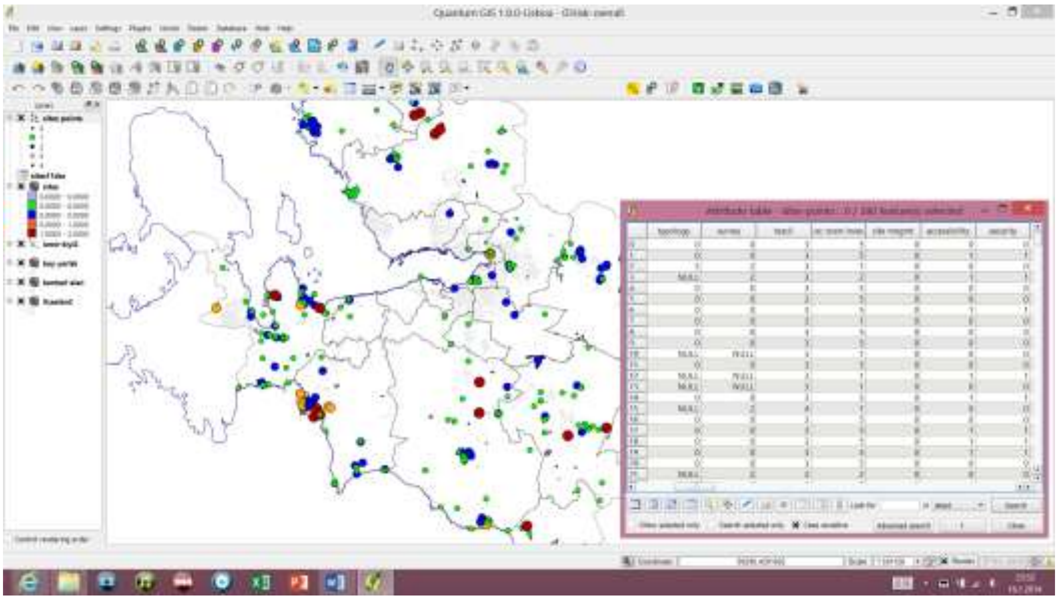

Figure 1.2. Construction of the Risk Assessment Information System through QGIS (Quantum GIS 1.8.0 – Lisboa)

Based on this research methodology, theoretical framework is constructed through literature research. The thesis is structured according to the defined objectives. The first chapter is the introduction of the thesis, in which the context of the thesis as the territories with aggregates of archaeological assets, the definition of the problem, the objectives, the methodology and the structure of the thesis are introduced.

The second chapter constitutes the theoretical background of the research. This chapter provides both international context/theories and the context of Turkey. It is important to note that risk assessment framework should be in line with the internationally accepted cultural heritage conservation and management principles developed by the intergovernmental and nongovernmental organizations. Therefore, these principles are reviewed and used for guidance. All related documents developed up to date by intergovernmental and non-governmental organizations are reviewed through interpretive-historic research. After an overview of theory of archaeological heritage conservation and management policies developed by non-governmental organizations, evolution of the concept of preventive conservation within the conservation field is examined.

Concepts and principles developed by non-governmental and intergovernmental organizations in the field of cultural heritage conservation are reviewed to display significant milestones as well as principles in this field, focusing on archaeological heritage. This analysis led to the analysis and synthesis of concepts to form the theoretical background of the research.

This is followed by examining the context of Turkey. The review of the current archaeological heritage management system in Turkey is made with the aim to assess the effectiveness the current system in terms of dealing with risks to archaeological heritage. The archaeological heritage management policies and legal and administrative context of the country are analyzed in relation to decision-making mechanisms and procedures regarding survey, registration, planning, excavation, conservation and site-management phases. This section begins with an overview of hazards affecting archaeological heritage in Turkey. In addition to an extensive literature survey, the TAY database is utilized to understand the **distribution and kinds of threats** to archaeological sites thanks to the fieldworks undertaken at archaeological sites of Turkey since 2000 by the TAY (Archaeological Settlements of Turkey) Project, a nongovernmental organization in Turkey[28]. Through this project, based on the surveys carried out by a team of specialists including archaeologists, geologists, surveyors, and photographers, more than 2800 archaeological settlements located in cities, towns and villages throughout Turkey have been explored, documenting any destruction[29]. This valuable data is used to create maps, showing the kinds, distribution and intensity of various hazards -including natural hazards, dam construction, illicit digging, agricultural activities, new building construction, road construction and mining - throughout the country. This analysis helps make

[28] The TAY (Archaeological Settlements of Turkey) Project, which began in 1993 as a nongovernmental organization, aims to thoroughly document all archaeological settlements within Turkey. For more information see: TAY 2012. The database that has been developed by TAY teams is very important to understand current threats to archaeological heritage in the face of the rapid development and change processes the Turkey has been undergoing, especially after 1970's.

[29] Field works have been undertaken at archaeological sites, monuments and find-spots located in Marmara, Aegean, Mediterranean, South-east Anatolia, Central Anatolia, Black Sea, Eastern Anatolia regions of Turkey. TAY 2013a

a comparative assessment regarding various kinds of hazards and their impacts. This section is followed by an overview of archaeological heritage management context of Turkey. In order to outline the present legislative and administrative context, three research questions guide the content of the research: “Who are the actors working in the fields of archaeological heritage management?”, “What are their roles and responsibilities?”, and “What are decision-making processes regarding archaeological heritage management?” At the end of this section, the capacity of the Ministry of Culture and Tourism, as the main responsible public institution in conservation, in managing risks to archeological heritage is evaluated.

The third chapter focuses on risk assessment, starting with a theoretical framework for risk assessment and followed by a proposal for risk assessment of archaeological heritage at territorial scale. Within the first part, a concise look at the theory of risk as well as risk assessment and management processes in the field of cultural heritage conservation is followed by a thorough exploration of the experiences on risk assessment in the field of conservation. While undertaking this research, first, it is necessary to elaborate on the construction and use of the concept of ‘risk’. The literature on ‘risk’ is reviewed for the establishment of parameters that need to be analyzed. Based on literature review, the basic definition of the abstract term ‘risk’ that guides this research is that “risk is the togetherness of elements at risk (archaeological sites), hazards, and vulnerabilities to these hazards”. The following discussions stem from this basic definition. In addition, experiences on risk assessment in the field of cultural heritage conservation are evaluated. Within this chapter, principles, processes and parameters of risk assessment are determined. The first section ends with evaluations on risk assessment theory and practice in the conservation field.

The second part of Chapter 3 puts forth a comprehensive methodology for risk assessment of archaeological heritage, based on the theories and previous experiences in the risk assessment of cultural heritage. This section starts with the conceptual base that is formed for building up the methodology for risk assessment of archeological heritage at territorial scale to support the archaeological heritage management processes. Logical framework and problem analysis models, which are management sciences-originated concepts, which enable analyzing complex problems, are examined. The approaches of social sciences in theorizing the concept of vulnerability and measuring vulnerability through identifying useful indicators are analyzed as well. In that way, the adaptable points of these approaches while dealing with analyzing complex problems regarding risks and measuring the abstract concept of vulnerability through developing indicators are determined. Following the frameworks utilized in other fields as well as in conservation, the main stages of the proposed methodology is identified as ‘hazard identification’, ‘vulnerability assessment’, and ‘risk evaluation’. The problems facing archaeological heritage are put forth, carrying out an extensive research on natural and human-induced hazards threatening World Heritage sites. Besides, online database of State of Conservation reports of World Heritage sites is analyzed, creating analysis graphics and tables, since this database is very important to understand and analyze various threats that World Heritage properties have been subjected to since the last decades of the 20th Century. 1532 reports highlight various natural and human-induced threats to 310 out of 759 cultural properties located in 108 State Parties. This database is used to identify kinds of threats as well as the most widespread hazards as well as the trends of various threats in the last years. Accordingly, kinds of hazards threatening archaeological heritage are defined, and categorized for analytical purposes.

Referring to the rationality and terminology of the ‘Logical Framework Approach’, the methodology proposes to facilitate the vulnerability assessment in four stages. These include **cause-affect analysis** for analyzing factors that affect vulnerability through ‘problem tree model’; **developing indicators** that are specific, measurable, attainable, relevant, and time-bound (SMART); **identifying means of verification** for grounding the assessment framework in the realities of a particular setting and considering how data will be obtained, and **measuring level of vulnerability** through the evaluation matrixes. As a result, a set of vulnerability indicators including physical, institutional (legal and managerial) and social factors is developed for each hazard category of natural, institutional and individual-induced. The methodology and the indicators for vulnerability assessment of archaeological sites are tried to be refined and extracted from the issues delineated in the conservation legislation and administrative system of Turkey, as well as in literature. Among all, in addition to physical aspects, a special attention is paid to the 'institutional vulnerabilities', especially registration categories, excavation and management aspect, as these factors affect vulnerability of archaeological heritage to all kinds of hazards. Accordingly, evaluation matrixes are developed for each category of hazard (natural hazards, development, and individual-induced hazards). At the final stage, level of vulnerability is evaluated through determining the effect of each indicator to the level of vulnerability to a specific hazard, and subsequently defining various levels of vulnerabilities (within a logical framework in the form of a series of connected prepositions) that necessitate expert judgments. Finally, the **risk evaluation**, as the last stage of risk assessment, is introduced, which enables producing risk maps for all kinds of hazards through a continuous risk assessment system based on GIS. As ways of explaining the methodology, flowcharts and tables are prepared.

Chapter 4 concerns with the implementation of the proposed assessment method and its evaluation through the case of Izmir Metropolitan Area in detail and the discussions on the results of the case-study. While examining the multiple complex dynamics (that create hazards and vulnerabilities) that result in risks, the case study has explanatory (i.e., explains the application of the proposed framework), and exploratory (i.e. explores the levels of risks for the case) purposes. Therefore, first, the context of the case study research, outlining archaeological characteristics of Izmir and its surrounding as well as the planning context of Izmir is introduced. Next, in the second section, following the methodology proposed in Chapter 3, as mentioned earlier the comprehensive system for **Assessment of Risks at Territorial Scale (ARTS)** is introduced. This chapter displays the application of the proposed risk assessment methodology and its outcomes that enable prioritization, focusing on prevention and mitigation and guides all aspects of archaeological heritage management at national and regional levels.

Finally, Chapter 5, which is the conclusion of the thesis, outlines an evaluation on the proposed methodology aiming at both highlighting the necessity of managing risks at territorial scales and contributing to management of archaeological heritage process in Turkey, particularly in Izmir Metropolitan Area through the established system - ARTS. This chapter also discusses the results of the research in terms of use and implications of the proposed methodology in various decision-making processes of archaeological heritage management, and proposes ways of the integration of this system into current administrative system in Turkey. The thesis concludes with further research topics that this study opens way to develop the proposed risk assessment methodology, outlining data needed to make this framework an effective process of archaeological heritage management.

CHAPTER 2

THEORETICAL BACKGROUND

2.1. International Context and Theories

In recognition of the special needs of archaeological heritage, international standards for the protection and management of archaeological heritage have been established by nongovernmental organizations. In addition, awareness of adverse impacts of natural events and human activities on natural and cultural heritage has increasingly grown in the wider conservation field especially after the 1990's. Commitment being made to preventive approaches as well as importance accorded to this subject in the managerial process has eventually increased[30]. It is significant to review these international principles to highlight the progress in archaeological heritage management practice around the world, and to examine approaches to risk management of cultural heritage.

2.1.1. Archaeological Heritage Conservation and Management

Archeological heritage consists of sites found below ground surface retrievable by excavation, monumental structures and extensive cultural landscapes, as well as discrete small surface sites[31]. Addressing policies at regional and national levels, 'archaeological heritage management'[32], incorporates a wide range of topics concerning the preservation and use of archaeological assets[33]. The

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[30] Laenen 1998: ix

[31] ICAHM 2002

[32] Archaeological Heritage Management is also referred to as Archaeological Resource Management.

[33] Rather than focusing on the individual sites, or group of sites that are managed under a single scheme, archaeological heritage management deals with policies. Although these policies are also part of managing the individual site, it is within the scope of Archaeological Site Management to emphasize the impact of these policies on the management of a specific site. Some issues such as

literature on archaeological heritage conservation and management has grown substantially in the last decades. Progressively, archaeological heritage management has evolved into a greater discourse as new approaches and perspectives developed by government agencies, non-governmental organizations and related disciplines as a response to various social, political and economic concerns. International Charters and documents, which have been developed by intergovernmental organizations and non-governmental organizations, have contributed to the development of principles of conservation and management of archaeological sites. These charters and documents are reviewed to reveal significant milestones in this field (See Figure 2.1).

presentation, interpretation, or solutions for visitor management can be addressed more specifically at the site level. Getty Conservation Institute 2003: 5

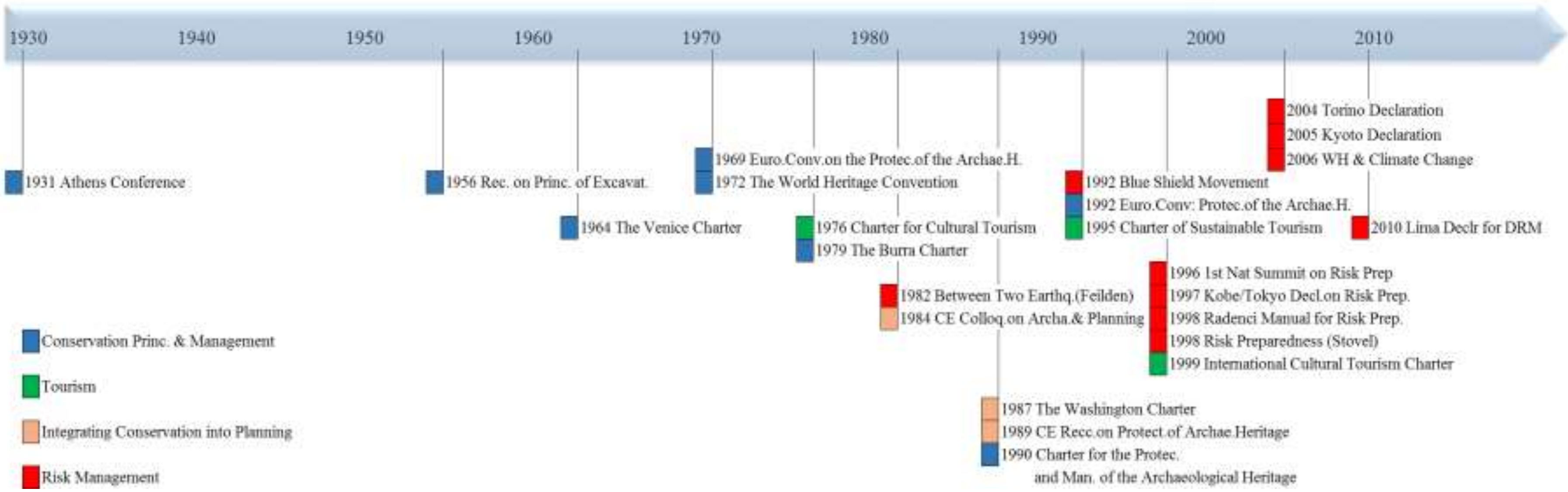

Figure 2.1. Timeline of development of significant international documents regarding cultural heritage conservation (S. YILDIRIM ESEN, 2014)

The first International Congress of archaeology was held in 1905 in Athens[34]. As stated by Jokilehto, the concept of a 'universal heritage', which was gradually developing during the eighteenth and nineteenth centuries, has eventually reached a formal expression in international agreements and conventions[35]. In 1931, Athens Conference was held in Athens, where special emphasis was laid on the idea of a common **world heritage**, as well as on the importance of **setting**, and on the **reburial** of archeological remains when their conservation cannot be ensured through *"Recommendations of the Athens Conference (1931)"*. In 1954, the resolutions of an intergovernmental meeting held in Hague included the 'Convention on Protection of Cultural Property in the Event of Armed Conflict', which was ratified by 39 States, established an 'International Register of Cultural Property under Special Protection' marked with a special emblem. The Convention defined cultural heritage covering "movable or immovable property of great importance to the cultural heritage of every people, such as monuments of architecture, art or history, whether religious or secular; archaeological sites; groups of buildings which, as a whole, are of historical or artistic interest"[36] together with collections and archives and their covering buildings. As underlined by Jokilehto, this definition for the first time covered not only single monuments but also groups of buildings, highlighting their universal value, showed the way towards other UNESCO conventions and recommendations, such as the "The World Heritage Convention" of 1972[37].

In 1956, the General Conference of UNESCO was held in New Delhi. "*Recommendation on International Principles Applicable to Archaeological Excavations* (New Delhi*, 1956)"* which was adopted in this meeting, set forth international principles governing the protection and excavation of archeological

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[34] Jokilehto 1999: 396
[35] Jokilehto 1999: 397
[36] Final Act of the Intergovernmental Conference on the Protection of Cultural Property in the Event of Armed Conflict, the Hague, 1954, UNESCO, 1954, 8: Art. 1,a. In Jokilehto 1999: 420
[37] Jokilehto 1999: 420

sites. These recommendations focused on a wide range of issues including[38]:

- necessity of studying, preserving and protecting archeological remains,
- ensuring protection of archeological heritage,
- general administration of archeological work,
- ensuring regular provision of funds to carry out a program of work, to provide for the upkeep of excavation of sites and monuments,
- supervising over the restoration of archeological remains and objects,
- maintaining untouched a certain number of archeological sites of different periods,
- educating public,
- guarding, maintenance, conservation and restoration of the site, during and on completion of excavation work,
- protection of archeological sites against clandestine excavations and damage,
- international cooperation.

In 1964, *"International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter, 1964)"* was developed. The Venice Charter, which mostly focuses on architectural conservation, has been an influential international document, and introduced many significant concepts and principles of conservation[39]. Another important document regarding

[38] UNESCO 1956
[39] ICOMOS 1964
Later, in 1979, the concept of authenticity and cultural significance were further set forth in "Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (The Burra Charter)", which aimed at establishing principles for the management and conservation of cultural

archaeological sites is *"European Convention on the Protection of the Archeological Heritage"*, which was prepared within the framework of the Council of Europe, entered into force in 1970 after being signed by member States of the Council of Europe. The convention emphasized[40]:

- protecting archeological sites and creating reserve zones for the preservation of material evidence to be excavated later,
- prohibiting and restraining illicit excavations,
- ensuring that excavations are authorized and entrusted only to qualified persons,
- controlling and protecting the results obtained from excavations,
- ensuring scientific publication concerning excavation and discoveries,
- facilitating the circulation of archaeological objects for scientific, cultural, and educational purposes through international cooperation,
- raising public awareness of the historical and cultural value of the archaeological heritage and the necessity to preserve it.

These principles were in line with those included in the *"UNESCO Recommendation on International Principles Applicable to Archaeological Excavations", which was adopted in 1956.* In 1972, the '*Convention concerning the Protection of the World Cultural and Natural Heritage'* (The World Heritage Convention)[41], was adopted by the General Conference of UNESCO. The Convention has been instrumental in bringing the concept of the "shared heritage

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heritage in Australia. This document introduced the process for using cultural significance to manage and conserve cultural heritage sites. Australia ICOMOS 1979

40 Council of Europe 1969

41 "The World Heritage List includes 890 properties forming part of the cultural and natural heritage which the World Heritage Committee considers as having outstanding universal value. These include 689 cultural, 176 natural and 25 mixed properties in 148 States Parties". UNESCO World Heritage Center 2010: para 2

of humankind" through its exploration of the "exceptional universal value" of cultural heritage sites. Since its adoption, the Convention has increasingly been supported by the international community.

In the 1980's, the integration of archaeological conservation into town planning policies and practices began to be important. Council of Europe adopted "*Conclusions of the Colloquy on Archaeology and Planning"*, indicating the **impacts of rural and urban developments** on archaeological values[42]. Aiming at mainstreaming archaeological conservation into town planning, and avoiding problems due to planning decisions, it pointed out the necessity of revising development plans if archaeological potential of a site is known[43]. Besides, in 1989, *"Recommentation R(89)5 on Protection and Enhancement of the Archaeological Heritage in the Context of Town and Country Planning Operations"* underlined such issues as[44]:

- the significance of completing archaeological inventories,
- utilizing this data during the processes of town and country planning, and
- taking legislative, financial and technical measures to ensure the integration of archaeological heritage conservation into development.

Similarly, in 1987, the "*Charter for the Conservation of Historic Towns and Urban Areas"* was adopted by ICOMOS General Assembly. Establishing the principles for the conservation of historic towns, this Charter also promoted the integration of preservation objectives into planning policies, and the participation of residents in the planning process. As an example of this approach, *"100 Coastal Historic Sites of Common Interest within the Mediterranean"* was initiated by UNEP-MAP-PAP in 1985[45]. This intergovernmental program, which

[42] Council of Europe 1984
[43] Council of Europe 1984 : article 5.2
[44] Council of Europe 1989
[45] UNEP/MAP 1987

aimed at mainstreaming cultural heritage conservation into planning, incorporated 100 historic sites including archaeological sites selected from different countries of the Mediterranean basin, and led to development of conservation principles.

Increasing threats to archeological sites worldwide, especially from looting and land development led to the creation of the "*Charter for the Protection and Management of the Archaeological Heritage (ICAHM Charter, 1990)"* in 1990 by the ICOMOS International Committee on Archaeological Heritage Management (ICAHM). The significance of integrating archaeological heritage conservation into planning policies was also stated in ICAHM Charter. The Charter sets forth general principles and guidelines relating to the different aspects of archeological heritage management including the responsibilities of public authorities and legislators in terms of integrating protection policies, legislation and funding; the professional performance of the processes of inventorisation, survey, excavation, maintenance, conservation, presentation, and public access of the heritage, qualifications of professionals, and international co-operation. The Charter states that one of the responsibilities of public authorities and legislators is integrating policies for the protection of archeological heritage into the policies relating to land use, development, and planning at international, regional, and local levels. The Charter also notes that development schemes should aim to minimize their impact upon archeological heritage, and be implemented after archeological heritage impact studies are carried out by developers. As part of integrative approach, public authorities are also required to ensure active participation by the general public for the protection of the archaeological heritage.

In addition, the Charter indicates that legislation should forbid the destruction, degradation or alteration through changes of any archeological site or monument or to their surroundings. It also highlights the significance of proper maintenance, management and conservation of the archaeological heritage. Another significant principle is related to providing for the temporary protection of sites and monuments that are unprotected or newly discovered prior to carrying out an archaeological evaluation. Besides, it indicates that public authorities are responsible for allocating adequate funds for the supporting programmes necessary for effective heritage management.

Furthermore, the Charter sets forth principles regarding the professional performance of the processes of archeological heritage conservation and management. It is indicated in the Charter that protection of the archaeological heritage must be based upon inventories, which is regarded as a ‘continuous and dynamic process’ and general surveys of the resources. In addition, in terms of investigation, the Charter encourages non-destructive techniques, aerial and ground survey, and sampling rather than total excavation. The Charter also explains, sites and monuments that are at risk from development, land-use change, looting, or natural deterioration should be excavated. On the other hand, unthreatened sites may be excavated only if illuminating research problems or interpreting them more effectively to the public is deemed significant. The Charter also points out the significance of preserving monuments and sites in situ in their original contexts, ensuring proper maintenance, conservation and management. Proper maintenance and management after excavation is specifically mentioned as follows: “…the archeological heritage should not be exposed by excavation or left exposed after excavation if provision for its proper maintenance and management after excavation cannot be guaranteed”.[46]

Another important point is about the selection of a sample of sites and monuments for active maintenance, considering limited resources available. Scientific assessment of their significance and representativeness of the diversity should be taken into account in this selection of sites. Finally, it points out the role of high academic and professional standards in relevant fields of expertise and the need for international cooperation.

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[46] ICAHM 1990

In 1992, the member States of the Council of Europe and the other States party to the European Cultural Convention signed the Revised *European Convention on the Protection of the Archaeological Heritage*. This revised Convention aimed at completing the principles set forth in the *European Convention for the Protection of the Archaeological Heritage* signed in 1969, because of evolution of planning policies in European countries. The new text focused on[47]:

- making the conservation and enhancement of the archaeological heritage one of the goals of urban and regional planning policies,
- making arrangements for co-operation among archeologists and town and regional planners in order to ensure optimum conservation of archaeological heritage,
- setting guidelines for the funding of excavation and research work and publication of research findings,
- providing public access to archaeological sites,
- undertaking educational actions to develop public awareness of the value of the archaeological heritage,
- establishing an institutional framework for pan-European co-operation on the archaeological heritage, entailing a systematic exchange of experience and experts among the various States,
- strengthening and co-ordinating archaeological heritage policies in Europe.

Charters and international documents created regarding tourism are also guiding documents for the conservation and management of archaeological sites, as tourism industry may have not only positive but also negative impact on

[47] Council of Europe 1992

archaeological assets. The first charter outlining an approach to cultural tourism is *"Charter for Cultural Tourism (1976)",* which recognized sites and monuments as a source of economic benefit, emphasizing the significance of educating the public and training professionals responsible for these sites. Charter of Sustainable Tourism, which emerged from the World Conference on Sustainable Tourism held in 1995, set forth the following principles of sustainable tourism[48]:

- Generating appropriate planning and management mechanisms,
- Respecting the vulnerability of the cultural and natural heritage,
- Decreasing the impact on the environment,
- Being aware of local interests and contributing to the local economy,
- Accepting participation from all sectors and levels,
- Expanding opportunities and forms of tourism,
- Accepting codes of conduct by the tourist industry.

Parallel to these developments, the literature on archaeological heritage management has addressed many aspects of archaeological heritage management including damaging human activities and solutions to mitigate their impacts. Among various type of human-induced threats, development pressures have been the most explored subject by the researchers, focusing on

[48] As a complementary document to the "Charter of Sustainable Tourism", in 1995, "Segesta Declaration (1996)", addressing specifically the protection and proper use of archaeological monuments of performance including theaters, amphitheaters, stadia, hippodromes, and arenas from Greek and Roman periods, was adopted at a colloquium organized by the Council of Europe. Council of Europe 1996

- integration of archaeology and planning[49],
- challenges of rescue excavation[50],
- fostering cooperation between developers and archaeologists[51],
- sustainable development and archeology[52],
- demands of preserving sites in the face of development pressures[53],
- impact from modern development[54].

In addition to the issues of development, illicit looting[55] of archaeological sites and illegal trafficking[56] are other problems emphasized in the literature. Another widely discussed concern is the marketing and exploitation of heritage for tourism. In response to various problems that archaeological heritage has been facing, the following aspects of mitigation have been discussed:

- the development and implementation of policy and legislation (both national and international)[57];
- the survey, collection and management of data[58];
- forecasting impacts and mitigation[59];
- the training of professionals[60]

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49 Lipe 1974: 213-245; Darvill 1987: 25-31
50 Tilley 1989
51 Davis 1989: 233–36
52 Morales Juarez 1996
53 Greene 1999: 43-60
54 McManamon and Hatton 2000
55 Society for American Archaeology 1995; Schmidt and McIntosh 1996
56 McManamon and Hatton 2000
57 Bourke, Miles and Bal 1983; Cleere 1984; McManamon and Hatton 2000; O'Keefe and Prott 1984
58 Cleere 1989; Ronald 1994
59 Schiffer and Gumerman 1977; Wildesen 1982: 51–96

- public outreach and education[61].

Parallel to these developments, awareness of adverse impacts of natural events and human activities on natural and cultural heritage has increasingly also grown in the wider conservation field especially after the 1990's. Commitment being made to preventive approaches as well as importance accorded to this subject in the managerial process has eventually increased[62].

2.1.2. Evolution of the Concept of Preventive Conservation and Risk Preparedness

The earliest international document that pointed out destruction caused by various natural and human-induced threats is the "*Convention concerning the Protection of the World Cultural and Natural Heritage"* (The World Heritage Convention), adopted by the General Conference of UNESCO in 1972[63]. The Convention highlights[64]:

> disappearance caused by accelerated deterioration, large-scale public or private projects or rapid urban or tourist development projects; destruction caused by changes in the use or ownership of the land; major alterations due to unknown causes; abandonment for any reason whatsoever; the outbreak or the threat of an armed conflict; calamities and cataclysms; serious fires, earthquakes, landslides; volcanic eruptions; changes in water level, floods and tidal waves.

As a way of indicating properties in need of extraordinary measures and addressing international cooperation to guarantee their survival, the Convention

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[60] Society for American Archaeology 1995

[61] Greenberg 1994; Society for American Archaeology 1995; McManamon 2000

[62] Laenen 1998: ix

[63] The Convention has been instrumental in bringing the concept of the "shared heritage of humankind" through its exploration of the "exceptional universal value" of cultural heritage sites. Since its adoption, the convention has increasingly been supported by the international community and as of April 2009, 186 countries had been adhered to the World Heritage Convention. "The World Heritage List includes 890 properties forming part of the cultural and natural heritage which the World Heritage Committee considers as having outstanding universal value. These include 689 cultural , 176 natural and 25 mixed properties in 148 States Parties". UNESCO World Heritage Center 2010: para 2

[64] UNESCO 1972: Article 11

enabled the World Heritage Committee to establish, update and publish a “list of endangered World Heritage sites”. Therefore, the World Heritage Committee started to monitor the condition of properties listed on the World Heritage List, and threats to these sites. While the Convention focuses on the World Heritage Sites, one of the significant benefits of the Convention, Stovel explains, is that “the lessons gained from World Heritage Sites and efforts to improve their state of conservation are transferable to all sites of cultural heritage value”[65].

In the 1980’s, **“risk preparedness”** has started to be discussed in the field of cultural heritage conservation. A particular attention has been given to conserve cultural heritage in seismic regions by the international organizations. In these years, a number of meetings and conferences have been devoted to this subject, emerging from the fact that an important part of cultural heritage is located in earthquake-prone areas[66]. These meetings have contributed to a growing body of knowledge about the disaster preparedness to save cultural properties in seismic regions[67]. In 1987, a handbook titled “Between Two Earthquakes”, written by Sir Bernard M. Feilden, was published by ICCROM and the Getty Conservation Institute to provide information on conserving historic buildings, monuments, and archaeological sites in seismic zones[68].

Although there had been several international meetings and studies focusing on conserving cultural properties located in seismic zones, particular attention has been given to the concept of “prevention” in the 1990’s. In response to increasing

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[65] Stovel 1998: 3
[66] “[T]he 1979 ICOMOS meeting in Antigua, Guatemala; the 1982 conference organized by the Architectural Research Center Consortium, National Academy of Sciences, United States; the 1985 United States/ Yugoslav Seminar at Petrovac and Budva; and the 1985 ICCROM/IZIIS seminar at Skopje, Yugoslavia” ; and 1986 “International Workshop on Structural and Functional Rehabilitation of Housing in Historic Buildings in Seismic Regions” at Mexico City have contributed to a growing body of knowledge about disaster preparedness.
[67] For more information, see: Final Recommendations of the International Course on Preventive Measures for the Protection of Cultural Property in Earthquake Prone Regions, Skopje, Yugoslavia, 1985; and Conclusions and Recommendations of the Workshop on Structural and Functional Rehabilitation of Housing in Historic Buildings in Seismic Regions, Mexico City, 1986 In Stovel 1998
[68] Feilden 1987

losses of cultural heritage values caused by the Gulf War, the civil war in ex-Yugoslavia, the looting of Angkor, floods in Quebec's Saguenay, earthquakes in California[69], international organizations have started to focus on a wide range of risks threatening built heritage, and measures of prevention[70]. Stovel explains, different from built heritage conservation, there was an interest in preventive approach in other fields of conservation[71]:

> While an interest in prevention has long motivated conservators of museum objects, collections and archaeological sites, built heritage conservation professionals – given their over-riding preoccupation with fundamental utility of heritage buildings – have oriented their conservation activities to episodes variously involving repair, upgrading, restoration and rehabilitation. This approach has ensured development of a body of doctrine conceptually oriented to guiding curative or restorative interventions, but less well suited to guiding elaboration of strategies of prevention.

As a reflection of the growing concern, the International Council on Monuments and Sites (ICCROM) initiated the *Blue Shield* Movement in 1992, aiming to reorient conservation attitudes and practices towards a **preventive approach**. Within this framework, an Inter-Agency Task Force involving ICCROM, UNESCO, ICOMOS, ICOM and many others have been established in order to coordinate activities in five major areas including funding, emergency response, training and guidelines, documentation, and awareness. In the context of the ICCROM Blue Shield Movement, Inter-Agency Task Force Meetings have resulted in "awakening of interest in risk-preparedness" among cultural heritage professionals[72].

This ICOMOS initiative was continued with several international meetings. Two important meetings were held in Canada and Japan. In 1996, the first national 'Summit Meeting' on Cultural Heritage and Risk Preparedness was held in

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[69] Stovel 1998: 1
[70] Stovel 1998
[71] Stovel 1998
[72] As a result of the efforts of the Inter-Agency Task Force, the International Committee of the Blue Shield (ICBS) was established in 1996. Stovel 1998: 2

Quebec, Canada. A series of workshops helped international participants shape the '*Declaration of Quebec*', which was developed as a "Canadian model" of risk preparedness for adaptation within similar contexts in other places in the world[73]. The Declaration mainly focused on protection of heritage in times of emergency (considering potential risks and associated impacts of disasters).

In 1997, "on the second anniversary of the Great Hanshin-Awaji Earthquake in Kobe, *The International Symposium on Risk Preparedness for Cultural Properties* was organized in Kobe and in Tokyo"[74] to discuss how to improve risk preparedness for cultural heritage in Japan and elsewhere in the World. At the end of the meetings to which approximately 150 professionals and 550 observers attended, *Kobe-Tokyo Declaration for Cultural Heritage at Risk* was developed. The Declaration focused on integrated strategies for improving risk preparedness for cultural heritage. One of the measures to improve risk preparedness for cultural heritage mentioned in the Declaration was "reducing risks to cultural heritage by natural agents or human action through systematic monitoring, regular maintenance, risk assessment, and appropriate preventive care"[75]. Besides, the need for introducing principles of risk-preparedness for cultural heritage was mentioned in the Declaration. These meetings have been followed by many other initiatives at the regional, national and local levels[76]. It has been widely accepted that, Stovel explains, "the negative impacts of those

[73] The Declaration of Quebec provides a framework for improving the state of preparedness in Canada for the protection of cultural heritage in emergency situations by increasing awareness of the nature and value of cultural heritage among those responsible for heritage and emergency response, encouraging collaboration among all those involved with cultural heritage conservation, building local capacity, and strengthening enabling framework for heritage protection. "Blue Shield Summit Meeting Declaration of Quebec", Quebec City, Canada, 1996 In Stovel 1998: 119-122

[74] Stovel 1998: 123

[75] In addition, the Kobe-Tokyo Declaration calls for the development of a set of "principles of risk preparedness" for cultural heritage at risk, in the form of a charter. Stovel 1998: 125, 127

[76] For information about these meetings: Stovel 1998: 133-134

brief moments of disaster far outweigh the cumulative impacts of daily wear and tear"[77].

World Heritage Committee's annual meetings have also been effective in raising awareness regarding the growing threats to cultural heritage. The Committee's interest in monitoring the state of conservation of the properties inscribed on the List of World Heritage in Danger, and discussions in meetings regarding the World Heritage properties' condition as well as particular hazards threatening them increased concerns and interest in "risk preparedness", as mentioned by Stovel. This issue was highlighted in the Twenty-year Review of the Committee's activities, which was published in 1992. In addition to mentioning to undertake systemic monitoring of Word Heritage Sites, the review defined one of the objectives specifically related to this point as "to promote the adequate protection and management of the World Heritage Sites". Related actions were described as[78]:

- "Take specific steps to assist in strengthening site protection and management;
- Take appropriate actions to address threats and damage to sites".

Besides, the issues related to risks, and monitoring cultural heritage were among the subjects discussed in the expert meetings in 1992 and 1993. For instance, Stovel mentions[79],

> …discussions have focused on establishing baseline data from which changes –for better or worse – can be measured on properties. This concept is …valuable in efforts to work within a framework concerned with assessing risks associated with potential hazards.

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[77] Stovel 1998: 2 Similarly focusing solely on natural disasters, the Council of Europe, Committee of Ministers adopted the Recommendation No. R(93)9 (of the Committee of Ministers to Member States) on the Protection of the Architectural Heritage against Natural Disasters on 23 November 1993 at the 503rd Meeting of the Ministers' Deputies. For information on this document, see: Council of Europe 1993

[78] Stovel 1998

[79] Stovel 1998:7

These discussions eventually led to philosophical changes in the conservation field itself. Concerns for risk preparedness brought a new approach to cultural heritage conservation, focusing on prevention, rather than on healing. While earlier texts of the built heritage conservation (including the Venice Charter and related documents) have mainly focused on curative intervention, Stovel argues, that they have not dealt with "consequences of neglect or deferred maintenance"[80]. With a different perspective, a *cultural-heritage-at-risk framework* has emerged from the new conservation paradigm based on prevention. Stovel compares the framework with earlier approaches to conservation as[81]:

> It has come to be understood that this framework offers a more holistic outlook than conventional approaches to conservation; an outlook viewing all sources of deterioration as linked in a single continuum, from the daily attrition of use at one extreme, to the cataclysmic losses occasioned by disasters or conflicts at the other.

The significance of cultural-heritage-at-risk framework in the history of the preservation movement is explained by Jean-Louis Luxen, 1998 ICOMOS Secretary-General, as follows[82]:

> Risk-preparedness is a critical part of a wiser use of our cultural environments. Risk analysis and mitigation ensure better use of scarce resources, and optimal conditions for extending the life of cultural property. And a cultural-heritage-at-risk framework offers those concerned with the conservation of the built environment the chance to fully root their efforts in a concern for the preventive for the first time in the history of the movement.

As a reflection of this attitude change and interest in raising awareness in risk preparedness, the World Heritage Committee financially supported the publication of *Manual for Risk-Preparedness for World Cultural Heritage*,

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[80] Stovel 1998: 134
[81] Stovel 1998: 2
[82] Stovel 1998: xi

written by Herb Stovel, published in 1998[83]. The Manual aimed at assisting property managers in their efforts to heighten risk preparedness for cultural heritage sites in their care[84]. Marc Laenen, ICCROM Director-General (1998) and the writer of the ICCROM Preface of the Manual, points out that this Manual "recognizes the increasing importance accorded this subject in the managerial process, but also the increasing commitment being made to preventive approaches in the wider conservation field"[85]. The Manual introduces principles of risk preparedness and proposes developing property-specific strategies to improve risk-preparedness for cultural heritage. While natural threats have been widely explored, hazards of human origin have not been examined in detail in the Manual.

In 1998, two international meetings were organized by ICOMOS. Resulting documents of these meetings were Radenci Declaration[86], and the Declaration of Assisi[87]. In 1999, the ICOMOS initiated the Heritage at Risk Project as a complementary to the UNESCO List of World Heritage in Danger. Significance of the project is that it collects and publishes information on dangers threatening monuments and sites in various places of the world, and encourages taking precautions to prevent or at least alley them[88].

[83] "Risk Preparedness: A Management Manual for World Cultural Heritage" was prepared by ICOMOS with the support of UNESCO's World Heritage Committee, and edited and published by ICCROM.

[84] Stovel 1998: 3

[85] Laenen 1998: ix

[86] Blue Shield 1998

[87] ICOMOS, *The Declaration of Assisi, Workshop organized by the ICOMOS Scientific Committee for the Analysis and Restoration of Structures of Architectural Heritage*, Assisi, 27-28 February 1998, In Stovel 1998: 143-145

[88] Petzet 2001: 7. ICOMOS disseminates this information through its publications titled ICOMOS World Reports as well as through the internet. In 2000's, several other international meetings concerning natural disasters and cultural heritage have been held. These meetings include the 2004 First Blue Shield International Meeting in Torino, Italy; the 2005 International Symposium in Kyoto, Japan; the 2005 World Conference on Disaster Reduction in Kobe, Japan; the World Heritage Committee (2006) 30th Session, in Vilnius, Lithuania; the 2007 International Workshop on Impact of Climate Change on Cultural Heritage, New Delhi, India. In the last two decades, literature on risks, analysis, assessment and management of risks, and risk preparedness has expanded.

In 2000’s, intergovernmental organizations have started to focus on developing policies for sustainability of coastal cultural heritage. Particularly, impact of climate change on cultural heritage has been one of the emerging concerns in the field. The report on “World Heritage and Climate Change”[89] was prepared in 2006 by the UNESCO World Heritage Committee. One of the significant recommendations included in the report was “risk preparedness” for World Heritage Sites that are at risk from the climate change and coastal flooding.

Moreover, the publications of a series of World Heritage Resource Manuals, which is a joint undertaking by the Advisory Bodies of ICCROM, ICOMOS, and IUCN, and the UNESCO World Heritage Center, help State Parties build their capacities in managing cultural and natural world heritage properties. In particular, the Resource Manual titled *"Managing Disaster Risks for World Heritage"* in this series, which was published in 2010, aims to provide a methodology for identifying, assessing, and reducing risks. As it is highlighted in the Foreword of the Manual by Francesco Bandarin, the Director of the UNESCO World Heritage Center, this manual also reflects the desire "to achieve the much-needed shift in attitudes that would finally lead to building a true culture of prevention within the heritage community"[90].

These international initiatives are significant in that they have apparently raised awareness of international community regarding threats particularly of nature origin, and have contributed to the development of knowledge on risk reduction and emergency preparedness. Today, such a proactive approach in the conservation field is apparently essential as current threats to cultural heritage is much greater than the earlier times, due to the rapid development and change processes the World has been undergoing since the last decades of the 20th Century.

[89] UNESCO The World Heritage Center 2006
[90] Bandarin 2010: 3

2.2. The Context of Turkey

Surveys and excavations that have been carried out in Turkey since the 19th Century reveal that cultural traces of Anatolia and Thrace date to at least 400.000 years ago[91]. Turkey possesses an extensive amount of archaeological heritage with 11.399 registered archaeological sites, 32 urban archaeological sites, and 444 mixed-type sites as well as 1.909 registered archaeological remains, as of September 2013, according to the cultural heritage inventory. In addition, some of these assets have universal values. Currently, Turkey possesses nine cultural and two (both cultural and natural) properties under the category of 'mixed', inscribed on the List of World Heritage. For instance, Archaeological Site of Troy (1998), Hattusha: the Hittite Capital (1986), Historic Areas of Istanbul (1985), Nemrut Dağ (1987), Neolithic Site of Çatalhöyük (2012), Xanthos-Letoon (1988), Göreme National Park and the Rock Sites of Cappadocia (1985), and Hierapolis-Pamukkale (1988) are World Heritage sites. There are also 41 sites on the Tentative List[92].

Due to wealth of archaeological assets, archaeological heritage management in Turkey is a challenging work of ensuring the protection of more than 10.000 archaeological heritage sites from different periods, and with various characteristics. Effective use of limited financial and human resources in the country for managing vast number of archaeological sites is very critical for the conservation of irreplaceable and invaluable cultural heritage. However, a wide range of both natural (e.g. earthquake, landslide, flood, local conditions) and human-induced (e.g. rapid urbanization, tourism impact, illicit digging) threats to this heritage magnifies this complexity. After an overview of hazards affecting archaeological heritage in Turkey, this section introduces the archeological

[91] TAY 2012

[92] Cultural properties include Archaeological Site of Troy (1998), City of Safranbolu (1994), Great Mosque and Hospital of Divriği (1985), Hattusha: the Hittite Capital (1986), Historic Areas of Istanbul (1985), Nemrut Dağ (1987), Neolithic Site of Çatalhöyük (2012), Selimiye Mosque and its Social Complex (2011), and Xanthos-Letoon (1988). In addition, there are two more properties, which are Göreme National Park and the Rock Sites of Cappadocia (1985), and Hierapolis-Pamukkale (1988), having both natural and cultural values. UNESCO 2013b

heritage management context of the country through examining the policies, legislative and administrative aspects in terms of decision-making mechanisms and roles and responsibilities of stakeholders, focusing on their effectiveness in managing a wide range of risks threatening archaeological sites in Turkey.

2.2.1. An Overview of Hazards Affecting Archaeological Heritage in Turkey

In Turkey, archaeological sites are subjected to increasing risks from various natural and human-caused destruction. As systematic and periodic monitoring of the state of conservation of archaeological heritage has not been carried out in the country, the knowledge about the impacts of these hazards on archaeological heritage sites is limited. Still, it is possible to understand the **distribution and kinds of threats** to archaeological sites thanks to the fieldworks undertaken at archaeological sites of Turkey since 2000 by the TAY (Archaeological Settlements of Turkey) Project, a nongovernmental organization in Turkey[93]. Through this project, based on the surveys carried out by a team of specialists including archaeologists, geologists, surveyors, and photographers, more than 2800 archaeological settlements located in cities, towns and villages throughout Turkey have been explored, documenting any destruction[94](See Figure 2.2).

This database reveals that the most widespread hazard in the country is **development**, which mostly relates to *new building construction* and *transportation infrastructures*. *Construction of dams* and *mining* are other two destruction factors regarding development that affect particularly some areas of the country. Activities of individuals/groups such as **biological resource use and modification** in rural areas and **illicit digging** have also had impacts on

[93] The Archaeological Settlements of Turkey (TAY) Project, which began in 1993 as nongovernmental organization, aims at documenting thoroughly all archaeological settlements within Turkey (TAY, 2012). The database that has developed by TAY teams is very important to understand current threats to archaeological heritage in the face of the rapid development and change processes the Turkey has been undergoing, especially after 1970’s.

[94] Field works have been undertaken at archaeological sites, monuments and find-spots located in Marmara, Aegean, Mediterranean, South-east Anatolia, Central Anatolia, Black Sea, Eastern Anatolia regions of Turkey. TAY 2013a

archaeological heritage in Turkey.

Another important database is the State of Conservation (SOC) Reports that have been prepared by the World Heritage Centre and the Advisory Bodies to the World Heritage Committee on the World Heritage properties of the country. These reports disclose some challenges regarding conservation of World Heritage properties in Turkey. The sites indicated in 26 SOC reports include Historic Areas of Istanbul, Neolithic Site of Çatalhöyük, Xanthos-Letoon, Göreme National Park and the Rock Sites of Cappadocia, and Hierapolis-Pamukkale. In addition to widespread management and institutional factors such as lack of a management plan, financial and managerial issues, problems indicated in these reports include natural hazards such as earthquake, flooding and water (rain/water table).

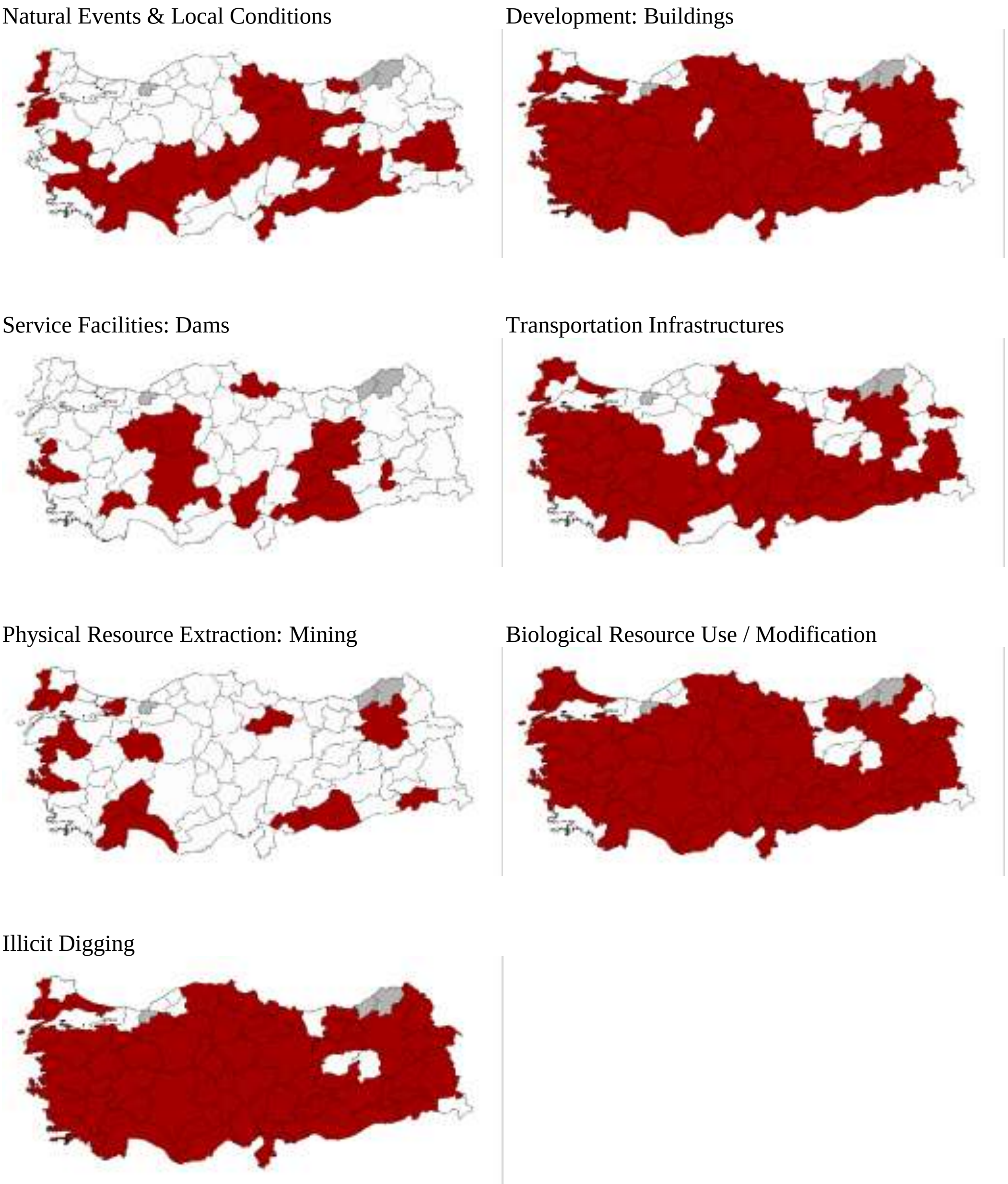

Figure 2.2. Map of Turkey showing provinces where at least one archeological site exposed to the above-mentioned hazards has been identified through field studies, carried out by TAY (Archaeological Settlements of Turkey) Project[95] (*Maps are prepared by S. YILDIRIM ESEN based on TAY database*)

[95] The maps were prepared by the author based on the database provided from TAY 2013.

Other significant issues indicated in the reports are related to development, and particularly construction of housing, major visitor accommodation and associated facilities, and interpretative and visitation facilities as well as transportation infrastructure including ground transport infrastructure and underground transport infrastructure. In addition, another concern for the World Heritage properties is the social and cultural uses of heritage, mostly for tourism and recreational purposes. Social aspects such as identity, social cohesion, changes in local population and community, society's valuing of heritage are also highlighted in the reports. Finally, deliberate destruction of heritage is another threat to the conservation of cultural assets in Turkey[96].

Based on these evaluations, threats to archaeological heritage in Turkey can be examined under three main categories: **Natural Hazards**, **Institutional Hazards** and **Individual-Induced Hazards**. Natural hazards include both sudden geological and ecological events as well as slow and progressive hazards such as local conditions affecting the physical fabric, and climate change. Certain human-induced hazards are institutional, as destruction results from development programs/projects of public institutions such as urban development, construction of tourism facilities, transportation and services infrastructures, dam construction, and physical resource extraction. Besides, human-induced hazards are caused by activities of individuals/groups such as social and cultural uses of heritage, biological resource use / modification in rural areas and other unfavorable human activities and mostly illicit digging. In the following part, hazards threatening archaeological heritage in Turkey are examined under these three categories.

[96] For instance, factors affecting Xanthos-Letoon identified in 1992 and 1994 COS reports were road near the site with increasingly heavy tourist traffic, absence of a management plan, absence of an irrigation canal to divert water from the site, and use of the theatre for the tomato-festival. Similarly, recently, COS report of the year of 2013 for Neolithic Site of Çatalhöyük also indicated some financial and managerial issues. UNESCO 2013a

2.2.1.1. Natural Hazards

Natural factors that affect archeological heritage consist of sudden geological or ecological events including earthquake, landslide, rockfall, and flooding and local conditions affecting the physical fabric such as water, relative humidity, wind, temperature, erosion and siltation/deposition[97].

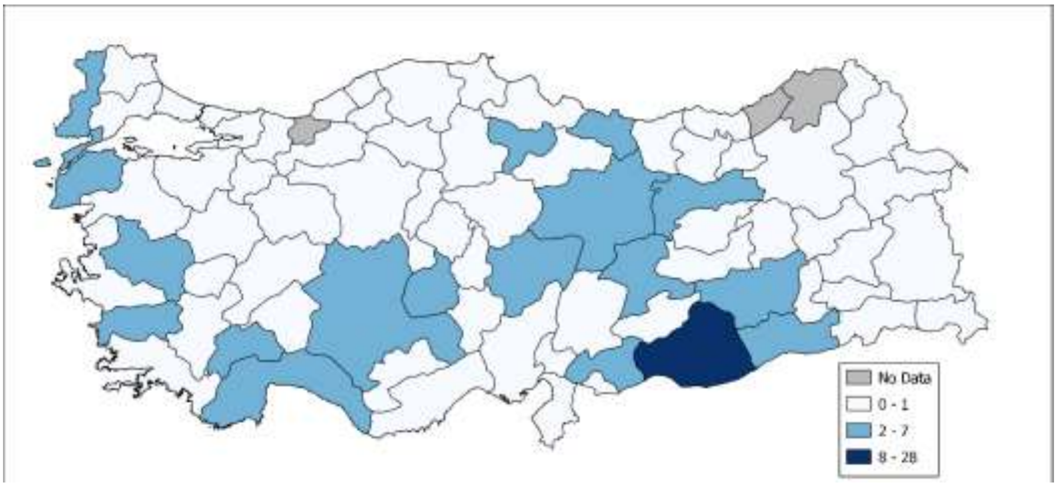

Figure 2.3. Map of Turkey showing territorial distribution of destruction of archaeological sites due to natural hazards (*Prepared by S. YILDIRIM ESEN based on TAY database*)[98]

Figure 2.3 shows territorial distribution of archaeological sites where impacts of natural events or local conditions on heritage values have been documented through the field studies carried out by TAY (Archaeological Settlements of Turkey) Project. While these numbers do not indicate what kind of natural events have made the most of the damage in these places, it is possible to suggest that some areas are more exposed to some kind of natural hazards, especially due to their geological and meteorological characteristics. In case of hazards regarding

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[97] Yildirim Esen 2012

[98] The database of the TAY Project was utilized. This map has been prepared using natural breaks (jenks), an algorithm that tries to find "natural groupings of data to create classes". The resulting classes are such that there are maximum variance between individual classes and least variance within each class. QGIS 2013

the local conditions affecting the physical fabric of the heritage, due to lack of available research on this subject, it is not possible to examine and compare different regions and territories of the country in terms of the impacts of slow and progressive hazards. Similarly, an analytical analysis on how and to what extent geological and hydro-meteorological events have damaged archaeological heritage does not exist. However, as explained in the following section, the frequency of these events shows which areas are mostly exposed, and discrete examples from different places help understand the consequences.

Sudden Geological, Ecological or Weather Events

Due to its tectonic and geological structure, topography and meteorological properties, Turkey is at risk from a wide variety of natural hazards, including earthquakes, landslides, floods, avalanches, forest fires, droughts, and blizzards. Among these, earthquakes, landslides, rock fall and floods are the most experienced and the most damaging hazards. The most damaging natural disasters in Turkey is earthquakes (See Table 2.1)[99]. As an earthquake country, Turkey is located in an active seismic zone on the Alpine-Himalayan fault line, which extends from Edremit's Kaz Mountains in the West to the Çaldıran Mountains near Van in the East[100]. Being situated in between three huge tectonic plates of Europe, Asia, and Africa, Turkey experiences earthquakes mainly due to compressive forces created by the movement of the Eurasian and Arabian Plates, which results in the movement of the Anatolian Plate toward west (See Figure 2.4)[101].

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[99] Gokce, Ozden and Demir 2008: 10; Bayindirlik ve Iskan Bakanligi 2004
[100] Mitchell 1995
[101] Japan International Cooperation Agency (JICA) 2004: 29

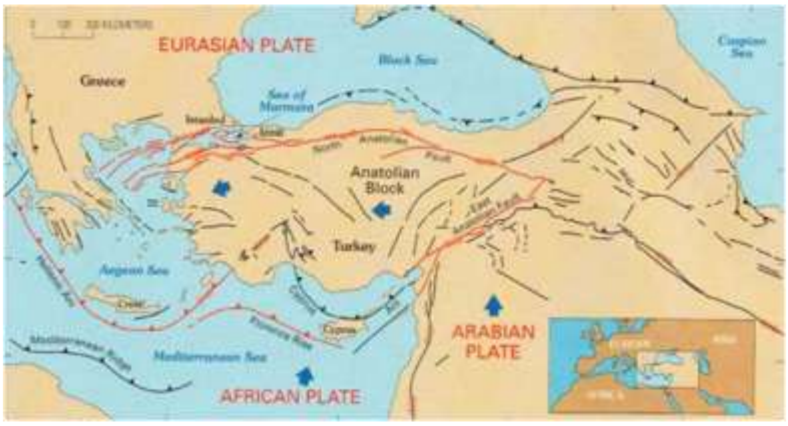

Figure 2.4. Relative Movements of Eurasian, African and Arabian Plates. (*Source: http://comet.nerc.ac.uk/for_schools_earthquakes4.html*)

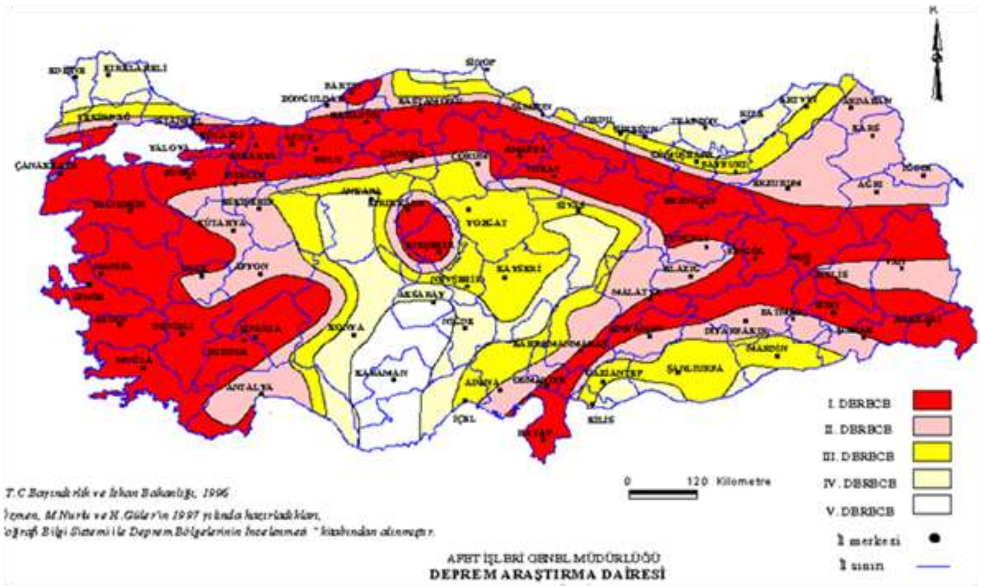

Figure 2.5. Earthquake Hazard Map of Turkey (*AFAD*)

Table 2.1. Significant earthquakes that have occurred since 1983. (*Boğaziçi University, Kandilli Observatory and Earthquake Research Institute*)

Date	Place	Ms	Dead	Damaged Buildings
30.10.1983	ERZURUM – KARS	6,9	1155	3241
13.03.1992	ERZİNCAN	6,8	653	8057
01.10.1995	Dinar (AFYON)	6,1	90	14156
27.06.1998	Ceyhan (ADANA)	6,2	146	31463
17.08.1999	Gölcük (KOCAELİ)	7,8	17480	73342
12.11.1999	DÜZCE	7,5	763	35519
06.06.2000	Orta (ÇANKIRI)	6,1	1	1766
15.12.2000	Sultandağı (AFYON)	5,8	6	547
03.02.2002	Çay - Sultandağı (AFYON)	6,4	44	622
01.05.2003	BİNGÖL	6,4	176	6000
25.03.2004	Aşkale (ERZURUM)	5,6	9	1280
02.07.2004	Doğubayazıt (AĞRI)	5,1	17	1000
23.10.2011	Van	Mw=7.2	573	3713

According to the Official Seismic Hazard Map of Turkey[102], which shows the distribution of seismic risk elements to five earthquake regions, the most risky 1st degree earthquake zones, presented in red, are noticeably covering a large area (See Figure 2.5). A significant number of cities including partially İstanbul, Aydın, Balıkesir, Bingöl, Çanakkale, Denizli, Düzce, Hatay , İzmir, Manisa, Muğla are located in the first degree earthquake zones. Specifically, 66% of

[102] Seismic Hazard Map of Turkey was prepared in 1996 by the Ministry of Public Works and Settlement, General Directorate of Disaster Affairs. The map was formed on the basis of average Peak Ground Acceleration (PGA) (m/s2), with 90% probability that it will not exceed in 50 years. JICA 2004: 29

Turkey's territory is located on the 1st and 2nd Degree Earthquake Zones, and 71% of its population lives within these regions[103]. Because of the country's high social and physical vulnerability, natural events usually result in big disasters with loss of human life and property (See Figure 2.6)[104].

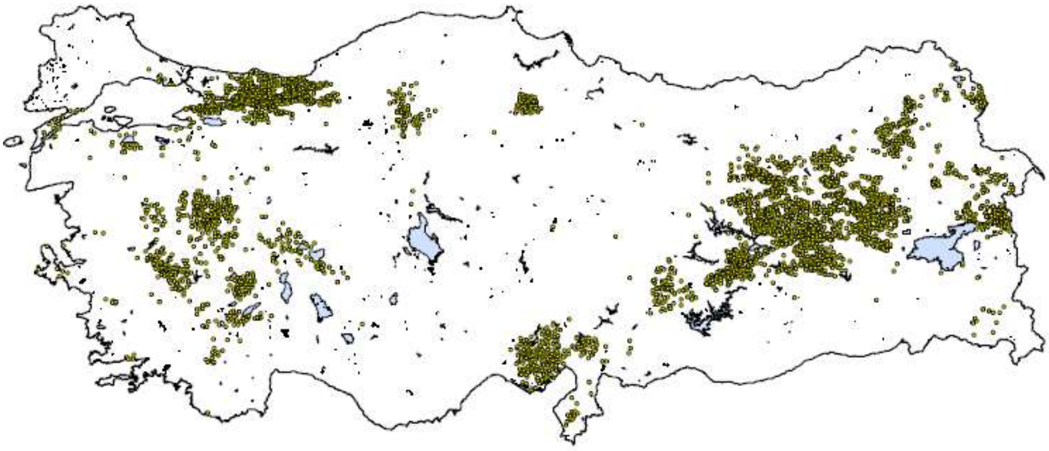

Figure 2.6. Distribution of settlements that have been affected by earthquakes. (*Gokce, Ozden & Demir 2008: 18*)

In addition to their social, economic, psychological, and cultural impacts, natural hazards are also threatening for the conservation of Turkey's irreplaceable cultural heritage including archaeological assets. Although there is not any statistical data regarding impacts of past earthquakes on archaeological heritage, it is obvious that significant amount of archaeological sites are under risk, as they are located at the 1st degree earthquake zones (See Table 2.2). There are 1979

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[103] JICA 2004

[104] Between 1990 and 2004, Turkey has experienced many disasters that took the lives of 87,000 people, injured 210,000, and affected 20.0000, and demolished or heavily destroyed more than 651,000 residential buildings. JICA 2004: 27. Earthquakes are followed by floods, landslides, rock falls and avalanches in terms of destructiveness. During the same period, the number of buildings that had been demolished due to landslides is 63.000, while those that had been demolished due to floods are 61.000, and those that had been damaged due to rock falls are 26.500. JICA 2004: 27-30

archaeological, 12 urban-archaeological, and 104 other multi-type sites located in cities at the first-degree earthquake zone[105].

Table 2.2. Number of registered sites located in cities located on the first-degree earthquake zone

		Archaeological Sites	Urban Archaeological	Mixed	Total
1	Aydin	121	0	1	123
2	Balikesir	168	0	6	174
3	Bingol	7	0	1	8
4	Canakkale	243	1	17	261
5	Denizli	149	0	9	158
6	Duzce	13	0	3	16
7	Hatay	181	0	3	184
8	Izmir	401	7	38	446
9	Manisa	152	0	2	154
10	Mugla	544	4	25	573
	TOTAL	**1979**	**12**	**104**	**2095**

As earthquakes repeatedly devastate settlements and destroy irreplaceable cultural properties across the country, traces of earthquakes occurred throughout history can be observed at antique cities. For example, Nayci states, archeological remains and structures at the harbor of the Elauissa Sebaste Archaeological Site, located in Merdivenlikuyu, Ayas, Mersin in the Southern Turkey, confirm the occurrence of a past destructive earthquake that caused damages to this site[106]. Another structure on which the effects of earthquakes can be observed is Hellenistic Tower in Olba Diocaesearia, in Mersin[107]. Effects of earthquakes can be seen on other archeological structures such as Column of Constantine, and Theodosian Wall in İstanbul (Figure 2.7).

[105] İzmir, Manisa, Aydın, Muğla and Denizli are located in the first degree earthquake zone, while Uşak, Kütahta and Afyon are in the second degree earthquake zone.
[106] Naycı 2010: 233-234
[107] Nayci 2010: 233


Figure 2.7. a) Column of Constantine, İstanbul (*Source: http://www.degisti.com*) b) Theodosian Wall, İstanbul

In addition, landslides are frequently experienced in many settlements of Turkey[108]. Especially, Trabzon, Kastamonu, Zonguldak, and Kahramanmaraş are the most adversely affected provinces with more than 200 landslide events occurred in the past. These cities are followed by Erzurum, Rize, Malatya, Sivas, Ankara, Erzincan, Sinop, Çorum, Bingöl, Artvin, and İçel, with more than 100 events (See Figure 2.8)[109]. In addition to loss of life and property, landslide events threaten archaeological sites. For instance, being vulnerable to flood and landslide problems due to its geomorphologic characteristics, İçel (Mersin) is one of the provinces that frequently experience landslide events, as stated by Nayci. Effects of heavy rainfall and landslides can be seen in geological depression (çöküntü) areas. For instance, Olba Archaeological Site located in Mersin is one of the sites that have been damaged due to landslides (See Figure 2.9). In the

[108] Gokce [et al.] 2008: 11 The authors indicate that 5472 settlements had been affected due to landslide events between 1950 and 2008.
[109] Gokce [et al.] 2008

same region, Nayci mentions, archaeological sites located in the riverbeds such as Olba and Adamkayalar Archaeological Sites, as well as those vulnerable due to their geological formations such as Korykion-Antron (Cennet-Cehennem) and Kanytelleis (Kanlıdivane) Archaeological Sites are at risk of landslide danger[110].

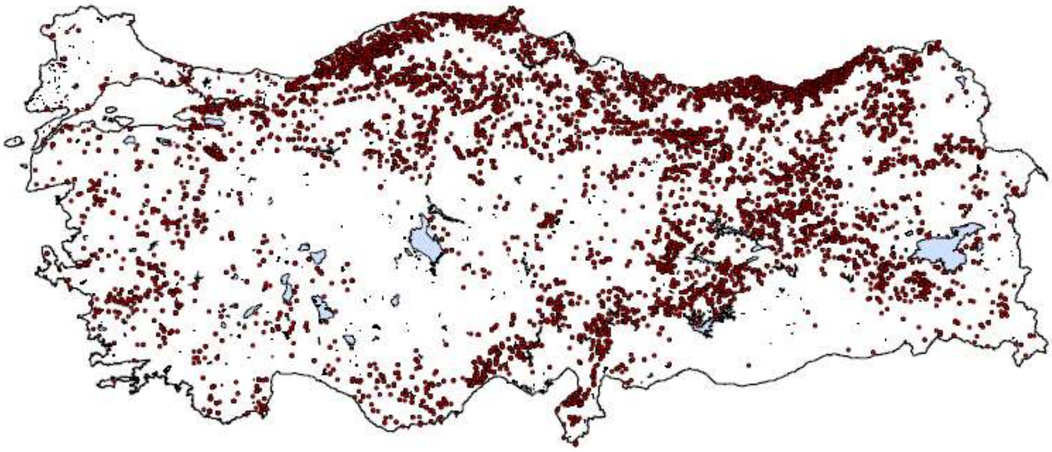

Figure 2.8. Distribution of settlements that have been affected by landslides. (*Source: Gokce, Ozden & Demir 2008: 30*)

In Turkey, rock falls also have impacts on people as well as on buildings, as yearly average number of heavily damaged buildings due to rock fall or avalanche events is 625[111]. Rock falls are generally experienced in some parts of Central Anatolia Region and East Anatolia Region. The provinces at the highest risk of rock falls include Kayseri, Niğde, Erzincan, Aksaray, Karaman, Kahramanmaraş, Adıyaman, Sivas, Bitlis, Diyarbakır, Nevşehir, Mardin, Malatya, Hakkari, and Kars (See Figure 2.10)[112].

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[110] Nayci 2010: 379

[111] JICA 2004: 27 The public institution that is responsible for identifying rock fall danger and risk and minimizing its deficits was the General Directorate of Disaster Affairs. Currently, this responsibility is given to the Disaster and Emergency Management Presidency under Prime Ministry (Afet ve Acil Durum Yönetim Başkanlığı)

[112] Gokce [et al.] 2008: 47

Figure 2.9. Effects of landslide in Olba (*Personal Archive of Nida Naycı, 2008*)

Rock falls not only threaten human lives and properties, but also pose risks to cultural properties in the country. For instance, Ihlara Valley in the Central Anatolia, possessing rock-hewn churches and dwellings, is one of the areas vulnerable to rock falls due the geological characteristics of the region (See Figure 2.11)[113]. Another place subject to rock falls is Hasankeyf in Southeastern Anatolia where rock hewn cave houses, which had been in use from about 800 AD to the near past, have been effected by rock fall incidents in the past[114].

[113] Yildirim Esen & Bilgin Altinoz 2013
[114] It is also estimated that rock fall events will continue due to cracks observed on some main rocks in different parts of the region. Hasankeyf'i Yaşatma Girişimi 2010

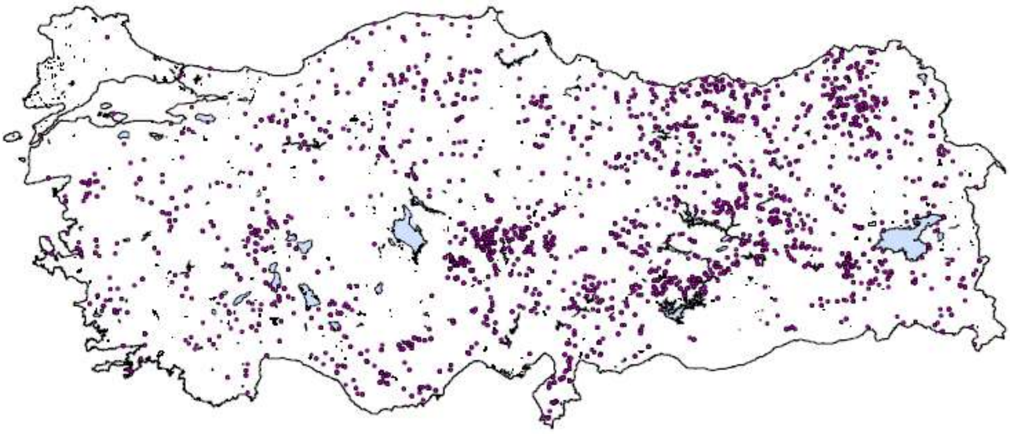

Figure 2.10. Settlements affected by rockfalls (*Gokce, et. al 2008:47*)

Figure 2.11. Rock-fall risk at Ihlara Valley, Capadoccia (*Source: Konya Directorate of Survey and Monuments, 2012*)

In Turkey, following earthquakes, floods are the second most damaging disasters. Annually in average, 24 people die, 100 people are injured, 1220 buildings are heavily damaged, 700 buildings are moderately damaged, and 3.000 buildings are slightly damaged due to floods. Frequency and magnitudes of floods vary from region to region due to local climatic and environmental differences. Atmospheric and environmental conditions such as climate, topography, and vegetation affect the occurrence and intensity of floods. Especially, steep slope areas and dry regions with scarce vegetation are vulnerable to destructive floods. In Turkey, environmental deterioration that results from fires, deforestation, loss of natural vegetation, etc. is the basic reason in the increase of the frequency and intensity of floods. Floods that affect large areas usually occur as a result of rising underground water level after long rains[115]. Besides, decrease in water absorption capacity in settlements due to urbanization as well as insufficient water drainage systems increase flood risk in cities. In recent years, floods happened in big cities including İstanbul, Ankara, İzmir, Adana, Bursa are due to mistakes made in land-use decisions and insufficient drainage systems[116]. Cities that are most frequently affected by floods are İzmir, Rize, and Kahramanmaraş (See Figure 2.12)[117].

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[115] According to the statistics of the years between 1971 and 2002, because of floods, 1235 people died and 62,000 residential buildings were damaged. JICA 2004: 27-31

[116] River type floods, which happen at 50- to 100-year intervals, can generally be prevented. Besides, mitigation measures such as early warning systems, sound land-use decisions, engineering precautions and public awareness rising activities help decrease damages caused by river type floods. In fact, floods can be decreased by certain effective and significant measures including planning based on local meteorological and hydrological conditions, appropriate land-use decisions, and construction techniques. In the years between 1970 and 1980, the Flood Prevention and Mitigation program initiated by the General Directorate of State Hydraulic Works (DSİ) had been effective in decreasing the number of flood events. While the annual average number of river type floods was 80 between the years 1955 and 1969, the number of this type of floods had been decreased to 24 between 1970 and 2000. Engineering works completed by the General Directorate of State Hydraulic Works (DSİ) as part of this program has been successful in preventing floods in 3300 settlements. JICA 2004: 32-33

[117] Gokce [et al.] 2008: 41

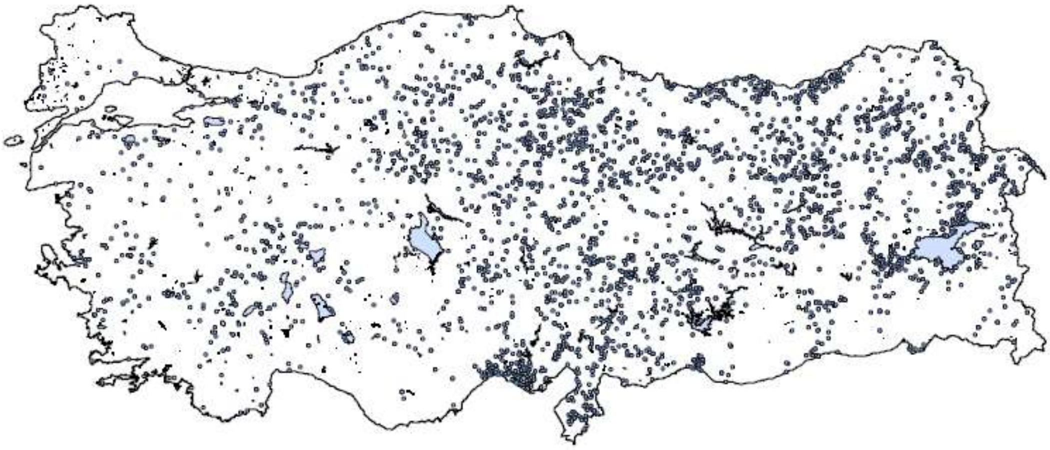

Figure 2.12. Distribution of settlements that have been affected by flooding. (Gokce, Ozden & Demir, 2008: 41)

According to Kadioglu, “the coming decades are likely to see a higher flood, landslide and avalanche risk in Turkey and greater economic damage. More information are needed on future flood, landslide and avalanche risk. Many factors impact on what future flood, landslide and avalanche risk might look like, including changing land use patterns, climate change and how well flood, landslide and avalanche risk is currently being managed”[118]. “..an increasing trend is obvious in deaths and damages. The causes of the increases are classified as natural factors and human factors. Since no increase trend has been observed in the rainfall intensities, it has been concluded that the main causes of the flood damages are related to human factors. Wrong land usage, deforestation and wrong urbanization and settlement have been evaluated as the most important human factors. In addition, some technical mistakes and insufficient coordination between related institutions have been evaluated as the other factors”[119].

Floods are also one of the risk factors threatening archeological heritage. Cultural properties, in some places, especially those located close to rivers are at risk. For instance, Olba Archaeological Site and Kızkalesi settlement, Mersin, both of

[118] Kadioglu 2008: 2
[119] Yuksek, Kankal, Onsoy and Filiz 2008: 17-18

which are located along the Mintan River, were adversely affected by two flood events in 2002 and 2006 due to heavy rainfall, as stated by Nayci. Upper parts of Olba Archeological Site and lower parts of Kızkalesi, structures close to the river, have been damaged due to these events. Similarly, located in the same region, terraces of Seytan Valley, built with masonry walls during ancient periods, and buildings located at its inner outskirts have been damaged by floods[120]. Another example is Yarim Mound in Burdur/Tefenni, a prehistoric site, which was damaged due to flooding events (See Figure 2.13)[121].

Figure 2.13. Yarim Mound (Burdur/Tefenni): ≈7000 years. (*Source: Tanindi et. al 2001*)

Local Conditions Affecting the Physical Fabric

Cultural properties are affected by local conditions such as radiation/light, relative humidity, temperature, water (rain/water table), and wind (erosion, vibration), and deteriorated due to contribution of a range of environmental and biological factors. While geographical location determines the local condition of

[120] Naycı 2010: 309
[121] Archaeological Settlements Of Turkey Project 2012

a heritage property, both the site-specific conditions and the type of attributes determine the impacts of these factors on the heritage property. These usually have low impact on the cultural property over a long duration. However, small changes can magnify the impact of these factors due to change in the balance between the others. For instance, biological factors worsen the impact of environmental factors. Microorganisms and any form of biological growth, associated with the temperature, relative humidity, water and light, have impacts on cultural properties[122].

Archaeological sites, especially those that are not maintained and managed properly, are subject to deterioration, which may be seen in various forms such as material losses, discoloration and cracks. For instance, material and structural problems observed on Yazılıkaya (Midas) Monument in Eskişehir, located in the Central Anatolia Region, is the result of a process of climatic conditions and atmospheric events. Erosion seen on the surface of the Monument, which is open to atmospheric conditions, is the result of long-term effects of strong winds, temperature changes and heavy rain falls.

Like many other sites, similar degradation process due to climatic conditions can be seen in Adamkayalar reliefs, where temperature and humidity as well as heavy rainfalls have resulted in material deterioration such as oxidation and erosion of the surfaces, as stated by Nayci. She also mentions that monuments of Olba archaeological site including Nymphaeum, monastery building and monumental tomb, located at the southern part of Acropolis, have been damaged due to climatic events. Similarly, remains of Kanlıdivane archaeological site have been affected by heavy rainfalls[123].

In addition, coastal processes of erosion, coastal depositions and sea level rise effect coastal heritage. Exposure to sea-waves, which can be more destructive

[122] UNESCO 2012: 60
[123] UNESCO 2012: 309

with strong winds and storms, results in *erosion* of structures located at shoreline. For instance, effects of coastal processes can be observed on the coastal structures of Teos Archaeological Site on the Aegean coast, and on the remains of Korykos, located on the Mediterranean coast of Turkey (See Figure 2.14)[124].

Figure 2.14. Coastal Processes, Coastal Erosion on Korykos Archaeological Site, Mersin (*Source: Nida Nayci Personal Archive, 2008*)

In addition to erosion caused by sea waves, **depositions** accumulated on river mouths is another kind of natural threat. As a result of coastal depositions, which have occurred throughout centuries, local beaches have been formed especially in river mouths, eventually, coastal archaeological remains have been buried under these beach areas. An example of this kind of loss can be seen in Elauissa-Sebaste, an archaeological site located on the Silifke-Erdemli coastal area (See Figure 2.15)[125].

Another coastal process that has adverse effects on cultural heritage is ***sea-level rise***, a long-term natural process that has been going on for centuries like other

[124] Naycı 2010: 308
[125] Naycı 2010

coastal processes. This process changes shoreline level and eventually erases coastal structures and settlements off map. For instance, the Mediterranean Region of Turkey has adversely been influenced by the long-term effect of sea-level rise. Archaeological structures have been submerged by water as in the examples of ancient settlements of Korykos and Elauissa-Sebaste[126].

Figure 2.15. Coastal erosion and deposition processes affects archaeological sites of Korykos and Elauissa-Sebaste (*Source: Nida Naycı, 2010:179*)

Besides, invasive or hyper-abundant species of plants have direct impact on archaeological heritage through the physical deterioration of the material used for heritage structures. Structural problems arise due to plants with extensive roots grow near or on top of heritage structures. For instance, in Mediterranean and Aegean Regions, maquies type of vegetation causes structural problems to historic structures. Briefly, unlike geological and hydrometeorological hazards, natural processes of weathering, coastal processes of sea level rise, coastal depositions, and erosion, temperature changes, wind erosion, macro-vegetation, etc. occur slowly and repeatedly with noteworthy level of destruction in the long term.

[126] Nayci 2010

Climate Change

Climate change is another concern for the conservation of cultural heritage. Coastal archaeological heritage is at risk of coastal processes including erosion, deposition and sea level rise caused by climate change[127]. Scenarios on how the world's climate will change in the coming century were introduced in the Intergovernmental Panel on Climate Change (IPCC) Special Report in 2000 to provide the basis for future assessments of climate change and possible response strategies of the future. These scenarios were created through the development of narratives, and then the quantification of these narratives with the help of six different integrated models from different countries[128]. Based on these scenarios, the impact of climate change on Turkey has been assessed in the Report, titled Turkey's Fifth National Communication under the UNFCCC" in 2013[129]. These assessments reveal that the impacts of climate change on Turkey are expected to include changes in temperature, precipitation as well as increase in climatic hazards including flooding due to heavy rainfalls and sea level rise because of global warming, and others. First, according to the regional climate change simulation, which was developed over the Eastern Mediterranean for the last 30 year of the 21st Century[130], the **surface temperature** is projected to increase between 0.5 and 1.0 degree Celsius all over Turkey for the period of 2011-2040. However, significant increase in surface temperature is expected after 2041. According to the simulation results, the temperature of the interior parts of Eastern Anatolia Region will increase in winters, while the Southern and Southeastern Anatolia Regions will experience increase in the summer temperatures[131]. In addition, **precipitation trends** are also expected to change due to climate change. Especially, the areas where precipitation level is lower than average will become much dryer and the areas where precipitation is above

[127] Cassar 2005: 5; Kadıoğlu 2001: 277
[128] Intergovernmental Panel on Climate Change 2000
[129] Ministry of Environment and Urbanization of Turkey 2013
[130] The regional climate change simulation was developed based on the IPCC A2 scenario. For more information: Ministry of Environment and Urbanization 2013: 161
[131] Ministry of Environment and Urbanization 2011

average will become much wetter[132]. Due to this unbalanced shift in precipitation trends, and surface temperature increase, the **rivers' flow** will be affected as well. The simulations aforementioned predict that there will be increase in surface runoff in almost all parts of Turkey for both winters and springs.

Based on these changes of climatic parameters, Turkey is expected to face with the climatic hazards including **flooding** caused by sudden and heavy rainfalls, **drought**, and **sea level rise**. Because of gradual shift in seasons, the rainfall patterns will be affected in a way that rains will be more irregular with greater frequency of **sudden and heavy rainfalls** that may cause floods. Besides, the frequency of **drought** is also expected to increase especially after 2041[133]. Finally, in the long term, due to changes in surface temperature and additional mass, the level of the whole Mediterranean Sea may rise by between 3cm and 61cm on average as a result of the effects of global warming[134].

Based on these evaluations, it is possible to estimate that cultural properties in Turkey will be effected from the consequences of the climate change in the future. Changes in the local conditions will accelerate the rate of deterioration of archaeological heritage in all places. Climatic conditions and atmospheric events like temperature changes, strong winds and heavy rainfalls can be expected to cause erosion and deterioration. Sea level rise will have impacts on coastal archaeological heritage located along the Mediterranean and Aegean coast.

2.2.1.2. Institutional Hazards

Aiming to provide the society with various services, public sector interventions continuously shape and change the built environment. Within the responsibility of public institutions, development planning at various scales aims to plan future

[132] Ministry of Environment and Urbanization 2011
[133] Ministry of Environment and Urbanization 2013
[134] Marcos and Tsimplis 2008

development of settlements. Significance of integrating conservation into development planning has been widely accepted in the international mediums since the 1980s. However, in practice, particularly in developing countries, destruction due to development is an ongoing concern for the conservation of cultural assets, as in the case of Turkey.

In Turkey, certain cities have been subjected to rapid urbanization and population increase for decades. During this process, development pressures have threatened archaeological sites in Turkey. For example, historic center of İstanbul, which is one of nine properties in Turkey listed as a World Heritage Site by UNESCO, has been subjected to several threats related to infrastructure, renewal and development projects. With its strategic location on the Bosphorus peninsula in between two continents, İstanbul is a significant historical city as it possesses architectural masterpieces and traces of history that goes back more than 2000 years. In the last decades, the city has increasingly been under the pressure of population increase, rapid urbanization and industrial pollution. UNESCO reports have shown that threats affecting the historic quarter of İstanbul have considerably increased in the late 2000s[135]. Destruction of archeological heritage due to development pressures is a significant issue not only in Istanbul, but also in many places. Abovementioned TAY fieldworks show that most of the destruction in the country has been caused by **new constructions for housing**, **industrialization** and **tourism facilities** (See Figure 2.16).

[135] The Special Report prepared for Istanbul also points out threats to which the city has been subjected. Concerns stated in the report of 2009 were related to urban renewal projects, the possible impact of the new metro bridge across the Golden Horn, the Bosphorus road tunnel from the Asian shore to the Historic Peninsula, and historic timber houses that have been neglected. UNESCO 2009

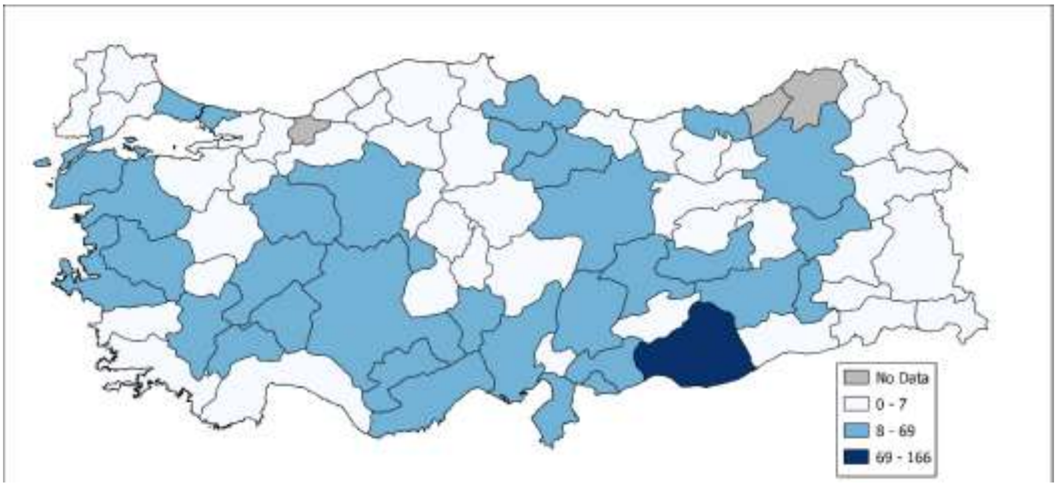

Figure 2.16. Map of Turkey, Number of archaeological sites destructed due to new building construction (*Prepared by S. YILDIRIM ESEN, based on TAY database*)

Cities that go through an urbanization and population increase process inevitably face with the need for infrastructure. When heritage conservation concerns are not integrated into other activities of the public authorities, the results are likely to be damaging for cultural heritage, and mostly for archaeological heritage. Constructions of highways, roads, bridges, airports, marinas, etc. on areas that are rich with cultural assets threaten traces and documents of previous periods (See Figure 2.17). The extent of damage was highlighted by Gates as flows[136]:

> Conservation, restoration, and inventory of sites through regional surveys have become standard for all excavation programs in Turkey. Scientific, geomorphological, and geophysical studies and increasingly sophisticated recording techniques have also become common fare. Yet overriding preoccupation for these archaeologists remains the ineffectiveness of their numbers and their tools in even registering, let alone stemming or stopping, the destruction of ancient sites from roadwork, construction, and illegal digging (all three equally devastating). To cite only one of many examples: the medieval university city of Harran, where excavations started anew a decade ago, was last year demoted from first-ranked to second-ranked historical site, this no longer fully protected against modern

[136] Gates 1994: 249

construction. Electric pylons, municipal buildings, and gasoline stations were immediately erected among its standing monuments.

Similarly, as stated by Nayci, citadel walls, a church, and the colonnaded street of Korykos and important buildings of Elauissa-Sebaste have been damaged due to the construction of Mersin-Silifke road. Enlargement of this road in 2005 by General Directorate of Road Infrastructure was resulted in destruction of necropolis area located between Elauissa-Sebaste and Korykos during salvage excavations executed by Mersin Museum. Similarly, construction of Kumkuyu Marina in Akkale archaeological site caused destruction of the ancient port[137].

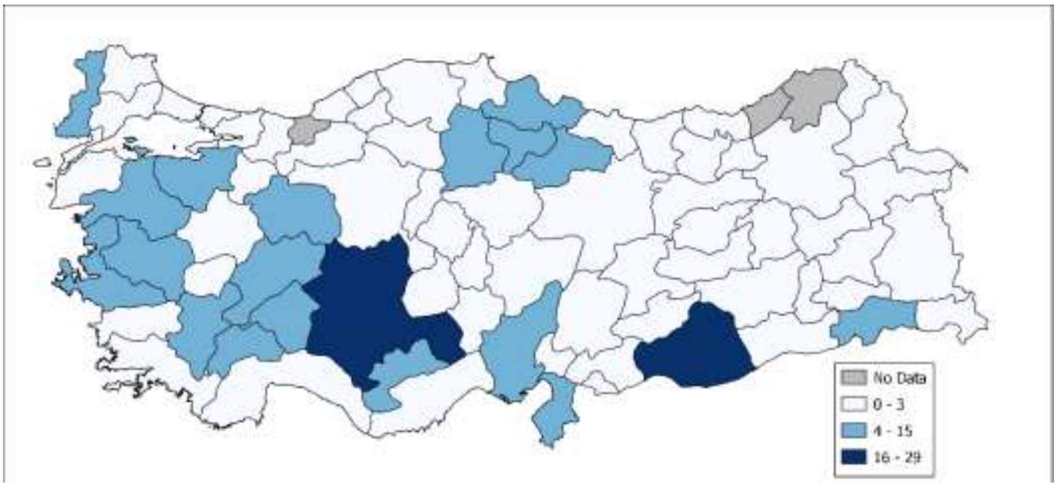

Figure 2.17. Map of Turkey, Territorial Distribution of Destruction of Archaeological Heritage due to Development of Transportation Infrastructure (*Prepared by S. YILDIRIM ESEN, based on TAY Database*)

In some places, **tourism industry** seems to be basic motive for conservation, and has a positive impact on the continuity of cultural properties, but, on the other hand, uncontrolled mass tourism represents a danger. Besides, unmanaged construction of tourism-related facilities (hotel, shops, road, etc.) is likely to have negative impacts. Since 1970s, population of coastal towns has rapidly increased

[137] Naycı 2010

parallel with the rise of tourism activities, and coastal towns of Turkey have been dramatically affected from such tourism-related developments. This process has brought about the construction of tourism-related facilities as well as secondary housing at coastal areas. According to the Cultural Heritage at Risk Reports, archaeological sites located on the western and southern coasts of Turkey are threatened by these tourism-oriented initiatives[138]. For instance, new developments, mostly tourism facilities (motels, daily tourism and camping) and secondary housing at coastal sections between Erdemli and Silifke, based on the Western İçel Coastal Territorial Development Plan' (TDP), prepared and approved in 1993 by the Ministry of Public Works and Settlements, resulted in the destruction of Yemişkumu, Elauissa-Sebaste, Korykos, Narlıkuyu Archaeological Sites[139]. Furthermore, initiatives to make archaeological sites more accessible to visitors can be damaging for archaeological remains as in the examples of implementations carried out in Kanlıdivane and Cennet-Cehennem archaeological sites in the 1990s for building parking areas and service facilities[140].

Development related risks also result from economic pressure and large development projects such as dam constructions (See Figure 2.18). For instance, areas threatened by dams include Hasankeyf, which is an ancient city inhabited for at least 10,000 years and will partially inundate through the construction of Ilisu Dam, and Allianoi, where 2nd Century Roman baths submerged beneath Yortanli Dam[141].

[138] UNESCO 2009
[139] Naycı 2010
[140] Naycı 2010
[141] Christie-Miller 2011

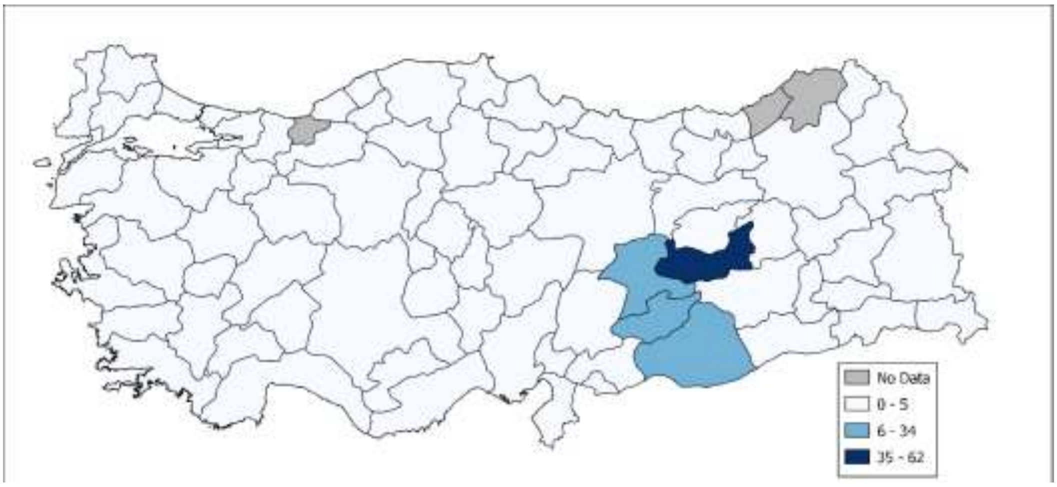

Figure 2.18. Map of Turkey showing number of archaeological sites where impacts of dam constructions on heritage have been identified (*S.YILDIRIM ESEN based on TAY database*)

Physical resource extraction (mining) is another issue threatening archeological heritage in Turkey (See Figure 2.19).

Figure 2.19. Map of Turkey showing number of archaeological sites where impacts of mining have been identified (*prepared by S.YILDIRIM ESEN based on TAY database*)

2.2.1.3. Individual-Induced Hazards

Social/cultural uses of heritage may have negative impacts on heritage values. In this sense, **mass tourism** is one of the concerns in the conservation field. In Turkey, number of visitors to state museums and archaeological site museums has grown from 6.887.344 to 28.781.308 between the years 2000 and 2012. Relatively small number of sites are open to the public, as of the 10.132 registered archeological sites, only 127 are actually open to the public[142]. This results in the huge concentration of visitors at only a few sites, and increases the likelihood of visitor impact for those sites. For instance, Efes archaeological site in Izmir attracted 1.888.173 visitors, Hierapolis in Denizli had 1.561.485 visitors, and Troya Archaoelogical Site had 506.708 visitors, according to the annual visitor statistics of 2012[143]. Another problem is lack of user control in 1st degree archaeological sites that are used as camping areas as well as for daily tourism activities.

[142] There are 10.132 registered archaeological sites, 31 urban archaeological sites, and 436 mixed-type sites as well as 1.909 registered archaeological remains, according to the cultural heritage inventory of the year 2012, obtained from the Ministry of Culture and Tourism.
[143] Ministry of Culture and Tourism 2013a

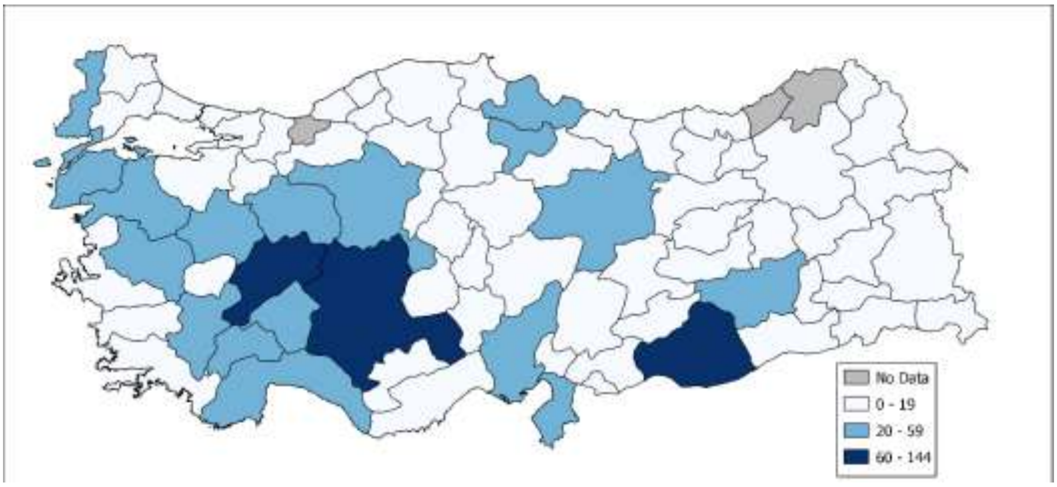

Figure 2.20. Map of Turkey, Distribution of destruction of archaeological sites due to agricultural activities (*prepared by S.YILDIRIM ESEN, 2014 based on TAY database*)

Another widespread hazard in Turkey is **biological resource use/modification** in rural areas (See Figure 2.20). For instance, Barcin Mound, an Early Bronze Age settlement in Ayas, Ankara, and Eldes Nodalar Mound, another Early Bronze Age settlement in Ilgin, Konya have been damaged due to agricultural activities (See Figure 2.21)[144].

[144] Archaeological Settlements of Turkey Project 2003

Figure 2.21. Biological resources extraction at Barcin Mound, an Early Bronze Age Settlement in Ayas, Ankara (*Source: Tanindi et. al 2001*)

Development of new agricultural areas and large agricultural terraces damages archaeological layers below surface. As fertile farmlands located along coastal areas have been transformed to built-up areas due to tourism and secondary housing developments, agricultural areas were moved to less productive upper sections, as in the example of coastal strip of Mediterranean Region. In these circumstances, local people occupied with agricultural produce have a tendency to open large terraces for agricultural uses. This kind of interventions has been made in the Erdemli – Limonlu area as well as upper sections of Ayaş and Kızkalesi in İçel. For instance, archeological and natural sites of Ayaş, Kızkalesi and Hüseyinler were damaged by these terrain modifications[145]. In addition, irrigation projects are developed in order to increase agricultural capacities of fertile lands. However, implementation of these projects on archaeological areas may have negative impacts on ancient remains. For instance, Aksıfat Watering Project implemented in İçel have had physical and visual impacts on archaeological sites. Ancient remains of Canbazlı Church or Hüseyinler Village

[145] Naycı 2010. As mentioned by Nayci, these events have taken place in parallel with improvements of irrigation conditions of the area with watering projects realized in the past years. Following the mentioned destructive events, Adana Regional Conservation Council took action and required taking permission from related museum before executing such implementations

have been damaged due to installation of water pipes to provide water to settlements[146].

Treasure searching is another problem. Legislations define conditions concerning treasure searching, which can be carried out outside designated areas (i.e. immovable cultural and natural assets, conservation sites, and cemeteries) with a license and under the inspection of the officials of the Ministry of Culture and Tourism[147]. As archeological heritage inventory is not complete in Turkey, archaeological assets that are not legally protected are at risk of destruction through treasure searching. In addition, as security deficit is a major problem, archeological sites in Turkey is at risk from **theft and illegal excavations**. TAY Project fieldworks and reports reinforce this with reporting illicit digging incidents that have occurred in all regions of the country (See Figure 2.22). As stated by Ozgen[148]:

> regions in the south, east and southeast of Turkey are open to constant looting by local people suffering from economic hardship. In 1997, 565 people were arrested who had more than 10,000 objects in their possession but the actual number of unrecovered, illegally excavated objects must be three times that number.

The database of the Ministry of Culture and Tourism, the General Directorate of Cultural Properties and Museums regarding reported illicit excavations reveals that in two years, between the years 2010 and 2012, illegal diggings have occurred in most provinces of Turkey (See Figure 2.23).

[146] Nayci 2010
[147] The Act No 2863: article 50
[148] Ozgen 1999

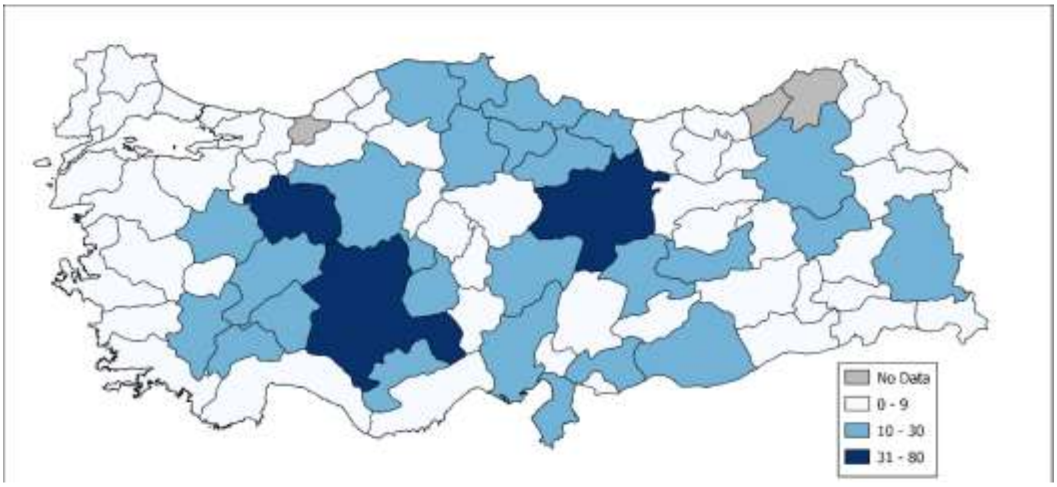

Figure 2.22. Map of Turkey showing number of archaeological sites where impacts of illicit digging on heritage have been identified (*S. YILDIRIM ESEN, 2014 prepared based on TAY database*)

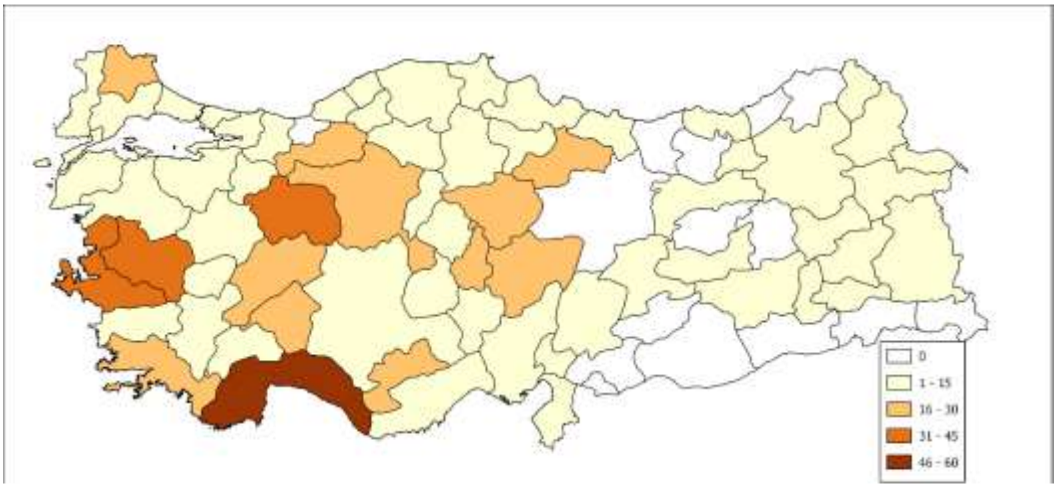

Figure 2.23. Turkey, Map of Provinces showing the number of reported illicit digging events between the years 2010-2012[149]. (*S. YILDIRIM ESEN, 2014*)

[149] The map was prepared by the author based on the unpublished reports of the Ministry of Culture and Tourism, The General Directorate of Cultural Properties and Museums.

The damage caused by the looting of archaeological sites is evidenced by past investigations, as explained by Brodie[150]:

> A survey of burial tumuli in the area of western Turkey that comprised the iron age kingdom of Lydia recorded 397 tumuli; 357 tumuli (90 percent) showed signs of looting and 52 had been completely destroyed. To this figure of 52 could be added a further 20 previously-known tumuli that had disappeared (Roosevelt and Luke 2006a, 178-179). A follow-up survey of 116 tumuli in the area of Bin Tepe, probably the royal burial ground of Sardis, the capital of Lydia, confirmed the earlier findings, with 111 tumuli (96 percent) showing signs of illegal excavation, and 11 badly scarred by bulldozers or other heavy earth moving equipment (Roosevelt and Luke 2006b, 193)

Caykoz Mound, an Early Bronze Age settlement 5000 years old in Sivrihisar, Eskisehir, and Dizik Mound, another 5000 years old settlement in Maden, Elazig are only two of many examples of destruction due to illicit digging (See Figure 2.24)[151]. Particularly, archaeological sites located in rural areas far from settlements are vulnerable against illegal excavations.

Figure 2.24. Destruction due to illicit digging at Caykoz Mound, an Early Bronze Age Settlement in Sivrihisar, Eskisehir and Dizik Mound, a 5.000 years old Settlement in Maden, Elazig (*Source: Tanindi et. al 2004*)

[150] Brodie 2013
[151] Archaeological Settlements of Turkey Project 2003

Illegal interventions and building constructions of users or local people also threaten all sites including those listed and legally protected. Lack of monitoring mechanism and panel sanction in the current administrative system encourage people make changes they desire rather than dealing with bureaucracy and taking essential permission from related conservation council. Therefore, archaeological sites are threatened by new constructions, which are against conservation and development plans. For instance, rapid urbanization and building process in the coastal areas of the Mediterranean Region has increased the amount of illegal interventions on archaeological and natural sites of the area. Coastal towns of Narlıkuyu, Kızkalesi and Ayaş have quite a few examples of illegally constructed pensions and small motels[152]. Vandalism is another threat for cultural heritage including archeological assets. For instance, owners of lands that are part of archaeological sites may desire to benefit from urban development initiatives by destroying archeological remains on purpose as experienced in Kızkalesi and Ayaş (Merdivenlikuyu)[153].

Forest fires is another issue for archeological heritage. While 5-6% of incidents may be caused by natural events such as lightning, forest fires are mostly one of the human-induced disasters. Especially Mediterranean counties including Turkey are at high risk of forest fires[154]. Particularly, coastal areas along Mediterranean Sea and Aegean Sea are areas at high risk with 7.182.051 ha total area of the first-degree forest fire risk zones, while the second-degree risk area constitutes 5.091.788 ha[155]. These regions also comprise cities that are rich in archaeological sites. Particularly, sites that are close to high-risk forest areas are threatened by this hazard. For instance, remains of the archaeological site of Kanlıdivane were threatened by the forest fire that occurred in the vicinities of

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152 Nayci 2010:350

153 Nayci 2010

154 Every year approximately 4 million hectares forests disappear due to forest fires in the World, while approximately 550 thousand hectares of this belong to Mediterranean countries. Ministry of Forestry and Water Works 2012

155 Approximately 2 million ha forest area, which makes up to 60% of all forest areas in Turkey, is located in fire-sensitive region. Ministry of Forestry and Water Works 2012

the site in 2008[156]. Forest fire as well as bushfire risk increases for hot-arid areas particularly during summer periods. For instance, Teos Archaeological Site was affected from bushfire in 2011 (See Figure 2.25).

Figure 2.25. Teos Archaeological Site, affected from bushfire in 2011 (*S. YILDIRIM ESEN, June 2012*)

2.2.2. An Overview of Archaeological Heritage Management Context in Relation to Risk Management

In Turkey, legislative tools regarding archaeological heritage management include laws, regulations, and Principle Decisions of High Council of Conservation of Natural and Cultural Assets. Within the framework of these legislations, archaeological heritage is managed through certain decision-making mechanisms within the responsibility of several units of the Ministry of Culture and Tourism. Administrative system and decision-making processes regarding archaeological heritage are analyzed in the following part to identify significant legal and administrative aspects regarding risk management of archaeological heritage.

[156] Nayci 2010: 311

2.2.2.1. Administrative System

Turkey has a centralized public administration system, which is also evident in the field of cultural heritage conservation. The Ministry of Culture and Tourism plays the major role with broad responsibilities, stated in the Law no. 4848[157]. One of the duties of the Ministry of Culture and Tourism, as stated in its Establishment Law, is "the protection of historic and cultural properties"[158]. According to the Constitution, the State has the responsibility to protect cultural and natural heritage, and to take essential supportive and incentive measures[159], and this duty was delegated to the Ministry of Culture and Tourism. As a matter of fact, the Ministry manages the cultural heritage in line with the Conservation Act No 2863/5226, which was adopted in 1983, and amended in 2004[160] and with related sub-legislation[161].

With a budget of 1,851,734,000 Turkish Lira (TL) in 2013[162], Ministry of Culture and Tourism is composed of headquarters, provincial, and overseas branches, and underlying organizations. Headquarters is formed of main service units, counseling and audit units, general service units[163]. The Ministry's central body that is responsible from cultural heritage conservation is the General Directorate of Cultural Properties and Museums (GDCPM). Department of Conservation Councils, Department of Excavations, Department of Restoration, Department of Implementations, Department of Properties, and Department of Illegal Trafficking carry out duties at the national level regarding listing, excavations, expropriation, conservation/restoration, designing and implementing visitor facilities for site museums, designating management areas and assigning directors and scientific committees for management areas (See Table 2.3).

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[157] The Law no. 4848
[158] The Law no. 4848: Article 2
[159] 1982 Constitution: Article 63
[160] The Act no 5226 - Amendments on Conservation Act on Culture and Natural Assets and various Acts (OG: 14.07.2004)
[161] The Act no 2863- Conservation Act on Cultural and Natural Assets (OG: 23.07.1983/18113)
[162] Law No 6313 on 2013 Central Government Budget Law, Annex A: Allowances
[163] Ministry of Culture and Tourism 2010

Table 2.3. Decision-makers and Decision-making Processes of Cultural Heritage Management in Turkey (YILDIRIM ESEN, 2014)

Decision-Makers			Ministry of Culture and Tourism															Local Administrations			Other Public Institutions			Gov't
			Central Org: GD of Cultural Prop.&Museums						*Periph.Bodies of Centr.Org*		*Scientific Councils*		*Periph. Bodies*		*Scientific Committees&D*									
Resp. Level			National						Regional		Natio	Reg	Prov	Terr	Site Level			Provincial & Municipal			Site	National		
Main Inst./Departm./Units			Dept. of Cons. Councils	Dept. of Excavations	Dept. of Restoration	Dept. of Implementations	Dept. of Properties	Dept. of Illegal Trafficking	Direct. of Arch. Survey&Monuments	Directorships of Regional Cons. Councils	High Council of Conser.	Regional Cons Councils	Prov. Dir. of Culture&Tour	Museum Directorships	Advisory Committee	Coordination and Control Committee	Director of Manag. Area	Cons. Impl.& Supervision Bureaus (KUDEB)	Municipality	Governorship (ProvincialS.A.)	Academic Institutions	Ministry of Finance	Ministry of Env.&Urbanization	Council of Ministers and President
Decision - Making Processes		Developing Policies									X													
	Listing	Survey Archaeology												X							X			
		Identification	X							X				X										
		Registration										X												
	Planning	Approval of Use&Dev. Conditions for Buffer Zones										X												
		Territorial Dev. Planning																		X				
		Local Dev.Planning&Spec. Dev.Pl(neighboring areas)																	X					
		Planning areas w/out Munic.																		X				
		Conservation Planning																		X				
		Approval of Cons. Plans										X												
		Expropriation/Exchanges					X													X		X		
	Excavations	Conducting Excavations												X							X			
		Approval of Turkish Excav.		X																				
		Approval of Foreign Excav.		X																				X
		Salvage Archaeology												X										
		Drilling Excavations												X										
		Monitoring Excavations												X										
	Conserv. & Rest.	Approval of Cons/Rest. Projects										X												
		PublicTendering of Conserv./Rest. Projects&Impl.			X				X															
		Technical Inspection of Conserv. Projects&Implement.Works			X				X									X						
	Publ. Interpr.	Designing & Impl. Visitor Facilities				X																		
		Managing Site Museums				X								X										
	Site Management	Designation of Mangmnt Areas																						
		Preparation of Site Man. Pl.													X		X							
		Approval, Monitoring Impl.of Site Mangmnt Plans														X	X							
		Monitoring of Impl.of Site Mangmnt Plans															X							

Peripheral administration is formed of provincial administrations and units directly affiliated with the headquarters. The Ministry has provincial administrations (tasra teskilati) in all 81 provinces, called ‘Provincial Directorates of Culture and Tourism’ (PDoCT)[164], having duties at the provincial level[165]. Except for the PDoCTs, all peripheral units are directly affiliated with the General Directorate. In other words, within the administrative system, the Cultural Properties and Museums Directorate General work directly with Directorates of Architectural Survey and Monuments, Directorates of Regional Councils for Conservation of Cultural Properties, and Museum Directorates. ‘Directorates of Architectural Surveys and Monuments’ (Rolove ve Anitlar Mudurlugu) are established in 11 provinces[166], and each one provides services to a specified region. These Directorates are responsible from project and implementation works such as maintenance, repair construction, restoration, restitution, landscaping, presentation of (registered) immovable cultural properties and museums[167].

Besides, scientific councils are established within the conservation system of the country. High Council of Conservation of Cultural Properties develop policies and guiding principles for conservation and restoration of cultural heritage that provide framework for Regional Councils for Conservation of Cultural and Natural Properties. There are 33 Regional Conservation Councils (RCC), which have critical roles and authorities in all phases of conservation of immovable cultural heritage. They have the authority to designate cultural properties and to approve conservation and development interventions in registered cultural

[164] In Turkish: Il Kultur ve Turizm Mudurlukleri.

[165] The following organizations form the stakeholders of Provincial Culture and Tourism Administrations: Governor’s offices, District Administrations, Line Ministries’ Provincial Administrations, municipalities, Special Provincial Administrations, NGO’s, private sector, tourism companies, travel agencies, police department, universities, tourists, media, citizens, students, and artists. Ministry of Culture and Tourism 2010

[166] These provinces are Ankara, Istanbul, Izmir, Konya, Kayseri, Diyarbakir, Adana, Erzurum, Antalya, Bursa and Trabzon.

[167] Directives regarding the Works of Directorates of Building Documentation and Monuments, General Directorate of Cultural Heritage and Museums, Ministry of Culture and Tourism 2005

properties[168].

In addition, as of 2013, 98 museum directorates (MD) work under GDCPM and possess significant responsibilities such as conducting and monitoring excavations, managing 189 museums and 131 archeological site museums (orenyeri)[169]. In addition, Turkish and foreign universities are involved in the conservation field in practice through conducting archaeological excavations and surveys in archaeological sites.

Besides, Site Management Directorates, which can be established by the Ministry for the most outstanding sites, carry out conservation works at site scale. A registered site can be designated as a 'management area' by the General Directorate. Such designation necessitates the establishment of an 'Advisory Committee', 'Coordination and Control Committee', and a 'Control Unit', all of which are responsible from certain tasks specific to that site. Advisory Committee gives recommendations on the preparation of management plans, which are approved, and implementation of which are monitored by the Coordination and Control Committee. Control Unit can be established to assist the Coordination and Control Committee during the monitoring process[170].

Local Administrations are also involved and have active roles in the conservation field. Particularly, responsibilities regarding planning of the built environment are given to the local administrations. In addition, at local levels, "Conservation Implementation and Supervision Bureaus" (KUDEB) are established as local control authorities under the structure of metropolitan municipalities, municipalities and 'Provincial Special Administrations' to carry out

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[168] Law no. 2863: Article 51

[169] Ministry of Culture and Tourism 2014

[170] Regulation on Foundation and Duties of Site Management and Monument Councils and Condition and Principles related to Establishment of Management Areas (OG: 27.11.2005/26006): article 4

responsibilities given by respective jurisdictions[171].

As the main responsible public institution, the Ministry of Culture and Tourism needs to collaborate with several public institutions and mostly with Ministry of Environment and Urbanization, and Ministry of Finance within the processes of territorial development planning and expropriations of private property cultural properties.

2.2.2.2. Decision-making Processes

Archaeological heritage is conserved as a result of a series of decision-making processes within which a number of units of public institutions, and mostly those affiliated with the General Directorate of Cultural Properties and Museums are involved. These decisions basically relate to 'listing', 'planning', 'excavations', 'maintenance, conservation and restoration', 'providing public access', and 'site management' of cultural properties including archaeological heritage. Several Departments of the General Directorate of Cultural Properties and Museums, regional and local peripheral units of the Ministry as well as local administrations including municipalities and Provincial Special Administrations are involved within these processes. In the following part, these decision-making processes are examined within current legislative system of Turkey in order to identify institutional systems and capacities in managing risks to archeological heritage.

Listing:

In Turkey, Ministry of Culture and Tourism has the authority and responsibility of identification and registration of cultural properties, according to the Act no. 2863. Processes of official listing of cultural heritage are carried out by the units

[171] The Regulation on Foundation, Permission, Working Procedures and Principles of Conservation, Implementation and Control Offices; Projects Offices and Education Units (11.6.2005/25842)

of the Ministry of Culture and Tourism based on the Law no 2863. After identification process, cultural properties are officially registered by the Regional Conservation Councils, which have the authority and responsibility of the designation of immovable cultural and natural properties. Conservation of all registered sites are under the responsibility of the State, even those that are private property.

Archaeological assets can be registered as ‘sites’ or ‘single structures’, based on the scale of the property, based on the Law no. 2863. An archaeological asset is designated as an ‘immovable cultural asset’ if it is a single structure or building such as a tower or citadel. Archaeological sites are defined in the legislation as “areas that include underground, above ground and underwater traces of past civilizations since the existence of humankind and reflecting social, economic and cultural aspects of their periods”[172]. Archaeological sites can be registered as 1st Degree, 2nd Degree, 3rd Degree or ‘urban archaeological site’, based on the characteristics of the sites in order to identify different degrees of limitations concerning physical interventions and usage[173].

Planning:

Within the hierarchy of planning from top to bottom, while upper-scale plans provide a more general and conceptual framework, implementation plans include concrete decisions regarding implementation. Archaeological sites that are located within the urban or rural planning areas are affected and mostly threatened with planning decisions and new developments, although there are mechanisms for conservation planning for registered properties. Therefore, it is essential to overview the entire planning process for a holistic view of physical planning and interventions in the built environment.

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[172] MoCT, High Council; Principle Decision No: 5.11.1999/658 Archaeological Sites, Protection and Development Principles

[173] MoCT, High Council; Principle Decision No: 5.11.1999/658 Archaeological Sites, Protection and Development Principles

Development Plans (İmar Planı) are prepared within the framework of the Settlement Act (no. 3194), which regulates planning and development of urban and rural settlement areas. In Turkey, from large-scale to lower scales, following categories of development plans are prepared in various scales:

- Regional Plans
- Territorial Development Plans
- Local Development Plans (Master and Implementation Plans)

Regional policies and goals related to socio-economic developments of settlements, sectoral goals as well as spatial distribution of related activities and infrastructures are defined through **regional plans** (Bölge Planı) in accordance with national policies. The *Ministry of Development* (Former State Planning Organization) is the institution responsible from preparing regional plans for geographical areas defined as 'planning regions' based on their geographical, administrative and economic characteristics[174]. In line with upper-scale national and regional plans, **Territorial Development Plans** (Çevre Düzeni Planı) are prepared in 1/25.000, 1/50.000 and 1/100.000 scales in order to develop land-use decisions regarding settlements, industrial, agricultural, tourism uses and transportation infrastructures. Conservation of natural, cultural and historic values of registered areas are among the main objectives of these plans, which are required to be prepared based on the findings of scientific researches on economic, social, cultural, political, historic, sectoral and technological aspects of the planning area[175]. Currently, territorial development plans are prepared by the *Ministry of Environment and Urbanization* in 1/50.000 and 1/100.000 scales[176]. Based on the legal frameworks, planning process of these plans include participatory meetings open to related public authorities and NGOs. At provincial

[174] Sizes of planning regions can be larger than a city, and smaller than a province, or large enough to include couple of provinces. The Settlement Act no 3194: article 8/a
[175] Regulation no 24220: article 5, 6
[176] The Environmental Act no 2872/5491.

scale, *Provincial Special Administrations* in coordination with *Municipalities* are responsible for preparing Territorial Development Plans[177]. Since 1990's, in Turkey, development policies have been identified through these plans, which have been shaping and transforming built environments, in which archaeological assets above or below ground are located.

Local Development Plans (İmar Planı) include Master Plans (Nazım İmar Planı) and Implementation Plans (Uygulama İmar Planı). Local level development plans are prepared for planning towns and counties. The Settlement Act. (no. 3194) gives the responsibility and authority of preparing local development plans to the *municipalities*[178]. While municipalities with more than 10.000 population are obliged to prepare local development plans, those with less population are given option to prepare plans or not, based on the decision of municipality councils. Municipalities may also prepare 'Special Development Plans' (Mevzii İmar Planı) for neighboring areas[179]. Identifying development, new construction, and repair principles and conditions for areas outside the limits of municipalities and their surroundings (i.e. villages, districts and other small and scattered rural settlements) are within the responsibilities of *governorships*, based on the Regulation for Development of Unplanned Areas[180].

Archaeological assets located within shore-strips are subject to special planning conditions stated in the 'Regulation for the Implementation of the Coast Act'[181]. Following the approval of the coastline by the governorships, and then by Ministry of Public Works and Settlement (MoPWS)[182], **implementation plans for shore-strips** are prepared in <u>1/1000 scale</u> and approved either by

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[177] The Act no 5302: article 6, 2005.
[178] Master Plans include zoning decisions and principles of future developments, while implementation plans provide details for new developments such as density of settlements related to building blocks within each zone, roads and implementation programmes. The Settlement Act. no. 3194, revised in 1985.
[179] The Settlement Act. no. 3194: article 7c.
[180] Regulation No 30.06.2001/24448.
[181] The Regulation for Implementation of the Coast Act (OG: 3.08.1990/20594)
[182] The 3621 Coast Act: article 6

municipalities if the area is within their boundaries, or otherwise by governorships[183]. Other specially planned areas are '**Culture and Tourism Conservation and Development Areas**', for which plans, including Territorial Development Plans, are prepared and approved by the *Ministry of Culture and Tourism*[184] with the participation of related local authorities[185]. Those special plans that identify the conditions for tourism developments by taking into account conservation areas are evaluated and approved by Regional Conservation Councils.

In Turkey, **conservation planning** for registered sites including archaeological sites is carried out either by municipalities or governorships. If a site is located within the boundaries of a municipality, its conservation plan is prepared by the municipality, otherwise, by the related governorship, based on the Act no. 2863. According to the Law, designation of an area as an archaeological site makes current planning decisions, including those of upper-scale plans (1/25.000) ineffective, and requires revisions to these plans. Conservation plans can be considered complementary to local development plans. With a strategic planning approach, conservation plans are supposed to address problems, opportunities, goals, tools and strategies. Conservation Plans are prepared through participation of various interest groups including members of chambers of related professionals, NGOs, universities and local community and property owners affected from plan decisions. Tentative plans are discussed in local meetings. Participants have rights to submit their written comments about the tentative plans. Proposed plan together with these comments are reviewed by the related Regional Conservation Council, which is the final approval authority. Once a

[183] However, in cases, when these areas fall within the 'partial development' areas identified through the development plans of related towns, counties, or tourism areas, 'shore strips' and 'building approach line' of those areas are subject to the conditions of related development plans. Regulation no 20594: article 16/b. Areas within Culture and Tourism Conservation and Development Areas are also approved by Ministry of Culture and Tourism. Regulation no 20594: article 12

[184] The Regulation on Preparation and Approval of Development Plans within Culture and Tourism Conservation and Development Areas and Tourism Centers (No:03.11.2003)-

[185] The Regulation on Preparation and Approval of Development Plans within Culture and Tourism Conservation and Development Areas and Tourism Centers (No:03.11.2003): article 15

conservation plan is approved, conservation plan decisions are depicted onto upper-level plans to guide future developments[186].

Conservation plans define the conditions for conservation and development, and aim to integrate conservation areas into the rest of the town. Designation status of a site determine conditions for its conservation and development. Conservation and use conditions, and kinds of physical interventions permitted in each category of archaeological sites (in addition to other categories of conservation including natural, historic, urban, and conservation areas of immovable cultural assets) are defined by the ‘Principle Decisions’ of the ‘High Council for Conservation of Cultural and Natural Assets. All kinds of activities except for the scientific researches with conservation purposes are forbidden in the 1st Degree Archeological Sites, while infrastructure constructions, limited seasonal agricultural activities and visitor facilities can be allowed through the approval of the related Regional Conservation Council. Similarly, 2nd Degree Archeological Sites are subject to the same conditions, except for allowing simple repairs for unregistered buildings within the framework of the conditions defined by the related Regional Conservation Councils. Unlike 1st and 2nd degree archaeological sites, 3rd Degree Archeological sites can be subject to new developments, in cases when a drilling excavation is executed by the related Directorship of the State Museums responsible from that area, and followed by a construction permission given by the related Regional Conservation Council based on the results of the excavation[187]. The Directorships of State Museums also have the responsibility of overseeing all kinds of construction works carried out in these areas, after approval of the projects.

Local development plans as well as conservation plans are implemented by local administrations within the framework of five-year-planning-programs that incorporate *land readjustment processes* as well as *exchange/bartering activities*

[186] Act no. 5226
[187] The Act no 2863

for immovable cultural assets and conservation sites that are not allowed for new constructions. As all kinds of construction activities are banned for a parcel upon its registration as a 1st or 2nd degree archaeological site, even if it is a private property, local administrations are responsible from the translocation of lots in order to protect present construction rights of property owners[188]. The translocation of the construction rights are carried out either by municipalities, or by governorship -if registered sites are outside the boundaries of municipalities- within the framework of a programme, based on the conditions set forth in the Act no 2863[189]. Private property cultural assets and their conservation zones can be expropriated based on the programs of the Ministry of Culture and Tourism[190].

As mentioned earlier, archaeological assets that are single structures (e.g. castle, tower, etc.) are registered as 'immovable cultural assets'[191], rather than an 'archaeological site'. A buffer zone called 'conservation area' is identified for each immovable cultural asset in order to control construction pressures and activities around the registered assets. Activities, including the repairs of unregistered buildings, that are carried out within the conservation zones are subject to 'usage and development conditions' identified through the Principle Decision of the High Council[192], and approval of the related Regional Conservation Council.

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188 The Act no 2863: article 15. Reserve areas are allocated by local administrations during the conservation planning processes to be used for exchanges. Instead of translocation of building rights, owner and property owner may sign a protocol, which allows the owner continue with limited construction activities while agreeing on conditions for conservation and maintenance of the property. Rules of expropriation processes are defined in the Expropriation Act no. 294291

189 The Act no 2863: article 17. Private property archaeological sites can be expropriated, and registered as treasury properties. The Act no 2863: article 42

190 Private property 1st degree and 2nd degree archaeological sites can be exchanged with treasury properties, upon the application of property owners to the Provincial Directorates of Culture and Tourism, and after their inclusion in the Exchange/Bartering Programme, overseen by the Ministry of Finance in coordination with Ministry of Culture and Tourism. Similarly, cultural assets that are single structures can be expropriated by local administrations (i.e. municipalities, provincial special administrations). The Regulation on Exchange of Immovable located in Conservation Sites with Immovable Cultural and Natural Assets banned from Construction Activities with Treasury Properties (OG: 08.02.1990/22930); article 4, 5. Exchange/Bartering programme necessitates consensus of owners and responsible authorities. Regulation No 22930: Article 15/a

191 The Act no 2863: Article 3/5

192 Ministry of Culture and Tourism, High Council; Principle Decision No:664/5.11.1999

Surveys and Excavations & Conservation Works:

Research and excavation of archaeological assets have been carried out in Anatolia since early 19th Century within the framework of related legislations. According to the Archaeological Excavations List, compiled by the TAY Project, archaeological excavations have been undertaken in 912 archaeological sites, located in 73 provinces of Turkey[193] (See Figure 2.26).

Surveys and excavations are undertaken by the Directorates of Museums and academic institutions, both foreign and Turkish[194], based on permits. **Archaeological surveys** are carried out by Turkish and Foreign teams of researchers who walk extensive areas, and identify and record surface finds[195], once the permits are given by the Ministry of Culture and Tourism. Relationships among the State, excavation directorship and land owners are determined in the Act no 2863. Permits of the foreign academic institutions are renewed each year, issued by the Council of Ministers and approved by the President[196]. Issues regarding archaeological excavations including application for permissions, compensation of damages aroused by excavation studies[197], conduct and control of excavations and responsibilities of excavation directorships are defined through related Regulation[198]. A representative from the Ministry, mostly from the staff of the Museum Directorships, monitor the fieldwork.

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193 Archaeological Settlements of Turkey Project 2013b

194 Turkish excavation groups are funded by the State, while foreign groups are mostly funded by their institutions or foundation grants.

195 As explained by Brodie, "Over a period of weeks, small team of researchers systematically and comprehensively walk a pre-defined area of land, noting and describing feature of archaeological interest". Brodie 2013

196 Law no. 2863: Article 35

197 Compensation of impacts aroused by excavations in private property sites is within the responsibility of excavation directorships. Amount of compensation is defined by a commission established by the Ministry of Culture and Tourism. Excavations can be carried out in private property registered sites, after compensations are paid to owners. Owners are obliged to give permissions for excavations in their properties, after the related compensations are paid. The Regulation for Research, Drilling and Excavation Studies related to Cultural and Natural Assets; (RG: 10.8.1984/18485)

198 The Regulation for Research, Drilling and Excavation Studies related to Cultural and Natural Assets; (RG: 10.8.1984/18485)

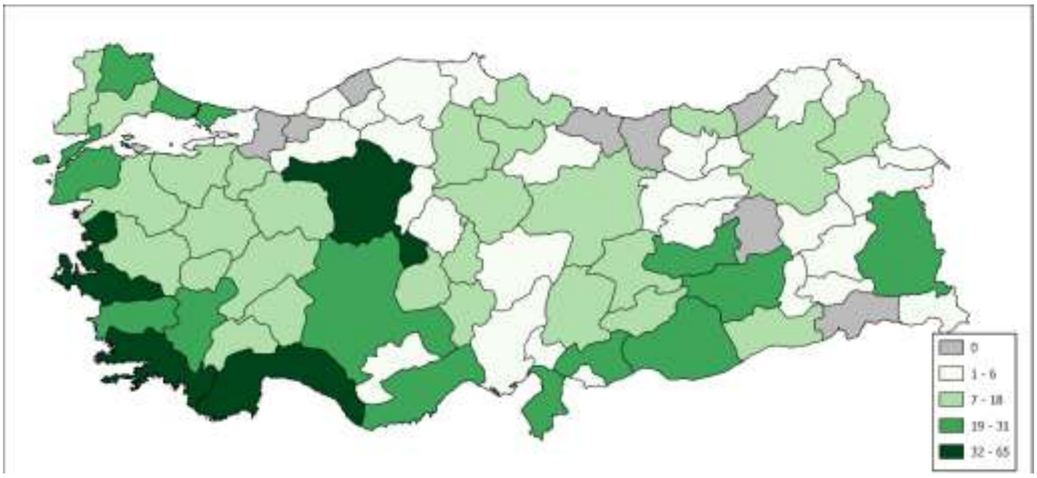

Figure 2.26. Turkey, Map of Provinces showing the number of archaeological sites that have been excavated since 1857 (Sibel YILDIRIM ESEN)[199]

In addition, salvage archaeology has been widely carried out due to major development projects such as transportation infrastructure development and dam construction. Exclusive authority over salvage archaeology is assigned to the Museum Directorates. These salvage excavations are funded by different public institutions such as the Directorate of State Water Works, Ministry of Transportation. Museum Directorates also undertake ‘Drilling Excavations’. In recent years, the number of archaeological works has significantly increased. State funding for archaeological works has grown from 1.8 to 48.1 million TL, between the years 2002 and 2011. In 2012, 202 research excavations, 102 surveys, 179 salvage excavations were carried out, as follows[200] (See Table 2.4):

- 116 Turkish and 39 foreign *excavations* issued by the Council of Ministers and approved by the President,
- 84 Turkish and 18 foreign *archaeological surveys* permitted by the Ministry,

[199] The Map is prepared by the author, utilizing the list of excavations provided by TAY. Archaeological Settlements of Turkey Project 2013b
[200] Ministry of Culture and Tourism 2013b

- 47 *excavation, conservation, restoration and landscaping works* of the MDs permitted by the Ministry,

- 151 salvage excavations, 5 Nabucco salvage excavations for Transportation Development, 17 salvage excavations for development of Ilısu Dam and Energy Project (HES) and 6 salvage excavations for other energy and dam development projects

Table 2.4. Excavations and surveys carried out in 2012

Excavations	**Turkish**	**Foreign**	**MDs**	**Total**
Excavations issued by the Council of Ministers	116	39		202
Excavations permitted by the Ministry	-	-	47	
Archaeological Surveys	84	18	-	102
Salvage Excavations	-	-	179	179

Based on the 2012 statistics of the Ministry, Izmir, Antalya, Mugla, Aydin and Canakkale are the provinces, where most of the ongoing excavation works are carried out (See Figure 2.27).

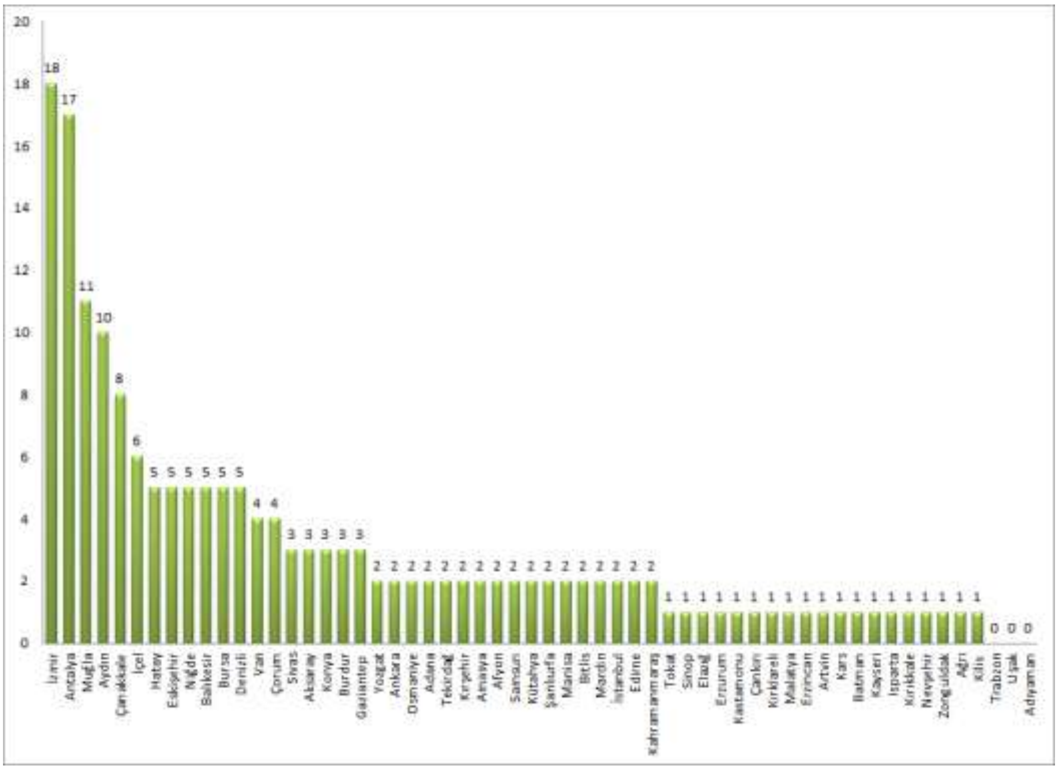

Figure 2.27. Quantity of excavated archaeological sites in provinces (*S. YILDIRIM ESEN, 2014*)

Maintenance, Conservation and Restoration of excavated sites is within the responsibility of Excavation Directorships, or Museum Directorships. Besides, Directorates of 'Architectural Survey and Monuments' carry out technical and administrative works of obtaining services from private firms for conservation and restoration projects as well as implementation of these projects mostly through public tendering. KUDEBs are also involved in implementation of restoration projects. Projects for all kinds of physical interventions at archaeological sites are submitted to the Regional Conservation Councils for approval before implementation.

Providing Public Access:

Only a few sites are open to public as 'archaeological site museums', called 'ören yeri' in Turkish, literally meaning 'ruined places'. Orenyeri is defined in the Act no 2863 (with amendments in 5226) as[201]:

> partially built and combined areas of human contribution and natural environments, where cultural assets are integrated with natural assets that are products of civilizations from antiquity onwards, which are distinctive, topographically identifiable and remarkable in means of historic, archaeological, artistic, scientific, social and technical terms.

These ‘archaeological site museums’ are administered by the Directorates of Museums. Together with state museums, 127 archaeological site museums attracted 28.7 million visitors in 2012[202]. Most of the site museums are located at provinces along the coastal areas of Aegean and Mediterranean Regions (See Figure 2.28).

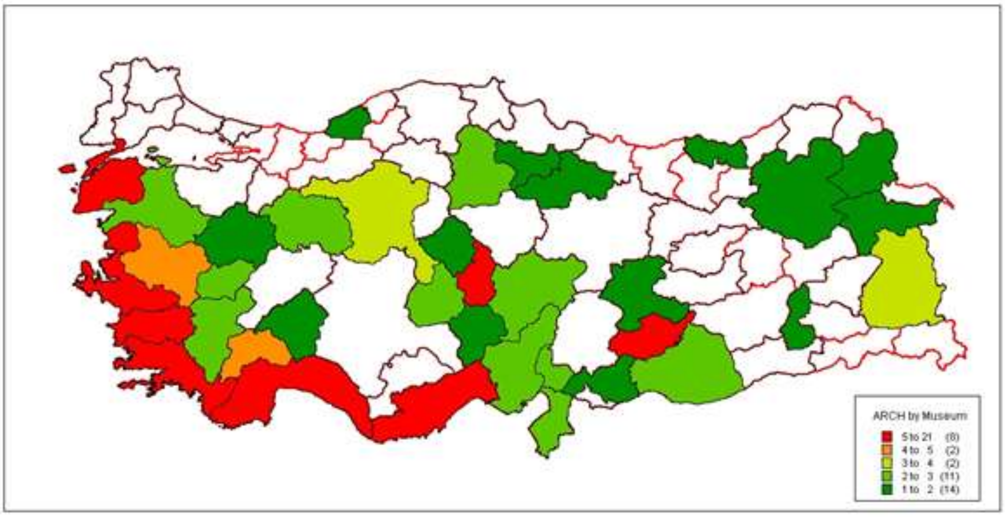

Figure 2.28. Distribution of archaeological site museums in Turkey (*Prepared by S. YILDIRIM ESEN, 2014*)

[201] Act no 2863: article 3a/7
[202] Ministry of Culture and Tourism 2013a

Site Management:

Registered archaeological sites do not have juridical status, rather being physical entities. Sites that are considered ‘managed’ are those protected through systematic monitoring, maintenance, and security systems under the responsibility of a director. Accordingly, these sites are the least vulnerable to natural and human-induced threats. Sites that are actively ‘managed’ in this sense are those excavated and/or presented to the public as ‘site museums’ (‘ören yeri’). Sites that are excavated are managed under the responsibility of Excavation Directorships (202 sites in 2012), while site museums are managed by Museum Directorates (127 sites) (See Figure 2.29, 2.30).

Archaeological sites may be located within the boundaries of a management area, which can be designated by the Ministry of Culture and Tourism or related municipalities[203] within the framework of the Conservation Amendment Act (no 5226), and based on the Regulation No. 26006. ‘Management Areas’ cover sites, site museums and their interaction areas and connection nodes[204]. Management plans are prepared for management areas either by the Ministry or by related municipality[205]. If a site is designated as a ‘management area’ by the Ministry of Culture and Tourism, such designation necessitates the establishment of an ‘Advisory Committee’, ‘Coordination and Control Committee’, and a ‘Control Unit’, all of which are responsible from certain tasks specific to that site. Advisory Committee gives recommendations on the preparation of management plans, which are approved, and implementation of which are monitored by the Coordination and Control Committee. A ‘Control Unit’ can be established to assist the Coordination and Control Committee during the monitoring process[206]. In addition, the ‘director of management area’ (Alan Başkanı) is assigned to oversee all tasks related to preparation, implementation and control of

[203] Regulation No 26006: article 4
[204] Regulation No 26006: article 1
[205] Regulation No 26006: article 8
[206] Regulation No 26006: article 4

‘Management Plans’[207].

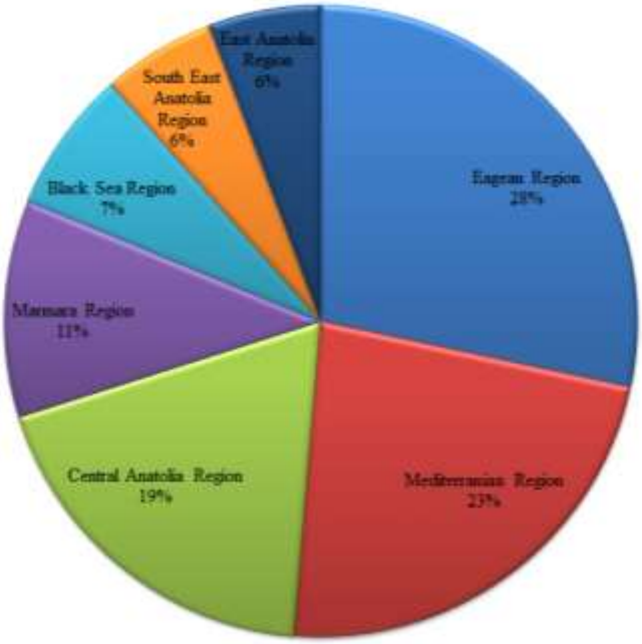

Figure 2.29. Distribution of total number of managed (site museum-orenyeri or excavated site) archaeological sites to the regions of Turkey as percentages (YILDIRIM ESEN, 2014))

[207] Regulation No 26006: article 14

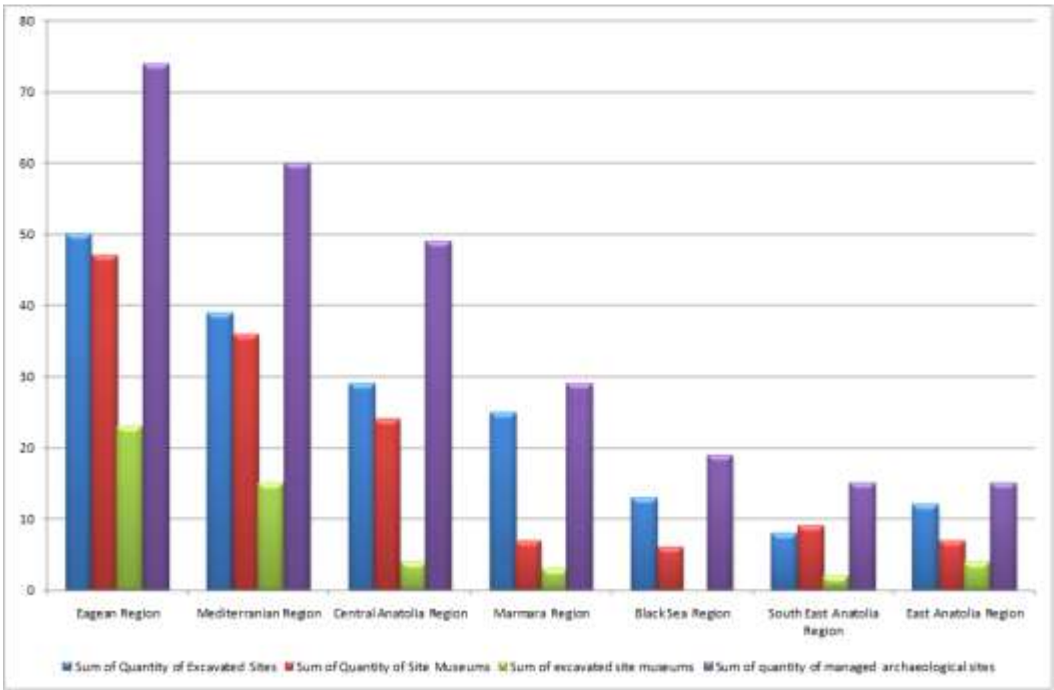

Figure 2.30. Regional comparison in terms of number of archaeological sites managed as excavation sites or site museums (YILDIRIM ESEN, 2014)

2.2.3. Evaluations on Risk Management and Institutional Vulnerabilities in Turkey

The success in managing risks to archeological heritage highly depends on the success of the Ministry of Culture and Tourism, as the main responsible public institution. Realizing a mission or creating a *public value* necessitates building *capacity* and gaining *support,* as stated by Mark H. Moore. He introduces the model called "public value strategy", which identifies three basic requirements necessary for success (for nonprofit organizations): *social mission* (the value an organization seeks to create), *support* provided by community and governments, and *organizational capacity*, ability of reaching the desired social mission. These three aspects of an organization constitute the "strategic triangle", which is explained by Moore as follows[208]: (See Figure 2.31)

> First point of the triangle – focuses attention on the key question of what constitutes the ultimate value that the organization seeks to produce. … The second point of the triangle - the legitimacy and support circle – focuses attention on [community of consumers, donors and governments]. The third point of the triangle focuses attention on "operational capacity" – the question of whether the enterprise has the ability to achieve the desired goals.

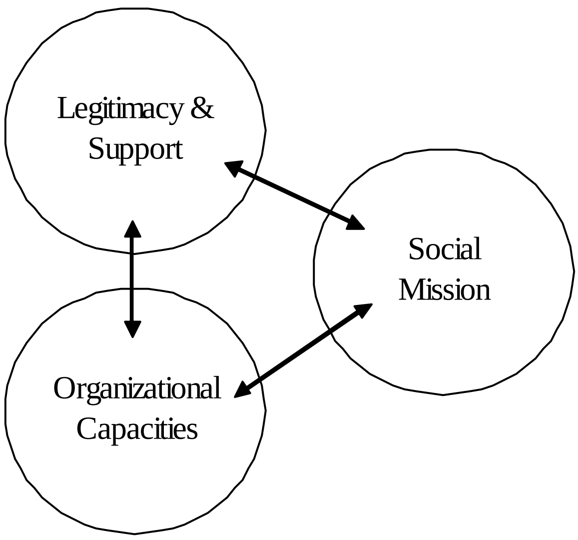

Figure 2.31. Strategic Triangle (*Source: Mark H. Moore, 2003:21*)

Therefore, these three elements of the triangle, writes Moore, are "important calculations" which "become the focus of measurement systems used to monitor the execution and the success of the strategic vision". An analogous model is used by many public and non-profit organizations to determine the priority of problems and which problems to address[209]. Identified problems are examined

[208] Moore 2003

[209] This model is also used UN organizations such as UNDP and UNDG while developing programs and projects.

through three lenses: value, support, and capacity and comparative advantage (See Figure 2.32).

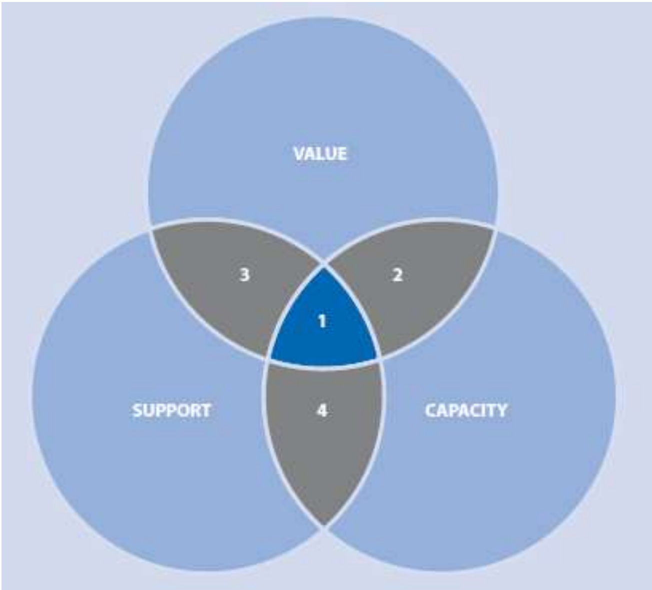

Figure 2.32. Model to determine the priority of problems (*Source: UNDP, 2009:37*)

The area 1, where all three circles overlap is called as the ‘Just Do It’ zone, as it represents a priority, for which the organization would have partner support, internal capacity and comparative advantage to deal with the identified problem. Area 2 represents an area for advocacy, as it would bring value to stakeholders, and the organization has capacity and comparative advantage, but necessitates efforts to mobilize support and build partnerships and further awareness. Areas 3 and 4 are more challenging, both of which may represent areas within the scope of other organizations with greater capacity or comparative advantage[210].

With this perspective, the Ministry’s success in conservation archaeological heritage and managing risks depends on three measures:

[210] UNDP 2009:37

- Prioritizing risk management, and highlighting value that it would bring to the community, region, or country;
- Having financial, human, technical capacity to work on the challenges
- Having support to work towards solving problems (support from senior management, government, other public institutions to partner with, and local community)

With respect to valuing and prioritizing risk management, it is supposed to be high-level priority for the Ministry as conservation of cultural properties is one of the main duties of the Ministry, which has the mandate to act. Here, the question to ask is ‘Is there relevant policies and preventive approach within the decision-making processes? In addition, the second important aspect is to question the capacities to carry out the challenging task of risk management at national, local and site levels. Third, it is significant to look into whether there is internal (senior management) and external (other public institutions and communities) support to collaborate and work towards dealing with challenges. In fact, institutional glitches in these three measures make archeological sites vulnerable to a wide range of natural and human induced hazards. In the following part, the current administrative system will be reviewed within this framework.

2.2.3.1. Decision-Making Processes

As effective planning starts from top to bottom, planning for managing risks to archaeological heritage should start from strategic planning. First strategic plan of the Ministry of Culture and Tourism was prepared for the years 2010 to 2014. One of the strategic objectives of the Ministry of Culture and Tourism for the years 2010 to 2014 is ‘conservation of natural and cultural properties’, which supports one of the economic and social development axes identified in the 9th Development Plan for the Years 2007-2013 through “protecting and improving culture and strengthening social dialogue"[211]. In order to achieve this strategic objective, strategies regarding cultural heritage conservation are defined as:

- Converting and uploading data and information related to cultural heritage to electronic means to ease access to information,
- Adopting related EU Directives on protection of cultural heritage against illegal trade and illegal change of ownership, and building capacity
- Completing the inventory of intangible cultural heritage

The strategic plan reveals that managing risks to ensure conservation of cultural properties are not among the priorities of the Ministry, and hence there is not a preventive approach at this high-level management document. With respect to administrative system, at the national level, the Directorate of Cultural Properties and Museums is structured in departments, each carry out tasks that relate to a specific aspect of archaeological heritage management such as identification/registration, expropriation, excavation, or responsible from a group of sites such as sites currently excavated, sites open to public as 'site museums'. Within this fragmented system, at the national level, it is striking that an administrative body that deals with the management of the entire archaeological heritage, addressing priorities and processes of management with a holistic and preventive approach, does not exist. Therefore, decisions regarding excavations, conservation of sites are not based on priorities.

Similarly, although there are peripheral units in all provinces, the Ministry does not have an archaeological heritage management system at provincial scale. Without territorial scale heritage planning and management, conservation

[211] Strategic planning process started in public administration after the issuance of the by-laws on "Strategic Planning Process and Principles in Public Administrations" in the 26179th issue of official gazette on 26 May 2006. According to this by-law, the strategic plan of the Ministry of Culture and Tourism, which covers the periods of 2010-2014, was prepared and submitted to State Planning Organization in January 2010. Ministry of Culture and Tourism 2010

planning is carried out at site scale on a case-by-case basis. However, most of the hazards threatening archaeological heritage can be prevented and mitigated through territorial scale risk management. At site level, it is not possible to grasp the variety and magnitude of problems, and hence it is not possible to overcome challenges. It is also critical to integrate conservation planning into current planning system; however, current system is focused on development. Briefly, current administrative system does not support a holistic management approach, essential for managing risks, at national and provincial levels due to organizational scheme and division of responsibilities.

In terms of decision-making processes, certain aspects affect vulnerability of archaeological sites against various hazards. Regarding identification and registration, incomplete inventory is the biggest challenge that make undesignated sites particularly vulnerable to development. Although scientific surveys and excavations carried out in various places have contributed to the body of knowledge about archaeological assets in Turkey, locations of many sites remain unknown. Many continued to be destroyed, and it is not possible to grasp what has been lost. However, this issue is not highlighted in the strategic plan, and likewise completing the inventory is not stated among the strategies for conservation.

3rd Degree archaeological sites is another concern, as most of the damage through development occur at the *3rd degree archaeological sites,* which can be designated as development areas, and occupied with new constructions[212]. Responsibilities given to the Museums are critical for the conservation of archaeological potentials possessed in the 3rd Degree Archeological Sites, as all

[212] As stated by Nayci, 'Western İçel Coastal Territorial Development Plan' (TDP), prepared and approved in 1993 by the Ministry of Public Works and Settlements, allowed new developments, mostly tourism and secondary housing uses, at all coastal sections between Erdemli and Silifke. Naycı mentions that this plan gave rise to development activities that endanger archaeological and natural assets of the area. Besides, 3rd degree archaeological sites, which were designated as development areas for secondary housing and tourism, were occupied with new constructions. Yemişkumu, Elauissa-Sebaste, Korykos, Narlıkuyu Archaeological Sites were affected from this approach. Naycı 2010

intervention decisions and construction approvals depend on their works (drilling excavations).

Another significant challenge, which relates to excavations, is *leaving sites exposed to atmospheric conditions and/or not maintained and managed when excavations have been discontinued for long periods,* or have been abandoned[213]. In addition, only a few sites, only those currently excavated or open to the public, are actively managed. Absence of site management increases vulnerability against all kinds of threats. Conservation of cultural heritage sites can be possible through effective site management. Lack of means for the simplest maintenance in the long-term leads to physical problems, and eventually to loss of values. As part of management problems, security deficit is the basic reason for widespread destruction due to illicit digging. Briefly, lack of policies regarding risk management of archaeological heritage is a significant problem for managing risks to archaeological heritage in Turkey.

The last but not least, in the strategic plan of the Ministry, terror, cultural alienation, illegal digging, smuggling, unplanned urbanization and insufficient urban infrastructure, claim to convert natural and cultural heritage to commodities are identified among ‘threats’[214]. Since risk assessments are not carried out within decision-making processes, wide range of natural and human-induced threats could not be identified. Hence, essential preventive strategies could not have been developed for the conservation and management of cultural assets.

2.2.3.2. Capacities to Manage Risks

It is also significant to look at the capacity of the Ministry to manage risks to archaeological heritage. Internal Stakeholder Survey, which was carried out in

[213] Interview at the Department of Excavations on 15 December 2012.
[214] MoCT 2010: 53

2007 and 2008 by the Ministry of Culture and Tourism to provide input for the strategic planning process of the Ministry reveals certain aspects regarding the human, financial and technical capacities of the Ministry. According to the results of the Internal Stakeholder Assessment Survey, to which 2589 staff of the Ministry had participated, 73% of participants agreed on the need to re-structure the Ministry's organizational body. Besides, majority of the participants (64 %) stated that working environment and facilities are not sufficient in the Ministry. Inadequate resources and red tape (too much bureaucracy) were mentioned as the main reasons of ineffectiveness and inefficiency. Hence, the need to re-define and to analyze and redesign job descriptions and work processes was highlighted in the Strategic Plan. The following weaknesses of the Ministry are pointed out in the Strategic Plan[215]:

- Lack of efficient human resource planning,
- Limited communications and coordination among units,
- Resistance against change,
- Limited budget resources,
- Inefficient working environment offered to staff,
- Limited training for staff,
- Ineffective use of budget,
- Legislation that needs to be updated,
- Limited utilization of technical infrastructure.

As indicated in the Strategic Plan, human, financial and technical resources are limited, particularly at the peripheral units of the Ministry. For instance, Museum

[215] Ministry of Culture and Tourism 2010: 52

Directorships, which have critical roles in conservation of archaeological heritage, assigned exclusive authority over salvage archaeology, and managing all site museums, which attracted 10.3 million visitors in 2012, have limited capacities and chronically understaffed. In general, carrying out these duties is challenging for Museum Directorships. As opposed to their extensive duties regarding archeological heritage conservation and management, the MDs execute within the framework of directives of the central administration, as they do not have much autonomy, independent budget or decision-making powers. Similarly, at provincial level, Provincial Directorates of Culture and Tourism have limited human resources, since as of 2010, 70 director, 98 deputy-director, 174 section-manager as well as only 3 engineers and 2 architects have been employed in 81 provincial directorates[216].

The last but not the least, collaboration with other public institutions and local administrations related to development planning and disaster risk management from central to local levels is needed for the success of conservation efforts. In order to integrate conservation of archaeological heritage into planning, two major authorities responsible from conservation and planning – Ministry of Culture and Tourism and Ministry of Environment and Urbanization- have to collaborate at all levels of management.

In addition, the Prime Ministry Disaster and Emergency Management Presidency (AFAD) (Afet ve Acil Durum Yonetimi Baskanligi), which is the main responsible institution that acts within the framework of the Law no. 5902 adopted in 2009, can play a significant role within the process of assessing and managing risks to cultural heritage. However, it is necessary to enhance disaster risk management policies related to pre-disaster activities such as risk assessment, preparedness, prevention and mitigation, considering the fact that policies that have long been implemented in Turkey have focused on post-

[216] MoCT 2010: 40-41

disaster-interventions[217]. Besides, the national archive of natural disasters lacks data on damaged cultural assets. In cooperation with the Ministry of Culture and Tourism, establishing a national system for recording impacts of hazards on cultural heritage is significant for assessing and managing risks to cultural heritage. Finally, collaboration is needed not only in the preparedness stage of disaster risk management, but also in the response and recovery stages through integrating cultural heritage management into disaster risk management systems administered by the Prime Ministry Disaster and Emergency Management Presidency (AFAD).

[217] JICA 2004: 40

CHAPTER 3

RISK ASSESSMENT OF ARCHEOLOGICAL HERITAGE AT TERRITORIAL SCALE: FROM THEORETICAL FRAMEWORK TO PROPOSAL

While the frequency of multiple natural and human-induced hazards threatening archaeological assets continuously increase, at the same time, cultural assets are becoming more and more vulnerable to these dangers due to various physical, managerial and social factors. As a result, levels of risks to irreplaceable cultural properties including archaeological assets are growing. Understanding the concept of risk, and factors contributing to its occurrence and increase is critically important to develop strategies to mitigate risks. Most of the human-induced hazards can be prevented, and catastrophic impacts of natural hazards can significantly be decreased through effective and preventive management strategies. Risk assessment is the first step of preventive conservation of cultural heritage.

In this chapter, first, literature on risk as well as on risk assessment and risk management process in the field of cultural heritage conservation are examined to build a theoretical background for developing a risk assessment methodology for archeological heritage. Following, existing approaches in the literature are evaluated in terms of various aspects of a risk assessment process, focusing on archaeological heritage. In the second part, proposed risk assessment methodology, which is based on the existing level of knowledge on risk assessment of cultural heritage, is introduced.

3.1. Theoretical Framework for Risk Assessment of Archaeological Heritage

In this section, the literature on risk, risk assessment and management is examined under three main headings: Theory of Risk, Risk Management and

Risk Assessment; Risk Assessment of Cultural Heritage; and Risk Assessment Experiences in Cultural Heritage Conservation. International documents and guiding principles developed by non-governmental organizations have been reviewed to outline theory on risk assessment and risk management in the field of cultural heritage conservation. After the concept of risk and principles of risk management of cultural heritage are introduced, process of risk assessment, which include successive steps of risk identification, risk analysis and risk evaluation, is examined through the guidelines developed for World Heritage sites. In addition, risk assessment experiences in the field of cultural heritage conservation are examined. Finally, current body of knowledge on risk assessment theory and practice is evaluated.

3.1.1. Theory of Risk, Risk Management and Risk Assessment

3.1.1.1. Concept of Risk

> Risk is a complex, and at the same time curious concept. It represents something unreal, related to random chance and possibility, with something that still has not happened. It is imaginary, difficult to grasp and can never exist in the present, only in the future. If there is certainty, there is no risk. [218]

Risk is an abstract and extremely complex concept. As identified by Cardona, it is about something that may happen in the future. So, it is not certain, but there is *chance and probability* of occurrence. According to *"UNISDR Terminology of Disaster Risk Reduction",* risk is "the combination of the probability of an event and its negative consequences"[219].Granger adapts the most basic risk equation as:

risk = hazard x elements at risk x vulnerability[220]

[218] Cardona 2003
[219] UNISDR 2007a
[220] Granger, Jones & Scott 1999

According to this theoretical explanation, risk is the combination of three sets of constructs: elements at risk, hazard and vulnerability (See Table 3.1). This means, when one of these do not exist, there is no risk. Hazard can be explained as natural or man-induced phenomena that have negative consequences on elements at risk. V*ulnerability* is also an abstract concept that is defined as "susceptibility, or exposure to the hazard."[221]

Due to its complexity, the concept of risk has been researched, especially after the 1980s, in various fields, focusing on different aspects of the term. In the field of *natural sciences*, the issue of disaster risk has started to be examined with studies addressing several natural phenomena such as earthquakes, volcanic eruptions, mudslides, flooding and industrial accidents. As argued by Cardona, the general approach in these studies has been focusing on one of the main components of risk: the hazard. Therefore, the concept of risk is commonly confused with the term hazard, although risk cannot be conceived exclusively as the possible occurrence of a natural phenomenon[222].

On the other hand, Cardona debates, from the point of view of the *applied sciences*, the concept of risk is examined addressing the effects of the event, and not the event itself. In this approach, he explains, emphasis is given on analyzing physical vulnerability to define physical aspects, and in practice, physical vulnerability evaluation is substituted with risk evaluation. Besides, the author argues, as risk has been restricted to a consideration of the loss represented in physical damage, the approach to the concept of vulnerability is merely used to explain the physical damage, neglecting the overall consequences of disaster for the society, and the capacity of the society for recovery or to absorb impact. Due to this restricted vision of risk in the applied sciences, social, cultural, economic,

[221] ICCROM 2010: 6

[222] For the evolution of the concept of risk, and comprehensive evaluation of different approaches in natural, social and applied sciences regarding disaster risk and vulnerability; see: Cardona 2003

and political elements of vulnerability are ignored in the estimation of risk[223].

The *social sciences* approach differs in that it mostly focuses on individual and collective perceptions in case of emergencies. Issue of disasters from the perspective of social sciences has started to be analyzed with studies focusing on the response of population in case of war [224]. According to Cardona, in the fields such as history, sociology, and psychology, the risk is usually considered as a social construction, and hence, is analyzed in terms of the individual and collective perceptions, representations, and interactions of social actors. [225]

Again, Cardona highlights, this limited perspective has been changed through some works, which have contributed to the notion of disaster risk by addressing the capability of communities to absorb impact or to recover after an event. This approach emphasizes that vulnerability should not be diminished to the likelihood of physical damage[226].

[223] Cardona mentions that this approach is usually adopted by engineers, geologists, geographers, economists and epidemiologists. For more information see: Starr 1969; Cardona, 2003
[224] Quarentelli 1988
[225] Cardona 2003
[226] Cardona asserts that at the end of the 20th Century, the 'risk' has started to be theoretically conceived as the result of social, economic, and political processes, emphasizing both the concepts of vulnerability and hazard. Omar D. Cardona refers to the study of Westgate and O'Keefe, 1976. Omar D. Cardona 2003

Table 3.1. Definition of the term ‘risk’ in different contexts

Context	Definition of Risk	Source
Social Sciences	"the combination of the probability of an event and its negative consequences"	UNISDR (2007)
Disaster Risk Management	risk = hazard x elements at risk x vulnerability	K. Granger, et. al (1999)
Ecological and Fisheries Management	"probability (likelihood) of something undesirable happening"	Francis (1992)
Cultural Heritage Management	"a product of hazard and vulnerability"	ICCROM, ICOMOS, IUCN, UNESCO (2006:8)
Cultural Heritage Management	Risk = f (value, vulnerability, hazard)	A. Giammarusti (1987:105)

In the field of cultural heritage conservation, the concept of risk started to be discussed especially after 1990’s. In this context, Giammarusti explains, the term risk indicates “the susceptibility of a given monumental structure to the exposure to the occurrence or lasting of degradation processes.” Particularly, he adds, risk is a function of value, vulnerability and hazard and expressed as follows:

$$\text{Risk} = f\ (\text{Value, Vulnerability, Hazard})$$

In this sense, the term “hazard”[227] is used to define both natural and human-induced events that have the potential to cause negative consequences to cultural heritage values. Consequences of hazards are directly related to “vulnerability” of cultural assets, which may arise from various physical, social, economic, environmental, and even attitudinal factors, as stated by Jigyasu (2012)[228]. For instance, geographical location of a site in a conflict prone area, local soil conditions, exposure to hazards due to densely-built surroundings, sensitivity of

[227] Hazard is defined as "any phenomenon, substance, or situation, which has the potential to cause disruption of damage to infrastructure, services, people, their property, and their environment". Abarquez and Murshed 2004

[228] Jigyasu 2012a

material or structure due to inherent weaknesses or past conservation interventions, ineffectiveness or lack of management, etc. affect vulnerability of cultural heritage sites to certain hazards[229]. When hazards cause "widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources"[230], they are called *disasters*, as identified by UNISDR[231]. Indeed, complex interaction between multiple hazards and vulnerabilities create disaster risks.

3.1.1.2. Principles of Risk Management of Cultural Heritage

As risk is a perception, and a phenomenon that may exist in every aspect of life, risk management is carried out in various fields for the purpose of preventing and mitigating undesired consequences. For instance, risk management is widely practiced by organizations "to minimize risk in investment decisions and to address operational risks such as those of business disruption, production failure, environmental damage, social impacts and damage from fire and natural hazards"[232]. Besides, "risk management is a core issue for sectors such as water supply, energy and agriculture whose production is directly affected by extremes of weather and climate"[233]. In the context of disasters, disaster risk management is the systematic process of the implementation of policies, strategies, capacities, operational skills and tools in order to decrease the undesirable impacts of

[229] Jigyasu 2012a
[230] UNISDR, 2007b
[231] It is important to underline that "hazards such as earthquakes can trigger disasters although they are not disasters in themselves". ICCROM 2010:6
[232] UNISDR 2007b. Risk assessment is also widely used in the field of ecotoxicology. See: Astles, Holloway, Steffe, Green, Ganassin & Gibbs 2006: 290-303. It has recently been used in ecosystem-based fisheries management and habitat conservation. See: Hobday, Smith, Stobutzki, Bulman, Daley, Dambacher, Deng, et al. 2011: 372-384. In the context of marine ecosystem-based management, risk assessment calculates the likelihood that the success of desired marine management objectives will be hampered by human activities. In the habitat risk assessment perspective, habitats that are greatly exposed to human activities and high consequences are considered at high risk. See: Dawson, Jackson, House, Prentice & Mace 2011: 53-58
[233] UNISDR 2007b

hazards and the likelihood of disaster[234]. On the other hand, as mentioned earlier, **the purpose of disaster risk management of cultural heritage is to prevent or reduce risks to cultural heritage values as well as to human lives, physical assets, and livelihoods in and around heritage sites**.

Manuals prepared for managing World Heritage introduce certain principles for risk preparedness and management of cultural heritage. The "*Manual for Risk-Preparedness for World Cultural Heritage",* which was published in 1998, provides property managers with a risk-preparedness framework. As a complementary to the "*Manual for Risk-Preparedness for World Cultural Heritage",* a Resource Manual, titled *"Managing Disaster Risks for World Heritage" was published* in 2010. The Manual, which was a joint undertaking by the three Advisory Bodies of the World Heritage Convention (ICCROM, ICOMOS, and IUCN) and the UNESCO World Heritage Center, aims to explain the main principles of disaster risk management, and to provide a methodology for identifying, assessing, and reducing risks. These manuals are reviewed to identify international principles developed in this subject.

In the *Manual for Risk-Preparedness for World Cultural Heritage*, one of the benefits of a cultural-heritage-at-risk framework, and risk preparedness is explained as "the extension of the life of cultural properties, their collections and constituent elements"[235]. Another significant benefit of a cultural-heritage-at-risk framework is that it "refocuses conservation attention from the curative to the preventive, from the short-term to the long-term, and consequently offers property owners significant opportunities to realize long-term savings"[236]. With this perspective, the Manual sets forth a planning framework, which consists of three phases: Preparedness, Response and Recovery. A set of universal principles of risk-preparedness of cultural heritage were introduced in the *Manual*,

[234] UNISDR 2007b
[235] Stovel 1998:16
[236] Stovel 1998

addressing these three phases. These principles underline the significance of advance planning and preparation, addressing the following aspects[237]:

- be comprehensive enough to cover all aspects (buildings, structures, and their contents) of the property,
- integrate conservation objectives into prevention strategies to ensure the least impact on heritage values,
- be based on clear documentation of heritage properties and disaster response history,
- guide maintenance programs,
- be prepared in cooperation with users and occupants.

Other principles relate to the phases of response and recovery. First, during emergencies, “securing heritage features should be a high priority”. Second, following a disaster, the principle is “to ensure the retention and repair of structures or features that have suffered damage or loss”. Third, it is also indicated that “conservation principles should be integrated where appropriate in all phases of disaster planning, response and recovery”[238].

Preparedness phase comprises all required actions essential to improve preparedness for cultural heritage, focusing on hazards and the mitigation of related risk. The reinforcement of the property, the use of detection and early warning systems, and improving capacity of users, and emergency response professional in the face of emergencies are some of these actions to improve risk-preparedness for cultural heritage[239].

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[237] Stovel 1998:20-24
[238] Stovel 1998:20
[239] Stovel 1998: 25-26

Besides, the Manual focuses on different forms of cultural heritage as well as different types of hazards including fire, earthquakes, flooding, armed conflict, tsunami, avalanches, land and mud slides and flows, winds or tropical storms, and hazards of human origin. Important aspects of risk-preparedness for archaeological sites are stated, focusing on[240]:

- *site security* due to "potential for vandalism and arson, potential for looting and illicit removal of heritage objects or fragments, safety of visitors and residents",
- *respect for heritage values* "to ensure appropriate actions during emergencies to maintain desired integrity and authenticity",
- establishing *acceptable levels of risk* in various threats,
- *preventive aspects*, including public education, and
- *taking into account principles* related to archeological heritage conservation and management.

Risk assessment, which is the first step prior to taking required actions for risk preparedness, is not mentioned in the Manual. However, based on the abovementioned aspects, the following should be taken into account during risk assessment of archeological heritage:

- 'Comprehensiveness' and 'clear documentation of heritage properties' are two basic principles that should be taken into account during risk assessment while assessing the "elements at risk".
- Disaster response history should be reviewed for identification of hazards during risk assessment process.

[240] Stovel 1998: 31-32

- 'Site security' should be considered as one of the aspects that make archeological sites vulnerable to vandalism, arson, looting, and illicit digging as well as in terms of safety of visitors and residents.

- The extent of public education and cooperation with users and occupants are significant factors that affect the level of vulnerability of a site.

- 'Acceptable level of risk' should be identified as part of the risk evaluation methodology.

As mentioned earlier, the Manual titled *"Managing Disaster Risks for World Heritage"* is the other significant international document introducing certain principles. According to the Manual, disaster risk management of cultural heritage is a continuous process during which multiple stakeholders from heritage, and disaster management fields as well as the local community should be involved.[241] In addition, three phases of disaster risk management process are explained: before, during and after disaster. Risk assessment, risk prevention/mitigation, and emergency preparedness activities are undertaken before a disaster. Maintenance and monitoring, and developing and implementing various disaster management policies and programs are some of the **prevention and mitigation measures**. **Emergency preparedness** stage includes activities such as assigning an emergency team, developing an emergency evacuation plan and procedures, warning systems, and drills. **'Response'** is the stage implemented during the first 72 hours after the event. Establishing and practicing various emergency response procedures are needed to save people and cultural properties. After the disaster, during **recovery** phase, damage assessment as well as essential interventions such as repair, restoration, and rehabilitation are carried out to save damaged components of the cultural and natural property. It is also essential to do periodic communication and monitoring throughout the disaster risk management

[241] Jijyasu 2012b

cycle.[242] Establishing interlinkages between these stages of disaster risk management is another aspect of this continuous process[243].

In addition, the Manual focuses on the significance of collaboration with various related public and private organizations as well as the local community[244]. It is also noted that preparing a disaster risk management plan necessitates a core team, which is supported by professionals from various disciplines. The core team should consist of the site manager(s), the staff members representing related divisions and departments such as administration, maintenance, monitoring, and security. Therefore, the local municipality, local government, local community, the disaster management agency, police, health services, and emergency response teams should be engaged and involved in the process of creating the system, and formulating the plan for the disaster risk management. The core team should be supported by professionals from the fields of conservation and disaster risk management. While identifying and assessing risks; specialists such as hydrologists, seismic engineers, meteorologists, climatologists, public health experts, epidemiologists, and sociologists, etc. should be involved in the process[245].

Furthermore, key principles of DRM of cultural and natural heritage are introduced in the Manual as follows[246]:

- reducing risks to the heritage values as well as to human lives, physical assets and livelihoods,
- regarding values of the heritage as the foundation of all plans and

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[242] ICCROM 2010: 13-14
[243] Jijyasu 2012b
[244] Disaster Imagination Game (DIG) is an effective way of making DRM plan with Community Participation. ICCROM 2010; Okubo 2012a
[245] ICCROM 2010: 20-22
[246] ICCROM 2010

actions[247],

- addressing specific needs of various categories and characteristics of cultural properties (scale, tangible/intangible, movable/immovable, living/uninhabited, protected/unprotected)[248],

- addressing risks originating inside the property or in the surrounding environment[249],

- reducing vulnerability factors, such as lack of maintenance, inadequate management, progressive deterioration[250],

- integrating DRM into site management[251],

- using traditional knowledge and management systems in disaster mitigation[252].

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[247] In order to protect heritage values, a comprehensive inventory of movable and immovable cultural heritage is vital to identify the values that might be at risk.

[248] It is also significant to take into account the specific needs of various categories of cultural heritage property, such as historic buildings, historic vernacular districts, archaeological sites, cultural landscapes, etc. In addition to scale, characteristics of heritage attributes, such as tangible or intangible, movable or immovable, living or uninhabited, need to be addressed during the planning process. ICCROM 2010:11

[249] Surrounding environment may also increase risks by increasing vulnerability of cultural heritage sites. Besides, risks may originate from inside the cultural heritage site or from the surrounding environment (Jigyasu, 2012a) In addition, it is necessary to take into account the fact that disasters may happen in parallel or may follow each other. For instance, Indian Ocean Tsunami that occurred in Aceh, Indonesia in 2004 was a combination of multiple disasters including civil war, earthquake, tsunami, and looting. Similarly, Great East Japan Earthquake in 2011 was occurrence of several disasters (earthquake, tsunami, fire, flooding, and nuclear accident) following each other. Jijyasu 2012b

[250] While dealing with protecting heritage values from disasters; disaster risk management plan also addresses reducing vulnerability factors, such as lack of maintenance, ineffective management, which may increase the impacts of hazards. ICCROM 2010: 11

[251] It is important to mention that a disaster risk management plan for a cultural heritage site should form part of the site management plan (ICCROM 2010: 13). According to Rohit Jigyasu, disaster risk management plans at local, regional, and national levels should address protection of cultural properties. In other words, DRM of cultural heritage should be linked to disaster management systems at local/regional/national level. Jijyasu 2012b

[252] Cultural heritage can also play a positive role in disaster risk management, as traditional knowledge systems (such as earthquake resistant construction systems, or use of traditional open spaces as safe places during emergencies) provide accumulated knowledge and experiences on disaster risk mitigation and preparedness. Jijyasu, 2012b

It is significant to highlight that some of these principles of disaster risk management of cultural heritage should be taken into account during the process of risk assessment. For instance, while examining elements at risk heritage values, human lives, physical assets and livelihoods, various categories and characteristics of cultural properties should be included. In addition, while identifying hazards, variety of risks originating inside the property or in the surrounding environment should be questioned. Furthermore, while analyzing vulnerabilities, various vulnerability factors, such as lack of maintenance, inadequate management, progressive deterioration (physical condition), and the level integration of DRM into site management should be addressed. These principles also form the basis of a risk assessment framework for archeological sites.

3.1.2. Risk Assessment of Cultural Heritage

The relation between the concept of risk and management makes the measurement of risk essential for the benefit of grasping the feasibility and convenience of required decisions and actions to manage risk[253].As natural and human-induced events continue to intensify in and around cultural properties, so does **the need for assessing the risks** to prioritize management strategies. Risk assessment for cultural heritage sites is crucial for making **an informed judgment on nature of risks** as well as for **understanding level and extent of risks.** Based on risk assessment, Jigyasu explains, the goals of a disaster risk management plan can be set up, and then decisions regarding **priorities for risk mitigatio**n can be made[254]. For this reason, in the context of cultural heritage conservation, risk assessment is the first step in disaster risk management process (See Figure 3.1)[255] In this sense, risk assessment is explained as "an informed

[253] Cardona argues that a holistic conception and estimation of risk should necessarily be based on both qualitative and quantitative methods. Both the establishment of relationships between subjective risk perceptions and the scientific objective measurement are vital and needed for a complete view of risk, especially considering the inevitable intervention in risk from the public policy perspective. Cardona 2003
[254] Jigyasu 2012c
[255] ICCROM 2010: 13-14

judgment about risks, either a specific risk or all risks in the property"[256].

The outcome of the risk assessment together with other data on feasibility, on costs, and on the consequences of possible regulatory decisions are used for risk management[257]. As it provides heritage managers and decision-makers with informed judgments on the nature and level of risks, the efficacy of the following stages is directly related to the sound assessment of risks. As illustrated in Figure 3.2, planning works that are required for prevention and mitigation, emergency preparedness and response, and finally for recovery need data coming from the risk assessment stage in order develop strategies and activities for implementation[258].

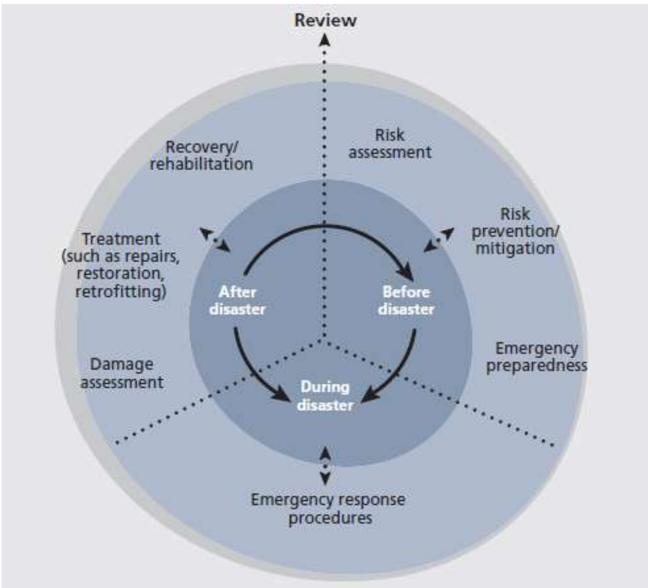

Figure 3.1. Disaster Risk Management Cycle (*ICCROM, 2006:13*)

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[256] Jigyasu 2010
[257] Patton explains the difference between risk assessment and risk management processes in the context of environmental decision-making. The author states kinds of information that are used for risk management but not for risk assessment. Patton 1993: 10-15
[258] ICCROM, 2010: 16

Figure 3.2. Main Components of a Disaster Risk Management Plan (*ICCROM, 2006: 16*)

Therefore, risk assessment is an indispensable part of risk management process. In the context of environment conservation, Dorothy E. Patton highlights that "risk assessment is a cornerstone of environmental decision making. As this statement is relevant in the case of cultural heritage conservation, it can be said that risk assessment is a cornerstone of cultural heritage decision making[259].

Risk assessment itself is a process. The process of risk assessment is explained in the Manual titled "*Managing Disaster Risks for World Heritage.*" Risk assessment process involves three main stages: risk identification, risk analysis, and finally risk evaluation, as explained in the following part[260].

[259] Although the current literature undertakes this subject within the framework of disaster risk management, in this thesis it is argued that it is crucial for all decision-making processes regarding archaeological heritage to ensure its preventive conservation. This will be discussed in detail in the following part of this chapter of the thesis.
[260] Rohit Jigyasu notes that "risk assessment is not one time but a periodic process". Jigyasu 2012c

3.1.2.1. Identifying Risks

The first step of risk assessment is identifying risk through an extensive research on the factors affecting its occurrence.[261]. The Manual above-mentioned explains information needed to identify disaster risks to a world heritage property[262].

Risk assessment of cultural heritage aims to **address risks to all elements of heritage**. As stated in the previous part, the *Manual for Risk-Preparedness for World Cultural Heritage* mentions the significance of being comprehensive in risk preparedness in order to cover all aspects of the property including buildings, structures, and their contents[263]. In addition to physical aspects, the second Manual (2010) adds, intangible attributes of the property should be taken into account in risk management planning. Hence, while examining elements at risk, heritage values, human lives, physical assets and livelihoods as well as various categories and characteristics of cultural properties should be addressed[264]. For instance, in the case of archeological heritage sites, Jigyasu mentions, various elements at risk may include staff, visitors, and physical attributes including buried and semi-buried remains, architectural structures on the ground, natural

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[261] For instance, in the field of Information Security Management (ISM), where risk assessment and risk management are major components, risk identification process involves looking at various factors related to risk such as its origin, a certain activity, or event, its consequences, results of impact, a specific reason for its occurrence, management systems, time and place of its occurrence. For more information: European Union Agency for Network and Information Security (ENISA) 2013. Similarly, in the field of cultural heritage conservation and management, threats, which may cause impacts such as material deterioration, structural problems or partial or complete destruction of heritage components, can be related to or characterized by: its origin (e.g. threat agents: natural, human-caused or both); a certain activity, or event (i.e. threat) (city or development planning policies, conservation legislation, etc); its consequences, results or impact (e.g. destruction or loss of archaeological elements, values); a specific reason for its occurrence (e.g. human intervention, failure to predict its occurrence, failure to be prepared); management systems (together with their possible lack of effectiveness) (e.g. policies, training, analysis, implementation, and monitoring); time and place of occurrence (e.g during extreme environmental conditions).

[262] Focusing on planning for Disaster Risk Management at cultural heritage properties, the Manual titled "Managing Disaster Risks for World Heritage", which is a joint undertaking by the three Advisory Bodies of the World Heritage Convention (ICCROM, ICOMOS and IUCN) and the UNESCO World Heritage Center as the Secretariat of the World Heritage Convention, provides a chapter on assessing disaster risks.

[263] Stovel 1998:20-24

[264] ICCROM 2010

features, landscape pattern, and the environmental setting[265]. Therefore, it is important to have complete **inventories** of the heritage[266].

In addition, as risk is a function of hazard and vulnerability, in order to identify risk, it is essential to identify hazards and vulnerability factors. Various primary sources such as site observations and interviews with stakeholders, and secondary sources such as written and visual documents, maps, reports can be utilized during risk identification process[267]. Besides, factors or processes that may cause damage to the property, geological, meteorological, hydrological, geographical characteristics of the property as well as its surrounding are important information that should be collected. Spatial planning documents such as regional plan, master plan, etc., hazard and vulnerability maps, risk maps (if available), documents about history of disasters that have occurred at the site or its surrounding are also used for risk identification. In addition, current management systems as well as disaster risk management systems, tools, procedures, related institutions, agencies, and communities who are interest groups for the management of the property are identified. Finally, information regarding local and traditional knowledge should be collected during this process[268].

3.1.2.2. Analyzing Factors that may Cause Risks

Risk analysis leads to a full description of the processes causing risks to cultural properties, through a scientific and technical study of risks. Hence, risk analysis involves identifying the most probable threats to cultural properties, analyzing the related vulnerabilities of the properties to these threats, and identifying the associated risks. The information collected from various sources are used to

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[265] Jigyasu 2010

[266] This is also mentioned in the in the Manual for Risk-Preparedness for World Cultural Heritage, focusing on clear documentation of heritage properties and disaster response history. Stovel 1998:20-24

[267] Jigyasu 2010:3

[268] ICCROM 2010:26

analyze hazards and vulnerability factors. This process has to be systematic and comprehensive enough to ensure that no risk is excluded. Stages of risk analysis include listing natural and human induced hazards, identifying vulnerability factors, analyzing 'cause-effect relationships' and analyzing potential impact on heritage values (See Figure 3.3)[269].

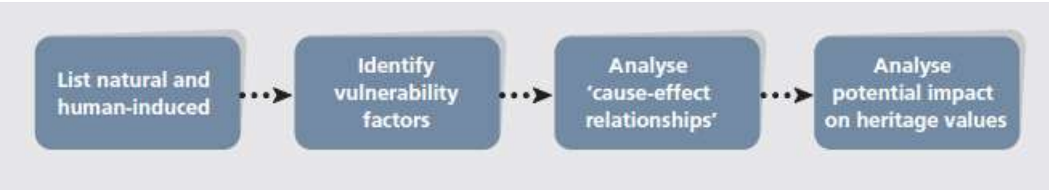

Figure 3.3. Risk Analysis Process (*Source: ICCROM, 2006:26*)

First, hazards, the external factors and agents of risks, are analyzed in order to determine whether the available scientific database describes a causal relationship between the external agent and potential negative impact to humans, environment or to cultural assets. Variety of threats would include both natural and human-induced hazards including hazards with potentially disastrous impact, such as earthquakes, as well as slow and progressive hazards, or underlying risk factors, such as the growth of vegetation on monuments and dampness from rising ground water.

While identifying hazards, historical records about past disasters as well as various data regarding geographical, geological, meteorological, spatial, and social characteristics of the area are used. For instance, hazard maps indicating geologically dangerous areas, flooding-risk areas, surface water (such as river, sea) as well as spatial plans showing land use, new development areas, infrastructure, industry and mining areas as well as census data regarding human

[269] ICCROM 2010:26

population growth and density are among those that are useful to identify possible hazards and vulnerabilities[270].

Second, vulnerabilities both internal due to inherent characteristics of the cultural property and external due to near surrounding of the property are analyzed to identify factors that expose various components of the property to risk. As stated in the Manual (2010), analyzing vulnerabilities necessitates identifying processes that might cause disaster risk to the property. For instance, physical factors such as existing damage and deterioration patterns, irreversible interventions, activities or physical planning increase the vulnerability of the property to various hazards. In addition to physical aspects, the effectiveness of existing management systems and disaster preparedness measures affect the level of vulnerability. It is also indicated in the Manual that social and even attitudinal factors may heighten the vulnerability of cultural assets. It is also important to monitor change of various vulnerability factors over time.

Third, cause-effect analysis is carried out to analyze multiple and lateral linkages between hazards and vulnerability factors, and their impact on each other (See Figure 3.4). The Manual (20210) proposes analyzing cause - effect relationships including the effects of secondary hazards. This is explained through the following example[271]:

> secondary hazard agents such as termites and vegetation affecting a historic building may be caused by a primary hazard, such as heavy rainfall due to improper drainage and lack of maintenance. This might in turn weaken the structure of the property, making it more vulnerable to earthquake (primary hazard). At the same time, a solution to a specific hazard may increase a property's vulnerability with respect to another hazard. For example, conservation guidelines for mortars developed because of a greater incidence of flash-storms may not be appropriate in terms of earthquake resistance.

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[270] ICCROM 2010:18-23
[271] ICCROM 2010:26

Through this analysis, in addition to analyzing physical aspects of vulnerability, relationships between various social, economic and institutional factors of vulnerability should be analyzed[272].

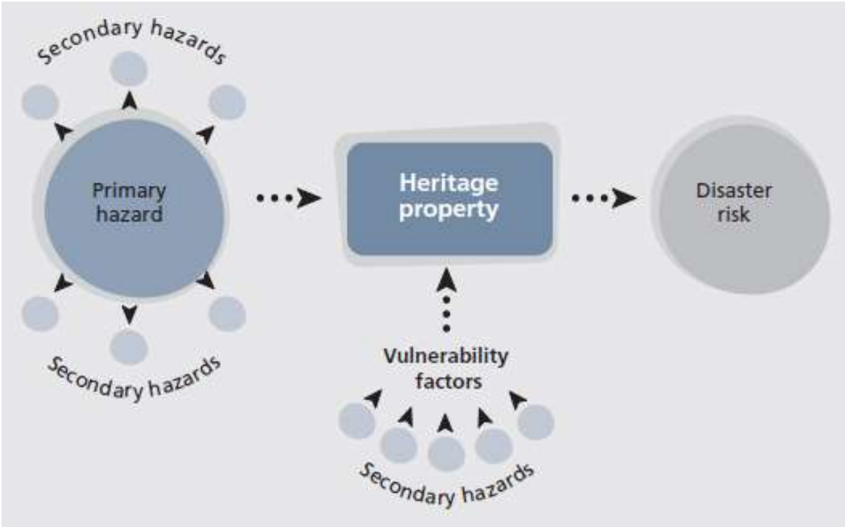

Figure 3.4. Relationship between hazard, vulnerability and disasters (*Source: ICCROM, 2006:26*)

3.1.2.3. Evaluating Risks and Prioritizing Risk Reduction Strategies

According to the methodology provided in the Manual aforementioned, the level of risk can be evaluated on the basis of three criteria (See Figure 3.5)[273]:

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[272] The Manual also proposes writing disaster scenarios. This exercise helps imagine the situation in the face of a disaster. These narratives, which are predictions of a particular situation in the future, are based on the current realities of a particular context, and on all factors contributing to the results of a disaster. For instance, vulnerability of a property to various types of hazards, current management systems are some of these variables that would be taken into account while writing disaster scenarios. In addition, alternative scenarios are created to assess different possibilities and their impacts on the components of the property. Different alternatives may include imagining occurrence of one extreme hazard such as a cyclone, or a disaster followed by another such as an earthquake followed by fire, or cumulative effect of two or more hazards acting concurrently such as civil unrest followed by looting and arson. For more information see: ICCROM 2010:27

[273] ICCROM 2010

- Probability of a particular disaster,
- Social, economic and physical consequences of the disaster on the property and its components,
- Potential loss of values.

Three categories of probability are suggested as high as in the case of heavy rainfall in a temperate climate; medium as in the case of extreme weather events in the tropics, and low as in the case of an earthquake that happen once every fifty years. Similarly, consequences can be expressed in terms of catastrophic or severe, mild, gradual and no consequence. Finally, various attributes of a cultural property are assessed in terms of their significance in conveying the outstanding universal value, as well as consequences of risks to which they are exposed. This process helps to devise a recovery index for attributes that can be restored[274].

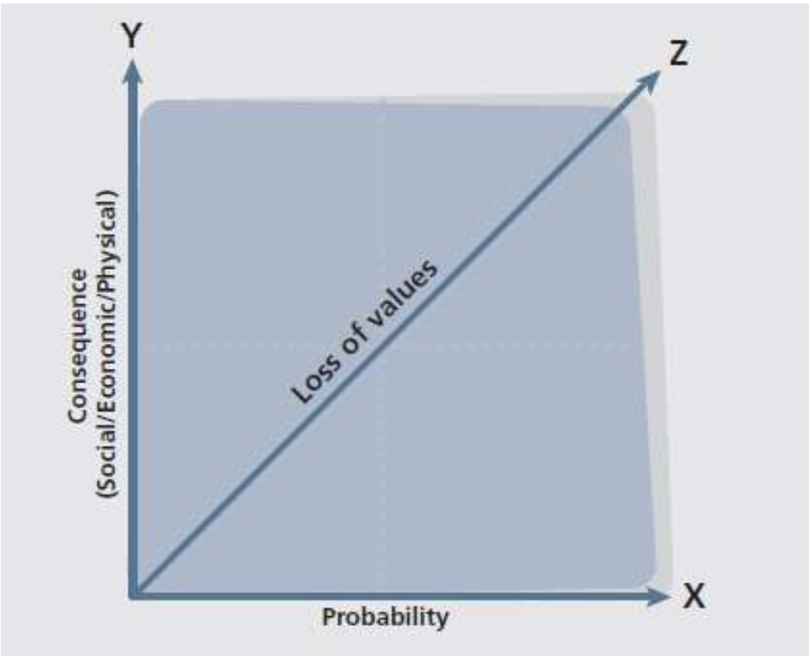

Figure 3.5. Assessing the Level of Risks (*Source:* ICCROM, 2006: 30)

[274] ICRROM 2010: 30

These three criteria, i.e. the probability, severity of consequence on people, lives and livelihoods, and potential loss of values, are used to assess the level of risk to a cultural property, for which a particular scenario is written[275]. At this point, there is need for selection of an analysis approach, or tool for evaluating the level of risks. The Manual indicates that "various quantitative and qualitative tools can be used to assess the level of risk to heritage sites"[276]. There are examples of one such quantitative tool developed for assessing the risk in the context of museum collections[277]. For instance, the methodology, proposed by Michalski for assessing the risk to museum collections is derived from these three indicators of risk: the **probability** of occurrence of the hazard, t**he percentage of objects** likely to be affected, and t**he expected loss of value** to the collection. The magnitude of risk for museum collections is calculated as the sum of these three indicators.[278]

In the context of built heritage conservation, probability, severity, and consequences can be used as parameters of risk especially for comparing different types of hazards in terms of their impacts on the values, and accordingly for calculating cumulative risk for each single unit through a quantitative/statistical approach by assigning weights to each hazard. Since in most cases there is not available quantitative data regarding probability, severity and consequences of different kinds of hazards (considering both natural and human-induced), calculating the level of hazards still depends on qualitative judgments. As risk is the function of hazard and vulnerability, it is also important to develop models for measuring level of vulnerability to a given hazard in order to evaluate the level of risk. Hence, other criteria are needed for measuring level of vulnerability, and accordingly of risk, considering each hazard separately.

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[275] ICCROM 2010:31
[276] ICCROM 2010:31
[277] Ashley-Smith 1999; Waller 1995
[278] Michalski 2007 cited in ICCROM 2010

3.1.3. Risk Assessment Experiences in Cultural Heritage Conservation

Since the end of 1990's, several methods have been proposed for risk assessments of museum collections[279]. In addition, at architectural scale, vulnerability of historic structures to different types of hazards are calculated using different methodologies in the engineering fields. For instance, a framework for vulnerability analysis was recently proposed for two churches in Portugal under seismic hazard by Pauperio et all, using three type of data (vulnerability indicators) inputs with pre-determined weights in the assessment of heritage vulnerability: 1. Data about the building, 2. Data about the collections, 3. Data about the building surroundings and access routes[280]. From structural point of view, Pauperio et all states, vulnerability of structures and the assessment of safety under different types of hazards can be calculated using two methods with different degrees of reliabilities. The first one, which provides detailed information, is based on extensive numerical simulation of the construction behavior, while the second one, with greater simplicity allows a rapid safety assessment, as it uses data from in-situ survey of the given structure. The authors also recommends using the second method as the first step of assessment as it is more simplified and practical. The results of this analysis help identify whether or

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[279] Ashley-Smith 1999; Waller 1995; Michalski 2007

[280] Data about buildings: Adapted from the indicators presented by Lorenço and Roque (2006), the following data about buildings is used: α: a coefficient reflecting the expected level of seismic intensity of the region (RSA, 1983); β: an equivalent static seismic coefficient considered to be 0.22 (Lorenço and Roque, 2006); φ: a friction angle considered to be 22º (Lorenço and Roque, 2006); fvk0: the cohesion of the wall material; γi: the volumetric weight of the wall; h_i: the height of the ith wall; A_id: in plan area of the ith earthquake resistant wall that is active when the earthquake effects are considered to occur in direction "d"; n: the number of active walls when the earthquake effects are considered to occur in direction "d"; Definitions of the weights are based on five value categories of buildings which range from normal building with no special value (0.2) to building listed as a national monument (1.0). In addition, as proposed by Waller, two kinds of data about collections are used: FS: fraction susceptible which represents part of the collection susceptible to a loss in value from exposure to earthquake (calculated as percentages); LV: maximum expected loss in value of FS (calculated as percentages). Definitions of weights are based on five value categories which range from collection with no special value (0.2) to priceless collection with a nationwide value (1.0). Finally, as proposed by Rodrigues (2009), three kinds of data about the building surroundings and access routes: are used: A: the level of accessibility of the heritage. Three categories of accessibilities are defined as easy, some difficulties and difficult, with quantitative values of 3, 6 and 9 respectively. C: the state of conservation of surroundings of the building. Three categories of state of conservation are defined as good, average and bad, with quantitative values of 1, 2 and 3 respectively. See: Pauperio, Romao and Costa 2012: 422

not a more detailed analysis with the first method to re-assess the vulnerability is needed or not.

At the national and local scale, development of databases for risk evaluation, emergency planning and management for developing a strategy of seismic prevention have also been researched in recent years[281]. At regional scale, the Italian-Greek Project titled 'Archimed-Central and Eastern Mediterranean- Risk Map of cultural heritage and mapping and description of cultural landscape' has been developed with the involvement of the Sicilian Region[282]. This project aims at developing a new model of knowledge management on cultural and environmental heritage. However, it is significant to note that risk assessment is a process that is rarely performed in the field of cultural heritage conservation. Therefore, the level of knowledge on the risk assessment of cultural heritage is still limited.

In the following part, *The Risk Map of Italy*, which is the first systematic attempt and a significant example of a large-scale risk assessment of cultural heritage, is reviewed in detail in terms of risk assessment methodologies implemented at different scales. *The Risk Map of Italy* was first initiated in 1987 by Italy's Central Restoration Institute (ICR). Later in 1990, the Italian Law no 84 incorporated initial analyses regarding the risk map, and provided legal basis for the initiation of "Risk Map for Italian Cultural Heritage", that eventually have become the most broad databank system in Italy. The primary objective of the project was to produce a system at central level at Central Restoration Institute (ICR) to collect, process, and manage both cartographic and alphanumerical

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[281] Liberatore 2009: 411-468

[282] The authors explain that "this identifies the regional scale as the standard observation for the heritage and the region as the leading actor of a joint project, aimed at building regional risk maps…The Risk Map, more in particular characterizes the presence and territorial diffusion of the historic, cultural and environmental heritage and values its vulnerability. Furthermore, the Risk Map observes, describes and values dangerousness levels present in the territory…and this allows to value risk indexes pertinent to the heritage and provides directions to an effective management of the territory…" For more information see: Meli and Garufi 2009

information and data related to the distribution of cultural assets, factors of degradation (hazards), and the state of conservation of the assets[283].

All components of the cultural assets including monuments (historical buildings), archaeological complexes, and artistic objects (movable objects in the museums) were included in this ambitious nation-wide program[284]. The phenomena of danger is analyzed in three thematic categories: static-structural danger, environmental danger, and anthropic danger. The category of 'static-structural danger" includes threats that have an effect on the structural stability of a building. Among numerous natural phenomena, only six dangers that are most common in Italy are selected to make an in-depth study: earthquake activity, landslides and slips, flooding, coastal dynamics, avalanches, and volcanic activity. The second category, 'environmental-air danger', defines three different phenomena: erosion, blackening, and physical stress. Finally, 'anthropic factors' are identified as the dynamics of demographic density (both depopulation and overpopulation), pressure of tourism, and liability to theft.

At national level analysis, risk relating to the cultural heritage is calculated for each municipality (the minimum unit of the analysis) based on two parameters: "territorial area" and "aggregate of components located in the area"[285]. Based on the type of data used, two risk models are formulated, one for measuring territorial risks, the other one is for measuring individual risks.

This project adopts a two-level methodology for risk assessment of cultural heritage. At first level, the municipality is studied as the minimum analysis unit, for which the level of territorial risk relating to the cultural heritage is defined through interrelation of indices of danger and characteristics of the cultural heritage. In other words, Michele Cordaro explains, lacking an exact

[283] Central Restoration Institute 2003: 65
[284] A. Giammarusti 2003: 105
[285] Coppi 2003: 89

corroboration between the individual cultural element and existing situations of risk, territorial risk analysis enables a comparative reading of the indicators of danger and the territorial distribution and indexing of cultural heritage[286]. On the other hand, at the second level, which was conducted on a sample area (the municipality of Ravenna), a more detailed analysis is carried out to calculate the level of risk for each individual cultural asset[287]. Cordaro also mentions, this 'individual analysis' "provides the quantitative data for every single unit of the heritage that can be surveyed, thus making an immediate verification possible of the state of conservation and of the provisions necessary to stop the damage found"[288].

The level of each risk factor, for each analyzed unit – whether municipality or a single building/site, is calculated through a 'risk model', which is constructed on the basis of a statistical approach, as explained by Renato Coppi, Professor of Statistic Methodological. It is also important to note that 'probability evaluation' is excluded while calculating the indices of risks, because, Coppi explains, "at the present state of knowledge, it does not seem realistic to represent the "stochastic context" in which the numerous not easily definable "events" characterizing the degradation process can occur"[289]. As part of the methodology, at each level of analysis, 'risk indicators' are determined (See Table 3.2). With reference to the individual risk analysis, risk indicators are expressed in terms of two parameters of risk: danger (hazard), and vulnerability to danger.

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[286] Michele Cordaro, "Methodology for the Construction of Cultural Heritage Risk Models", *The Risk Map of Cultural Heritage*,p.64

[287] Following the methodologies of creating the national risk map, local risk system was constructed for the municipality of Ravenna. In this scale, cultural assets were studied in detail in terms of their state of conservation, the levels of vulnerability and danger, and the risk levels. The local risk system was designed to manage three different information levels including the departmental (municipal and provincial) level, the municipal level and the monument level. Besides, survey scales have comprised of the territory of the department, the municipal territory and surrounds of the monument. Ibid, p.86.

[288] Cordaro 2003: 61

[289] Coppi 2003: 89

Table 3.2. Risk Map Project of Italy

<table>
<tr><th colspan="5">The Risk Map of Italy - Indicators of the Territorial and Individual Analyses</th></tr>
<tr><th colspan="3">Type of Analysis / Risk Indicators</th><th>Territorial Analysis
(Unit of Analysis: Municipality)</th><th>Individual Analysis
(Unit of Analysis: Single Site)</th></tr>
<tr><td rowspan="12">Hazard Indicators</td><td rowspan="6">Static Structural</td><td>Earthquake Activity</td><td rowspan="6">-absence/presence of the phenamenon&
-municipal area affected&
-(if data is available)intensity and frequency</td><td rowspan="12"><u>not calculated for each site:</u>
'danger level' of the municipality, in which the site is situated, is assigned to the site</td></tr>
<tr><td>Volcanic Activity</td></tr>
<tr><td>Landslides</td></tr>
<tr><td>Avalanches</td></tr>
<tr><td>Flooding</td></tr>
<tr><td>Coastal Dynamics</td></tr>
<tr><td rowspan="2">Environmental</td><td>Erosion</td><td>rainfall, sulphur deposition, nitric acid deposition, H ion, effect of marine aerosol</td></tr>
<tr><td>Blackening</td><td>air pollutants</td></tr>
<tr><td rowspan="4">Anthropic</td><td>Depopulation</td><td>decrease of population density, rate of depopulation</td></tr>
<tr><td>Population Concentration</td><td>increase in population density, the rate of increase, high density of population</td></tr>
<tr><td>Pressure of Tourism</td><td>cultural tourism attractiveness, (number of cultural assets), avarage annual visitors</td></tr>
<tr><td>Liability of Thefts</td><td>total number of thefts reported</td></tr>
<tr><td rowspan="3">Vulnerability Indicators</td><td colspan="2">Vulnerability to the Static - Structural Dangers</td><td rowspan="3">not calculated</td><td rowspan="2"><u>Physical Condition:</u>
Damage ascertained at the moment of the survey (qualitative judgement, quantified and weighted based on the empirical correlations</td></tr>
<tr><td colspan="2">Vulnerability to Environmental- Air Dangers</td></tr>
<tr><td colspan="2">Vulnerability to Anthropic Dangers</td><td>-safety
-use-enjoyment
-use-management of the component and the land where it is located
-anthropic damage</td></tr>
</table>

The Risk Map of Cultural Heritage in Italy was carried out in three phases. First, data regarding environmental, static-structural, and anthropic risk factors have been collected. Environmental, geological, physical and anthropic parameters have constituted the data banks of the Risk Map. The second phase aimed at cataloguing of cultural properties and determination of their vulnerability by analyzing their state of conditions as well as understanding the nature and rate of deterioration process. The final phase of the project has involved computer-based analysis of distribution and vulnerability of cultural properties in relation to the previously identified risk factors. [290]

The outcomes of the project, as explained by Stovel, enables "predicting preventive measures required most urgently, in relation to the environmental conditions in which Italian cultural heritage is situated, and time/cost effectiveness of available preventive measures."[291] Experiences gained during the development of the national risk map system in Italy have contributed to the creation of a system at the regional level for Sicily[292], where many historical buildings and archaeological sites exist, and to the development of another risk map project for the North Saqqara Archaeological Site in Egypt[293].

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[290] Central Restoration Institute (ICR) 2003: 60-95

[291] Stovel, 2010: 70

[292] This project was initiated in 2006 by the Sicily Regional Centre for Conservation. For more information see: Sommella, 2010: 1. Italian Risk Map Project has been a model for succeeding other initiatives at the regional and local level. Later in Portugal, Another Risk Map project has been developed for the Church of Nossa Senhora Do Rosario, located in Kambambe, Province of Kwanza Norte in Portugal. Alçada 2007: 1

[293] The Risk Map Project for North Saqqara Archaeological Site has been developed as a pilot project by the Supreme Court of Antiquities (SCA) of Egypt, the General Directorate for Development Cooperation of the Italian Ministry of Foreign Affairs, and the Egyptian Environmental Affairs Agency with scientific assistance of the University of Pisa. The northern part of Saqqara necropolis (about 6 square km), located on the eastern border of the Libyan Desert was the project site. As stated by Giammarusti (2003), Saqqara Archaeological Site, which presents a complex archaeological stratigraphy dating back to about 3000 BC and continuing until 960 AD, is an important archeological heritage site, and was selected as the site of project due to its wideness, number of visitors (over 600,000 yearly visitors), condition and environmental problems.

The Risk Map Project for the North Saqqara Archaeological Site in Egypt has been a pilot project focusing on a risk-based management approach in an archaeological site context. Giammarusti mentions that the aim of the project was to develop a management plan for archaeological sites by

These projects realized at different scales with different purposes show the potential and advantages of risk assessment to ensure effective management of cultural properties.

3.1.4. Evaluations on Risk Assessment Theory and Practice

Literature on risk assessment and management of cultural heritage mostly focuses on managing catastrophic natural events at site scale. This level of knowledge can be developed through a more holistic and comprehensive approach. With this perspective, various aspects that need further investigation and improvement are discussed in the following part.

3.1.4.1. Level of Decision-Making and Scale of Risk Assessment

Managing risks can be possible only if they are addressed and managed through various levels of decision-making. Focusing on individual sites may result in ignoring risks that may originate in the urban surroundings. Significance of preparedness at city scale is emphasized in the Manual (2010) through the example of the historic city of Lima, Peru, which was inscribed on the World Heritage List in 1988. Located in a region highly prone to earthquakes and fires, Lima has been significantly damaged due to earthquakes and fires in the past. After a major fire in 2001 and an earthquake in 2007, disaster preparedness has been initiated in individual monuments. However, Perez and Yague states, there

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taking into consideration risks to ensure promoting the socio-economical and tourist development, while mitigating the present degradation processes. The project has been carried out in three phases. The first phase involved gathering of environmental, archaeological data as well as information concerning tourism and conservation. Besides, a base map of the North Saqqara Site has been created. The second phase of project included issues regarding the "vulnerability and hazard analysis." After completion of the survey of the tombs, typology and conservation status of the walls of tombs has been recorded. Then, monitoring equipment has been installed on the walls for monitoring exterior environmental conditions and interiors' microclimate. The third phase included the construction of the GIS system and the development of a system for analyzing risks. Finally, thematic maps have been prepared. Scenarios created within this framework and the final risk map, Giammarusti states, help political and administrative authorities make decisions regarding restorations and development of the area. For more information see: Giammarusti 2003: 77-78, 89-100 is need for preparedness at city scale to ensure formulating a comprehensive risk management strategy based upon suitable land use, transport and evacuation routes, and the installation of emergency equipment such as fire hydrants, by closely coordinating with the municipality, fire services, hospitals and other relevant urban authorities. Another important aspect mentioned by Perez and Yague is the necessity of integrating the heritage needs not only at the level of individual historic buildings but also at the level of entire urban area[294].

In fact, risk assessment and management should be part of all decision-making mechanisms not only at site and city levels but also at provincial, regional and national levels. Risk assessment of cultural heritage enables making an informed judgment on nature of risks to the cultural heritage, for evaluating the level and extent of risk, for prioritizing actions for risk mitigation and prevention, and for setting the goals of disaster risk management. Therefore, it is significant to think of disaster risk management and preventive conservation of cultural heritage at different levels. However, type and detail of information needed at various levels of decision-making is different for managing risks, so different methodologies for risk assessment should be developed, based on the purpose of assessment and the level of decisions. Therefore, it is important to examine information needed at each level of decision-making as well as to develop risk assessment methodology for the purposes and needs of each level.

In addition, the Manual (2010) highlights the significance of integrating disaster management systems with two other management systems or plans: disaster management systems for the region/urban/rural areas, and existing site management systems or plans for World Heritage property. In case of risk management of archaeological heritage, this approach can be taken one-step forward through integrating risk assessment of archeological heritage into

[294] Maria D.C.C. Perez and Patricia I. G. Yague, 2007, communication by Peruvian participants at the International Training Course on Disaster Risk Management of Cultural Heritage, Rits-DMUCH, Kyoto. Case study In ICCROM 2010: 17

conservation decision-making mechanisms as well as development planning decisions at national, regional, provincial and city levels. Mainstreaming risk assessment of archeological heritage into conservation decision-making is significant, as all types of conservation decisions such as investigation (survey, excavation), registration, expropriation, conservation planning, training, treatment (conservation, restoration, etc.), and so forth are made based on judgments of priorities. Preventive conservation necessitates taking into account risks in all kinds of conservation decisions. In case of physical planning, in order to integrate conservation into planning, risk assessment of archeological heritage should be carried out prior to planning to prevent any possible impacts of development on heritage values. Briefly, it is important to develop policies and mechanisms for mainstreaming heritage-at-risk framework into these decision-making mechanisms, including development planning, which have the most impact on heritage values to ensure preventive conservation.

3.1.4.2. Addressing the full Range of Risks to Archaeological Heritage

Another important aspect is identifying, understanding and managing the full range of risks to archaeological heritage. Current literature on managing disaster risks (for World Heritage) provides information about processes of a risk management cycle, incorporating activities before, during, and after disasters in case of the occurrence of momentary catastrophic events such as earthquakes, landslides, fire, etc. How all types of risks, including momentary, mild, slow and progressive could be addressed under a single management scheme is another subject that need further examination.

Besides, current literature on managing disaster risks provides a general framework addressing properties of all categories both natural and cultural. Archaeological heritage is one of these categories that needs to be addressed specially due to the fact that archaeological sites are facing with different types of threats, some of which are different from those threatening other kinds of cultural properties, having different vulnerabilities because of their peculiar characteristics, and are managed through different type of decision-making mechanisms at various levels. Therefore, an assessment and management approach/methodology should be developed specifically for managing risks to archaeological heritage. Within this framework, kinds of hazards, vulnerabilities of archaeological sites to different kinds of hazards as well as decision-making mechanisms affecting conservation of archeological heritage should be examined.

3.1.4.3. Measuring Vulnerability

In case of understanding vulnerabilities, the literature provides insights into factors that make cultural heritage vulnerable to various threats. However, still, the concept of vulnerability, the roots of problems, indicators of vulnerabilities, methods for measuring vulnerability should be analyzed and strengthened through theoretical and empirical research. Indicators of vulnerabilities of archaeological heritage should be identified for measuring vulnerability. As vulnerability is an abstract concept, there is need for theories on vulnerabilities of archaeological heritage to develop suitable and reliable indicators, means of verification for measuring vulnerability. In addition, although in theory; physical, social, economic, administrative aspects of vulnerability are emphasized, in practice, the concept of vulnerability is limited to physical vulnerability.

Indicators have been used in social sciences since the 1960's to measure social characteristics that could guide public policy. In various examples of the use of indicators, selected indicators such as socio-economic indicators, urban social patterns, community medical needs, environmental parameters are quantified to rank spatial and social patterns. In some cases, indicators are developed from either primary (e.g. questionnaires) or secondary (e.g. census) data sources[295]. However, selecting the most relevant and suitable indicators from readily available information is highly challenging for researchers, and hence, a

[295] Andrews and Withey 1976:.4 cited in King and McGregor 2000: 52

conceptual framework, a rationale for the use of indicators is needed. Hence, principles and definitions developed for using social indicators provide insights for using indicators in other fields. As defined by Andrews and Withey, a set of social indicators should be developed in a way that it could be **monitored** over time, **disaggregated** to the relevant social unit, constitute '**limited**' number of indicators which include the most critical aspects of the society, and **'coherent'** as a whole to lead to a model about how society operates[296].

In the case of measuring social vulnerability to natural hazards, King and MacGregor evaluate rules of using indicators to measure vulnerability. They mention that the most important principle in using indicators is that indicators, as tools, should **serve a particular construct**, a concept, idea, or a theoretical model that define an issue or situation. In other words, indicators must serve the needs of the research question, which is formulated as a construct[297]. Besides, selection of indicators is so critical that it affects the results of the analysis. As stated by the authors, random selection and exploratory use of indicators may be beneficial for an empirical research. However, in order to identify patterns and relationships, the selection of suitable indicators is required to develop the model that may have been built on initial exploratory researches. In addition, generating a '**composite indicator**', aggregate of several indicator variables used together for a specific construct of interest, rather than relying on a single indicator variable helps to minimize measurement error[298].

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[296] Andrews and Withey 1976:.4 cited in King and McGregor 2000: 52

[297] Fenton and MacGregor identifies five classes of social indicators including informative indicators, predictive indicators, problem-oriented indicators, program evaluation indicators, and target delineation indicators. Each one of these serve different conceptual frameworks or particular ideas. Fenton and Mc Gregor explains these five classes of indicators. Informative indicators are used to describe the changes in the social system. Predictive indicators are also informative indicators that are used to predict subsystems of the social system. Problem-oriented indicators are used in a model attempting to point actions on specific social problems. Program evaluation indicators are used to monitor the success of particular policies. Target delineation indicators are used to describe various characteristics of geographical areas or population subgroups. Fenton and McGregor 1999; King and MacGregor 2000

[298] King and MacGregor 2000: 55

Within this framework, it is essential **to** develop useful indicators **to** measure archaeological sites' vulnerability to various hazards. The basic risk equation modified by Granger (1999) is a theoretical framework that contains three sets of constructs:

risk = hazards x elements at risk x vulnerability"[299]

Accordingly, hazards, elements at risk and vulnerability should be quantifiable to measure risk. Natural hazards are widely quantified thanks to the studies in related fields. These studies and hazard maps show if a site is exposed to a kind of natural hazard. The elements at risk are archaeological sites, which are tangible assets. Vulnerability remains the most difficult to identify and quantify.

Vulnerability is an abstract and complex concept. As suggested by King and McGregor, in the context of social vulnerability to natural disasters, the indicators should be grounded firmly in a model of vulnerability[300]. This is also crucial in the context of cultural heritage conservation for the consistency of the assessment. For instance, periodic maintenance is one of the aspects of vulnerability. It is also significant for archaeological assets to go through response and recovery phases of risk management after being subject to a risk in order to lessen the impacts. Gaps in institutional effectiveness, which can make an archaeological site vulnerable to hazards, hence can be considered as another indicator of vulnerability. Likewise, physical condition of a site also indicates vulnerability. Each one of these elements that define vulnerability becomes a separate construct that needs its own sets of indicators. So, the selection of the indicators should be based on the definition of the elements of vulnerability in the model.

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[299] King and MacGregor 2000: 55

[300] For instance, King and McGregor indicate that social vulnerability includes resilience and the ability to recover from a disaster, and identify indicators of vulnerability based on this vulnerability definition. King and MacGregor 2000: 55

In addition, vulnerability of archaeological sites should be constructed specifically for each natural or human-caused hazard, since elements identifying vulnerability depend on the type of hazard. Moreover, indicators should be selected by taking into account **scale**, such as national, regional, local, which is determined by the construct of intent.

3.1.4.4. Evaluating the Level of Risks

Evaluating the magnitude of risk is a way of categorizing heritage properties based on urgency of interventions to prevent and mitigate risks. The Risk Map of Italy is an example of quantitative risk assessment based on statistical models. In the same way, the quantitative calculation approach proposed for World Heritage is based on models developed for assessing risks to Museum Collections. The type of method should depend on the level of assessment (e.g. site scale, regional/provincial, or national). Usability of each method should be examined considering the level of assessment, type of data needed, availability of data, the purpose of assessment, and information needed (output) as a result of the assessment. For this reason, standards and methodologies should be developed for risk calculation/assessment.

Moreover, it is important to note that the quantitative calculation framework proposed for World Heritage is based on calculation of probability, (severity) percentage of affected collection and (consequences) value of lost. Probability, severity, and consequences are parameters required for comparing levels of different types of risks, and calculating cumulative risk for each single unit. Nevertheless, in case of comparing several sites in terms of the level of risk to a certain hazard, other criteria are needed for measuring level of risk. For the reason that probability, severity, and even consequences are likely to be similar, if not same, for the same kind of properties located in the same territory in case of a catastrophic event like earthquake, or progressive phenomenon like the local conditions affecting the physical fabric. The theory on risk calculation is still limited in this respect, and there is need for empirical research. Considering the limitations of quantitative risk assessment in understanding realities of context that may enhance risks, or when it is not feasible, another issue that could be examined is examining the potentials, pros and cons of qualitative comparative risk assessment.

3.2. A Proposal for Risk Assessment of Archeological Heritage at Territorial Scale

Success of efforts to conserve archaeological assets depends on effective proactive conservation and management strategies that take into account **management of a wide range of natural and human-induced risks**. Effective management and mitigation of risks threatening archaeological sites requires **analytical approaches**. The success of risk management depends on the soundness of risks assessment. Risk assessment should enable heritage managers and decision makers

- to know what the threats, and their roots are,
- to comprehend and focus on priorities,
- to plan for conservation of heritage with *better judgment of natural and human-induced risks*,
- to manage and mitigate risks,
- to use time, money and other resources efficiently.

Assessing risk and developing a methodology for assessing risks to archeological heritage at territorial scale necessitates constructing a theoretical framework, on which the methodology is grounded. The concept of risk, its various components (hazards, vulnerability), risk management and assessment, has been researched, especially after the 1980's, in various fields, focusing on different aspects of risk. Besides, risk assessment, as an analytical endeavor, necessitates incorporating various analysis tools used in other fields, especially in management and computer sciences. Therefore, throughout the thesis research, it has been inevitable to refer to various disciplinary fields and to examine applicability of approaches and/or analysis methods into the risk assessment methodology developed for archaeological heritage through this study (See Table 3.3) [301].

For such an assessment methodology, it is essential to start with describing the concept of risk, on which the parameters of analysis can be structured. Based on the discussions in the literature review (See Section 3.1), in this study, the risk is considered as a function of *hazard* and *vulnerability*. In some cases 'value' of the analyzed unit (which can be museum collections, single structure or a site) is also taken as the third parameter of risk definition[302]. However, it can be quite controversial to identify the level of 'value' of each component of the heritage. It can be taken as a parameter for evaluating the level of risk, if such 'value assessment' for each analyzed unit can be carried out at site level based on a set of scientific criteria. Hence, it is not included as a parameter within the proposed risk assessment approach at territorial scale.

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[301] Several frameworks for quantitative risk assessment have been proposed by many experts in natural sciences: Duzgun and Lacasse 2006: 426-433; Diamantidis, Duzgun, Nadim, et al 2006; Duzgun, Ozdemir 2006: 245-263
In addition, both quantitative and qualitative risk assessment frameworks have been proposed for ecological/environmental risk assessment: Astles, Holloway, Steffe et al, 2006: 290-303; Hobday, Smith, Stobutzki, et.al. 2011: 372-384; Peterman and Holt 2008;
Difference between risk assessment and management has been clarified: Patton 1993: 10-15.
In the field of environmental sciences, the concept of 'uncertainty' has been introduced: Burgman 2005;
In health and safety literature, the concept of acceptable risk has been researched: Woodruff 2005: 345-353
In the area of disaster risk management, risk assessment frameworks have been developed: Plattner 2005: 357-366; Hollenstein, 2005: 301-307;
Mapping and assessing natural hazards has been discussed: Boz, Tofan, Toma 2009
Social sciences researches have focused on the concept and perception of risk: Boyne 2003; Suddle and Ale 2005: 35-53; Lima, Barnett and Vala 2005; Lupton 2013;
Theory of developing useful indicators has been proposed: King and MacGregor 2000: 52-57
In information sciences, components and process of risk assessment is developed by European Union Agency for Network and Information Security (ENISA) 2013.
Frameworks have been proposed for managing project risks: Telford 2005
[302] La Torre 2003

Table 3.3. Contributions from other Disciplines to the Various Components of the Proposed Methodology (YILDIRIM ESEN, 2014)

Components of Proposed Methodology / Contributions from Other Disciplines		Theory of Risk	Process Design	Hazard Identific.	Vulnerability Assessment				Risk Evaluation		
					Cause-Effect Analysis	Developing Useful Indicators	Identifying Means of Verification	Measuring Level of Vulnerability	Identifying Sites at Risk	Generating Indices (Comparative Analysis)	Evaluating Overall Risk
Natural Sciences	Geology, Seismology										
	Earth Sciences (Climatology)										
	Life Sciences (Public Health Research)										
Social Sciences	Management										
	Environmental Studies										
	Development Studies										
	Disaster Risk Management										
Formal Sciences	Computer Sciences (Information										
	Statistics/Social Statistics										
	Systems Science										
Applied Science	Spatial Science/ GIS										
Cross-Disciplinary	Conservation Science										
	ISO 31000 Risk Management										

The framework is based on analyzing each one these, and then evaluating the consequences, i.e. risk of losing values, when these two come together. Based on this theoretical assumption, the risk assessment process is designed in three main stages: Hazard Identification, Vulnerability Assessment, and Risk Evaluation, parallel to the risk assessment approaches in the conservation field as well as in other disciplines including natural and social sciences.

Each phase has to be developed on the basis of the scale of the assessment. As discussed in the previous part of the study, risk assessments can be carried at various scales with different purposes and changing levels of refinement. It can be national/regional assessment, where the minimum unit of analysis is a territory[303]. Assessment of several territories (i.e. regions, provinces, municipalities, districts) at national, provincial, or municipal level may be plausible if there are extensive amount of archaeological heritage sites distributed across the territory. In this case, possible sources of information include secondary sources such as literature, reports, inventory etc. Information about the number of sites located in each territory (e.g. province, municipality, etc.), which is the unit of analysis is essential to understand the distribution of archaeological sites. At this more general and territorial level of assessment, comparative analysis of territories in terms of the level of various risks can be based on statistical data, ideally, about type and frequency of hazards that have caused damages to archeological heritage across the territory. However, this may not be obtainable in many cases[304].

Risk assessment can also be carried out at site scale, based on information specific to the site in question, as proposed in the Manuals developed for World Heritage sites. At site scale analysis, data availability becomes less of a concern, compared to territorial analysis. At site level, risk assessment can be carried out individually for each single tangible and intangible component of a cultural heritage site: buildings, movable heritage, cultural traditions, cultural landscapes, etc.[305] Site scale analysis requires collecting data regarding physical, architectural, technical characteristics of sites, and social and cultural features of their surroundings, all of which may make them vulnerable to different type of hazards. For a site scale analysis, in addition to the secondary sources such as literature, maps, and reports, more data can be obtained from primary sources through site-survey, technical studies, and interviews with people including staff

[303] Territorial assessment is carried out as part of the Risk Map of Italy. See Chapter 3.1.3.

[304] Central Restoration Institute (ICR) 2003

[305] This is explained by Jigyasu as follows: “Disasters pose risks not only to physical attributes that carry the heritage values of the property, but also to the lives of visitors, staff and local communities living on the site or in neighboring areas, and also to important collections and documents. They can also have negative consequences for the local community due to the loss of tourism revenues, and for the livelihoods of local people who are dependent on the property”. Jigyasu 2012c

and inhabitants who have deeper knowledge on the site. Information regarding history of past incidents at the site, past interventions and existing management systems can be collected from staff of the site and staff of related institutions as well as from inhabitants living around or close to the sites. Finally, site observations are essential to collect data regarding vulnerabilities of sites, in view of possibility of various hazards. Site observations helps identify problems; location; possible sources of problems and potential impact on the heritage site. Besides, information is acquired regarding chronology, the level of visitation, and whether or not belonging to urban/rural planning contexts etc.[306].

However, **there is also need for a risk assessment approach at territorial scale** (i.e. town, city, province), where the minimum unit is ‘site’, in order to develop comprehensive preventive conservation strategies and to integrate archaeological heritage conservation into territorial development and risk management. Considering the fact that natural hazards such as earthquakes, landslides, as well as human-induced hazards related to urban development affect not only a single site but also a territory with many sites, risk assessment for archaeological heritage at **territorial scale is of great importance** for effective management of these risks (See Figure 3.6)

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[306] ICCROM 2010: 11; As expressed by Jigyasu "risk assessment is not just condition assessment. It is about assessment of all existing problems, phenomena, planning” Jigyasu 2012c

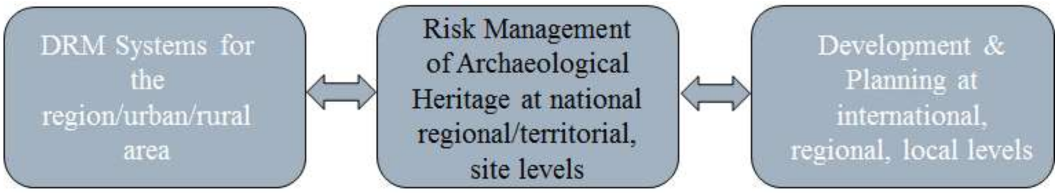

Figure 3.6. Significance of risk management of archaeological heritage at all levels of decision-making

Besides, a risk assessment methodology has to contemplate the characteristics of the 'objects at risk', and hence the **category of the cultural heritage** determine approaches to hazard identification and vulnerability assessment. Although it can be adapted to other heritage categories, this methodology is developed particularly on the case of the archaeological heritage. Assessing risks threatening archaeological sites necessitates a unique approach developed especially for archaeological assets, taking into account a wide range of physical characteristics, and problems, some of which are specific to this type of heritage. Therefore, it is significant to answer, "What kind of hazards are archaeological sites subjected to?" and "What are the factors affecting vulnerabilities of archaeological sites?"

Collecting data is another significant aspect of the assessment. Each level of assessment generates different kinds of information (assessment results/outputs) that support different levels of decisions, and hence demands different inputs. Therefore, the type of information that can be collected through various research methods and sources of information depend on the purpose, scale and scope of the assessment (See Table 3.4).

Table 3.4. Primary and secondary sources that can be utilized for risk identification at national, territorial and site-level risk assessment (YILDIRIM ESEN, 2014)

Scale / Process	**National** (assessment of territories, e.g. province,municipality)	**Territorial/Provincial** (assessment of aggregates of sites located in the same territory)	**Site-level** (assessment of a single heritage site)
Data Collection for Risk Identification	-secondary sources: literature, documents, etc. -number of sites in a territory (e.g. municipality, province)	-secondary sources: literature, documents, hazard maps, master plans etc. - cultural heritage inventory & maps, geographical location and coordinates of sites	- primary sources: technical studies, site observations, interviews, etc. - secondary sources: literature, maps, reports, researches, etc.

As stated in the previous section, in order to undertake risk assessment, an extensive research on both all types of hazards that are likely to damage the heritage values and the characteristics of cultural heritage are needed. As the level of information about areas exposed to various types of hazards as well as quantity, and characteristics of archaeological heritage located in these areas increase, the detail and reliability of the assessment increase. Quality and completeness of cultural heritage inventory is critical to ensure soundness of the analysis. Moreover, as the analysis at territorial scale can be carried out using GIS, it is important to have geographical coordinates of archeological sites and to locate various kinds of hazards on the base maps. Using the analysis tools of GIS, **a direct corroboration between areas of hazard and** sites located in these hazard zones enables to assess the level of risk for each archeological site examined. In addition to archaeological heritage inventory, sources of information include master plans, hazard maps, scientific evaluations and reviews, reports of public institutions and nongovernmental organizations, country risk assessments, census and archive data regarding hazards and so forth.

Briefly, the data collection for analyzing risks for archaeological sites involves compilation of data from different institutions, from literature, newspapers or historical records. While the steps and core approaches[307] are parallel with those of introduced in international documents, assessing risks to many sites through territorial risk assessment necessitates developing each stage and identifying essential elements that are integral to the scale of assessment.

Scale of assessment determines approaches in terms of collecting data and evaluating level of risks. At territorial scale, identifying hazards has to be followed by categorizing hazards, considering common factors affecting vulnerability of archaeological sites to these hazards. Besides, territorial scale assessment necessitates identifying vulnerability indicators as well as means of verification for each indicator and developing methodology for measuring level of vulnerability due to the scope, scale and complexity of the assessment (See Figure 3.7).

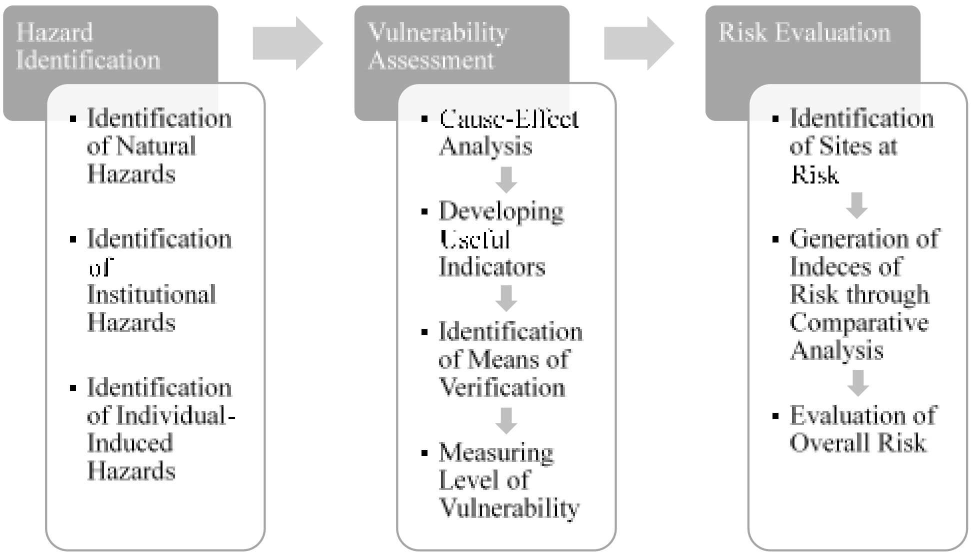

Figure 3.7. Components of the Main Stages of the Proposed Risk Assessment Methodology (S. YILDIRIM ESEN, 2014)

307 Main steps including identifying hazards, identifying vulnerabilities, analyzing cause-effect relationships, and analyzing potential impact are discussed in the Section 3.1.2.

Moreover, a territorial risk assessment obliges using the potential of geographical information systems (GIS)[308], due to the complexity of the assessment with many sites and various hazards of different origin. In other words, risk assessment of archaeological heritage at territorial scale has to be in the form of a spatial analysis, because of utilizing various and numerous data with geographical references (See Figure 1.2). Hence, it is essential to create a computer database of spatial information about hazards and archaeological sites with information about factors affecting their vulnerabilities to various kinds of hazards.

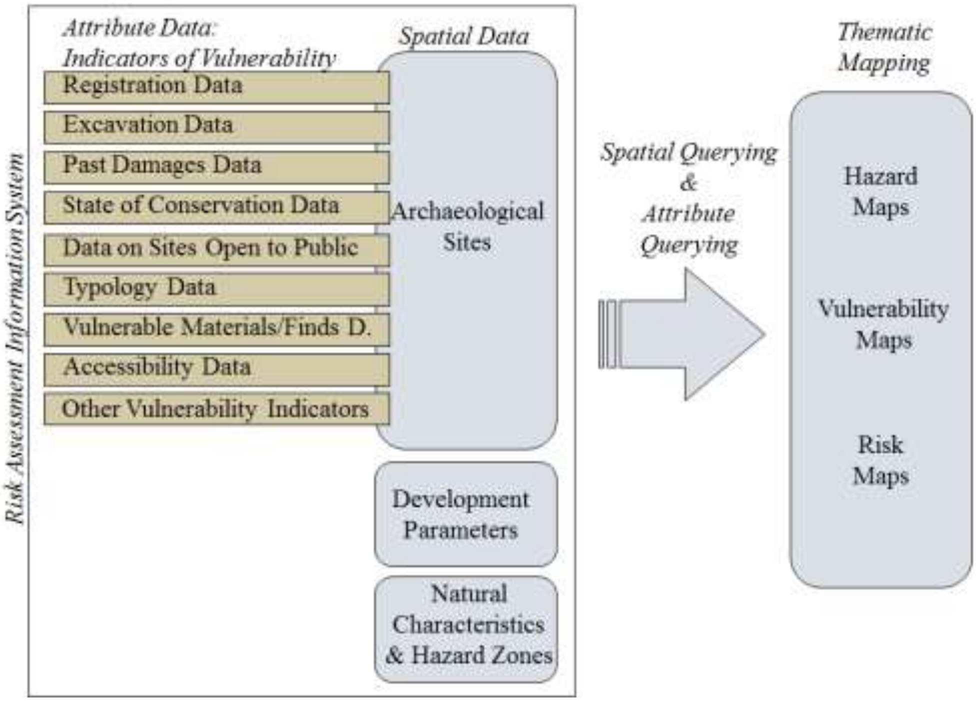

Figure 3.8. Structure of the Proposed Risk Assessment Methodology (YILDIRIM ESEN, 2014)

308 The Geographic Information Systems (GIS) is utilized for developing the Italian Risk Map. In this project, with the information available in the databases, GIS enables to overlap data on various kinds of hazards with areas having presence of cultural assets in question. Central Restoration Institute 2003: 65. As an example of a site-scale risk assessment project, the Risk Map of North Saqqara Site Project is divided into correlated and iterative phases that include the construction of site information system, vulnerability and hazard analysis, and risk analysis. See: Giammarusti 2003: 76

The process of collecting and organizing data in different formats is a significant aspect of this analysis, as it aims to assemble, rationalize all available knowledge at various sources about all natural and human-caused factors that cause degradation of archaeological sites, and to set up a structured, complex data bank with the capacity of processing all the data. This database enables spatial analysis using spatial query tools (See Figure 3.8).

Within the light of these discussions, and addressing above-mentioned issues, the following part of this chapter introduces the proposed methodology for risk assessment of archaeological heritage at territorial scale**.** While adhering to the basic principles and processes for risk assessment introduced in the Manual, titled *"Managing Disaster Risks for World Heritage"*, this chapter provides a methodology for the implementation of these general concepts in risk assessment of archaeological heritage at territorial scale. The following part provides a systematic description on how to undertake risk assessment at territorial scale, and includes considerations for monitoring.

3.2.1. Hazard Identification

Identifying and categorizing hazards is important for analytical purposes. As hazards threatening archaeological heritage are numerous and include both natural events and processes that range from natural disasters to local conditions affecting the fabric, and human activities that range from development to unfavorable human actions such as deliberate destruction and illicit digging, identifying hazards requires in-depth information on various subjects. Natural disasters including momentary geological and ecological events as well as severe weather events have been increasingly analyzed, and quantified by experts of the related fields[309]. Here, the aim of the hazard analysis is to identify areas that are

[309] The quantitative risk assessment frameworks are widely used in natural sciences for computation of the risk of natural hazards such as landslides. The quantitative risk assessment aims to calculate a mathematical value for the risk and involves several consecutive stages. For instance, widely accepted procedure proposed for the quantitative evaluation of risk for landslides has seven stages including Danger Identification, Hazard Assessment, Identification of Elements

exposed to these hazards, based on the studies conducted in other fields.

At territorial scale, it is also critical to be comprehensive in addressing all kinds of possible natural and human-induced hazards to various archaeological sites located in the territory. To ensure a complete and all-encompassing view, SOC reports prepared for cultural properties inscribed on the World Heritage List[310] and located in different parts of the World, are significant sources of information to identify hazard categories. Since 1979, the World Heritage Committee has carried out periodic monitoring of the state of conservation of some selected World Heritage properties, inscribed on the list because of their outstanding universal values. As part of this monitoring process, State of Conservation (SOC) Reports have been prepared by the World Heritage Centre and the Advisory Bodies to the World Heritage Committee to be examined by the World Heritage Committee (See Figure 3.9). Since these reports are an extensive documentation of threats and conservation issues that World Heritage properties have been facing in different parts of the World, UNESCO established a comprehensive and integrated computerized "state of conservation information system" for the World Heritage properties in order to support analytical studies and assist all stakeholders in site-management[311].

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at Risk, Vulnerability Assessment, Risk Computation, Risk Evaluation, and Risk Management. "Each stage differs depending on the scale of assessment, i.e. whether the assessment to be made is for single rock slide or rock slides in a region." Duzgun 2008

[310] A list of cultural and natural properties, under the title of "World Heritage List," has been established and published by the World Heritage Committee, after the adoption of the 'Convention concerning the Protection of the World Cultural and Natural Heritage' (The World Heritage Convention) in 1972 by UNESCO. The Convention has been instrumental in bringing the concept of the "shared heritage of humankind" through its exploration of the "outstanding universal value" of cultural heritage sites. Since its adoption, the convention has increasingly been supported by the international community and as of April 2009, 186 countries had been adhered to the World Heritage Convention. "The World Heritage List includes 890 properties forming part of the cultural and natural heritage which the World Heritage Committee considers as having outstanding universal value. These include 689 cultural, 176 natural and 25 mixed properties in 148 States Parties." UNESCO 2010: para 2

[311] For more information see: UNESCO, 2013a

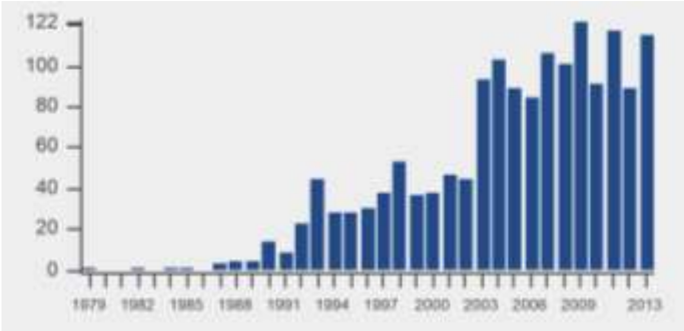

Figure 3.9. Number of World Cultural Heritage for which SOC report was prepared (YILDIRIM ESEN, 2014)

This database is very important to understand and analyze various threats that World Heritage properties including cultural properties have been subjected to since the last decades of the 20th Century. 1532 reports highlight various natural and human-induced threats to 310 out of 759 cultural properties located in 108 State Parties (See Figure 3.10). Some of these relate to management and institutional factors such as management system/management plan, management activities, legal framework, human resources, financial resources, governance, and high impact research/monitoring activities. The other factors relate to both natural factors and human use/interventions. Categories for natural factors, both momentary events and progressive/constant damaging conditions or processes, include:

- Sudden geological or ecological events,
- Climate change and severe weather events,
- Local conditions affecting physical fabric, and
- Invasive/alien species or hyper-abundant species.

Sudden geological or ecological events that have affected World Cultural Heritage involve earthquake[312], erosion and siltation/ deposition, avalanche/ landslide[313], fire, (wildfires), volcanic eruption[314], and tsunami/tidal wave[315].

[312] 'Geological hazard', defined as geological process or phenomenon, which may result from internal earth processes that cause earthquakes, volcanic activity, and emissions; or related geophysical processes that lead to mass movements, landslides, rockslides, surface collapses, and debris or mudflows. Earthquake may be due to faulting, transient shaking; dam- and reservoir-induced mass movement, mining-induced, explosion/nuclear induced. Geological hazards may cause loss of life, injury or other health impacts, loss of livelihoods, economic, social and environmental impacts 'geological hazard' UNISDR 2007b.

Examples of damage due to earthquake include 1995 Kobe Earthquake (and post-earthquake fire in Kobe-Jan 17 1995); 2003 Bam Earthquake; Oct. 2004 Niigata-Chuetsu earthquake; 2004 Big earthquake and tsunami in Sumatra; June 2006 Indonesia Earthquake affecting World Heritage Site of Prambanan Temple, Java; 2008 Sichuan big earthquake; and 2011 East Japan Great Earthquake and tsunami.

[313] Slope failures are examined in the field of geotechnical engineering. Geological and topographical properties as well as soil characteristics of a place affect its vulnerability to slope failure disasters. Areas that are vulnerable to slope failure are mostly vulnerable to debris flow as well. Fukagawa, 2012

[314] Volcanic activity include lawa flows, pyroclastic flows, ash and block falls; mining-induced (e.g. mud volcano) ICRROM 2010

[315] Tsunami, an oceanic process, is another threatening hazard triggered by undersea earthquakes and other geological events. However, tsunami is difficult to categorize, as it is also a coastal water-related hazard. The most significant vulnerability factor for tsunami is geographical characteristics of a settlement. While places with elevated areas in the coast are more advantageous, cultural properties located at sea level are vulnerable as they are likely to be exposed to tsunami waves. Besides, presence of a river mouth is another factor that increases vulnerability in a coastal settlement because of the extension of impacts of tsunami to inner areas close to river. Second, density of the built environment in the coastal area, population density, and age of population affect the tsunami vulnerability of a settlement. Shaw 2012

Management and institutional factors	Local conditions affecting physical fabric
Management systems/ management plan	Water (rain/water table)
Management activities	Relative humidity
Legal framework	Wind
Financial resources	Micro-organisms
Human resources	Temperature
Governance	Radiation/light
High impact research/monitoring activities	**Pollution**
Buildings and Development	Solid waste
Housing	Surface water pollution
Commercial development	Air pollution
Interpretative and visitation facilities	Input of excess energy
Major visitor accommodation and associated infrastructure	Pollution of marine waters
Industrial areas	Ground water pollution
Social/cultural uses of heritage	**Climate change and severe weather events**
Impacts of tourism/visitor/recreation	Flooding
Identity, social cohesion, changes in local population and communit	Storms
Changes in traditional ways of life and knowledge system	Desertification
Ritual/spiritual/religious and associative uses	Other climate change impacts
Society's valuing of heritage	Temperature change
Transportation Infrastructure	Changes to oceanic waters
Ground transport infrastructure	**Biological resource use/modification**
Effects arising from use of transportation infrastructure	Land conversion
Marine transport infrastructure	Crop production
Underground transport infrastructure	Livestock farming/grazing of domesticated animals
Air transport infrastructure	Fishing/collecting aquatic resources
Other human activities	**Services Infrastructures**
Deliberate destruction of heritage	Water infrastructure
Illegal activities	Localised utilities
Civil unrest	Major linear utilities
War	Renewable energy facilities
Terrorism	Non-renewable energy facilities
Military training	**Physical resource extraction**
Sudden ecological or geological events	Mining
Erosion and siltation/ deposition	Oil and gas
Earthquake	Quarrying
Avalanche/ landslide	Water (extraction)
Tsunami/tidal wave	**Invasive/alien species or hyper-abundant species**
Fire (widlfires)	Invasive/alien terrestrial species
Volcanic eruption	Hyper-abundant species

Figure 3.10. Threats that have been identified by World Heritage Committee since 1979

Threats listed under the category of 'climate change and severe weather events[316]' include changes to oceanic waters, flooding[317], storms, temperature change, desertification, and other climate change impacts. Climate change is the increased transformation in global climatic conditions due to human activities. The disruption of the climatic equilibrium results in the alteration of the local climatic conditions, which has impact on natural and cultural properties. For instance, the melting of the icecaps and glaciers raises the level of oceans, whereby low-lying areas and islands are affected. Factors considered under this category include flooding, desertification, storms, temperature change, changes to oceanic waters (changes to water flow and circulation patterns at local, regional

[316] Slope Failures includes landslide, steep slope failure (rock-fall), and debris flow. In recent years natural events have caused damage to World Heritage properties. For instance, in 2009 debris flow disaster occurred in Taiwan. Besides, slope failures and debris flows were caused by heavy rainfall of Typhoon no. 12, which occurred in Japan in Sept. 2011. Kumano-hongu, Kumano-Nachi-Taisha, which is a world heritage site, and Seigantoji were influenced by this disaster. These sites were heavily damaged by this heavy rainfall and slope failure disasters. The debris flow was flooded into the main hall of Kumano-Nachi-Taisha. Nachi-no-Taki is also a cultural heritage site located close to the Nachi Waterfall, which was also heavily damaged by the typhoon no. 12. A significant part of Saijyo, where Shinto events take place in front of the basin of the waterfall, were lost. Due to the dramatic increase in the river water level, a large amount of rock was flown out from the basin of the waterfall. Another World Heritage site that was damaged by the typhoon was Kumano-Kodo in Japan. Stone paved road of the site was heavily damaged. Fukagawa 2012.

[317] Hydrometeorological events, defined as process or phenomenon of atmospheric, hydrological or oceanographic nature, which include tropical cyclones (also known as typhoons and hurricanes), thunderstorms, hailstorms, tornados, blizzards, avalanches, coastal storm surges, and floods. Hydrometeorological conditions can also be a factor in other hazards such as landslides, wildland fires, etc.. Hydrometeorological hazards may cause loss of life, injury or other health impacts, loss of livelihoods, economic, social and environmental impacts. 'Hydrometeorological hazard' UNISDR 2007b

Topography of a place affects occurrence of floods, since floods may occur in a steep slope area, or in a mild slope area. Flash flood and debris flow, both of which are hardly predictable, occur in steep slope areas. In a mild slope area, inundation may occur inside a levee or by river water. Inundation inside a levee, which is built to protect a city from river water, occurs when rainfall intensity exceeds the rainwater drainage capacity of a city. Therefore, another factor that affects vulnerability to floods is the effectiveness of drainage system. Especially densely built urban areas are vulnerable to inundation inside a levee, because the inundation risk increases when the infiltration rate decreases. In addition, outburst of bank may cause river water flooding, which also results in serious damage. Therefore, areas close to riverbeds are vulnerable to this type of hazard, especially if there is not land use regulation, which is significant to mitigate these disasters. Source: Satofuka 2012 or global scale, changes to pH, changes to temperature), and other climate change impacts[318].

As explained in the UNESCO publication titled "Understanding World Heritage in Asia and the Pacific - The Second Cycle of Periodic Reporting 2010-2012", archaeological sites are one of the most directly impacted cultural properties due to climate change, as they have been preserved under stable conditions and specific climatic conditions for centuries. Increased instability and fluctuations in the hydrological, chemical and biological conditions rises their vulnerability, and lead to an accelerated deterioration. Change in the water content of the ground and air cause direct erosion or deterioration through efflorescence. Other impact of climate change include deterioration of the finishes, ornamentation and often the movable culture heritage contained within the structure. Climate change can have physical impact on cultural heritage by initiating flooding and storms, which cause prolonged immersion of the materials of historic structures in water, leading to erosion and material deterioration. Climate change can also initiate desertification, which lead to salt weathering and erosion[319]. Having effects on significant underlying risk factors such as increase in soil moisture, climate change may also increase the impact of disasters on World Heritage cultural properties by increasing their vulnerability to natural hazards such as earthquakes and floods[320].

Besides, threats to cultural properties are related to local conditions affecting physical fabric. Heritage properties are deteriorated due to contribution of a range of environmental and biological factors. While geographical location determines the local condition of a heritage property, both the site-specific conditions and the type of attributes determine the impacts of these factors on the heritage property. Factors included under this category are micro-organisms, radiation/light, relative

[318] UNESCO 2012: 66
[319] UNESCO 2012: 66
[320] ICCROM 2010: 10

humidity, temperature, water (rain/water table), and wind (erosion, vibration)[321]. These usually have low impact on the cultural property over a long duration. However, small changes can magnify the impact of these factors due to change in the balance between the others. This is explained in the abovementioned UNESCO publication as follows[322]:

> …when wind works together with dust, it can lead to heightened erosion of surfaces. This can especially be a concern when important attributes are inscriptions, painted surfaces or delicate ornamentation of monuments. Erosion caused by wind and water can create havoc with properties that have structures constructed of materials such as earth, that can disintegrate into dust or dissolve in water. Ground water and humidity impact many historic structures, especially when there are daily or seasonal fluctuations. The construction materials absorb water and when the surface dries, the water transports and deposits dissolved salts on the surface – called efflorescence.

Biological factors worsen the impact of environmental factors. Microorganisms and any form of biological growth, associated with the temperature, relative humidity, water and light, have impacts on cultural properties. The excessive growth of vegetation such as trees, bushes and larger plants on top of or near monuments and archaeological remains lead to structural problems, especially if they have extensive roots. The growth of microorganisms such as mosses, lichens and algae, bacteria, fungi and moulds causes various forms of deterioration of the material used for historical structures and archaeological vestiges[323].

Invasive or hyper-abundant species of plants and animals could also have direct impact on cultural heritage properties through the physical deterioration of the material used for heritage structures. Structural problems may arise due to plants with extensive roots or vines grow near or on top of heritage structures. The large abundance of pests such as rodents can damage artefacts and various construction

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[321] UNESCO 2012: 60
[322] UNESCO 2012: 60
[323] UNESCO 2012: 60

materials. Similarly, insects such as termites can have detrimental impacts on historic structures[324].

These SOC reports also show that human destruction far outweigh the impacts of natural factors. In the past decades, cultural properties inscribed on the World Heritage List have been threaten by various human activities related to urbanization or development. The categories of this kind include:

- Buildings and development
- Transportation infrastructure
- Services infrastructure
- Physical resource extraction
- Pollution

One of the major threats to cultural World Heritage properties is development. Investment and development related to improving the accessibility, uncontrolled development such as housing and industries have impacts on cultural properties including World Heritage properties. New construction and encroachments can lead to loss of cultural heritage values and setting, if an understanding and prioritization for conserving the property does not exist[325].

Types of threats under the category of buildings and development consist of commercial development (e.g., skyscrapers, large shopping malls, encroachment/changes to skyline, etc.), housing (e.g., urban high-rise, encroachment), industrial areas (e.g., individual factories, industrial areas/parks, encroachment/changes to skyline, etc.), interpretation and visitation facilities, major visitor accommodation and associated infrastructure. Similarly,

[324] UNESCO 2012: 60
[325] UNESCO 2012

development of transportation infrastructure including marine transport infrastructure (harbors), water infrastructure, underground transport infrastructure, effects arising from use of transportation infrastructure (vehicle traffic on roadways, shipping traffic in shipping routes, air traffic), ground transport infrastructure (e.g. roads, car parks, railways, including easements, transport depots), and air transport infrastructure (e.g. airports, airstrips) have had impacts on cultural heritage values[326].

Cultural landscapes and historic urban areas are among cultural properties that have usually been threatened by various forms of development activities including new building construction and the introduction or the widening of roads, which can even take place within the heritage boundaries. Besides, historic towns are usually under pressures for commercial developments. The impact of development such as construction of highrise buildings, industrial development or transportation structures might be visual or related to the usage of these amenities. For instance, pollution is one of these impacts, which may have a direct effect on material deterioration of the heritage structures[327].

Services infrastructures are also other issues indicated in the reports above-mentioned. Examples of these include localized utilities (e.g. cell-phone towers, radio towers), major linear utilities (e.g. power lines, pipelines), renewable energy facilities (e.g. thermal, wave, solar, wind), water infrastructure (e.g. dams, water tanks, locks, pumping stations, introduction of new systems/infrastructure), and non-renewable energy facilities (e.g. nuclear power plants, oil/gas facilities).

Constant upgrading of service facilities and utility lines is a necessity for living cultural properties such as historic cities. However, electrical cables, water and sewage pipes, communication and TV cables laid under the streets or pavements, may have impact on the historic fabric and the possible archaeological finds, if a

[326] UNESCO 2013a
[327] UNESCO 2012: 68

special care is not given. Service facilities such as communication towers, electrical poles and street lighting, may also have impact on the visual integrity of cultural properties, especially in urban settings. Renewable and non-renewable energy facilities that are located within or near the properties may also affect heritage values. For instance, the visual integrity may be threatened due to the size of these facilities. Pollution is another threat, caused by non-renewable energy facilities, especially due to the use of fossil fuels, or by nuclear power plants releasing radioactive waste. Construction of dams, which can inundate large areas of land, is another significant concern that affects human habitation and cultural properties in these areas. Relocation of cultural properties results in the loss of integrity and authenticity. Another risk factor arising from the dam construction is the likelihood of a damage to the dam through an earthquake or landslide. Then, the impacts of such natural hazards, and consequently damage to the heritage values are magnified through flash-flood further down the river[328].

In addition, another factor of destruction to heritage values is physical resource extraction such as mining, oil, gas, quarrying (rock, sand, aggregates), and water extraction. The most forms of physical resource extraction have dramatic effects on the environment. While surface mining and quarrying can change the entire topography, various forms of subsurface mining, having less direct impact on the environment, affect the integrity of the property because of the related infrastructure. These physical resource extraction activities and the related infrastructure threaten the environment, cultural landscapes, and properties linked to the surrounding environment even when they take place outside the boundaries of cultural properties. It is important to note that the World Heritage Committee hence endorses that mining is not compatible with World Heritage status[329].

[328] UNESCO 2012: 68
[329] UNESCO 2012: 68

Rapid urbanization and development cause pollution in many ways. Pollution is another issue that have impacts on the heritage. For instance, air pollution[330], ground water pollution, input of excess energy, pollution of marine waters, solid waste, surface water pollution have been identified as threats to world cultural heritage properties[331].

In addition to urbanism or development, and pollution mostly caused due to these, there are other kinds of human-induced threats related to uses for different purposes: biological resource use and modification in rural areas and social/cultural uses of heritage. One of these destructive uses is biological resource use and modification such as crop production, fishing/collecting aquatic resources, land conversion, livestock farming/grazing of domesticated animals.

Besides, social / cultural uses of heritage can be source of danger. These social and cultural factors consist of identity, social cohesion, changes in local population and community, changes in traditional ways of life and knowledge system, society's valuing of heritage, ritual/spiritual/religious and associative uses[332], and impacts of tourism/visitor/recreation[333].

Finally, threats caused by human activities also include unfavorable human activities including deliberate destruction of heritage (e.g. vandalism, graffiti, politically motivated acts, arson), illegal activities (e.g. illegal extraction of geological resources (mining/fossils), illegal trade, illegal occupation of space, illegal excavations, illegal construction, looting, theft, treasure hunting), civil unrest, war, terrorism and military training. Individuals or small groups with

[330] Transformation processes in the urban surroundings of world heritage sites can be threatening as in the example of World Heritage Monument Zones of Katmandu Valley.
[331] UNESCO 2012: 68
[332] For instance, Gao Cathedral was damaged by fire in 2004 due to conflicts between built heritage needs and religious needs. Another example is forest fires. Pre-historic rock shelters of Bhimbhetaka was subjected to conflicts between people's needs, environmental concerns and the needs of archaeological heritage. ICRROM 2010
[333] UNESCO 2012: 68

various motivations, such as personal gain, ideological, political or psychological reasons, carry out these activities. Damage to the heritage can be resulting from larger conflicts, becoming a target due to its symbolic or religious value, its use as a protective shield, or just other surrounding circumstances. Illegal excavation or looting, graffiti damaging surfaces, paintings, ornamentation of historic structures, vandalism, arson are other threats that cultural properties have been facing[334].

As there have been cases where important cultural properties have been destroyed due to terrorism, civil unrest and outright war, international non-governmental organizations have developed international conventions to prepare for the protection of cultural heritage properties during armed conflicts. The threat of armed conflict on cultural heritage was addressed by "*the Convention for the Protection of Cultural Property in the Event of Armed Conflict (the Hague Convention)*" of 1954 along with its first and second Protocols[335]. This convention enabled the establishment of the Blue Shield network working on the protection of cultural properties in the incident of armed conflict. Besides, there is the "*Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property" of* 1970 addressing illicit import and export of cultural property[336].

334 UNESCO 2012: 78
335 UNESCO 1954
336 UNESCO 1970

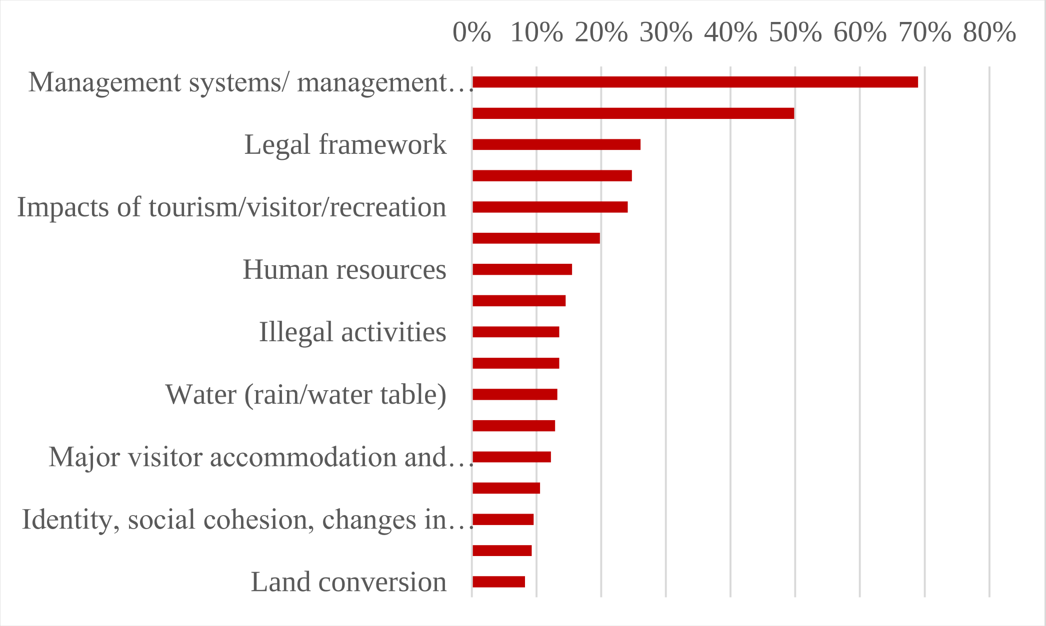

Figure 3.11. Percentage of reported World Heritage cultural properties affected by the most common threats (*YILDIRIM ESEN, 2014*)

Archaeological properties have been subject to these natural and human-induced threats in different parts of the World. The database on World cultural heritage not only illustrates variety and distribution of threats in different parts of the World but also shows the most common problems. Figure 3.11 shows percentages of reported 310 World Heritage cultural properties affected by major threat categories. <u>Management systems/ management plan</u> is the most frequent issue as it has been a concern for 69% of the sites that have been subjected to a kind of threat. This is followed by <u>housing</u>, which has been a problem for the half of all 310 properties. The succeeding two subjects, <u>legal framework</u> and <u>management activities</u>, again relate to the management and institutional problems. Next, <u>tourism/visitor and recreation</u>, which has negatively affected 24% of sites, reveals the negative aspects of tourism, while it also has a potential for positive impacts. When there is physical development and construction, there is also need for infrastructure. So, the chart also shows that <u>ground transport infrastructure</u> has become a threat for the 20% of World Heritage cultural properties that have been threaten in the last 40 years. These most common and major problems are followed by other kinds of threats such as lack of capacities in <u>human resources</u> (16%), and in <u>financial resources</u> (14%). While <u>deliberate destruction of heritage</u> has a rate of 15%, <u>illegal activities</u> has affected 14% of sites aforementioned. Other damages through <u>construction of visitation facilities</u> (13%), and <u>major visitor accommodation and associated infrastructures</u> (12%) once more touch on tourism. It is significant to note that all these major threats to World Heritage cultural properties are of human-origin. The first natural factor on the list of threats is '<u>water (rain/water table)</u>', which also becomes an issue mostly related to human interventions such as ineffective drainage systems.

Frequency of various above-mentioned threats is summarized in Figure 3.12, which shows the major categories of problems. Main issues that have affected more than 20% of the threatened World Heritage cultural properties have been related to management and institutional factors, buildings and development, social/cultural uses of heritage, transportation infrastructure, and other human activities (e.g. deliberate destruction, illegal activities, civil unrest, etc.).

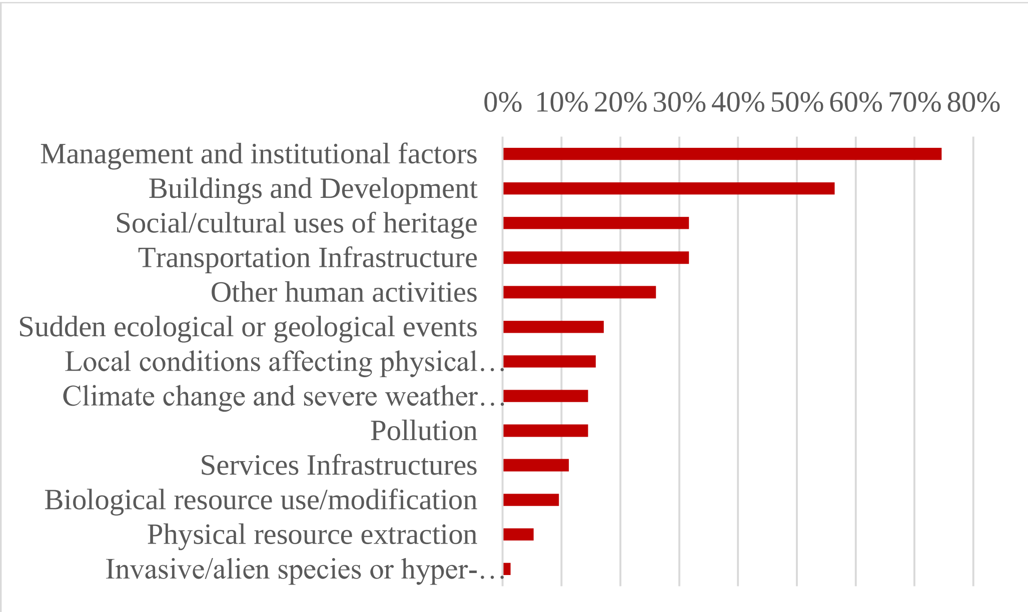

Figure 3.12. Percentages of reported 310 World Heritage cultural properties affected by major threat categories (YILDIRIM ESEN, 2014)

Being less common compared to those of human-induced, natural events and processes are still worth mentioning. The statistics of the World Heritage monitoring carried out since 1979 show that sudden ecological and geological events (e.g. earthquake, erosion, landslide, etc.) (17%), local conditions affecting physical fabric (e.g. water (rain, water table), temperature, wind) (16%), and climate change and severe weather events (storms, flooding, temperature changes) (15%) have been equally significant issues for the World Heritage cultural properties.

In addition, it is significant to analyze the trends of various threats in the last years (See Figure 3.13). Through these years, management / institutional factors, and development have been increasing threats affecting most of the properties. Transportation infrastructure have also continued to have detrimental impacts on heritage. In addition, other destructive human activities have apparently increased. If these threats could have occurred, and increased even after these sites had been acknowledged by the international community for having outstanding universal values, it is possible to assume that the problems are higher for other numerous properties located in different geographies of the World.

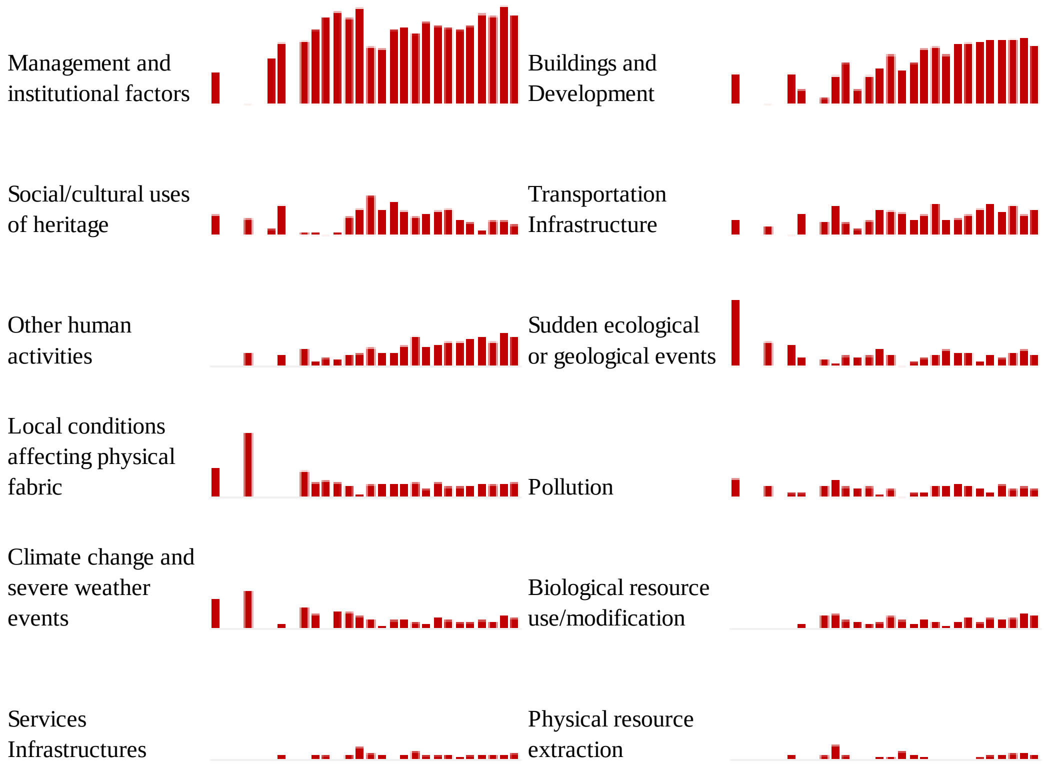

Figure 3.13. Percentage of sites affected by threats to the total number of properties subject to a SOC report, from 1990 to 2013 (YILDIRIM ESEN, 2014)

Among these properties, there is a significant amount of archaeological heritage subject to various kinds of threats. This is supported in the Heritage at Risk Reports, with two-thirds of the accounts verifying threats to archaeological heritage[337]. The ICOMOS Committee on Archaeological Heritage Management (ICAHM) highlights the following prevailing risks specific to archaeological heritage[338]:

- Loss of in situ excavated archaeological heritage
- Loss of unidentified archeological heritage
- Loss of archaeological potential

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[337] ICOMOS published six World Reports on Monuments and Sites in Danger. See ICOMOS, “Heritage at risk: ICOMOS 2011; ICOMOS 2008; ICOMOS 2006; ICOMOS 2004; ICOMOS 2002; ICOMOS 2001

[338] ICOMOS Committee on Archaeological Heritage Management (ICAHM) 2002

- Loss of diversity of archaeological heritage
- Loss of ownership of archaeological heritage

ICAHM states that loss of in situ excavated heritage is one of the widespread problems for archaeological heritage. This threat was reported by many countries including Bolivia, Bulgaria, Cambodia, the Czech Republic, Guatemala, India, Israel, Italy, Jordan, Kenya, Lebanon, Mexico, Pakistan, Thailand and Yugoslavia in Heritage at Risk Reports. **Lack of maintenance and conservation of in situ excavated remains** is the most extensively reported risk to archaeological heritage. When excavated archaeological finds are left exposed without any measures for their conservation, protection and management, damage is almost assured. Exposure to new environmental conditions above ground results in rapid deterioration of sub-surface structures and artefacts. Impacts due to exposure include physical deterioration (e.g. the cracking of stone structures and crumbling of mudbrick features) of the features that are excavated as well as the erosion and slumping of unexcavated cultural layers. As a result, both excavated and unexcavated evidences are damaged, together with other consequences such as vandalism and looting[339]. Therefore, standards developed through international charters[340] necessitates providing for maintenance or conservation prior to undertaking the excavation of archeological heritage. As indicated by ICAHM, backfilling, which is a condition of excavation permits in some countries, can be incorporated in the management planning of an excavated site as a measure to control this risk[341].

Loss of unidentified archaeological heritage due to development projects are another widespread threat reported by several ICOMOS national committees. Examples provided in the "*ICOMOS World Report 2001-2002"* include urbanization (New Zealand, Turkey, Yugoslavia); road widening (Denmark,

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[339] ICOMOS Committee on Archaeological Heritage Management (ICAHM) 2002
[340] ICOMOS 1990: Article 6; UNESCO 1956: Principle 6 (b) and Principle 21
[341] ICOMOS Committee on Archaeological Heritage Management (ICAHM) 2002

Germany, Slovakia, Turkey); railway building (Germany); dam constructions (China, India, Turkey); underground parking in historic cities (Switzerland); and modern agricultural deep ploughing (Norway, Denmark). In these cases, especially sites without prior identification is at risk. Impacts of these development constructions include damage to entire or particular elements of archeological remains, loss of the integrity of cultural landscapes, and potential damage to sub-surface remains due to groundwater and compression changes to the surrounding environment. As a response to this threat, ICAHM Charter 1990 mentions the need for carrying out archaeological heritage impact studies before development schemes are implemented[342]. However, this international standard is not met in many countries. For instance, regional surveys of archaeological heritage is lacking in Austria, Norway and Panama; environmental impact studies, including archaeological heritage, as part of approval requirements for development projects in the Czech Republic; geographic information systems and inventories that record archaeological potential and sensitivity do not exist in Lebanon, as indicated by ICOMOS Committee on Archaeological Heritage Management. As mentioned earlier, it is important to balance development pressures with archeological heritage protection.

Another concern related to the development projects is the **loss of archeological potential due to rescue archeology**. In many cases, construction proceeds through salvage archeology, retrieving the archaeological sites and objects that are in the way. However, according to the ICOMOS Committee, rescue archaeology is more likely to result in the loss of most heritage, as it damages future archaeological potential since the total site is excavated and/or information can not be documented properly due to insufficient time. Mostly, nothing is left for future investigation, and data is lost forever. However, international principle set forth in the ICOMOS Charter for Archeological Heritage Management requires “not (to) destroy any more archaeological evidence than is necessary for

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[342] ICOMOS 1990: Article 4

the protection or scientific objectives of the investigation"[343].

Heritage at Risks reports also reveal that certain types of archeological heritage including non-monumental sites which are less visible, recent archeological heritage such as industrial archaeological heritage, and sites of particular cultures (to excavate a particular period of culture) are at risk as they are not considered significant as much as other heritage. This approach results in the **loss of diversity due to risks related to a lower level or no statutory protection**, or limited resources for protection, management and conservation. However, as stated in the ICOMOS Charter for Archeological Heritage Management, "..active management … should be applied to a sample of the diversity of sites and monuments, …, and not confined to the more notable or visually attractive monuments"[344].

In addition, **loss of local ownership** is an ongoing risk to the full identification, and maintenance and management of archaeological heritage, as mentioned by ICOMOS Committee on Archaeological Heritage Management. It is widely accepted that involvement of local communities is very important for the conservation of heritage values. In brief, while there are various previously mentioned risks to archaeological heritage, most risks ultimately result from a lack of funding, law enforcement, and sufficient training[345].

Based on the analysis of the World Heritage SOC database and literature review, hazards threatening archaeological heritage can be categorized as **natural hazards**, **institutional hazards**, and **individual-induced hazards**, considering the fact that factors affecting factors affecting vulnerability of archaeological assets change according to the origin/source of hazard. Natural factors (some of which may be triggered due to human activities) of damage and deterioration to

[343] ICOMOS 1990: Article 5
[344] ICOMOS 1990: Article 6
[345] ICOMOS Committee on Archaeological Heritage Management (ICAHM) 2002

archaeological heritage include:

- sudden geological or weather events
    i. seismic activity (e.g. faulting, transient shaking, mining induced, dam- and reservoir-induced mass movement)
    ii. avalanche/landslide/rockfall
    iii. flooding (caused by heavy rainfall, flash flood, dam or levee failure, etc.)
    iv. storm
    v. tsunami/tidal wave, and
    vi. volcanic eruption,
- climate change
    i. drought,
    ii. desertification,
    iii. changes to oceanic waters,
    iv. temperature change,
    v. other climate change impacts
- local conditions affecting the physical fabric
    i. water (rain/water table),
    ii. relative humidity,
    iii. wind,
    iv. temperature,

v. dust,

vi. erosion and siltation/deposition,

vii. micro-organisms,

- hyper-abundant species (rapidly spreading plants and animals).

Indicators of these hazards are various. Hazard maps help identify which sites are exposed to a particular hazard such as earthquakes[346], volcanoes, landslides, flooding and tsunamis. Besides, occurrence of past events indicates the likelihood of happening of the same hazard in the future. It is because of the fact that the areas, which in the past have been subjected to detrimental events such as geological, ecological, or atmospheric events, are permanently in a critical position.

In the matter of hazards related to local conditions, such as water table, relative humidity, wind, microorganisms, and temperature as well as hyper-abundant species, site-level analysis is essential to identify presence or likelihood of these hazards. While geographical location determines the exposure to these hazards, both the characteristics of the site and the type of attributes determine the impacts of these factors on the heritage property. Therefore, risks due to local conditions can be assessed through risk assessment at territorial, if data regarding hazards and vulnerabilities to these hazards are collected at site scale.

Similarly, 'human-caused hazards' need a classification for analytical purposes as this term is a generalization of a more destructive and extremely complex concept. It is essential to think about the causes, motivations and mechanisms that

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[346] Quantitative assessment of seismic risk of historic structures is one of the specialization areas in the field of civil engineering. An example of this kind of assessment can be found in one of the projects of Ritsumeikan University Global COE program, which is called "Project on Sustainable Preservation of Cultural Heritage in Katmandu, Nepal". Through probabilistic seismic hazard analysis (PSHA), possible ground motions with different occurrence probabilities for a time period such as 50 years, can be calculated. Source: Furukawa 2012. See also Atkinson and Boore 2006

create these threats to archaeological heritage. Some of these are ‘planned and legal’ institutional activities mostly with the motivation for urban or economic development. These ‘**institutional activities** can be classified as:

- Buildings
    i. Housing
    ii. Commercial development
    iii. Industrial development
    iv. Tourism development (Interpretive and visitations facilities, major visitor accommodation, etc.)
    v. Greenery and recreation development
    vi. Large urban facilities (education, health facilities, etc.)
- Transportation infrastructures
    i. Ground transportation infrastructure
    ii. Effects arising from use of transportation infrastructure
    iii. Marine transportation infrastructure
    iv. Underground transportation infrastructure
    v. Air transportation infrastructure
- Services infrastructures
    i. Major linear utilities (pipelines, power lines)
    ii. Renewable/non-renewable energy facilities
    iii. Localized utilities

- Physical resource extraction
    i. Mining
    ii. Oil and gas
    iii. Quarrying
    iv. Water (extraction)

As mentioned earlier, especially sites without prior identification and registration is at risk of development, and particularly if archaeological heritage impact studies are not carried out prior to the implementation of development schemes[347]. In fact, as mentioned in ICOMOS reports, this international standard is not met in many countries, although the significance of integration of archaeological conservation into town planning policies and practices has been widely accepted. Even in cases, when construction proceeds after salvage archaeology, there is still a threat for archaeological heritage, as it mostly damages future archaeological potential when the total site is excavated and/or information can not be documented properly due to insufficient time. As a result, nothing is left for future investigation, and data is lost forever. It is critical to develop strategies to balance development with archaeological heritage conservation, and to mainstream archeological heritage conservation into development planning, and hence it is essential to identify development hazards.

Although the ideal is carrying out risk assessment of archaeological heritage as a phase of the process of physical planning, otherwise it is significant to analyze existing planning tools (e.g. long-term development plans, master plans), reports, statistics on sites damaged through development, and planning decisions to ascertain ‘institutional hazards’, which have the potential to damage archaeological heritage through planned interventions.

[347] ICOMOS 1990: Article 4

Pollution is another threat to archaeological heritage. It is mostly the consequence of urbanization and development. Pollution including air pollution, ground water pollution, input of excess energy, pollution of marine waters, solid waste, surface water pollution can have impacts on large areas, rather than a single site. Various types of pollution in an area or region need to be identified through scientific studies in environmental sciences.

Human-induced threats also stem from various actions of individuals or groups. These include:

- Social / cultural uses of heritage
    i. Impacts of tourism / visitor / recreation
    ii. Ritual/spiritual/religious and associative uses
    iii. Identity, social cohesion, changes in local population and community, changes in livelihoods, migration to or from site
- Biological resource use/modification
    i. Land conversion
    ii. Crop production
    iii. Livestock farming/grazing
- Unfavorable human activities
    i. deliberate destruction of heritage,
    ii. fire
    iii. looting and illicit digging,
    iv. civil unrest,

v. war,

vi. terrorism,

vii. military training

Impacts of tourism relate to unintended detrimental outcomes of tourism. Although, recreational uses have positive impacts on the conservation of cultural heritage, when not effectively planned and managed it becomes a hazard itself. Especially, if the number of visitors exceeds the carrying capacity of a site, in the long term, it may have negative impacts on the site. In the case of identifying the likelihood of visitor impact, number of visitors, policies for and effectiveness of visitor management, can indicate likelihood of damage. For the latter, each site needs to be examined separately to identify if this kind of pressure can be a hazard threatening archaeological values. Means of verification include reports, interviews and field study. So, risk due to tourism impact can be assessed if there is available data collected at site scale.

Regarding biological resource use and modification, such as land conversion, crop production, livestock farming/grazing, cultivation, terracing, leveling, soil removal, construction of irrigation channels; archaeological sites used as or surrounded by agricultural areas can be considered potentially exposed to that hazard. This data, which can be provided from development plans, needs to be verified with field studies to increase reliability.

Among all types of hazards, the most difficult one to identify, especially at territorial scale assessments is unfavorable human activities that can happen anywhere and at any site. There is need for data collected on site to assure the occurrence of past activities at and around the site. Statistics on these destructive human activities can reveal presence of hazards. On the other hand, a site, which has not been subject to such destruction in the past, cannot be considered secure in the future.

A hazard becomes a matter of risk if the site is vulnerable to that hazard. In the following part, factors making archaeological sites to these hazards will be examined.

3.2.2. Vulnerability Assessment

Vulnerability assessment aims to identify and analyze physical, institutional (and social, if there is available data) factors that affect vulnerability of archaeological sites in order to measure the levels of vulnerability to natural, institutional and individual-induced hazards. Vulnerability assessment process should help to address the right problems and the right causes of those problems. For this reason, it is important to undertake a thorough problem and situation analysis to understand factors affecting the level and occurrence of events adversely affecting archaeological heritage. On the other hand, understanding variety of hazards with their complexity and dynamics as well as identifying different inherent and external factors that make archaeological sites vulnerable to those hazards make vulnerability analysis of archaeological sites a complicated subject. Due to this complexity, this analysis requires in-depth knowledge about the mechanisms resulting in destructive incidents, and necessitates using a framework for identifying vulnerabilities, their indicators, and clarifying how to measure them.

As an analysis model, 'Logical Framework Approach" provides insights into developing a concise and systematic vulnerability assessment framework. In fact, the Logical Framework Approach (LFA)[348] is a management tool, which is based on a scientific model called "temporal logic model" that runs through the matrix and takes the form of a series of connected prepositions. Using the essence of a scientific method, the LFA is widely used for the **design, monitoring and evaluation of international development programmes/projects**. Since its creation in 1969 by Leon J. Rosenberg for the United States Agency for

[348] The LFA is also known as Goal Oriented Project Planning (GOPP) or Objectives Oriented Project Planning (OOPP).

International Development (USAID)[349], the Logical Framework has been widely used by many large multilateral and bilateral donor organizations like AECID, GTZ, Sida, NORAD, DFID, UNDP, EC and the Inter-American Development Bank[350]. As a management tool for effective planning and implementation of developmental projects, LFA provides clear, crisp and logical information about a project. Main elements in a project is structured in a way that logical linkages between intended inputs, planned activities and expected results can be highlighted[351]. (See Figure 3.14)

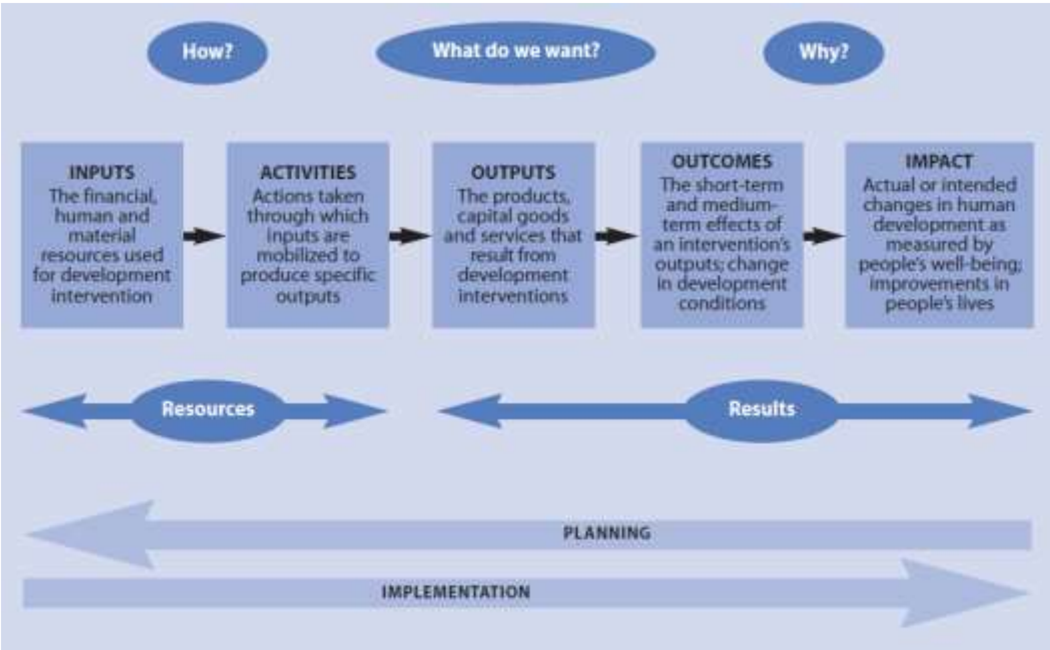

Figure 3.14. Logical Framework Approach: Logical Linkages in Programme Development (*Source: UNDP, 2009:55*)

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349 The LFA was based on worldwide study performed by Rosenberg, Hanley, and Posner. Fry Consultants Incorporated 1970

350 Fry Consultants Incorporated 1970
In the 1990s and until recently, aid organizations had been often required to use the LFA in their project proposals. Its modified version has also started to be used in the corporate sector in a number of countries. The member countries are encouraged by OECD's Development Assistance Committee to use the method. It is also used by Nordic countries and in Canada, where it is used not only in development aid but also in domestic public investment in general. The methodology is also developed by UN Organizations and the German Agency for Technical Cooperation, GTZ. It is explained in various publications, mostly in handbooks of development agencies. See: Norwegian Agency for Development Cooperation (NORAD) 1999

351 Norwegian Agency for Development Cooperation (NORAD) 1999

The LFA brings together different types of information about various components of a project. Particularly, four different components of the project implementation phase, including Activities, Outputs, Outcome (Purpose) and Impact (Goal) are described. Besides, Indicators of these components, the Means of Verification (MoV)[352], where information will be available on the indicators, and the Assumptions, which are external factors that could influence (positively or negatively) the described phases of the project, are listed. All these components are connected in one framework, leading to the achievement of the expected outcomes. The LFA brings together different types of information in a project table format, which is a matrix, the cells of which contains information about various components of a project (See Table 3.5)[353].

Table 3.5. The Results Framework developed through the Logical Framework (*Source: UNDP, 2009:54*)

Results	Indicators	Baseline	Target	Means of Verification	Risks & Assumptions
Impact statement *(Ultimate benefits for target population)*	Measure of progress against impact				Assumptions made from outcome to impact. Risks that impact will not be achieved.
Outcome statement *(Short- to medium-term change in development situation)*	Measure of progress against outcome				Assumptions made from outputs to outcome. Risks that outcome will not be achieved.
Outputs *(Products and services—tangible and intangible—delivered or provided)*	Measure of progress against output				Assumptions made from activities to outputs. Risks that outputs may not be produced.
Activities *(Tasks undertaken in order to produce research outputs)*	Milestones or key targets for production of outputs				Preconditions for implementation of activities.

352 Funds for NGOs 2010

353 For more information see: UNDP 2009; Norwegian Agency for Development Cooperation(NORAD) 1999

Certain stages of the LFA, including problem analysis, defining indicators and means of verification, can be modified to the context of vulnerability assessment of archaeological heritage, as a means of articulating vulnerabilities, and their measurement. Problem Tree Model can help analyze causes of vulnerabilities, while the indicators and means of verification force clarifications for how vulnerabilities can be measured. Briefly, the concept of problem analysis, identifying indicators, and defining means of verification are adapted within the proposed vulnerability assessment approach. Stages of the proposed assessment process are defined as 'cause-effect analyses, 'developing useful indicators', 'identifying means of verification', and 'measuring level of vulnerability'.

3.2.2.1. Cause – Effect Analysis

Vulnerability analysis can be carried out in the form of a cause - effect analysis to **understand relations between various factors** (hazards and vulnerabilities) that grow into risks distressing a site or a number of sites in a territory[354]. For each type of risk identified, a cause-effect analysis is needed. The problem tree, which is a problem analysis model, can be utilized to **study the root causes and major effects of problems**. Although, roots of problems may change from site to site, it is beneficial to **examine all possible causes** in this phase. Since, the emphasis is on what the problem itself is, it is also important to focus on the present and not the future.

Using the problem tree model[355] to undertake the problem analysis, first, the problem (risk) previously identified is written down on the trunk of the problem tree (See Figure 3.15). For instance, one problem may be "Destruction due to Planned Developments at Archaeological Sites". Next, the major causes of the problem is examined by asking "What is causing this to happen?" The aim is to

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[354] As mentioned in the Manual (2010), a multidisciplinary team work as well as collaboration with various related public and private organizations, and the local community are essential throughout the analysis and assessment process. ICCROM 2010

[355] For more information: UNDP 2009

analyze issues at a deeper level. The answers are attached to the roots of the tree. This continuous with a drill down further by asking “Why has this happened?” This is repeated for each cause identified to see whether something else is behind that cause. The aim is comprehensive examination of both inherent and external contributing factors such as physical, structural characteristics of the site, gaps in management, and surrounding physical, social, and cultural environment[356].

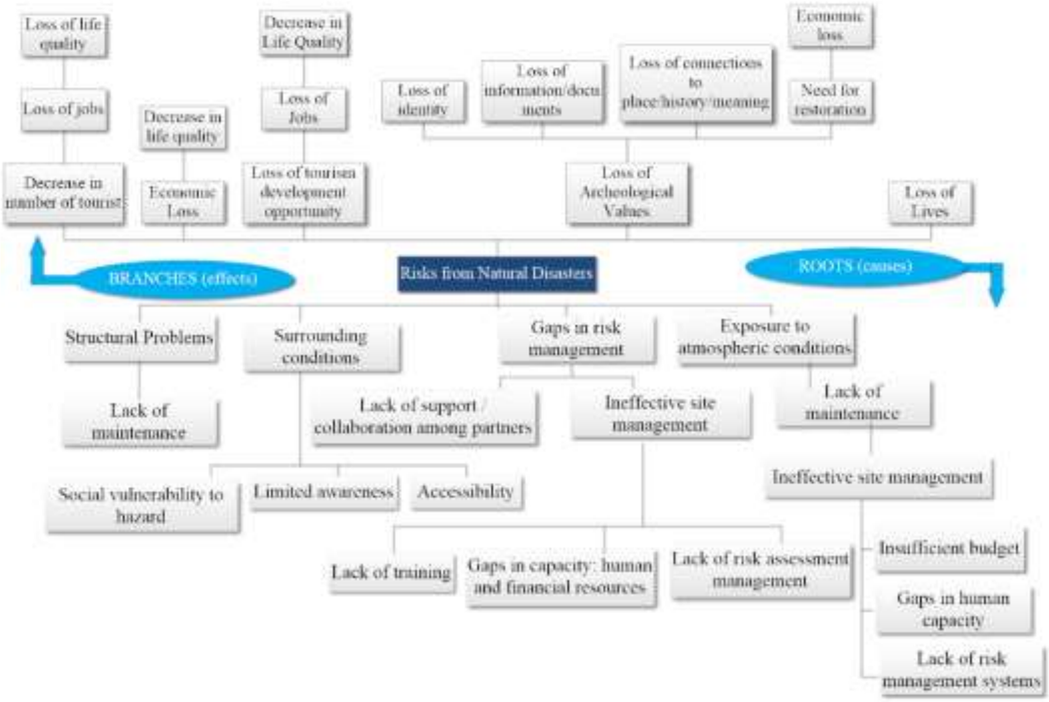

Figure 3.15. Problem Tree example for Analyzing Vulnerabilities to Natural Hazards (YILDIRIM ESEN)

In the example in Figure 3.15, the core problem on the trunk of the tree “’Risks from Natural Hazards” is one of the risks threatening archeological sites. Below the trunk, a narrower problem has been identified as “structural problems”. Another lower-level problem has also been identified “lack of maintenance”.

[356] Effects of the performance of existing management systems, existing damage patterns, surrounding physical, social, and cultural environment, and the poor restorations done in the past are explained in ICCROM 2010: 25-26

Likewise, all categories of risks are examined.

Completing the roots of problem tree provides a clear understanding of not only risks, but also their underlying causes (vulnerabilities) and constraints[357]. It helps to determine the real size and complexity of the problem and the relationships between different contributing factors. In addition, the mapping of all causes facilitates the determination of short-, medium- and long-term strategies and interventions that may be necessary for a sustainable solution. Besides, this analysis can be the initial step in identifying the partnerships that may be essential to address the problem, and then assessing the roles that different parties may need to play in solving the problem[358]. It also provides a basis for estimating the resources that may be required to deal with the problem and the causes. Subsequently, this analysis facilitates the identification of vulnerability indicators for each single site.

3.2.2.2. Developing Useful Indicators to Measure Vulnerability

Vulnerability of archeological assets to certain hazards can be measurable using indicators[359]. As mentioned by Fenton and MacGregor in the context of measuring social vulnerability to natural hazards, indicators as variables/tools should be grounded in a reasonable conceptual framework[360]. Cause and effect analysis help develop that framework to identify the most critical factors

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[357] Repeated subcauses on different roots can be seen as priority concerns to be addressed during the management process. Once the problems are accurately analyzed at regional level, programs or projects can be developed for smaller scales, at different times to address the specific causes. Some common problems with governance and legislation may also be addressed, using the same method. This approach is adopted in principle within the framework of management for development results developed by UNDP 2009

[358] Additionally, the risk analysis can play an important role in identifying stakeholders. It is important to develop a common strategy if there the risks are caused or increased by the actions of other parties.

[359] Indicators are signposts along the path to loss or damage of irreplaceable archaeological values. They are the obstacles on the way to achieve continuity of archaeological heritage in a rapidly changing world.

[360] Fenton and MacGregor provided the definition of indicators, in the case of measuring social vulnerability by developing indicators. For more information, see Fenton and MacGregor 1999

affecting vulnerability of archaeological sites. As mentioned by Jigyasu, “vulnerability” of archeological assets may arise from various physical, social, economic, environmental, and even attitudinal factors[361]. In previous examples of risk assessment studies, only physical vulnerability has been taken into account in terms of ‘the state of conservation’. In this proposal, based on cause-effect analysis, vulnerability of archaeological heritage is considered as the combination of three factors: *physical, institutional, and social vulnerability* (See Figure 3.16). In addition, a set of indicators should be developed for each main category of hazard including natural hazards, development hazards, and hazards due to activities of individuals/groups, as the kinds of indicators of vulnerability depend on the kind of hazards in question.

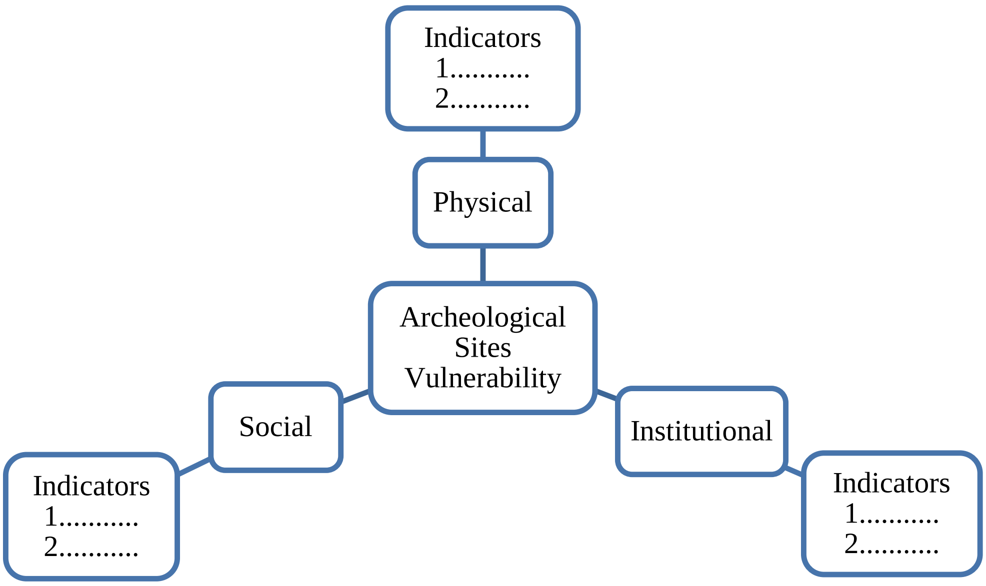

Figure 3.16. The concept of vulnerability archaeological sites, based on three parameters: physical, institutional and social vulnerability (*S. YILDIRIM ESEN*)

Within this framework, indicators can be selected for vulnerability assessment. On the other hand, various factors should be taken into account in the selection of

[361] Jigyasu 2012a

indicators[362]. First, setting indicators through a **participatory process** is critical for the effectiveness of indicators. Besides, **a range of indicator kinds** is more likely to be effective. In addition, **the fewer the indicators the better**. As measuring some indicators at site scale is costly, it is important to use as few indicators as possible, using indicators in sufficient number to measure the extent of various factors affecting vulnerability and providing cross-checking. In other words, a set of indicators for measuring vulnerability of archeological sites should be developed in a way that it constitutes limited number of indicators, which include the most critical aspects that affect conservation of a site, and 'coherent' as a whole to lead to a model about archaeological heritage vulnerability.

Another important aspect regarding indicators is that indicators can be either **quantitative or qualitative**. Quantitative indicators are explained as "statistical measures that measure results in terms of number, percentage, rate (example: birth rate—births per 1,000 population), ratio (example: ratio—number of males per number of females)"[363]. While the quantitative indicators may provide objective verification, those that are harder to verify may better capture the essence of the real situation. Unlike quantitative indicators, qualitative indicators reveal people's judgments, opinions, perceptions and attitudes towards a given situation or subject. "They can include changes in sensitivity, satisfaction, influence, awareness, understanding, attitudes, quality, perception, dialogue or sense of well-being" [364]. Accordingly, qualitative indicators can measure vulnerability in terms of:

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[362] Indicators are used in results-based-management (RBM) to measure success of management of programmes and projects. General aspects of RBM in using indicators are adapted to developing indicators for measuring vulnerability of archaeological assets. For more information on using indicators for measuring success of development programs: UNDP 2009

[363] UNDP 2009

[364] UNDP 2009.-Disaggregating indicators as much as possible is also important. UNDP 2009; Fenton and MacGregor 1999. Rather than general quantitative measures, which may hide disparities, indicators can be disaggregated by typology, physical characteristics, surrounding context, among other things.

- Compliance with…
- Quality of…
- Extent of…
- Level of …

Rather than being quantitative or qualitative, key aspects of good indicators is explained in the context of RBM as follows[365]:

> The key to good indicators is credibility—not volume of data or precision in measurement. Large volumes of data can confuse rather than bring focus and a quantitative observation is no more inherently objective than a qualitative observation. An indicator's suitability depends on how it relates to the result it intends to describe.

In some cases, data may not be available for the most suitable indicators of a particular aspect of a site. In these situations, **proxy indicators** can be used. Proxy indicators are defined as "a less direct way of measuring progress against a result"[366]. Rather than a direct measure, an indirect measure is used based on an assumption in the absence of reliable data. For instance, in the Human Development Index, 'life expectancy' is used by UNDP and other UN organizations as a proxy indicator for health care and living conditions, based on the assumption that if people live longer, then it is reasonable to assume that health care and living conditions have improved.

Within the light of above discussions, and based on the results of the cause-effect analysis, indicators for measuring vulnerability of archaeological sites to natural hazards are developed (Table 3.6). Results of the cause and effect analysis can be converted into a vulnerability indicators framework. Cause-effect analysis reveals that certain physical, institutional and social factors affect vulnerability of

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[365] UNDP 2009
[366] Use of proxy indicators is explained within the RBM framework. UNDP 2009

archeological assets to natural hazards such as earthquake, avalanche/landslide, flooding. First, archeological heritage is vulnerable to hazards, especially to natural events and processes, if they are not physically intact. So, *the state of conservation*, whether or not there are material deterioration or structural problems, is one of the physical indicators that affects a site's vulnerability to hazards[367]. Another indicator of physical vulnerability of archaeological properties is *being exposed without any measures* for their conservation after being excavated. As discussed earlier, exposure to new environmental conditions above ground results in rapid deterioration of sub-surface structures and artefacts. Because of exposure, both excavated and unexcavated cultural layers are deteriorated through erosion and slumping. Besides, they become more vulnerable to vandalism and looting[368]. When backfilling is not incorporated in the management planning of excavated sites, the risk of physical deterioration after excavation is unavoidable. Hence, excavated sites are mostly more vulnerable than those exist below ground surface. Especially, sites that possess **vulnerable materials**, **earthen structures, paintings, movable finds**, etc. are more vulnerable to the impacts of natural factors. Another indicator of vulnerability is **past damages** due to natural hazards. Sites that have been destructed in the past due to natural events or processes are more likely to be damaged in the future. Even structural **typology/characteristics of an archeological site** (e.g. single structure/find, settlement/area, mound, tumulus, rock structures, cave, etc.) influence its sensitivity to certain natural processes or events. For instance, compact structures are less likely to be open to the impacts

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[367] Quantitative assessment of seismic risk of historic structures is a part structural reinforcement projects for historic structures. Quantitative assessment of seismic risk of historic structures is one of the specialization areas in the field of civil engineering. An example of this kind of assessment can be found in one of the projects of Ritsumeikan University Global COE program, which is called "Project on Sustainable Preservation of Cultural Heritage in Katmandu, Nepal". In this research, which aims to make guidelines on disaster mitigation of cultural cities in earthquake zones, a world heritage site in Katmandu is chosen as the case study area. The procedure of seismic risk evaluation identified in this project consists of three parts: 1. estimation of earthquake ground motion by the probabilistic seismic hazard analysis, 2. experiments to obtain structural properties (stiffness, strength, dynamic characteristics), and 3. Numerical analysis using computers. As a result, the seismic behavior of masonry buildings during earthquakes can be analyzed in detail and the effect of reinforcement measures can be examined. Furukawa 2012

[368] IACHM 2002

of local conditions affecting the physical fabric.

Table 3.6. Indicators for Vulnerability to Natural Hazards (YILDIRIM ESEN, 2014)

Components of Vulnerability	**Indicators for Measuring Vulnerability to Natural Hazards** (i.e., "What can we see to know if the site(s) is vulnerable to natural hazards including earthquake, landslide, rockfall, flooding, tsunami/tidal wave, volcanic eruption, etc.?")
Level of Vulnerability due to Physical & Inherent Characteristics	▪ State of condition: material and structural vulnerability of all components ▪ Exposure to atmospheric conditions ▪ Typology ▪ Past damages/interventions
Level of Vulnerability due to Institutional Factors	▪ *National Level:* Presence/effectiveness of legislation&policies, ▪ *Regional/ Territorial Level:* Effectiveness and capacity of publlic administrations (administrative systems, human and financial resources), ▪ Effectiveness of site management & maintenance (i.e., presence and effectiveness of site management, human resources, budget), ▪ Effectiveness of risk management systems, ▪ Level of collaboration with other public organizations & stakeholders
Level of Vulnerability due to Social & Physical Surrounding	▪ Level of accessibility ▪ Level of social vulnerability to the hazard (population density, building density, etc.) ▪ Lack of / extent of awareness of local community (values, sense of ownership, attitudes, common sense and caution, behaviors)

In addition, literature on conservation and empirical research on the legal and administrative aspects of archeological heritage management in Turkey reveal that effective management is critical for safeguarding values of cultural properties, and hence archaeological properties are vulnerable to all kinds of hazards if they are not effectively managed at national, provincial/city, and site levels. At national and regional/territorial levels, indicators of institutional vulnerability of archaeological heritage include presence and/or effectiveness of legislation and policies (decision-making mechanisms) and effectiveness and capacity of public administrations (insufficient human and financial resources). At site level, effectiveness of site management and maintenance (lack of management system or management planning, ineffective maintenance and monitoring procedures, limited human and financial resources), effectiveness of risk management systems (ineffective risk management and gaps in visitor management) are among indicators that determine institutional vulnerability of archaeological properties. As indicated in the monitoring reports of several World Heritage sites, in cases when high impact research and monitoring activities such as excavation sampling using destructive techniques, or research involving extraction of samples from the archaeological sites, management can also be a hazard itself. Lack of collaboration with related public institutions and all stakeholders is another indicator of institutional vulnerability.

Vulnerability can also result from surrounding physical and social conditions. One of the surrounding factors of vulnerability is the level of *accessibility*, which is a characteristic of the surrounding conditions of a cultural property, is an indicator of physical vulnerability[369]. For instance, when a site is not easily accessible, in case of emergencies such as natural disasters or unfavorable human activities, the response can not be possible or otherwise effective. Besides, archaeological heritage is vulnerable to all kinds of hazards, especially to those of human-induced, when there is not community support and willingness to conserve heritage values. Social indicators of vulnerability of archaeological heritage include both level of social vulnerability to the given hazard, and extent of awareness of the local community. The extent of awareness/interest can be related to many factors, including

- general and local knowledge;
- the level of society's valuing of heritage (which determines how and why heritage is used or abandoned);
- sense of ownership (which relates to identity, social cohesion, changes in local population and community, changes in livelihoods, migration to or

[369] Accessibility of cultural heritage in case of a disaster is another factor that affects vulnerability of that site. Various computer simulations related to disasters help understand vulnerabilities including accessibility, and develop strategies. An example of this kind of initiative is the Virtual Kyoto Project, which was created by the support of Japanese public and private sectors. In this project, simulations are used as part of this project to assess how accessible cultural heritages would be when an earthquake hits the City of Kyoto, Japan. In order to predict the accessibility accurately, a simulation model was constructed. Source: Yano 2012

from site); and

- attitudes and behaviors towards cultural heritage conservation.

While identifying the kinds of indicators, it is critical to examine if the indicators are SMART to measure the level of vulnerability[370]. The 'S' in SMART stands for '**specific**', indicating that the indicator should be specific enough to measure the vulnerability. The 'M' stands for '**measurable**', indicating that data should be readily available, and a dependable, reliable and clear measure of vulnerability. The 'A' stands for '**attainable**', meaning the indicator should also be realistic to reveal vulnerability of a site. The 'R' stands for **relevant**, indicating that the indicator is relevant to the intended vulnerability indicator. Finally, the 'T' stands for 'time-bound', meaning that the indicator data should also be **time-bound**, available at reasonable cost and time. Using the abovementioned criteria, indicators should be reviewed to assess if they are SMART for measuring vulnerability of archeological assets at territorial scale (See Table 3.7).

[370] UNDP 2009

Table 3.7. Reviewing indicators: SMART (YILDIRIM ESEN, 2014)

Indicators for Measuring Vulnerability to Natural Hazards (i.e., "What can we see to know if the site(s) is vulnerable to natural hazards including earthquake, landslide, rockfall, flooding, tsunami/tidal wave, volcanic eruption, etc.?")	**Are indicators SMART for risk assessment at territorial scale?**
Level of Vulnerability due to Physical & Inherent Characteristics: • State of condition: material and structural vulnerability of all components • Exposure to atmospheric conditions • Typology • Past damages/interventions	• SOC & Exposure to atmospheric conditions & Past Damages: (SMAR) Necessitates field study: time/coast limited • Typology: Necessitates multidisciplinary work: time/coast limited
Level of Vulnerability due to Institutional Factors: • *National Level:* Presence/effectiveness of legislation&policies, • *Regional/ Territorial Level:* Effectiveness and capacity of publlic administrations (administrative systems, human and financial resources), • Effectiveness of site management & maintenance (i.e., presence and effectiveness of site management, human resources, budget), • Effectiveness of risk management systems, • Level of collaboration with other public organizations & stakeholders	• Legislation, policy, administrative capacity analysis: SMART • Effectiveness of Site Management: (SMAR): Necessitates field study: time/coast limited • Effectiveness of RM&Collaboration: (SMAR) Necessitates field study: time/coast limited
Level of Vulnerability due to Social & Physical Surrounding: • Level of accessibility • Level of social vulnerability to the hazard (population density, building density, etc.) • Lack of / extent of awareness of local community (values, sense of ownership, attitudes, common sense and caution, behaviors)	• Level of Accessibility: (SMAR) Necessitates field study: time/coast limited • Social Indicators: Necessitates social sciences research (time/coast limited).

Although all indicators are specific, measurable, attainable and relevant, some data may not be available at reasonable cost/time/effort, which depends on the scope, scale, and specific circumstances of risk assessment process. This is the biggest challenge for a large-scale assessment. For any analytical study, the depth of analysis depends on the available data. In some cases, data that are more general may be used. In such cases, Jigyasu suggests 'triangulation': "Where little historical data are available or where monitoring gaps occur, the best available data should be used and can be amplified through 'triangulation', i.e. the use of multiple sources"[371].

[371] ICCROM 2010: 24

3.2.2.3. Identifying Means of Verification

It is also important to consider how data will be obtained. Vulnerability assessment relies heavily on indicators from data gathering. Various data on physical, legal, administrative characteristics of archaeological sites that make them vulnerable are essential[372].Therefore, it is also important to identify **means of verification** for each single indicator. Means of verification play a key role in grounding an assessment framework in the realities of a particular setting. Without clearly defining the kind of evidence that will be required to ascertain the level of vulnerability, without fully considering the implications of obtaining such evidence in terms of effort and cost, an assessment can not be carried out. If indicators are not based on measurable, independently verifiable data, the extent to which an assessment is realistic or feasible is doubtful. Identifying means of verification should also take place in close coordination with key stakeholders. Based on this framework, the indicators framework can be developed. Again, using the example of vulnerability to natural hazards, means of verification are shown in the Table 3.8.

[372] Data collection can be a challenging issue due to unavailability of data and/or diversity of information sources. Even if there is available data, reliability of data may be questionable.

Table 3.8. Indicators Framework with Means of Verification (YILDIRIM ESEN, 2014)

Indicators for Measuring Vulnerability to Natural Hazards (i.e., "What can we see to know if the site(s) is vulnerable to natural hazards including earthquake, landslide, rockfall, flooding, tsunami/tidal wave, volcanic eruption, etc.?")	**Are indicators SMART for risk assessment at territorial scale?**	**Means of Verification**
Level of Vulnerability due to Physical & Inherent Characteristics: • State of condition: material and structural vulnerability of all components • Exposure to atmospheric conditions • Typology • Past damages/interventions	• SOC & Exposure to atmospheric conditions & Past Damages: (SMAR)&Necessitates field study: time/coast limited • Typology: Necessitates multidisciplinary work: time/coast limited	• Field study (requires expertise) • Documents • Reports
Level of Vulnerability due to Institutional Factors: • *National Level:* Presence/effectiveness of legislation&policies, • *Regional/ Territorial Level:* Effectiveness and capacity of publlic administrations (administrative systems, human and financial resources), • Effectiveness of site management & maintenance (i.e., presence and effectiveness of site management, human resources, budget), • Effectiveness of risk management systems, • Level of collaboration with other public organizations & stakeholders	• Legislation, policy, administrative capacity analysis: SMART • Effectiveness of Site Management: (SMAR): Necessitates field study: time/coast limited • Effectiveness of RM&Collaboration: (SMAR) Necessitates field study: time/coast limited	• Legislation • Reports documents • Interviews • Field study (requires expertise)
Level of Vulnerability due to Social & Physical Surrounding: • Level of accessibility • Level of social vulnerability to the hazard (population density, building density, etc.) • Lack of / extent of awareness of local community (values, sense of ownership, attitudes, common sense and caution, behaviors)	• Level of Accessibility: (SMAR) Necessitates field study: time/coast limited • Social Indicators: Necessitates social sciences research (time/coast limited).	• Field Study (requires expertise) • Special survey to be undertaken

3.2.2.4. Measuring Level of Vulnerability

Based on various physical, institutional and social indicators, the level of vulnerability of each archeological site located in the given territory can be evaluated. Measuring the level of vulnerability is essential for measuring the level of risk, and therefore for determining priorities and actions for risk management. Based on the level of information available for the assessment, indices of vulnerability can be qualitatively identified through expert judgment (See Figure 3.17). In the example of vulnerability to natural hazards, presence of one of the indicators of typology, exposure or past damages is considered ample to show the presence of vulnerability to natural hazards. Similarly, presence of one of the institutional indicators of ‘lack of/ineffective site management & maintenance’, ‘lack of/ineffective risk management systems’, or lack of/ineffective collaboration among partners is considered enough to increase the level of vulnerability to the upper level. As institutional ineffectiveness also eventually bring material/structural problems[373] due to ineffective maintenance, these two indicator exist together. In addition, existence of a problem with the physical and social surrounding (such as problems regarding accessibility, or social vulnerability to the hazard, or lack of awareness of local community) is considered as the last evaluation criteria (and less significant compared to the others) that would increase the level of vulnerability.

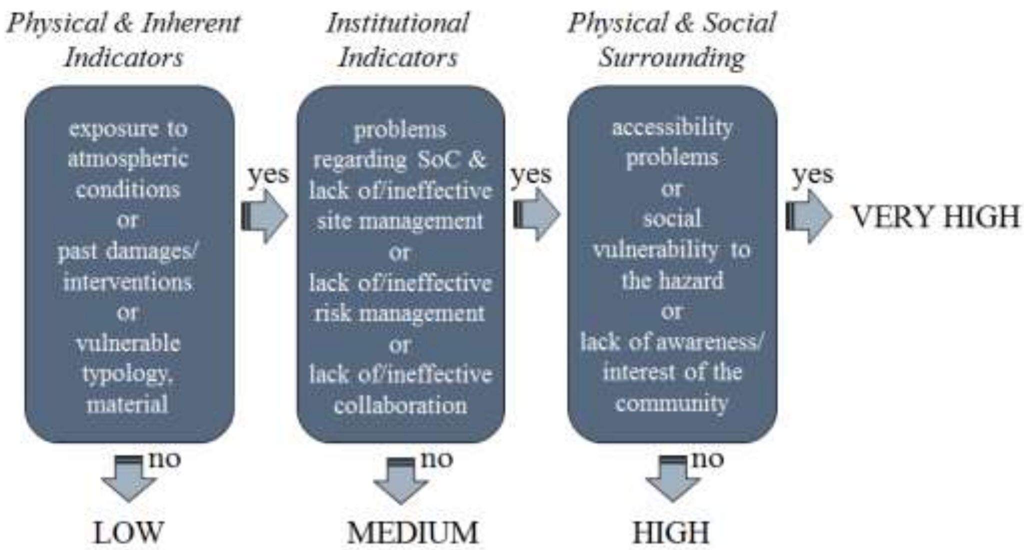

Figure 3.17. Vulnerability Evaluation for Natural Hazards (YILDIRIM ESEN, 2014)

With the most basic data on physical, institutional and social indicators, vulnerability of archaeological sites to the natural hazards can be categorized as follows:

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[373] Data on the state of condition can be obtained only after an in-depth analysis on site. In most cases, when the number of sites analyzed is abound, it may not be possible to obtain this data at reasonable cost/time/effort. Through site survey, state of condition can be qualitatively evaluated. For example, the site can be rated as ‘good’, if the site is in good condition or have only minor material problems and need only periodic monitoring, as ‘fair’ if the site has material problems and there is need for material conservation, as ‘poor’ if there are material and structural problems that necessitate urgent interventions.

- Low (if a site is not excavated, not exposed to atmospheric conditions, does not have a record of past damages, and not typologically disadvantaged),

- Medium (if a site is excavated and/or exposed to atmospheric conditions, but subject to management and maintenance, and hence in a good state of condition)

- High (if a site had been excavated in the past and/or damaged in the past, and currently left exposed and/or its state of condition necessitates repairs, but it is not subject to management and maintenance)

- Very high (if a site had been excavated in the past and/or damaged in the past, and currently left exposed and/or its state of condition necessitates repairs, but it is not subject to management and maintenance, and it is inaccessible in case of emergencies)

Likewise, each category of hazard (natural, institutional and individual-induced) requires expert judgment on the selection and use of indicators for evaluating vulnerability. Besides, the elements of analysis, kinds of available data and accordingly the components and the structural scheme of the vulnerability assessment matrix can change according to the kinds of prevailing vulnerability factors and according to the requirements arising in different cases. Hence, this proposal aims to provide a flexible vulnerability assessment approach adaptable to different circumstances for evaluating the level of risks to archaeological heritage.

3.2.3. Risk Evaluation

As 'risk' is defined as a function of *hazard* and *vulnerability*, the level of risk depends on the level of hazard and level of vulnerability. Through this study, the difficulty of a precise definition and quantification of the factors of each hazard has been verified, in view of the diversity of sources (coming from different fields) and different origin and characteristics of each type of hazard, both natural and human-induced. Providing the quantitative data and their change of trend for every single unit of archaeological heritage depends on quantification of all parameters relating to the factors of danger. While quantification of natural hazards (those that are sudden and catastrophic such as earthquake and landslide) is carried out in natural sciences, in most cases, it is not possible to obtain micro-level hazard zonation maps. In addition, for slow and progressive natural hazards (such as local condition affecting the physical fabric), measuring the level of hazard necessitates scientific multi-disciplinary scientific studies in studied territories to identify different level of damaging conditions that determine different degradation processes. With respect to human-induced hazards, which can be prevented as long as conservation could be mainstreamed into planning and development processes, measuring level of development-related hazards such as new construction and infrastructure development may necessitate employing statistical models and developing a set of useful indicators. Briefly, the current level of knowledge does not seem to be supporting a standardized quantitative or qualitative judgment of level of hazards for measuring the level of risk.

Following a uniform assessment approach to all kinds of hazards, the proposed assessment methodology is based on verifying the presence of all spectrum of hazards, which are mostly spatial problems, through identifying, categorizing and mapping hazards in order to examine their spatial distribution. This allows for the most fundamental criterion/standard for such territorial assessment: precise corroboration between the individual site and concrete locations of hazards. Presence and geographical locations of hazards together with results of vulnerability assessment -revealing different levels of vulnerability for each site studied- enable to evaluate risks to archeological heritage at territorial scale. The database on various kinds of hazards and archaeological sites within the scope of the assessment enable undertaking various analysis and producing risk maps. For the graphic production of the maps, three main models of data interrelations are possible for the evaluation of risks: 1. Identifying sites at risk through interrelation of binary type; 2. Generating indices of risk through interrelation of overlapping; 3. Evaluating overall risk.

First, sites at risk can be identified through overlapping two basic components of the assessment: archaeological sites and hazards. This enables producing risk maps for all kinds of hazards, based on the simple 'discriminant "presence/absence" of hazard for each site. Second, the level of risks can be calculated for each site with respect to various hazards. This derives from overlapping of two information: presence of hazard and level of vulnerability of each site to that specific hazard. Here, if the site is exposed to the given hazard, its vulnerability level determines its level of risk to the hazard. Third, the overall risk can also be calculated. The overall risk is presented by using the highest level of risk identified for each site in any one of the hazard categories. Finally, cartographic presentations of different type of risks and the summarized maps of risks are produced through GIS.

Database constructed for the assessment allow users select the most appropriate management strategies to reduce risk. For instance, sites at risk of natural hazards necessitate intensive interventions in all phases of disaster risk management. Sites with high vulnerability need strategies aiming at decreasing vulnerabilities. Sites with low vulnerability require focusing on monitoring and preparedness. Finally, this methodology enables producing relevant strategies for each hazard, and shows priorities in managing risks at territorial scales. Besides, due to the flexibility of the GIS, new parameters of analysis can be added, once the database is constructed.

CHAPTER 4

ASSESSMENT OF RISKS AT TERRITORIAL SCALE (ARTS) - İZMİR METROPOLITAN AREA

Since the early years of the Republic, aggressive cultivation, rapid industrialization and uncontrolled development have been the norm in Aegean Region. Consequently, traces of past civilizations have been systematically demolished in many places. According to the report titled "Archaeological Destruction in Turkey, Marmara and Aegean Regions", among many reasons for destructions of the archaeological heritage, the most widespread factors include urbanization/industrialization and aggressive agricultural activities. These are accompanied by extensive infrastructure development as urbanization/industrialization demand massive transportation infrastructure, while agricultural activities necessitate waterworks, irrigation channels, and so forth. Particularly, archaeological sites located along the Aegean coast are mostly damaged due to biological resource use and modification. This is followed by development of settlement areas and illicit digging. In the case of Aegean Inland, again, cultivation and other agricultural activities are the most widespread hazards, while the other causes of destruction are usage of archaeological sites as modern cemeteries and construction of dams[374].

Particularly during the last decades, these all have contributed to the devastation of archeological assets. As the inventory of Turkey is not yet completed, what have been lost is not exactly clear. As mentioned in the aforementioned report, "the urgency of the situation becomes even more pronounced when considering

[374] This report was prepared by TAY at the end of fieldwork carried out in the Region. For more information, see: Tanindi, O., Ozbasaran, M. [et. al.] 2001: 34

the fact that most of the destruction is occurring on the "officially registered" archaeological sites" [375].

Izmir is the most developed and urbanized city of the Aegean Region. Being the third biggest city and second most important seaport of Turkey, Izmir is a historic city that possesses rich and diverse archaeological assets ranging from monumental edifices to remains of ancient settlements. This dense archaeological setting, located in both urban and rural contexts, provides invaluable information about past civilizations. This case study research aims to assess risks to rich and valuable, yet vulnerable and irreplaceable archaeological heritage located in the Izmir Metropolitan Area, which covers the areas of twenty-one districts. Based on the methodology introduced in Chapter 3, this area is selected for case-study research since during the last decades, the destruction of archaeological heritage in this region have reached a critical situation that demand the most urgent attention. This assessment is at territorial scale, as various natural and human-induced risks to multiple archeological sites located in the same territory are assessed through a large-scale assessment. While the geographical, geological, physical, environmental characteristics of the region is evaluated in terms of factors threatening archaeological heritage, archaeological sites are analyzed in terms of their vulnerabilities to these hazards. In addition, the study area is physically identified in terms of components of natural and built environments, and types of land uses. Finally, through the proposed methodology, risks to these sites are evaluated.

4.1. Context of the Study Area

The province of İzmir[376], which extends along the outlying waters of the Gulf of İzmir, is located at the west of the Anatolian Peninsula. The City has housed important civilizations throughout its history because of its significant location

[375] Archaeological Settlements of Turkey Project (Tanindi, et.all.) 2001: 11
[376] The city's name had been Smyrna until the Turkish Postal Service Law of 1930 gave the name "İzmir". Wikipedia 2013

and natural characteristics. Izmir's metropolitan area extends to the north across Gediz River's delta, to the east along an alluvial plain shaped by a number of small rivers, and to the south along a more rugged terrain[377]. The climate of the region is the Aegean type Mediterranean climate in which summers are generally hot and dry and winters are warm and rainy[378]. Marine climatic effects of the coastal areas extend towards inner sections, as parallel mountains lie perpendicular to the sea. Within these climatic conditions, the widespread vegetation type of maquis, which tends to prosper in arid and rocky areas, spread areas with altitude of 0 to 600 meters, while most of the mountainous areas are covered by forests[379].

Thanks to the climatic conditions, agriculture-based industries are noticeably developed in the region, where main products produced in the region include cotton, grape, fig, dried fruits, vegetables, and spices. Being a port of a wide hinterland that spread from Çanakkale to Fethiye, İzmir is an important foreign trade city of Turkey with its free zones, industrial zones and maritime transportation opportunities[380]. In addition, having rich cultural assets, religious sites significant to people from different beliefs[381], geo-thermal resources, and natural beauties, Izmir is a significant tourism center in Turkey[382].

With all the advantages coming from its geographical location and rich historical and cultural background, physical, spatial characteristics of Izmir is continuously

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[377] Governorship of Izmir 2013
[378] Erlat 2004: 61-69
[379] Governorship of Izmir 2013
[380] Governorship of Izmir 2013
According to the study carried out by the Undersecretariat of State Planning Organization in 2003, titled Socioeconomic Ranking of Provinces, Izmir is at third place among other 81 provinces regarding development. Besides, Izmir has the highest share within the overall gross domestic product (GDP) produced throughout Aegean Region. In Izmir Development Agency 2009:4.
Data on year 2001 by Turkish Statistical Institute (TUIK) 2002
[381] The city has been significant for people from various cultures and religions throughout its history. For instance, the city possesses three out of seven churches mentioned in the Bible, and the first church ever built in the name of Virgin Mary. Izmir Development Agency 2009: 4
[382] Governorship of Izmir 2013

changing in the face of rapid urbanization within the complex dynamics of economic, social, cultural and political circumstances, just like all other metropolises. After 1945, the city has experienced rapid population increase, which has been a major factor contributing to the changing dynamics. Population of the city, which was determined to be 531,579 in 1927, increased to 4,005,459 in 2012, according to the data issued by Turkish Statistical Institute (TUIK)[383]. For the period of 1927-2012, Izmir's population has increased approximately by 7.5 times, while Turkey's population has increased approximately by 5 times. In addition to the population increase rate, which has happened to be above Turkey average, another point striking attention regarding population structure of Izmir is its extremely high population density[384], compared to regional, national and international data on population[385]. Furthermore, third important point regarding the population structure of Izmir is its urban population ratio, considerably higher than most provinces and regions. As of 2000, urban population ratio, which was at a level of 64.9% for Turkey, was 81.07% for Izmir. In 2012, according to the Address Based Population Registration System (ABPRS) database[386], urban population ratio of Turkey became 77.2%, while Izmir reached up to a level of 90.46%. With its significantly higher population density, population increase rate, and urban population values compared to Turkey average, there is need for policies not only in issues such as healthy urbanization, social health, transportation, contingency and disaster managemen[387], but also in cultural heritage conservation, which has always been neglected.

4.1.1. Archaeological Characteristics of Izmir and Its Surrounding

Archaeological excavations carried out since 2005 in Yesilova Mound in Bornova revealed that Izmir's history goes back to circa 6000 BC (See Figures

[383] Turkish Statistical Institute 2013a
[384] Population density of Izmir was 333 in 2012. Turkish Statistical Institute 2013b
[385] Izmir Development Agency 2009: 16-18
[386] Turkish Statistical Institute, 2013a
[387] Izmir Development Agency 2009: 16-18

4.1, 4.2)[388]. Throughout its history encompassing at least 8,000-9000 years, Izmir has been continuously inhabited by past civilizations since the ancient times. As one of the oldest port cities of the world, historic city of Izmir has witnessed many cultures including Hittites, Ionians, Lydians, Persians, Hellenes, Romans, Byzantines, and Ottomans, all of whose traces spread all around in the province (See Figure 4.3)[389].

Figure 4.1. Excavation Works at Yesilova Mound in Bornova (*Source: Zafer Derin, 2010*)

Figure 4.2. Yesilova Hoyuk, Bornova (*Source: Personal Archive, April 2013*)

[388] Derin 2011
[389] Governorship of Izmir 2012

Figure 4.3. The Agora of the Roman Period (*Source: Personal Archive, April 2013)*

Many of these are unique examples that have international significance. For instance, Temple of Artemis, one of the World's seven wonders, and important ancient cities such as Ephesus and Bergama that were the metropolises of the ancient ages are located within the boundaries of the province. Klazomenai, Ephesus, Bergama, Lebedos, Teos, Allianoi, Erythrai are some of the significant sites in Izmir province. Izmir was also an important settlement during Ottoman Era and hosted different cultures.

Today, in the province of Izmir, there are 581 archaeological assets registered in various categories, according to the cultural heritage statistics of the Ministry of Culture and Tourism. These include 84 remains of single structures, 453 archaeological sites, 7 urban archaeological sites; within the mixed category, 30 archaeological and natural sites, 2 archaeological and urban sites, 1 archaeological, natural and historic site, and 4 archaeological and historical sites[390].

Within the metropolitan area encompassing 21 districts, there are 209 archaeological sites, some of which are designated in multiple categories (1st, 2nd, 3rd, urban and archaeological, and mixed), as listed in the 'Cultural Heritage

[390] Ministry of Culture and Tourism 2013b

Catalog' of the Ministry (See Table 4.1)[391].

Table 4.1. Number of archaeological sites located in the districts of the Izmir Metropolitan Municipality area[392] (YILDIRIM ESEN, 2014)

DISTRICT	1st Degree	2nd Degree	3rd Degree	Urban& Arche.	Others	TOTAL
ALİAĞA	12	5	7	0	3	18
BALÇOVA	0	0	0	0	0	0
BAYINDIR	0	0	0	0	0	0
BAYRAKLI	4	1	3	1	1	6
BORNOVA	7	0	2	0	2	10
BUCA	1	0	1	0	0	2
ÇİĞLİ	2	0	0	0	0	2
FOÇA	7	7	3	0	6	19
GAZİEMİR	0	0	0	0	0	0
GÜZELBAHÇE	1	1	2	0	0	3
KARABAĞLAR	0	0	0	0	0	0
KARŞIYAKA	0	0	0	0	0	0
KEMALPAŞA	8	0	5	0	1	12
KONAK	7	7	4	0	8	21
MENDERES	7	1	4	0	0	8
MENEMEN	8	1	4	0	0	11
NARLIDERE	1	0	0	0	0	1
SEFERİHİSAR	24	3	8	0	5	33
SELÇUK	12	1	3	1	13	25
TORBALI	19	2	1	0	3	23
URLA	10	2	8	0	0	15
TOTAL	**130**	**31**	**55**	**2**	**42**	**209**

In addition to the registered archaeological sites, which are mapped on the 1/25.000 scale Urban-Region Development Plan (IKNIPR), those which are not registered, and geographically identified through TAY field works are within the scope of the case study. Based on TAY database, there are 20 sites without registration status. (See Figure 4.4).

[391] Single site can be divided into 1st, 2nd and 3rd degree designation zones. When, each designation zone (1st, 2nd, 3rd) of a site is calculated separately, the total number of sites are 260.

[392] As some sites have several registration zones that have different registration degrees (i.e. 1st, 2nd & 3rd), total number indicates each individual site, rather than the sum of various zones of the same site. The table is prepared by the author, analyzing the listing at "Turkey Cultural Heritage Catalog", accessible from http://www.kulturvarliklari.org/ Ministry of Culture and Tourism 2013c

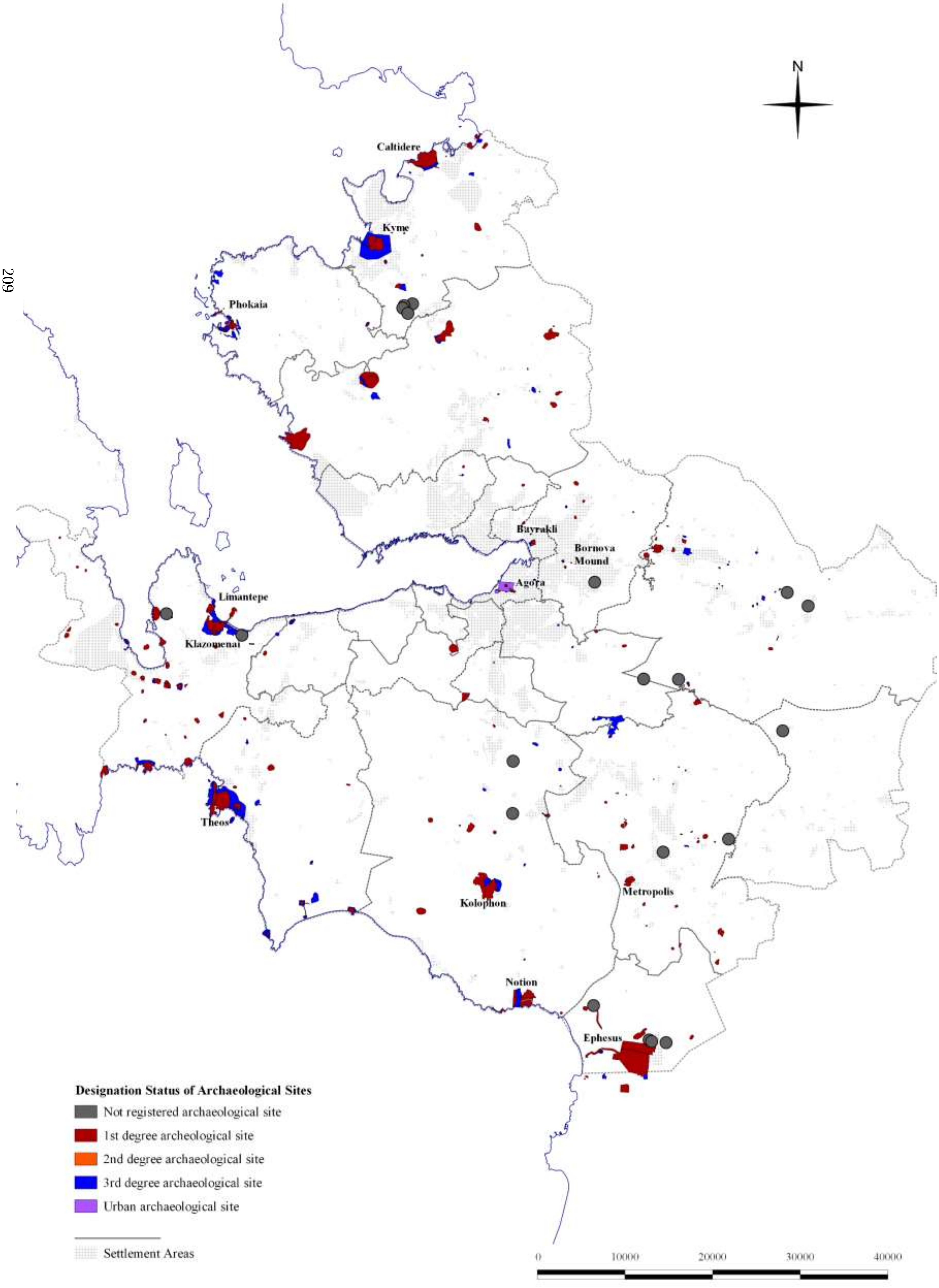

Figure 4.4. Archaeological sites in Izmir Metropolitan Area

4.1.2. Planning Context of Izmir

The city of İzmir constitutes several metropolitan districts. The "Greater İzmir Metropolitan Municipality" is vested with authority over the areas of twenty one metropolitan districts, namely Aliağa, Balçova, Bayındır, Bayraklı, Bornova, Buca, Çiğli, Foça, Gaziemir, Güzelbahçe, Karabağlar, Karşıyaka, Kemalpaşa, Konak, Menderes, Menemen, Narlıdere, Seferihisar, Selçuk, Torbalı, and Urla (See Figure 4.5). Konak district is the historic core of the city[393].

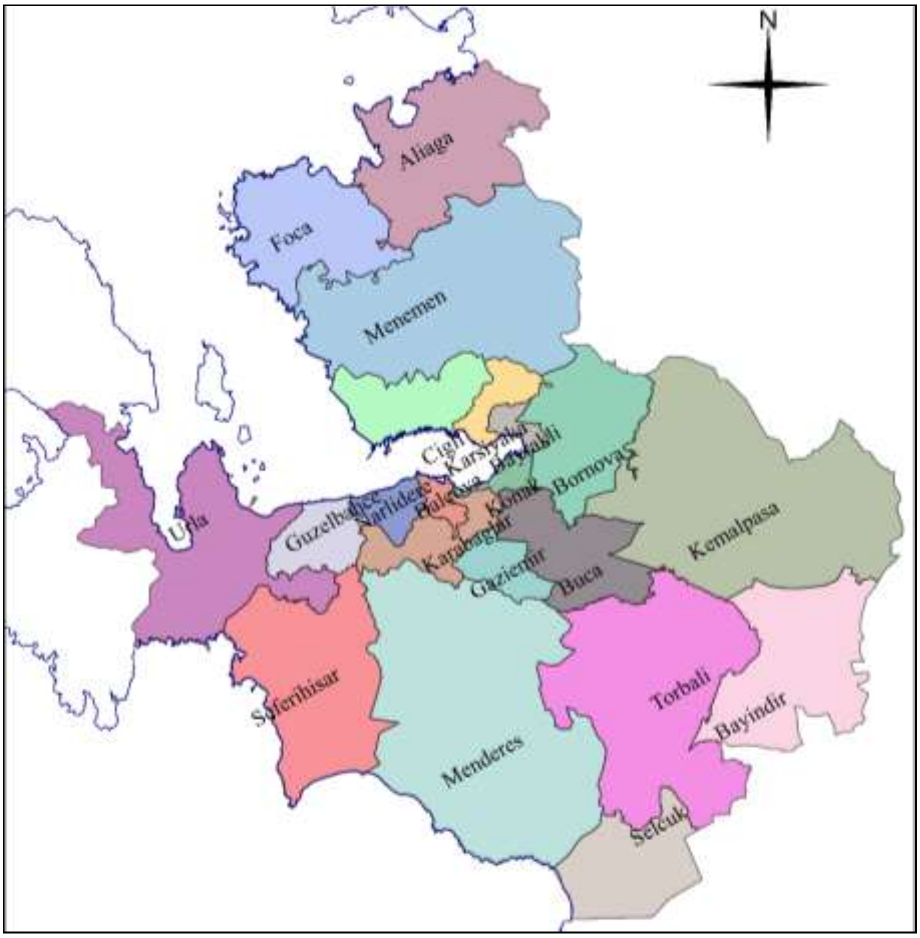

Figure 4.5. Districts within the boundaries of the Izmir Metropolitan Municipality as of January 2014

[393] Bergama, Beydağ, Çeşme, Karaburun, Kınık, Kiraz, Ödemiş, Tire Izmir Metropolitan Municipality

Besides, villages that are outside the boundaries of the municipality areas are under the responsibility of Izmir Provincial Administration. Among its responsibilities is the control of developments including infrastructure according to plans and legislations.

Izmir started to be modernized with the influence from western planning approaches, after the foundation of the Republic. The first attempt for citywide planning approaches in Izmir was the Danger and Prost plan (1925). The master plan for Izmir was prepared under the consultancy of the French planners Henri Prost and Rene and Raymond Danger, and approved by Izmir Municipality in 1925 and revised in 1933. However, Alsancak, which had been destroyed by war and fire, had been the only area where the plan was implemented. Because of financial problems, investment decisions could not be realized[394].

The second plan developed for Izmir was the Le Corbusier Plan (1949), which was based on a modernist design approach. The plan proposed a comprehensive land use scheme with commercial, business and residential zones, renewing the whole city and separating motor and pedestrian traffic. Although the plan did not come into force, it had been influential in the decisions of the master plans developed later.

In 1953, through a competition initiated by the Bank for Municipal Services, Aru, Ozdes and Canpolat Plan was approved. This plan proposed dividing the city into functional zones, similar to the approach of Le Corbusier, and identifying urban development areas, and at the same time conserving the historic commercial center, known as Kemeralti, in Konak. The plan had been revised due to demands of both the public and the public authorities. Passing through several revisions,

[394] According to Bilsel, principles of Ecole de Beaux Arts with radial roads, boulevards, and public squares at their intersection points has been applied in the development of this plan. Bilsel 2009: 12-17; Yuksel 2006: 149-151

this plan has been in force for 36 years until the 1989 plan was adopted[395]. During the 1950's and 1960's, Izmir started to face with urbanization and the gecekondu (squatter) phenomenon[396]. In 1973, the first Metropolitan Master Plan of Izmir started to be prepared by the newly established Master Plan Office[397] of Izmir through a participatory process. However, the plan (e.g. certain analytical works and the cadastral maps) could not be completed, and the previous plan continued to be used[398]. Meanwhile, the squatters had increased in the city due to urban sprawl, and mass housing projects began to be built.

In 1985, Izmir Metropolitan Municipality commenced the process of preparing a new Master Plan for Izmir, since municipalities were given the responsibility of preparing 1/5.000 master plan and 1/1.000 implementation plan through the Development Law of 1985. The new plan, approved in 1989, was criticized for its concentration on emerging developments, rather than designing the whole city[399]. 1989 Plan was implemented for eighteen years until 1/25.000 scale Urban-Region Development Plan (IKNIP) was approved in 2007[400], and revised in 2009[401]. 1/100.000 scale Izmir-Manisa-Kutahya Environmental plan was prepared and approved by the Ministry of Environment and Forest in 2009. In 2000's, the Metropolitan Municipality also initiated conservation projects around historic city center in Konak, after the establishment of a conservation unit within the

[395] Bilsel 2009
[396] Due to the need for revising the current plan, Albert Bodmer was invited to Izmir. He proposed a comprehensive plan that addresses the city, its surroundings as well as social issues regarding squatter areas. However, the municipality decided to revise the previous plan rather than following the comprehensive planning approach proposed by Bodmer. Can 2010
[397] Master Plan Office of Izmir (or the Izmir Metropolitan Planning Bureaux) was closed in 1984. Can 2010
[398] Arkon and Gulerman 1995: 14-20
[399] Can 2010: 181-189
[400] In 2000's, there had been substantial changes in the planning system of Turkey. In 2004, the 5216 Metropolitan Municipality Law enforce the metropolitan municipalities to prepare master and implementation plans. In 2005, Provincial Administrations and Metropolitan Municipalities were given the authority to prepare environmental plans for the provinces. In addition, in 2006, through the Environment Law (2006), the Environment and Forest Ministry was commissioned for the 1/50.000 and 1/100.000 scale regional environmental plans. Aysel and Goksu 2008: 36-39; Can, 2010: 181-189
[401] 1/25.000 scale Urban-Region Development Revision Plan Report (IKNIPR). Izmir Metropolitan Municipality 2009

Municipality. One of these is the Agora Project, aiming at excavation of the Agora Archaeological Site and expropriation of its surrounding[402].

4.2. ARTS – Izmir Metropolitan Area

Following the methodology proposed in Chapter 3, a comprehensive system for **Assessment of Risks at Territorial Scale (ARTS)** is developed for archaeological heritage in Izmir Metropolitan Area through this dissertation research, utilizing GIS. As risk assessment has to be a continuous process due to the changing dynamics affecting risks, the risk assessment system is designed in a way that it can be updated through **continuous monitoring of risks (using the established indicators)**. Setting up a system at territorial level allows the creation, arrangement, and revision of all the information about multiple hazards and vulnerabilities of heritage within a single system feeding all the levels of archaeological heritage management decision-making process. This enables the production and interpretation of information on risk, which are changeable due to dynamic processes of physical and social territories, at various stages of decision-making processes. Due to the flexibility of the GIS, **new parameters of analysis can be added**, and the databank can easily be updated once the database is constructed.

Within the process of ARTS Project, first, an extensive research on archaeological heritage and all types of natural and human-induced hazards that are likely to damage the heritage values are investigated. The data collection involves compilation of data from various institutions as well as from literature and historical records[403]. Main sources of information include archaeological heritage inventory, 1/25.000 scale Izmir Urban-Region Development Revision Plan (2009) (as base-map, and for identifying hazards, and locations of

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[402] Altinors and Yorur 2007

[403] See Chapter 1, 1.3. Research Methodology.

archaeological sites), hazard maps (landslide/rockfall), census and archival information, and literature.

4.2.1. Hazard Identification

As the first step of assessment process, hazards threatening archaeological sites in the study area have been identified by looking at what has happened in the past, and what is likely to take place in the future. Next, based on available data, areas subject to these threats have been identified. Various 'natural factors' as well as human-induced factors that relate to both 'development' and 'activities of individuals and groups' have been classified.

4.2.1.1. Natural Factors

Natural hazards threatening archaeological sites in Izmir Metropolitan Area are 'sudden geological and weather events' including earthquake, landslide/rockfall, and flooding, and coastal processes such as coastal erosion/deposition and sea-level rise due to climate change. In the matter of hazards related to local conditions, such as water table, relative humidity, wind, micro-organisms, and temperature, many sites are affected by natural processes of decay to some degree. As both the characteristics of the site and the type of attributes determine the impacts of these factors on the heritage property, a site-level analysis is essential for a comparative and substantial assessment. Hence, natural hazard of local conditions is not within the scope of the assessment.

4.2.1.1.1. Sudden Geological or Weather Events

Izmir has been greatly affected by some natural disasters, especially earthquakes and fires, many times in its history (See Figure 4.6). In the last decades, continuous expansion of urban land use in and around Izmir at the expense agricultural land uses and natural areas as demand for housing, industrial development and infrastructure growth have not only affected natural agricultural and ecological characteristics (e.g. climate, water and air), but also degraded soil properties. Various factors including topography with slopes surrounding the city, soil geology unsuitable to settle down in the build-up area as well as widespread illegal urban districts developed due to population growth and uncontrolled urbanization increase natural hazard risks to the city. According to Kutluca and Ozdemir, these pressures diminish soil structures, slope stability and sliding properties, and resistances of the soil, and cause lowering of the soil classes and decrease withstanding capacity of the soil against environmental pressures[404]. Therefore, natural hazards including earthquake, landslide, rock fall and flood have increasing impacts on Izmir.

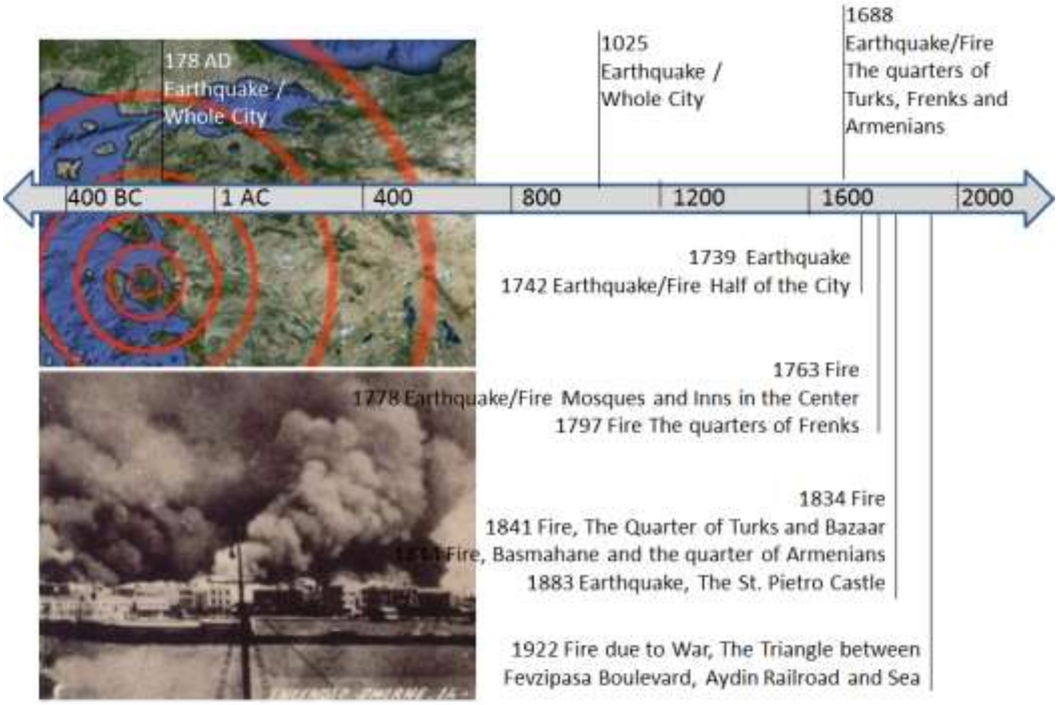

Figure 4.6. Timeline showing major earthquakes and fires that affected Izmir (YILDIRIM ESEN, 2014)

[404] Kutluca and Ozdemir 2008: 991-996

Throughout its history, Izmir has been affected by earthquakes of magnitude 6.0 and greater[405]. This is supported by historical and archaeological evidences. The first known earthquake that affected this area occurred in A.D. 17. According to Tacitus, who was a Roman historian, this earthquake had caused severe damages to a large area extending from Sardes (Salihli, Manisa) to the Aiol settlements on Northern Smyrna[406]. Another big earthquake that Smyrna had faced in its history happened in 178, and resulted in the destruction of the almost entire city, while the remaining had been crumbled because of post-earthquake fires. This information comes from the letters written by Sofist Aelius Aristeides from Smyrna to the emperor Marcus Aelius and his son Commodus. Ground floor of West Portico and Basilica of Agora reveal traces of repairs and reconstructions that had been carried out after this earthquake[407].

Figure 4.7. A base of a statue with a poem praising Judge Damokhares for his success in rebuilding Smyrna after an earthquake (Source: *Agora Excavation Archives*)

In addition to archaeological traces, there are epigraphic findings mentioning earthquakes. For instance, the inscription on the statue of the Judge Damokharis,

[405] Bogazici University, Kandilli Observatory And Earthquake Research Institute, National Earthquake Monitoring Centre 2013
[406] Ersoy, 2012
[407] Ersoy, 2012

dated to circa A.D. 550, indicates the success of the Judge in rebuilding the city after an earthquake (See Figure 4.7). This is also considered as an evidence of another earthquake in Smyrna which might had happened in the first half of the 6th century. Repairs on the basement floor of the Basilica of the Agora of Smyrna is considered to be made after this earthquake[408].

According to data provided by the Kandilli Observatory and Earthquake Research Institute, until the 19th Century, historical earthquakes occurred in and around Izmir in years 110, 177, 688, 1389, 1688, 1739, 1873, 1880 and 1889. (See Table 4.2). According to Soysal, earthquakes occurred in 1389, 1667, 1668, 1852, 1856, and 1866 were followed by tsunamis in Izmir Bay and its surrounding[409].

Table 4.2. Historical Earthquakes in Izmir (*Data from Kandilli Observatory and Earthquake Research Institute*)

Date	**Magnitude**	**Place**
110	IX	Izmir, Ephesus
177	X	Izmir, Sakiz, Sisam
688	IX	Izmir
20.03.1389	IX	Izmir ve Khios Island (with Tsunami)
10.07.1688	X	Izmir (15000 deaths, with Tsunami)
04.04.1739	IX	Izmir
01.02.1873	IX	Sisam Island, Izmir, Aydin
29.07.1880	IX	Menemen, Emiralem, Izmir (many deaths)
25.10.1889	IX	Midilli, Sakiz, Izmir

Izmir is on the first-degree hazard zone in the official Earthquake Hazard Rationalization Map of Turkey. As stated by Kutluca and Ozdemir, Izmir is located on the seismically active parts of the Aegean Plate, which "shows a very complex, active, moving and rapidly changing tectonic pattern due to the relative

[408] Ersoy 2012
[409] Soysal 1979 In Sezer 2004: 52

motions of surrounding tectonic plates” [410]. In the last century eight severe earthquakes occurred in Izmir and its surroundings, while especially three of them including 1928 Torbali, 1949 Karaburun and 1992 Seferihisar earthquakes, which mostly affected the southern part of Izmir, were damaging (See Table 4.3 and Figure 4.8).

Table 4.3. Major earthquakes that occurred in Izmir in the last century (*Data from: Kandilli Observatory and Earthquake Research Institute*)

TARİH	YER	ŞİDDET	MAG Ms
31.03.1928	Torbalı (İZMİR)	IX	6,5
22.09.1939	Dikili (İZMİR)	IX	6,6
23.07.1949	Karaburun (İZMİR)	IX	6,6
06.04.1969	Karaburun (İZMİR)	VIII	5,9
06.11.1992	Doğanbey (İZMİR)	VII	6
17.10.2005	Sığacık Körfezi (İZMİR)	VI	5,7
17.10.2005	Sığacık Körfezi (İZMİR)	VII	5,9
21.10.2005	Sığacık Körfezi (İZMİR)	VII	5,9

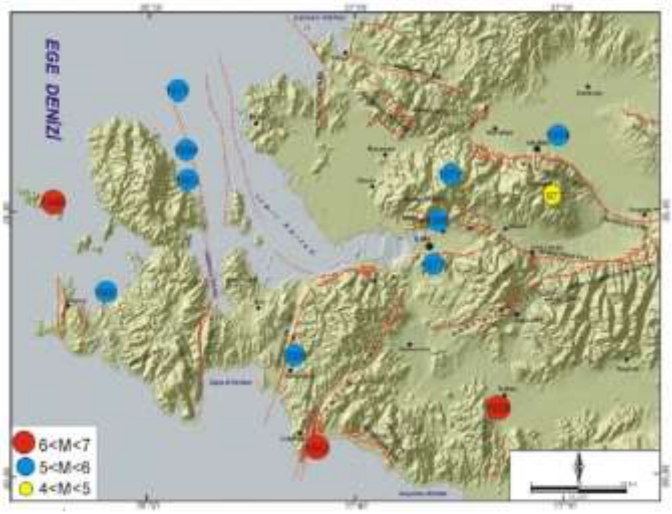

Figure 4.8. Fault lines and earthquakes (M>5) occurred in the last century in Izmir and its surrounding Fault Lines of Izmir (*Source: O. Emre et.all., 2005*[411])

[410] Kutluca and Ozdemir 2008: 991-996
[411] Emre, Özalp , Doğan and et. All. 2005

Besides, some areas of Izmir are susceptible to landslide hazard. A scientific study, which was carried out by Kıncal, Akgun, and Koca aiming at assessing the landslide susceptibility of Izmir through a logistic regression method, provides a database of landslide characteristics of the Izmir city center and its near vicinity. Based on a predicted map of probability, five categories of landslide susceptibility were identified for Izmir as: very low, low, moderate, high and very high (See Figure 4.9). According to these results, 11.69% of the total area of Izmir city center has very high susceptibility[412].

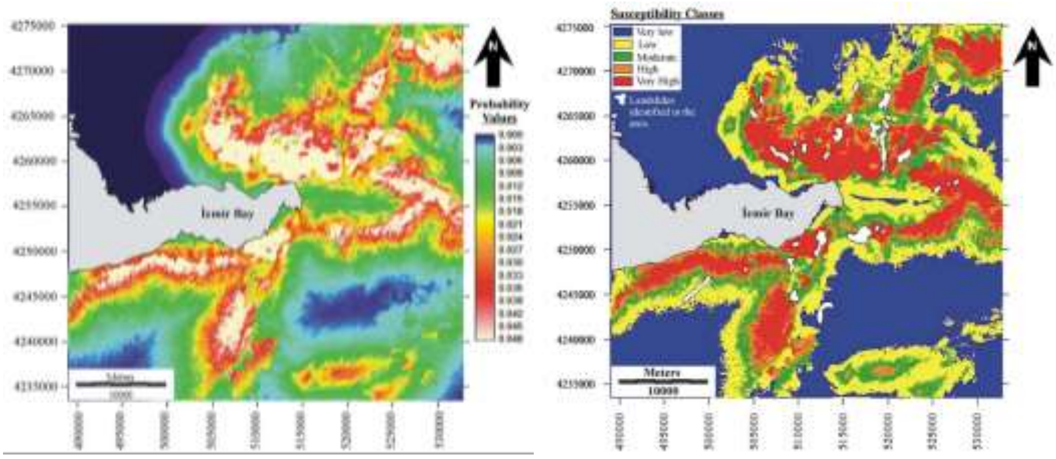

Figure 4.9. A) Landslide probability map obtained by logistic regression analysis B) Landslide susceptibility map of Izmir (*Source: C. Kıncal, A. Akgun, and M. Y. Koca, 2009: 753, 754*)[413]

As mentioned by Kutluca and Ozdemir, landslides mostly occur at two regions, one of which is in the northern part of Izmir Gulf covering the bed of Kocacay stream, Karagol and Yamanlar Village and their surroundings, and while the other one is the Cretaceous detritics in the South of Izmir Gulf. As indicated by

[412] Kıncal, Akgun and Koca 2009:745-756
[413] Kıncal, Akgun and Koca 2009:745-756

the authors, areas that have been subject to landslides in the past are located in Cigli, Konak, Altindag, and Narlidere[414].Landslide danger area in Konak, which is the historic center of Izmir, is nearby a dense archaeological setting (See Figure 4.10).

Figure 4.10. Konak - Kadifekale Landslide Danger Area and Registered 1st Degree Archaeological Sites (Redrawn by the author from Izmir Metropolitan Municipality, 2012)

In addition to landslides, rockfall events occur in Izmir. In the past, Cigli, Karsiyaka, Bayrakli, Buca, and Konak have been subject to rockfalls. However,

[414] Kutluca and Ozdemir 2008: 991-996

statistical data on these events are limited and mostly depends on the reporting of individuals. According to in-depth interviews carried out in Izmir Provincial Directorship of Disaster and Emergency Management, in most cases, unless there is an impact on lives or properties, these events are not reported[415]. Moreover, the impacts of these events on cultural properties including archaeological heritage are not investigated by the public institutions due to lack of monitoring and risk management approach for cultural heritage.

Moreover, flooding is a significant issue for Izmir. Intense rainstorm have led to flash floods many times in the past, with an increasing magnitude in recent years, in the Aegean and Mediterranean coasts including Izmir. For instance, in November 1995, rainstorms lasted for three days, led to devastating flash floods, which severely damaged settlements along the Aegean coast, including Izmir with loss of 67 people and residential and commercial property damage of more than 50 million dollars. According to K. Kutluca and S. Ozdemir (2008), main factors determining the impacts of flooding events are topography, geomorphology, land-use and urbanization. Particularly, the construction of new settlements in Karsiyaka and Yamanlar -because of population increase and urbanization - increased the vulnerability of soil to the storm runoff[416].

4.2.1.1.2. Coastal Processes

Izmir's coastal area is important for Izmir's socio-economic development. 101 km of 630 km long coastline is sandy beaches. In addition to coastline, many islands with are all registered as natural protected areas are not opened for settlements[417]. Karaburun and Foca districts are also internationally important

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[415] In-depth interview in Izmir Provincial Directorship of Disaster and Emergency Management (AFAD), in April 2013.

[416] Kutlucu and Ozdemir explains the magnitude of the disaster as follows: "In this disaster, 322 buildings were destroyed completely, nearly 10.000 houses suffered major damage as a result of the flooding in the city. Damage from the flood was greatest in the Karsiyaka district, which is the major commercial and residential centre of the city". Kutluca and Ozdemir 2008: 991-996

[417] Izmir Development Agency 2009: 112

coastal protected areas where should be handled with an integrated coastal management approach[418].

In addition, coastal processes of erosion, coastal depositions and sea level rise effect coastal heritage in Izmir Metropolitan Area. Exposure to sea-waves, which can be more destructive with strong winds and storms, results in *erosion* of structures located at shoreline. Coastal deposition affects coastal archaeological heritage, especially those located in the mouth of river basins through being submerged with the sediments brought by the river and collected by the sea-waves. As a result of coastal depositions, which have occurred throughout centuries, coastal archaeological remains have been buried with the sediments. Besides, ***sea level rise***, a long-term natural process that has been going on for centuries like other coastal processes, changes shoreline level and eventually erases coastal structures and settlements off map. Aegean coast has adversely been influenced by the long-term effect of sea-level rise throughout history, and have had impacts on archaeological settlements (See Figure 4.11).

[418] Izmir Development Agency 2009: 112

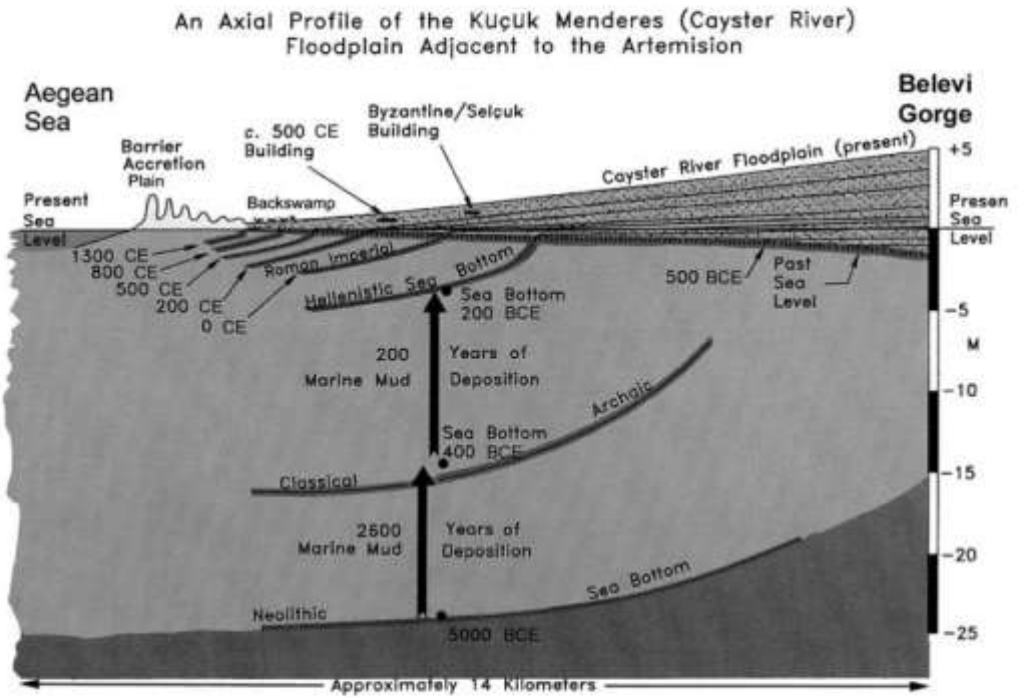

Figure 4.11. Profile of the Kucuk Menderes floodplain and the Neolithic embayment (*Source: John C. Kraft, George Rapp, Helmut Brükner, et al.,2011*)

Impact of coastline changes were noted by early authors such as Pausanias (second century CE), and Strabo (64 or 63 BCE–24 CE). For instance, as evidenced by geomorphological and subsurface geological data, archaeological excavation and ancient texts, Ephesus was effected by natural processes of estuarine infilling by sediments from the Kucuk Menderes River (ancient Cayster River). Strabo indicates harbor engineering efforts such as the construction of a mole to prevent siltation to preserve the harbours of Ephesus. John C. Kraft, George Rapp, Helmut Brükner, et al. indicates that it was a challenge for inhabitants in ancient Ephesus to keep vital harbours in operation because of these processes, as revealed by extensive palaeogeographical studies, based on sediment coring, geomorphology, archaeology and history (See Figure 4.12)[419].

[419] Kraft, Rapp and Brükner, et al., 2011: 27-36

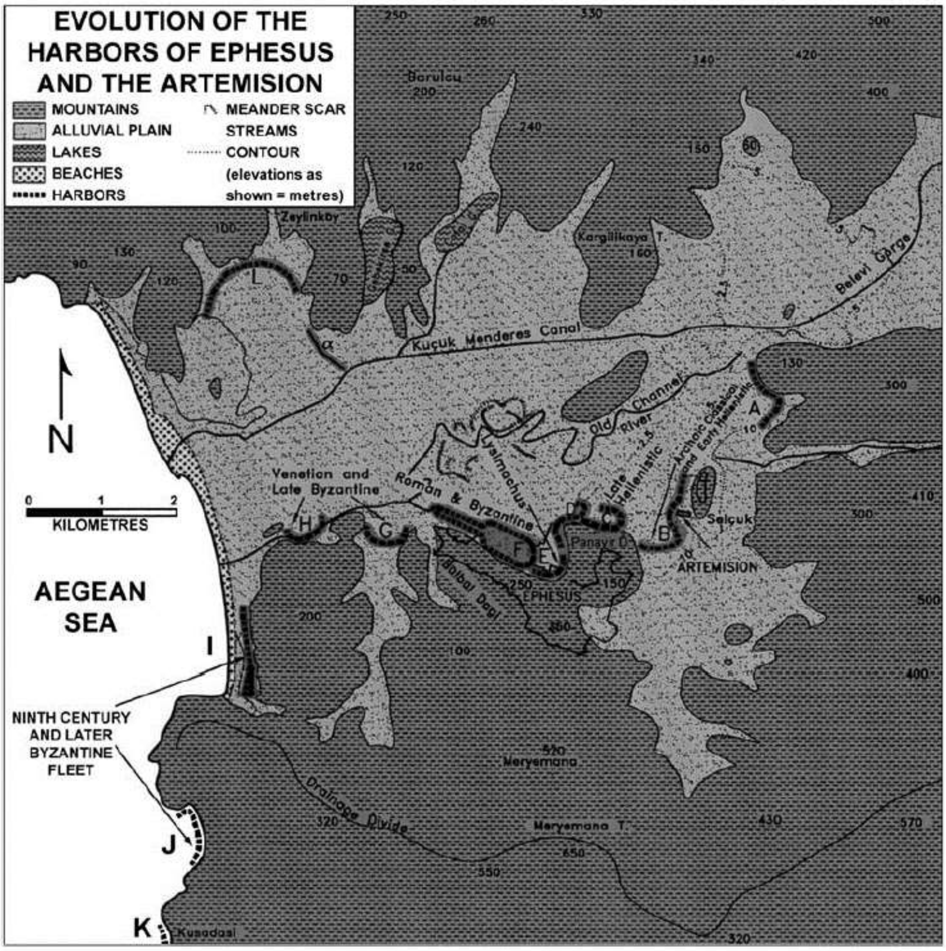

Figure 4.12. Evolution of the harbours of Ephesus and the Artemision over two millennia (*Source: John C. Kraft, George Rapp, Helmut Brükner, et al.,2011*)

Over the past seven millennia humans occupying the southern flank of the ancestral Gulf of Ephesus had to persistently adapt and change their patterns of occupancy due to ever-changing coastal configurations created by the alluvial sedimentary processes. [420]. Impacts of coastal processes on the ancient city of Ephesus is explained by J. C. Kraft, G. Rapp, H. Brükner, et al. as follows[421]

> From the time of construction of the first Artemision, c. 1000 BCE, buildings, roads and harbor facilities were affected by the dynamic

[420] For more information see: Kraft, Rapp and Brükner, et al., 2011: 27-36
[421] Kraft, Rapp and Brükner, et al. 2011: 27-36

> nature of the coastal environment. However, by the time of the Hellenistic construction of the greater city of Ephesus by Lysimachus the human actions came into direct conflict with the natural processes of progradation and aggradation of the Cayster River floodplain and delta. … The excavations by the Austrian Archaeological Institute indicate that two roads running from the Artemision to the lower city by the great harbour were buried by up to 5 m of a composite of colluvium, alluvium and structural debris. The area of the Artemision ruins was buried under up to 6 m of colluvium from Aya Suluk and alluvium of the Marnas and Selinus Rivers as well as the Cayster River delta floodplain. In these areas natural processes of deposition dominated … Currently, the nearest harbour to the city of Selcuk Ephesus is the resort harbour of Kusadasi far to the SW along the rocky coast of the Aegean Sea.

In addition, effects of coastal processes can be observed on the coastal structures of Teos Archaeological Site on the Aegean coast (See Figure 4.13). Particularly sea level rise is an increasing concern for coastal archaeological heritage like Teos due to climate change. As explained in Section 2.2, the Report, titled Turkey's Fifth National Communication under the UNFCCC" in 2013[422] reveals that the impacts of climate change on Turkey are expected to include sea level rise, combined with *changes in temperature*, *precipitation* as well as increase in climatic hazards including *flooding* due to heavy rainfalls, and others[423].

[422] Ministry of Environment and Urbanisation 2013

[423] The regional climate change simulation was developed based on the IPCC A2 scenario. For more information: Ministry of Environment and Urbanisation 2013: 161

Figure 4.13. Effects of coastal processes on Teos Archeological Site (*Source: Personal Archive, 2012*)

Eventually, due to changes in surface temperature and additional mass, the level of the whole Mediterranean Sea may rise by between 3cm and 61cm on average as a result of the effects of global warming[424]. In line with these evaluations, according to the Center for Remote Sensing of Ice Sheets (CReSIS), Izmir coastline will increasingly be affected by the sea level rise in the future (See Figure 4.14)[425]. Within the light of these evaluations, based on data provided in hazard maps and Izmir Urban Region Master Plan, natural hazards threatening archaeological heritage located in Izmir Metropolitan Area are identified and the "Map of Natural Hazards affecting Archaeological Heritage" is prepared (Table 4.4, Figure 4.15).

424 Marcos and Tsimplis 2008
425 CReSIS 2013

Figure 4.14. Map of Izmir coastline showing areas that will be affected by the sea level rise due to climate change[426]

Table 4.4. Kinds of Spatial Data Used for Hazard Identification

Natural Hazards	**Spatial Data**	**Geometry**
Earthquake	Fault Lines	Line
Landslide/Rockfall	Landslide/Rock Fall Areas	Polygon
Flooding	Flood Risk Areas	Polygon
Coastal Processes	Coastline	Line

[426] The image was prepared by the author, using the GIS layer provided by the Center for Remote Sensing of Ice Sheets (CReSIS). For more information: CReSIS, 2013

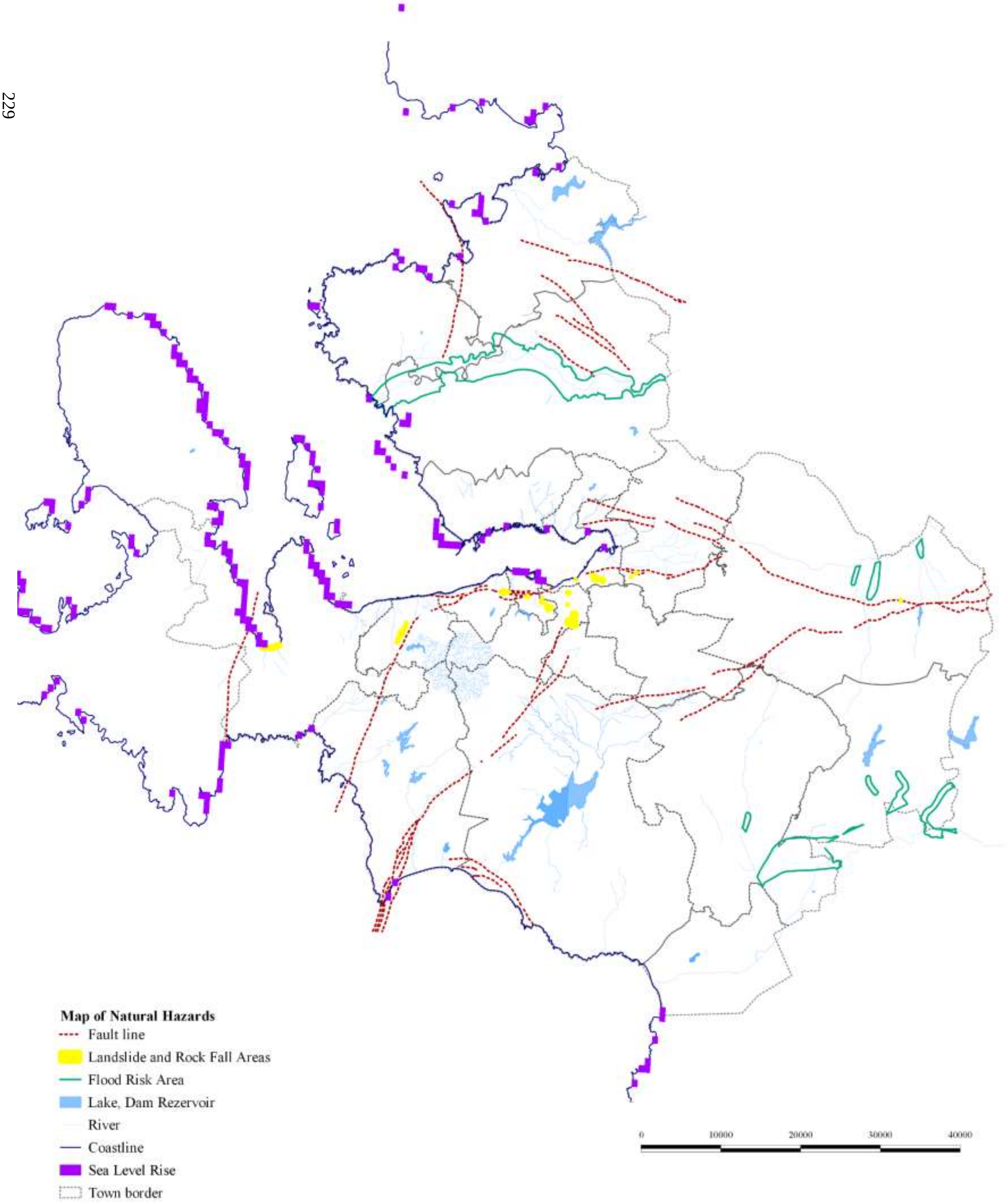

Figure 4.15. Map of Natural Hazards affecting the archeological heritage

4.2.1.2. Institutional Hazards - Development

Archaeological heritage is facing institutional hazards that include both incorrect conservation/use decisions/interventions of responsible public institutions and professionals, and development activities like new building construction and infrastructure development. As the first one can be more general problem that relates to policies, or site specific due to limited capacities in conservation and site management, it is assessed trough this territorial scale assessment in the case of Izmir Metropolitan Area. However, development is examined in detail as one of the major threats to archaeological assets.

The conception and expansion of transportation, industrial and utility infrastructure, urban development, and industrial plants are typically major factors for the advancement of economic development. However, rapid population growth that goes together with uncontrolled development create problems for metropolitan cities such as irreversible land transformations that increase impacts of natural hazards and lead to loss of natural and cultural assets. Particularly, when conservation is not integrated into development planning, development becomes one of the major threats to archaeological assets.

Izmir is one of those cities that face challenges of rapid urban development processes. Development threat to archaeological heritage in Izmir Metropolitan Area is examined under three main headings: ‘new building construction’, ‘transportation infrastructure’, ‘utility infrastructure development’. Mining and quarrying activities, which are concentrated in Bergama district of Izmir, is not included in the assessment, as Bergama is not within Izmir Metropolitan Area[427].

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[427] For instance, Çiftliktepe Mound in Bergama has been damaged due to mining. Archaeological Settlements of Turkey 2001

Another issue for conservation of archaeological assets is pollution, and particularly air pollution in urban settlement areas[428]. Rapid urbanization and industrialization cause pollution in many ways. For instance, air pollution, solid waste[429] are among the threats in Izmir. The major source of air pollution is fuel consumption in transportation, industrial plants and domestic heating. Sulphur dioxide from industrial plants, particulate matters from domestic heating, nitrogen oxides, volatile organic compounds, and carbon monoxide from traffic are the major polluting particulates in Izmir[430]. Wrong placements of industrial facilities such as cement factories, stone quarries and processing facilities, and steel factory are the main sources of air pollution. Especially Aliaga district hosts many plants with high pollution characteristics, which not only cause pollution in Aliaga but also in central Izmir as well. There exist six air quality stations in Izmir province, yet there is not any station in Aliaga, Torbali, and Kemalpasa[431]. In order to assess risks of air pollution for archaeological heritage, there is need for extensive research on air quality of different districts as well as on the material characteristics of archaeological assets, and impacts of air pollution through site scale studies.

Through this assessment, in order to ascertain development hazards, development areas are identified based on the Izmir Urban Region Master Plan (2009), which indicates areas of various development activities that have potential to damage archaeological heritage.

4.2.1.2.1. New Building Construction

Parallel to rapid population increase; demand for new construction, particularly for *housing*, has accelerated, especially after 1980s, in urban settlement areas of

[428] In-depth interview at the Excavation Directorship of Agora in April 2013.
[429] The amount of hazardous waste is above the capacity of the current disposal facilities, therefore illegal dumping increases in the region. Izmir Development Agency 2009: 111
[430] Izmir Development Agency 2009: 108
[431] The air quality levels have been improved after transition to natural gas both in industry and in domestic heating. Izmir Development Agency 2009: 109

Izmir (See Table 4.5)[432]. In 2010, in Izmir, construction permits were given to 6575 buildings, which include 5902 residential and 673 nonresidential buildings, which include 57 hotel and similar tourism buildings, 64 office buildings, 108 wholesale and retail trade buildings, 5 traffic and communication buildings, 164 industrial buildings and warehouses, 46 public entertainment, education, hospital, or institutional buildings, and 229 other nonresidential buildings[433]. Besides, in the same year, in Izmir (TR31) occupancy permits were given to 6499 buildings, including 5569 residential and 930 nonresidential[434]. Since 1950's, Izmir has faced with urbanization and the gecekondu (squatter) phenomenon[435]. Besides, especially after 1980's, coastal areas have been subjected to constructions of tourism facilities and mostly of secondary housing, as in the case of Seferihisar[436]. In addition to housing, *commercial and industrial developments*, which are key sectors of the economic structure, have taken place in districts near Centrum perimeter[437]. Particularly, industry sector, which include manufacturing industry, energy sector and renewable energy, and mining, has developed in

[432] Turkish Statistical Institute 2000
[433] Turkish Statistical Institute 2010a
[434] Turkish Statistical Institute 2010b
[435] Can 2010
[436] Kocman 2004: 43; Mutluer 2004: 71; Karadag 2004: 85
[437] According to the Izmir Development Agency, Izmir is the industry and services center for Aegean Region. While the other neighboring territories, which constitutes Izmir's hinterland, concentrate generally on industry and agriculture sectors, Izmir maintains concentration in industry and service sectors. Manufacturing industry is concentrated in Bornova, Cigli, Gaziemir, Menderes, Menemen, Kemalpasa, Torbali and Tire. Food, beverages and tobacco industry are developing sectors in Konak, Karsiyaka, Bornova, Kemalpasa, and Torbali, while Odemis is taking the lead and Buca is fading in this sector. Regarding textile, clothing and leather industry, Konak, Cigli, Bornova and Buca are significant districts with number of units and employment. Forest products and furniture industry emerges as a developing star sector in Gaziemir district. Furniture manufacturing is concentrated in Gaziemir and Karabaglar districts. Paper, paper products and printing industry, is located in Gaziemir, Kemalpasa, Menderes and Bornova. Chemicals, petrol, coal, rubber and plastic products industry is particularly concentrated in Aliaga. Cigli, and Kemalpasa, while stone and earth related industry is developed in Kemalpasa, Menemen and Torbali. Besides, Aliaga district have a basic metal industry. Metal equipment, machinery and apparatus, transportation vehicles, scientific and professional measurement tools industry (manufacture of fabricated metal products) are developed in Menderes. For more information: Izmir Development Agency 2009: 73

Konak, Karsiyaka, Bornova, Kemalpasa and Torbali[438].

Table 4.5. New building construction in Izmir by building use[439] (Data from: TUIK)

Year of Construction	Number of Buildings	Building Use					
		Mostly Residential	Mostly out of Residential	Commercial	Industrial	Education	Culture
-1929	21983	16513	1107	2896	155	69	29
1930-1939	10664	8799	519	801	75	22	3
1940-1949	15969	12756	845	1343	122	46	5
1950-1959	29604	24222	1569	2075	189	97	2
1960-1969	54355	43513	3375	3479	1574	173	9
1970-1979	98267	79089	9607	4294	1764	218	12
1980-1989	137020	105999	15858	6541	4325	332	9
1990-2000	149974	118175	16630	7092	3942	356	17
Unknown	4407	2853	541	396	134	25	2
Total	**522243**	**411919**	**50051**	**28917**	**12280**	**1338**	**88**

However, developments on and around urban archaeological sites have had impacts on archeological assets, like those located at the historic city center in Kadifekale and Bayrakli, both of which are densely built-up areas, where new constructions have led to loss of archaeological remains (See Figures 4.16, 4.17)[440].

[438] Bornova, Cigli, Gaziemir, Menderes, Menemen, Kemalpasa, Torbali and Tire are the centers of manufacturing industry. Izmir Development Agency 2009:73

[439] TUIK 2000

[440] In-depth interview at the Excavation Directorship of Agora in April 2013.

Figure 4.16. Densely built-up area around Agora Archaeological Site, Kadifekale, İzmir (*Source: Personal Archive, 2012*)

Figure 4.17. Dense built-up areas around Bayrakli Mound in Bayrakli (*Source: Personal Archive, 2012*)

In peripheral districts, among sites that have been destructed through new constructions are Çandarli Cemetery in Candarli, Ulucak Höyük, which is a mound and a cemetery, in Kemalpasa, Altin Tepe Mound in Menderes, Kabacakiri Cemetery and Tepekoy Mound in Torbali, and Limantepe Mound in Urla[441]. Another example is Klazomenai in Urla, where archaeological environments are severely threatened by new housing constructions (See Figure

[441] Archaeological Settlements of Turkey Project 2001

4.18)[442]. Besides, in some areas, coastal heritage has been damaged due to secondary housing constructions, as in the example of those built on the Necropole[443] of Teos Archaeological Site (See Figure 4.19)[444].

Figure 4.18. Housing on archaeological sites around Klazomenai Archeological Site Museum (*Source: Personal Archive, 2012*)

[442] In-depth interview at the Excavation Directorship of Klazomenai, in April 2013.
[443] The area, where the secondary housing was built, was shown within the boundaries of the necropolis of the archaic and classical periods on the map. See: Tuna 2004: 40
[444] In-depth interview at the Excavation Directorship of Teos in April 2013.

Figure 4.19. Secondary Housing built on the Necropole of Teos Archaeological Site (*Source: Personal Archive, 2012*)

In Izmir, city center and surrounding districts will further develop in industry and services sector, while outer districts will mostly host agricultural production and processing industry. Key economic activities of Izmir region will be agricultural production and processing industry, high technology industries and business support sectors, according to a report on Strategic and Rising Sectors of Izmir, dated 2007. In addition, food and beverage manufacture, clothing and textile are rising manufacturing industries in Izmir[445].

Besides, *tourism sector* is growing in Izmir, where popular attraction is mainly sun-sand-sea tourism, in addition to cultural, conference and thermal tourism[446]. Specifically, Cesme, Selcuk, Foca, and Karaburun districts are the most important tourism hubs in Izmir, while Selcuk and Menderes are the main destinations of foreign tourists due to the cultural heritage assets in these towns[447]. Investments of both private and public entities will carry on, since supporting tourism investment is one of the strategies of the government and local administrations in order to transform tourism potential of the region into a development and prosperity source. Particularly, Peninsula region, Izmir Centrum, Northern Izmir districts, and Southern Izmir districts are targeted for tourism development[448].

1/25.000 scale Izmir Urban-Region Development Revision Plan (2009) indicates new development areas including urban settlement areas (housing), commercial/administrative, industrial areas as well as area for recreation, and large urban facilities. Within this framework, building constructions that may cause threats to archaeological heritage in Izmir are examined. Map of hazard due to new building constructions (See Figure 4.20) is prepared based on the decisions of the Development Plan.

Among urban development areas, the category of housing include urban and rural residential areas as well as new development areas. In addition, commercial and administrative development areas consist of central business district, second and third degree business centers and public institution areas. Industrial areas of Izmir

[445] Izmir Development Agency 2009: 99; Izmir Development Agency 2010
[446] Izmir Development Agency 2010: 85-95
[447] Izmir Development Agency 2009: 96, 98
[448] Turkey's main goal in tourism is to be in the top five countries worldwide by 2023. Izmir Development Agency 2009: 85 For Izmir, developing tourism infrastructure of the town of Selcuk is proposed by the Izmir Development Agency as one of the strategies for tourism development. Izmir Development Agency 2009: 93-95; IDA, Izmir Development Agency 2010

are categorized in the development plan as organized industry zone, free trade zone and development areas, industrial areas separated based on environmental and health conditions, urban working area out of housing, small-scale industry (separated based on environmental and health conditions) and agricultural commerce. These areas are shown in the map as ‘industrial development’. In addition, there are tourism development areas that are allocated for tourism centers, tourism facilities development, accommodation, secondary housing, daily tourism facilities, golf areas and facilities, thermal tourism facilities, accommodation and camping. Another landuse type is greenery and recreation including urban green areas, large recreational areas, fairs and festival areas and large physical activity areas. Finally, large-scale urban facilities including university campus areas, education areas, health facilities and military zones are among development decisions of Izmir urban-region development planning.

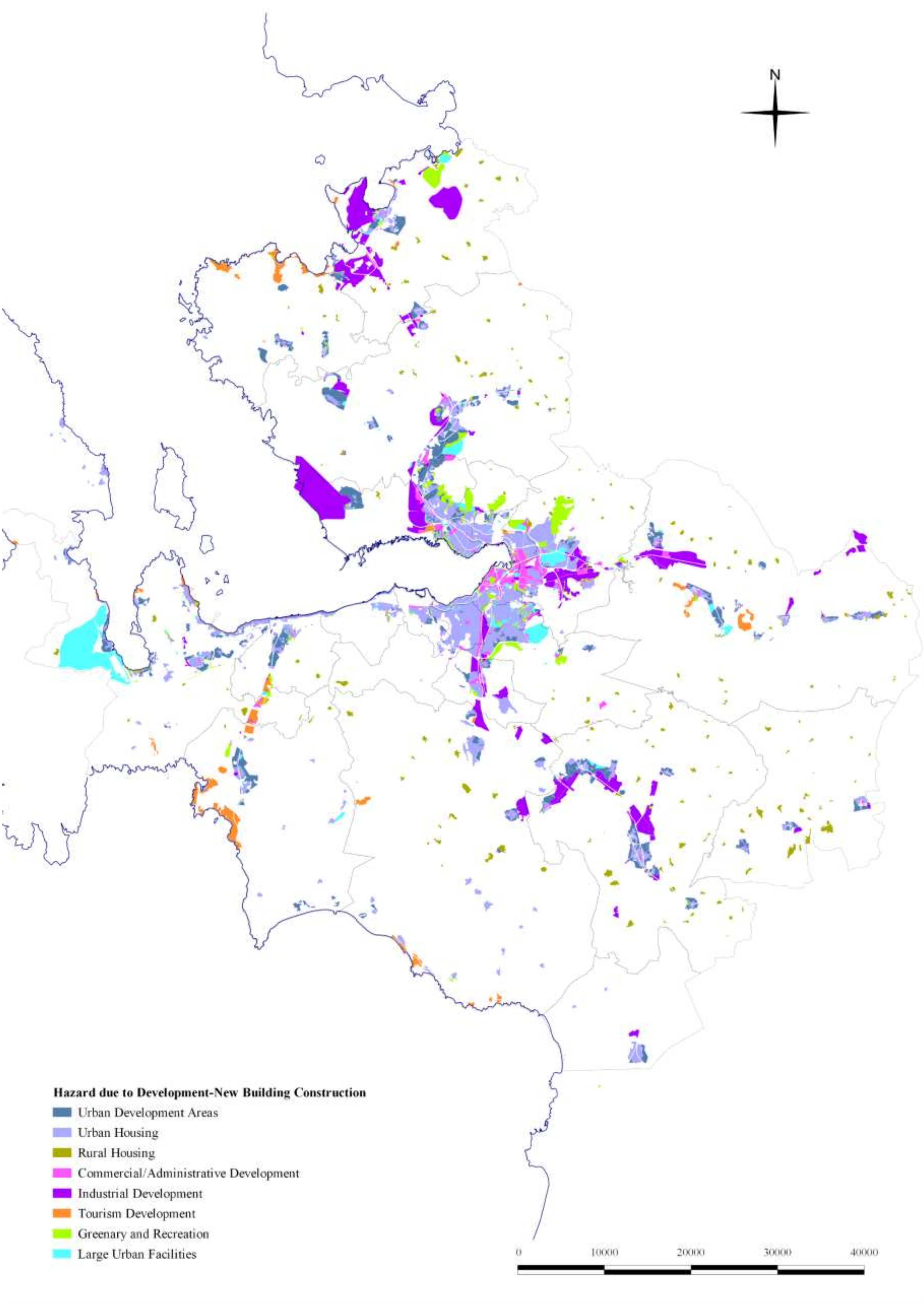

Figure 4.20. Map of Development Hazard - New Building Constructions

4.2.1.2.2. Transportation Infrastructure

In addition to new building construction, development of transportation infrastructure including ground transportation infrastructure (e.g. roads, railways), and underground transport infrastructure (subway constructions) have been the part of development programs in Izmir. In the 1990's, transportation investment plans have focused on construction of highways that led to decrease in the utilization of urban maritime, urban railway systems. Currently, road networks connect 532 villages, and 445 neighborhoods[449]. Besides, Izmir is connected to neighboring provinces with expressway, and state highway networks[450]. Yet, since 2000, the municipality has prioritized to diversify urban modes of transportation and has increased the maritime and urban railway lines in Izmir[451].

However, in the past, one of the threats to archaeological assets in Izmir has been transportation infrastructure development. For instance, Helvacıköy Mound in Menemen and Lembertepe Mound, a Chalcolithic Age mound in Develi Village, Konak, have been damaged due to highway construction (See Figure 4.21)[452]. Similarly, Helvaci Hoyuk in Aliaga, Bornova Mound in Bornova, Arslanlar Mound in Torbali, and Limantepe Mound in Urla have been damaged due to transportation infrastructure (See Figure 4.22).

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[449] 74 % of 5887 km of total highway is asphalt, 9%, 8%, and 9% are stabilized, levelled, and untreated road respectively. Izmir Development Agency 2010

[450] Expansion and improvement works continue in Izmir-Ayvalik-Canakkale axis, Menemen-Manisa-Turgutlu axis, Izmir-Istanbul axis, Turgutlu-Usak-Ankara axis, Bergama-Salihli-Denizli axis, and Seferihisar-Kusadasi-Bodrum axis. Izmir Development Agency. 2009: 123

[451] The total length of current subway system connecting Ucyol and Bornova is around 11,5 km Izmir Development Agency. 2009: 125-126

[452] The sections left on both sides of the highway were also subject to greenhouse construction and biological resource extraction. Archaeological Settlements of Turkey Project 2001

Figure 4.21. Destruction due to road construction: A) Helvacıköy Mound, Menemen (*Source: Tanindi et. al., 2001:46*); B) Lembertepe Mound, Develi, Konak (*Source: Izmir Provincial Directorate of Culture and Tourism*)

Figure 4.22. Limantepe (*Source: Personal Archive, 2012*)

Destruction due to transportation infrastructure development will continue, unless conservation of archaeological assets including those not registered is integrated into development schemes. According to the Izmir Regional Plan 2010-2013, improvements in transportation infrastructure are needed in Izmir. In addition to developing land routes connecting Izmir to neighboring cities, as well as to Ankara and Istanbul, enhancing the railroad system are among transportation improvement objectives[453]. Especially, Izmir has special role in railway

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[453] Izmir Development Agency 2010
The Ankara-Usak-Izmir project aims to double the lines and enhance the speed to 250 km. Besides, there exist four airports in the province. Izmir Adnan Menderes is the main airport connecting the region with both domestic and international flights. Cigli is for military purposes. Selcuk strip is used by small airplane for carrying tourists to Ephesus. Cesme airport is under construction. Izmir Development Agency 2009: 123, 124; Higway Projects within the Program of the General Directorates of Highway include Izmir Expressway and Izmir – Urla - Cesme highway. See: General Directorate of Highways 2012

transportation as the western gate of the railway network that connects the railway with the maritime lines. As stated by the Izmir Development Agency's Report, in order to enhance pivotal role of Izmir in trade, the capacity of Izmir harbor needs to be expanded, and connection roads need to be constructed[454].

Hence, new roads, railway and subway lines are proposed within the Urban Region Development Revision Plan of Izmir. Map of Hazard of Transportation Infrastructure Development is prepared based on the Urban Region Development Revision Plan, which shows existing as well as proposed transportation axes including roads (highways, first, second, third degree roads, and village roads), railways and subways (See Figure 4.23)

[454] Izmir Development Agency 2009: 100; Izmir Development Agency 2010

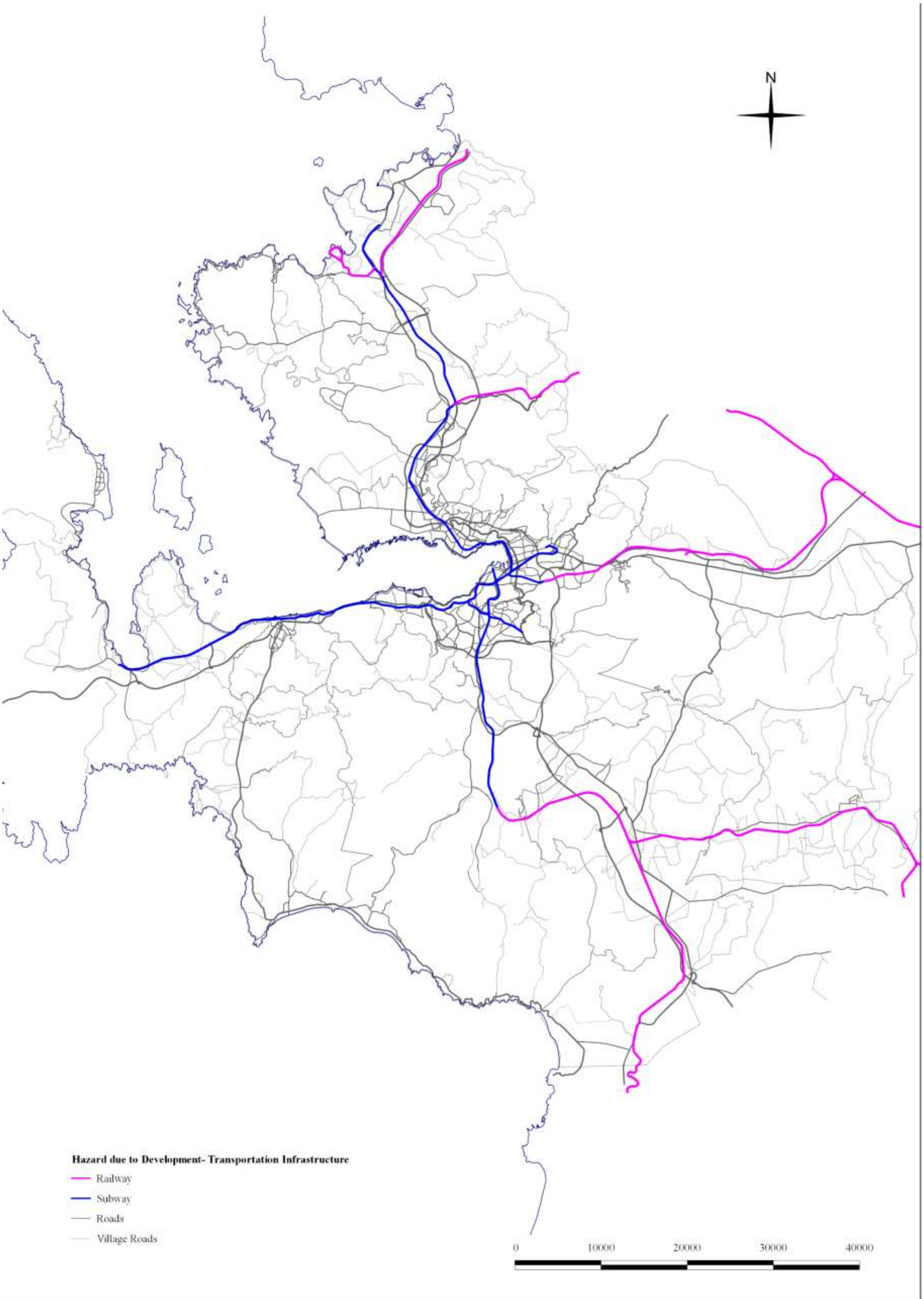

Figure 4.23 Map of Development Hazard - Transportation Infrastructure

4.2.1.2.3. Utility Infrastructure

As discussed in the previous parts, constant upgrading of service facilities and utility lines is a necessity for settlements. However, these infrastructure facilities including pipelines, power lines may have impact on the historic fabric and the possible archaeological finds, if a special care is not given. Service facilities related to pipelines such as electrical poles and street lighting may also have impact on the visual integrity of archaeological assets, especially in urban settings.

Construction of dams, which can inundate large areas of land, is another significant concern that affects archeological assets in these areas. Another risk factor arising from the dam construction is the likelihood of a damage to the dam through an earthquake or landslide. Then, the impacts of such natural hazards, and consequently damage to the heritage values are magnified through flash-flood further down the river[455]. As an example of destruction due to dam construction in Izmir is Bakla Tepe (mound) in Menderes[456].

Gediz, Kucuk Menderes, and Bakircay river basins are the major water bodies providing the main water sources for Izmir. However, irrigation water is provided from surface water from dams, as underground water table has significantly dropped in these water basins[457]. The available per capita water source is very limited in Izmir therefore the continuing dam and water infrastructure are needed in the Province. Further water investments are needed in Bayindir, Beydag, Bergama, Cesme, Foca, Menderes and Odemis[458].

Besides, renewable energy sector has been expanding in the region. Izmir has comparative advantage and potential of becoming the renewable energy center

[455] UNESCO 2012: 68
[456] Archaeological Settlements of Turkey Project 2001
[457] Izmir Development Agency 2009: 113
[458] Izmir Development Agency 2009: 116-117

especially in wind and geothermal resources. The region also has biomass and solar energy potential. The region is especially rich in wind energy with potential of 11,815 MW and total energy produces from this potential may reach upto 31 billion KWh/year. This production potential is more than the overall electricity consumption of the Aegean region. Hence, according to the Izmir Development Agency, regarding the investment needs, the priority should be given to transmission lines, electricity grid connections[459]. Therefore, in Izmir metropolitan area, services infrastructure is another development aspect that may pose risks to archaeological heritage. Two kinds of utility infrastructure development examined in the case-study research include: *major linear utilities* (i.e., power lines, natural gas pipelines) and *energy utilities: dams (See Figure 4.24)*

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[459] Izmir Development Agency 2009: 73-81

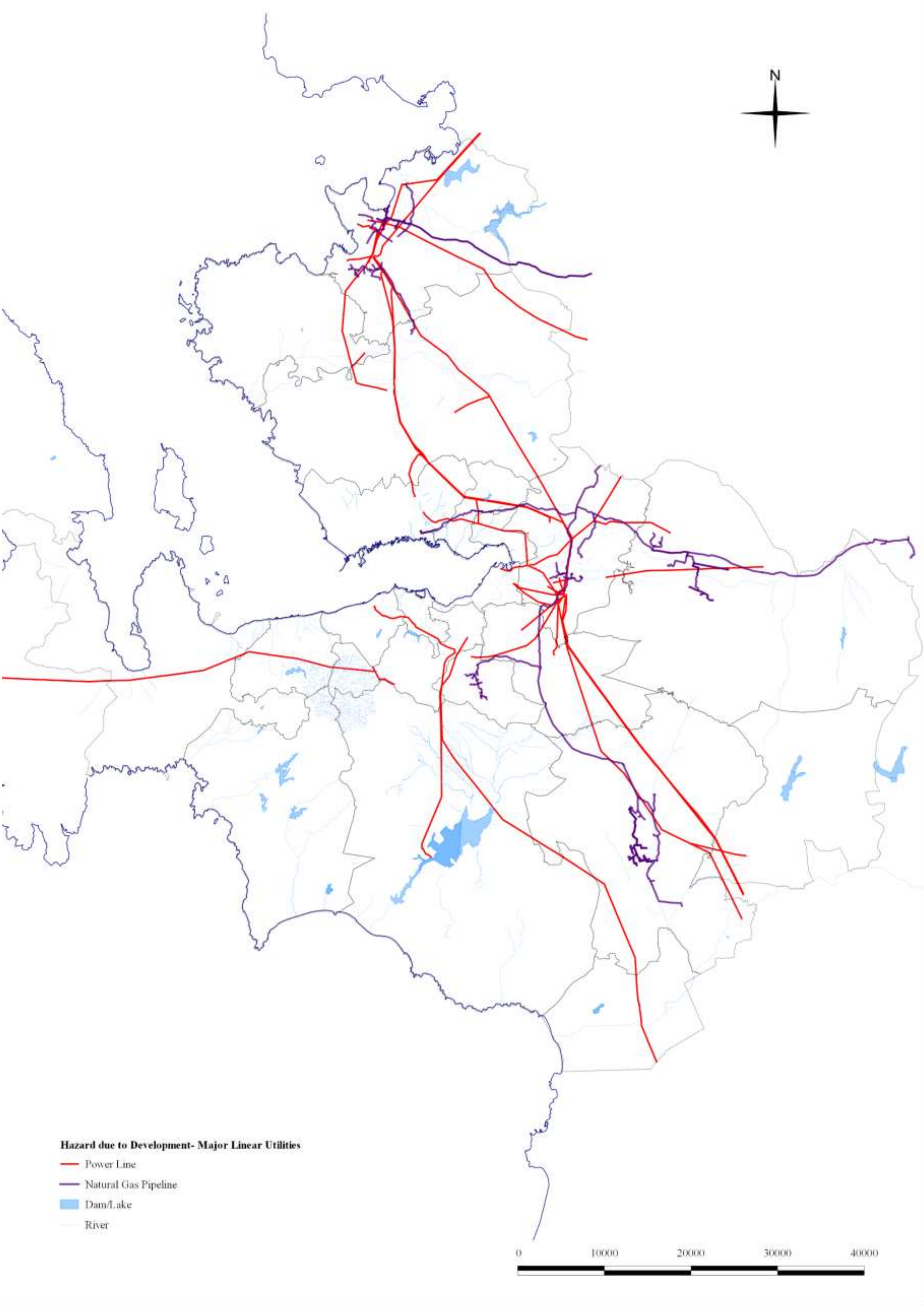

Figure 4.24. Map of Development Hazard - Utility Infrastructure

4.2.1.3. Activities of Individuals / Groups

In addition to natural hazards and development, individuals/groups pose threats to archaeological heritage. Impacts of tourism/visitor is a weighty concern, considering huge concentration of visitors in several sites. However, as assessing mass tourism necessitates a detailed assessment of sites that are open to public, hazard of tourism impact is not included in this territorial scale assessment.

Besides, illicit digging and agricultural activities in rural areas are widespread hazards in Aegean Region, including Izmir Metropolitan Area. For instance, Bozkoy Hoyucek (mound), which is a c. 5,000 years old EBA mound in Bozkoy Village of the Aliaga district, has been damaged due to illicit digging for treasure seeking, and Helvaci Hoyucek (mound) located in Helvaci Koy, Menemen has been severely damaged due to illicit digging and soil removal for road construction[460] (See Figure 4.25).

Figure 4.25. A) Bozkoy Hoyucek (mound) b) Helvaci Hoyucek (mound) (*Source: Tanindi et. al, 2001:39, 44*)

Illicit digging incidents were observed in many other sites including Bekirler, a flat settlement and Çaltidere Mound in Aliaga, Gümüsova 1 Mound in Bergama, Altin Tepe Mound, Bakla Tepe Mound and Oglananasi Mound in Menderes, and

[460] Tanindi, et.all. 2001: 37

Arapkahve Mound in Torbali (See Figure 4.26)[461].

Figure 4.26. Arapkahve Hoyugu (Mound) (*Source: Izmir Il Kultur ve Turizm Mudurlugu*)

However, it is not possible to predict areas where human destruction such as illegal excavation or looting, graffiti, vandalism, arson can happen, risk of these unfavorable human activities necessitate developing strategies for sites vulnerable to human destruction. In addition, forest fire is a hazard that may pose risks to archaeological heritage as Izmir is within a high-risk area regarding forest fires.

With respect to identification areas of hazards of individual/groups, in addition to forest fires, agricultural activities are examined. Agriculture is one of the main economic and land use sectors in Izmir. Almost in all areas except Cesme, Karaburun, and Urla significant portion of land is used for agriculture[462]. According to 2001 General Agricultural Census results, the province of Izmir possesses a total of 2,731,986 da agricultural field[463]. 40.6% of the total agricultural area is used for cultivating fruits, beverage and spice plants, while the 11.5% of the remaining is for vegetable gardens and 47.1% is for cereals and other plant products. Agricultural activities are distributed throughout Izmir except for the central districts, Cesme, Karaburun and Urla. Hence, a significant

[461] Tanindi, et.all., 2001: p.37
[462] Izmir Development Agency 2009: 55
[463] Turkish Statistical Institute 2001

portion of the terrain is used for agriculture. Especially, in districts located at the province periphery, agriculture sector maintains its concentration[464].

Water is a significant input for agriculture, and accordingly irrigation is a significant aspect of agricultural activities. Rational consumption of water is critical, considering the fact that a major portion of water resources is used for agricultural purposes. Effective use of water can be possible through the aid of pressure (sprinkler and drip) systems and other modern technology. In Izmir province, modern irrigation is utilized only in the 8% of the agricultural areas[465]. Besides, while approximately half of the agricultural zones are comprised of non-irrigated areas[466], 74.3% of the irrigable zones in the province are being irrigated[467]. Since the use of modern irrigation systems is considered crucial for utilizing agricultural zones in a sustainable way, Izmir Development Agency's report, titled *Izmir Situational Analysis*, proposed to complete the infrastructure necessary for irrigating all of the irrigable zones in the province[468].

However, use of machinery in agricultural activities, land conversion and development of irrigation infrastructure pose risks on underground archaeological assets. In the past decades, just like development pressures, agricultural activities have been the most damaging threat for this region, including Izmir province. For instance, Altintepe Mound, which is a c. 5000 years old Early Bronze Age (EBA) settlement located in the district of Menderes, Arslanlar Hoyugu (mound) in Torbali and Melengic Sekisi (Hoyucek 2) (mound) in Aliaga; Gokcealan Tepetarla Hoyugu (mound) have been damaged because of agriculture (See Figure 4.27)[469].

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[464] Izmir Development Agency 2009:48
[465] Tomar 2006
[466] Izmir Development Agency 2009:55; Izmir Provincial Directorate of Agriculture 2007
[467] TKB, 2006
[468] Izmir Development Agency 2009:55
[469] Tanindi, O., Ozbasaran, M. [et. al.] 2001; Izmir Provincial Directorate of Culture and Tourism 2008:1-5

Figure 4.27. Examples of archaeological sites, which have been damaged due to agricultural interventions: A) Altintepe Hoyugu (mound) in Menderes; B) Arslanlar Hoyugu (mound) in Torbali; C) Melengic Sekisi (Hoyucek 2) (mound) in Aliaga; D) Gokcealan Tepetarla Hoyugu (mound)(*Source: Izmir Il Kultur ve Turizm Mudurlugu*)

Other examples of destruction due to agricultural activities include Çaltidere Mound in Aliaga, Pinarbasi Mound in Bornova, Basantepe Mound in Dikili, Lembertepe Mound and Oglananasi Mound in Menderes, Cukurici Mound and Gökçealan/Kabila Mound in Selçuk, Arapkahve Mound, Kabaçakiri Cemetery and Sinektepe Mound in Torbali, Barbaros – Tepeüstü, which is a flat settlement in Urla[470].

Briefly, agricultural areas as well as forests are included in the hazard maps of individual-induced hazards (See Figure 4.28).

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[470] Tanindi, O., Ozbasaran, M. [et. al.] 2001; Izmir Provincial Directorate of Culture and Tourism, 2008:1-5.

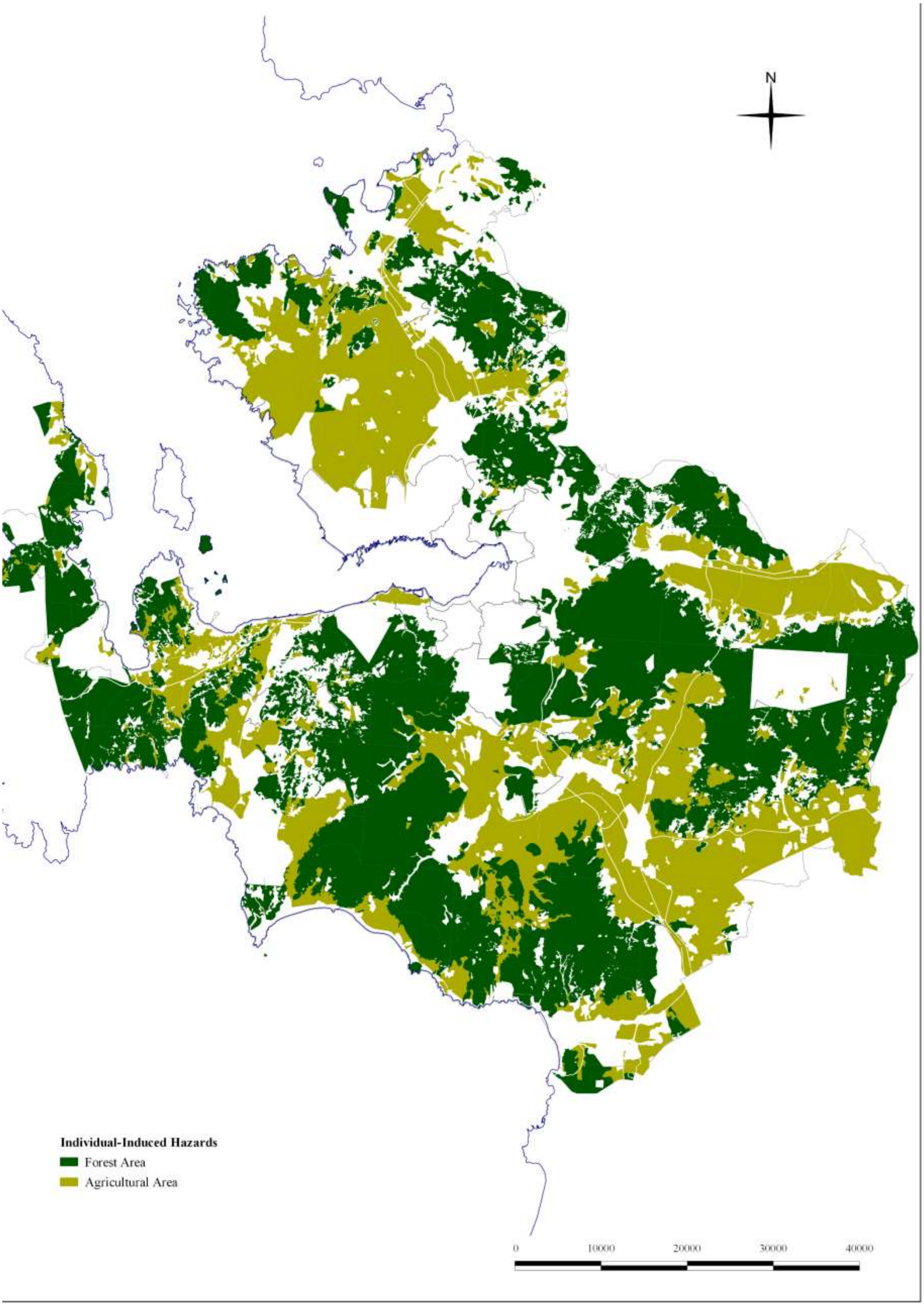

Figure 4.28. Map of Individual-Induced Hazards

4.2.2. Vulnerability Assessment

Based on the proposed methodology, vulnerability of archaeological assets are examined separately under three topics: vulnerability to natural hazards, vulnerability to development, and vulnerability to individual-induced hazards. A set of indicators are be developed for each main category of hazard including natural hazards, development hazards, and hazards due to activities of individuals/groups, as the kinds of indicators of vulnerability depend on the kind of hazards in question.

4.2.2.1. Vulnerability to Natural Hazards

Cause - effect analysis is carried out to **understand relations between various factors** (hazards and vulnerabilities) that grow into risks distressing a site or a number of sites in a territory. T**he root causes and major effects of problems** are analyzed through the problem tree model. This lead to comprehensive examination of both inherent and external contributing factors such as physical, structural characteristics of the site, gaps in management, and surrounding environment.

Next, indicators are developed based on the proposed methodology, as vulnerability of archeological assets to certain hazards can be measurable using indicators. Vulnerability of archaeological heritage is considered as the combination of three factors: *physical, institutional, and social vulnerability*. As mentioned in the previous sections, a range of indicator kinds are identified, using indicators in sufficient number to measure the extent of various factors affecting vulnerability and providing cross-checking. A set of indicators for measuring vulnerability of archeological sites is developed in a way that it constitutes limited number of indicators, which include the most critical aspects that affect vulnerability of a site are included. Based on the results of the cause-effect analysis, indicators for measuring vulnerability of archaeological sites to natural hazards are developed as explained in the Section 3.2.2.

Cause-effect analysis reveals that certain physical, institutional and social factors affect vulnerability of archeological assets to natural hazards. As mentioned earlier, while identifying the kinds of indicators, it is critical to examine if the indicators are SMART to measure the level of vulnerability by looking at whether the indicator is specific, measurable, attainable, relevant and time-bound. As obtaining data about the state of condition of each site and measuring effectiveness of site management and collaboration among partners including local community are not measurable with reasonable cost, effort and time within the scope and scale of this research, these are not identified as indicators.

Based on these evaluations, the following indicators are identified for assessing vulnerability of archaeological assets to natural hazards at territorial scale:

- **exposure to atmospheric conditions after excavations**, as because of exposure, both excavated and unexcavated cultural layers are deteriorated through erosion and slumping

- **past damages** due to both natural and human-induced hazards, as sites that have been destructed in the past due to natural events or processes are more likely to be damaged in the future

- presence/absence of **management at site level**

- **accessibility** as a surrounding condition, since in case of emergencies such as natural disasters or unfavorable human activities, the response can not be possible or otherwise effective.

Besides, means of verification is identified for each single indicator, as means of verification play a key role in grounding an assessment framework in the realities of a particular setting. Means of verification are identified as reports on past and ongoing excavations; past damages identified in the TAY databases, lists of sites open to public, city plans to identify sites located in or off settlement areas.

Based on various physical, institutional and social indicators, the level of vulnerability of each archeological site located in the given territory is evaluated. Based on the information available for the assessment, indices of vulnerability are qualitatively identified based on the logical framework approach, explained in Section 3.2. Presence of one of the indicators of exposure or past damages is considered ample to show the presence of vulnerability to natural hazards. Similarly, lack of site management & maintenance is considered enough to increase the level of vulnerability to the upper level. As institutional ineffectiveness also eventually bring material/structural problems due to ineffective maintenance, these two indicator exist together. In addition, existence of a problem with accessibility is considered as the last evaluation criteria (and less significant compared to the others) that would increase the level of vulnerability (See Figure 4.29). Briefly, with the most basic data on physical and institutional indicators, vulnerability of archaeological sites to the natural hazards are categorized as follows:

- Low (if a site is not excavated, not exposed to atmospheric conditions, does not have a record of past damages),

- Medium (if a site is excavated and/or exposed to atmospheric conditions, but subject to management and maintenance, and hence in a good state of condition)

- High (if a site had been excavated in the past and/or damaged in the past, and currently left exposed and/or its state of condition necessitates repairs, but it is not subject to management and maintenance)

- Very high (if a site had been excavated in the past and/or damaged in the past, and currently left exposed and/or its state of condition necessitates repairs, but it is not subject to management and maintenance, and it is inaccessible in case of emergencies)

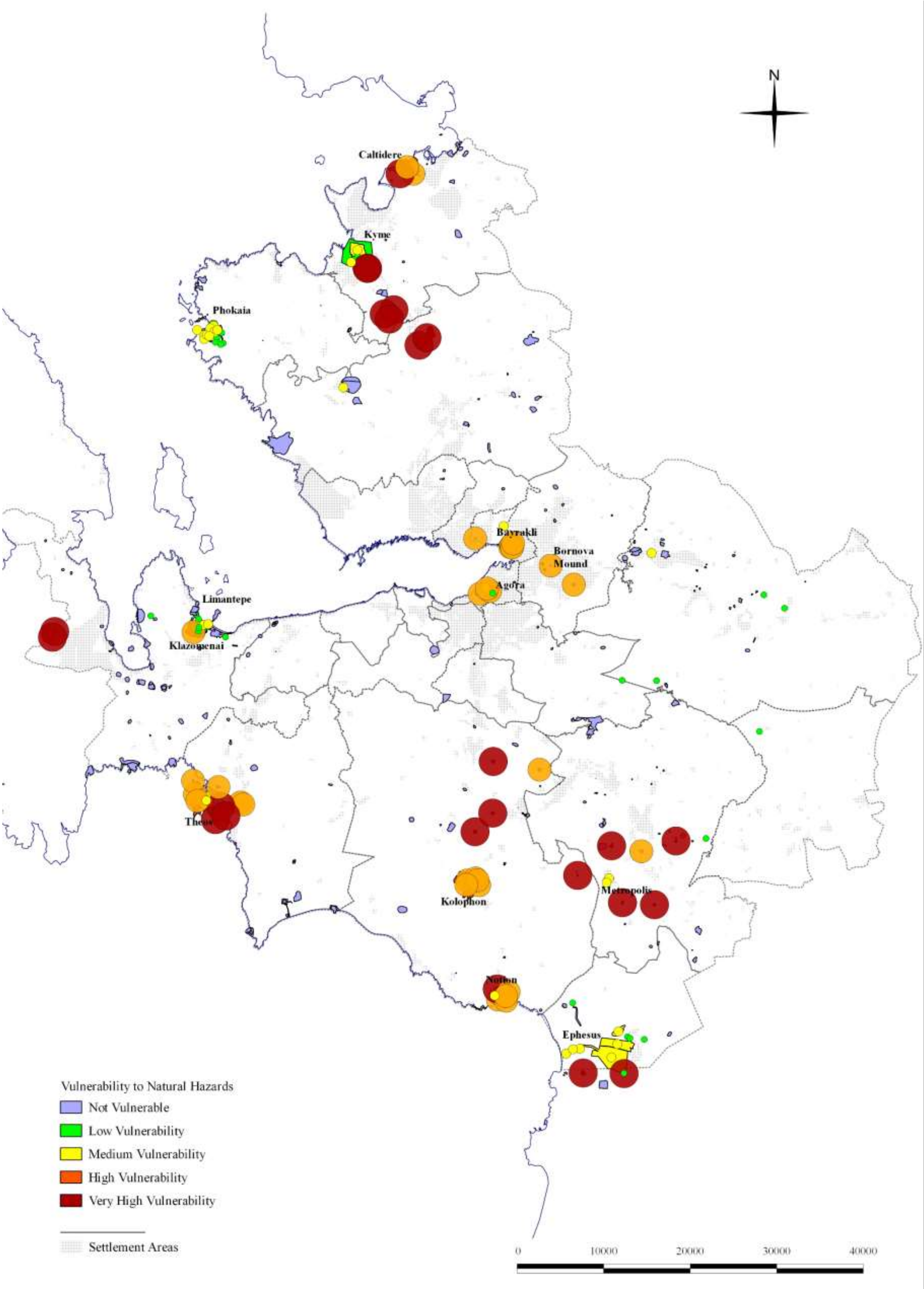

Figure 4.29. Map of Vulnerability to Natural Hazards

4.2.2.2. Vulnerability to Development

Likewise, vulnerability of archaeological assets to the hazard of development is assessed after the selection and use of indicators for evaluating vulnerability. Indicators for vulnerability to development, and indicators for vulnerability to individual/group activities are identified as in Table 4.6.

Table 4.6. Indicators for vulnerability to development

	Indicators for Vulnerability to Developments (i.e., "What can we see to know if site is vulnerable to developments such as housing, dam construction, mining, infrastructure construction, etc.?")
Institutional Indicators	▪ National level: legislation and policies: lack of impact studies, lack of/incomplete inventories, presence/type of legal protection status (i.e., registration degree of site), number / percentage of sites susceptible to damage through development (e.g. urban heritage), lack of regional survey, lack of impact studies, insufficient human and financial resources ▪ Effectiveness of risk management systems (at all levels)
	▪ Provincial/municipal: Lack of conservation planning and management, ▪ Site level: Lack of/ineffective site management (i.e., presence and effectiveness of site management, human resources, budget)
	▪ Lack of/extent of collaboration among partners (i.e., govermental institutions, NGOs, universities, etc.) at all levels
Social Ind.	▪ Lack of / extent of awareness of local community as well as values, sense of ownership, attitudes, common sense and caution, behaviors

With respect to development hazards, **lack of registration** (i.e. legal protection) due to incomplete inventory makes archeological sites vulnerable to development pressures, especially if conservation of archaeological heritage is not integrated into development planning. In some cases, registered sites may even be vulnerable to development due to legal framework that enables approval of constructions. Each archaeological site included in the assessment can be examined in terms of its vulnerability to development by using the following physical and institutional indicators: record of damage in the past, status of registration and presence/lack of site management. Briefly, each archaeological site included in the case-study research are examined in terms of its vulnerability to development by using the following physical and institutional indicators:

- Physical Indicators:
    - i. Record of damage in the past
        1. Not identified/No data
        2. Record of Damage
        3. No Damage
- Institutional Indicators
    - i. Status of Registration
        1. Not Registered
        2. 1^{st} or 2^{nd} Degree Archeological Site
        3. 3^{rd} Degree or Urban Archeological Site
    - ii. Presence/Lack of Site Management
        1. Lack of site management
        2. Managed as an Excavation Site and/or Site Museum

Finally, level of vulnerability of each site to development is evaluated (See Figure 4.30).

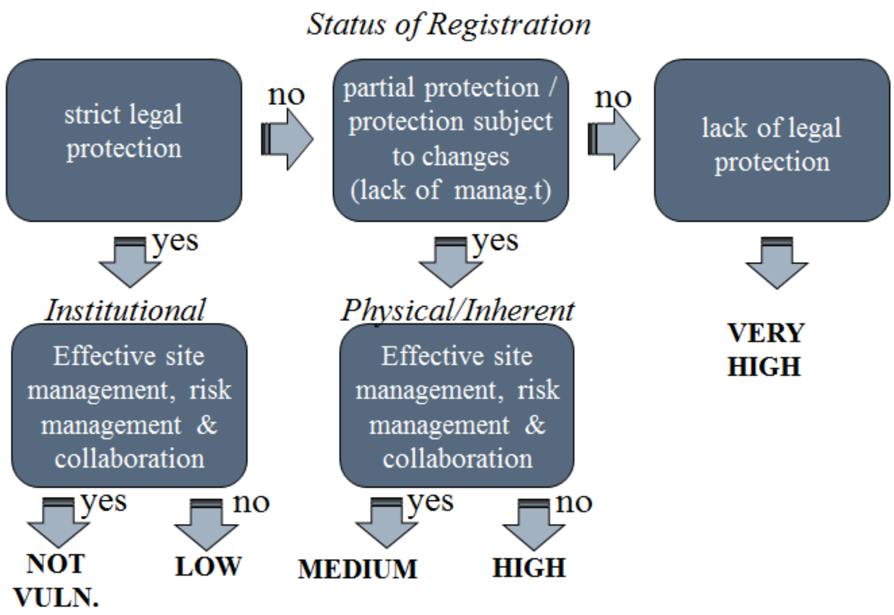

Figure 4.30. Vulnerability Evaluation for Development Hazards (YILDIRIM ESEN)

As a result, based on these criteria, vulnerability of archeological sites are rated as follows (See Figure 4.31):

- **Not Vulnerable**: Sites currently under the management of Excavation Directorship, or the related Directorship of Museum
- **Low**: Sites that are registered as 1st or 2nd degree archeological site
- **Medium**: Sites that are registered as 3rd degree or urban archeological site
- **High**: 3rd degree or urban archeological sites that have been subject to damage due to development in the past
- **Very High**: Sites without legal protection status

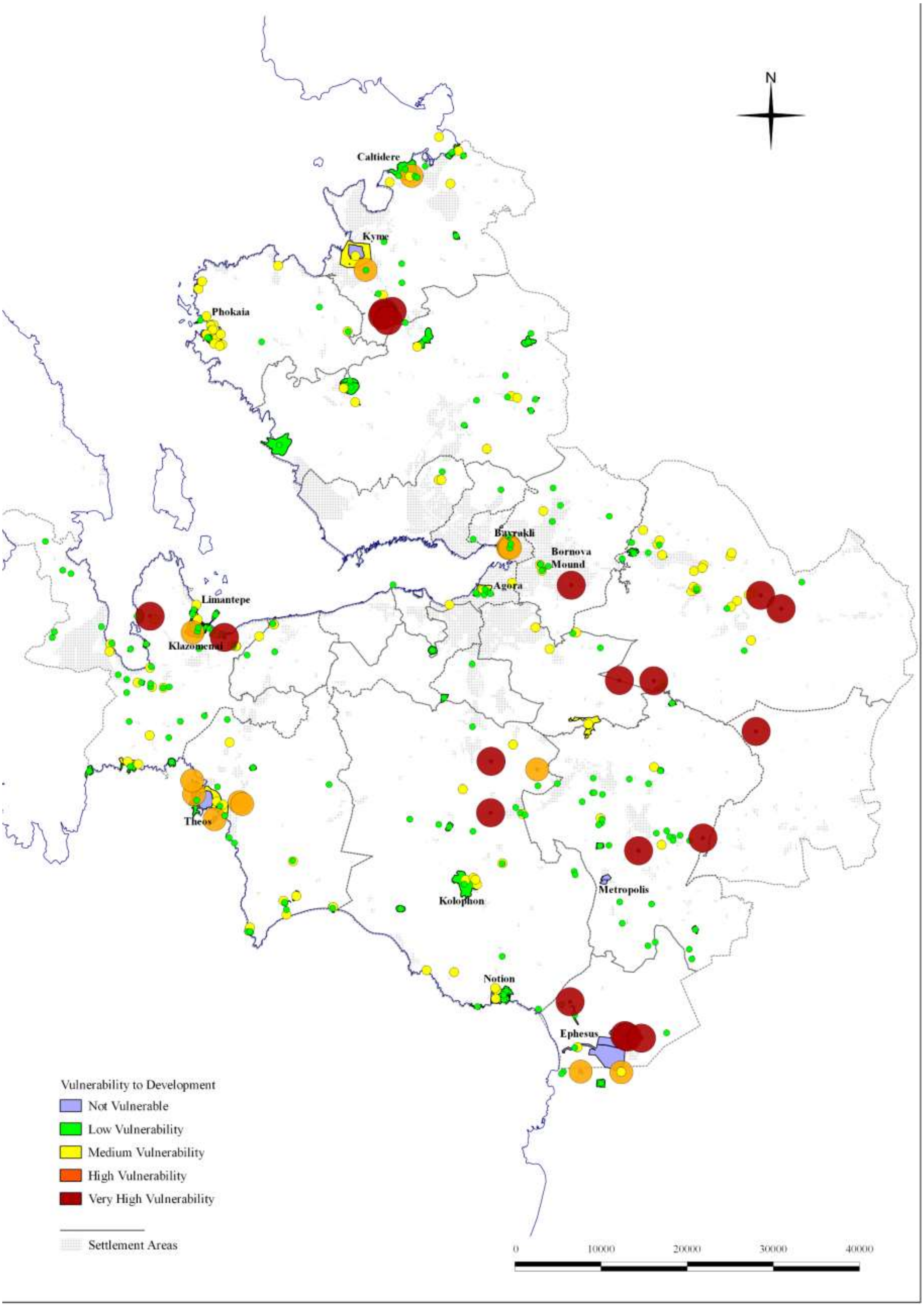

Figure 4.31. Map of Vulnerability to Development

4.2.2.3. Vulnerability to Individual-induced Hazards

Factors affecting vulnerability of archeological sites to activities of individuals/groups are shown in Table 4.8.

Table 4.7. Indicators for vulnerability to unfavorable human activities

	Indicators for Vulnerability to Unfavorable Human Activities (i.e., "What can we see to know if site is vulnerable to hazardous human activities (agricultural activities, illicit digging, fire?")
Physical Ind.	▪ Level of site security ▪ Level of accessibility ▪ Lack of preparedness and mitigation measures
Institutional Indicators	▪ Presence/type of legal protection status (i.e., registration degree of site)
	▪ Private ownership
	▪ Lack of/ineffective conservation planning ▪ Lack of/ineffective site management (i.e., presence and effectiveness of site management, human resources, budget), ▪ Lack of / ineffective risk management, ▪ Lack of / ineffective visitor management
	▪ Lack of/extent of collaboration among stakeholders (i.e., governmental institutions, NGOs, community associations etc.)
Social Ind.	▪ Lack of / extent of awareness of local community as well as values, sense of ownership, attitudes, common sense and caution, behaviors, ▪ Vulnerability of the community and surrounding to some hazards such as fire: area of buildings made of wood

Based on the proposed methodology, indicators for assessing vulnerability of archaeological assets to hazards of individuals/groups are identified as presence of past damages, Legal protection status and presence/absence of site management, which is critical for site security. Based on these indicators, level of vulnerability of each site is assessed as shown in the Figure 4.32.

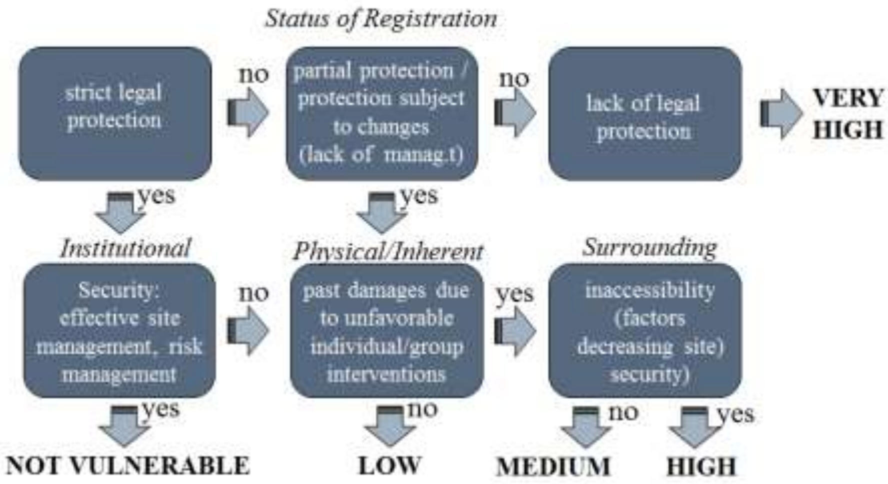

Figure 4.32. Vulnerability evaluation for individual-induced hazards (*YILDIRIM ESEN*)

Finally, Map of Vulnerability to Individual-Induced Hazards is prepared (Figure 4.33)

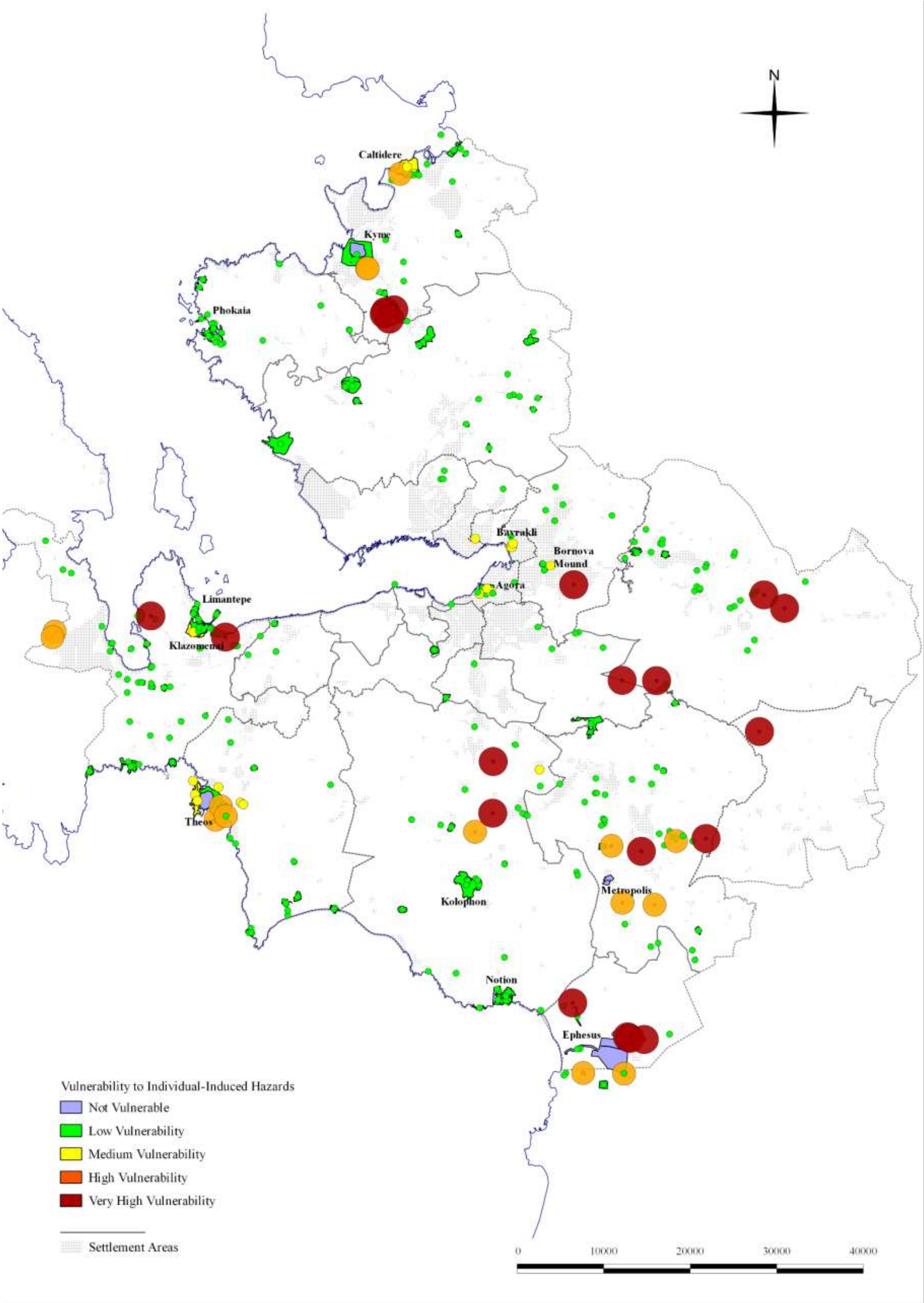

Figure 4.33. Map of Vulnerability to Individual-Induced Hazards

4.2.3. Risk Evaluation

Following the proposed methodology, the system developed for **ARTS – Izmir Metropolitan Area** enables the production and interpretation of information on risks. Presence and geographical locations of hazards together with results of vulnerability assessment -revealing different levels of vulnerability for each site studied- are used to evaluate risks to archeological heritage at territorial scale for Izmir metropolitan area. The database on various kinds of hazards and archaeological sites within the territory enables undertaking various analyses and producing risk maps.

Sites at risk are identified through overlapping two basic components of the assessment: archaeological sites and hazards. Risk maps are produced for all kinds of hazards, based on "presence/absence" of hazard for each site. Besides, the level of risks are calculated for each site with respect to various hazards. This derives from overlapping of two information: presence of hazard and level of vulnerability of each site to that specific hazard. Here, if the site is exposed to the given hazard, its vulnerability level determines its level of risk to the hazard. Besides, the overall risk is presented by using the highest level of risk identified for each site in any one of the hazard categories. Finally, cartographic presentations of different type of risks and the summarized maps of risks are produced through GIS.

4.3. Outcomes of the System and Evaluations

The system developed for **ARTS – Izmir Metropolitan Area** enables the production and interpretation of information on risk, which are changeable due to dynamic processes of physical and social territories, at various stages of decision-making processes. As mentioned earlier, due to the flexibility of the GIS, **new parameters of analysis can be added**, and the databank can easily be updated as the database is already constructed. Through the established system, valuable information about hazards threatening archaeological heritage, and sites vulnerable to these hazards can be obtained. Besides, based on the proposed methodology, sites at risk, and their level of risk can be identified. In order to evaluate the current situation in Izmir Metropolitan Area, the risk maps of natural, institutional and individual-induced hazards are generated:

Risk of Natural Hazards

With respect to natural hazards, maps are generated for:

- Risk of Landslide/Rockfall,
- Risk of Flooding,
- Risk of Coastal Processes,

In addition, Map of Overall Risks of Natural Hazards is created.

Risk of Landslide/Rockfall

Based on the proposed methodology, first, sites at risk of landslide/rockfall risk is examined. According to the assessment outcomes, the only area under landslide risk is Kadifekale, Konak. Located at the historic city center, the Stadium and Kadifekale archaeological sites may be subject to landslide risk with levels of low and medium respectively (See Figure 4.34).

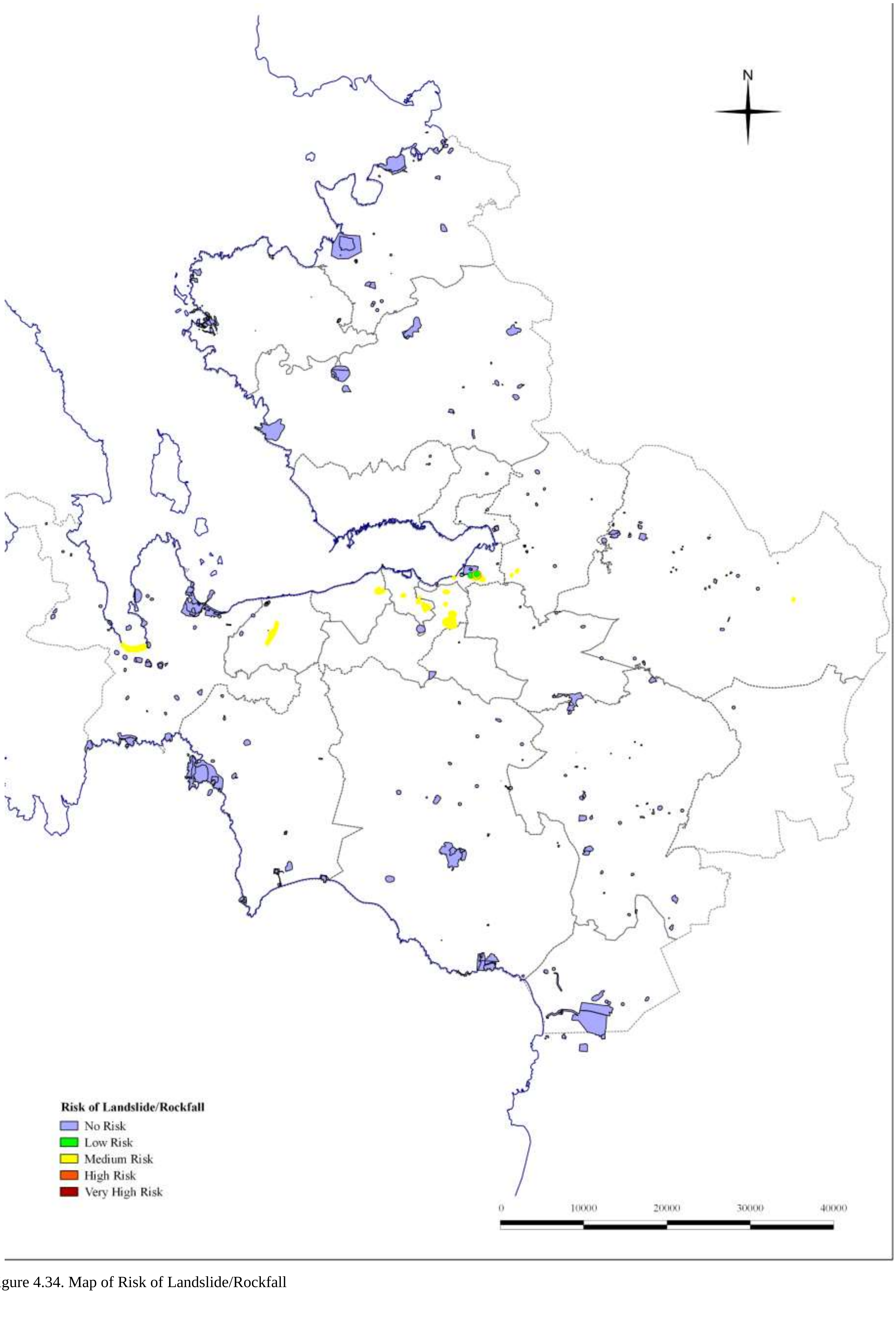

Figure 4.34. Map of Risk of Landslide/Rockfall

Risk of Flooding

Another natural hazard examined through the established system is flooding. According to the risk assessment outcomes, flooding is not a widespread threat for archaeological sites. Larisa Archaeological site is under the “very high risk” category, while Panaztepe Archaeological Site is under ‘medium’ risk, and Baspinar and Nemrut are under ‘low’ risk. In addition to these, nine sites are in areas where flooding danger exist but since there is not sufficient information to assess their vulnerability, these sites are categorized as “Risk level not identified”. It can be said that these sites are also at risk and their vulnerability levels should be identified (See Figure 4.35).

Risk of Coastal Processes

Besides, risks of coastal processes including erosion/deposition and sea-level rise are assessed for coastal archaeological heritage. Coastal sites within the 100 meters buffer zone from the sea is included in the assessment, considering their exposure to the impacts of coastal processes. The assessment can be repeated, based on a detailed assessment on the impact zone.

According to the assessment outcomes, risk of coastal processes is very high at Teos. Besides, in Caltidere and Notion, while the risk is at medium level for Phokaia, Limantepe, Klaros and Ege Gubre/Kyme. Besides, Clazomenai as well as some parts of Ege Gubre/Kyme and Phokaia are subject to low-level risk of coastal processes. Like in flooding assessment, certain sites’ risk level cannot be identified due to insufficient information, while the remaining sites are not subject to risks from coastal processes (See Figure 4.36).

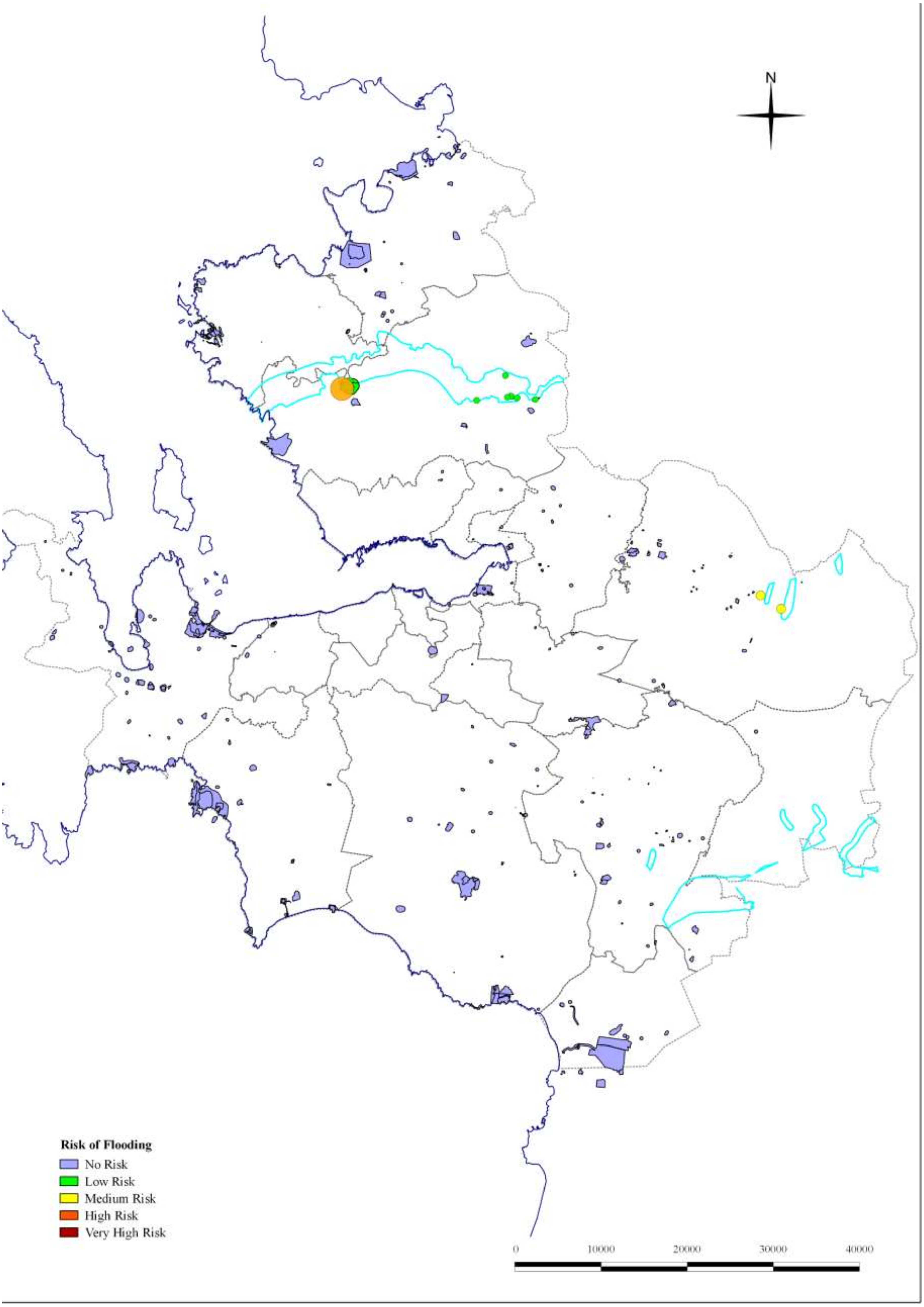

Figure 4.35. Map of Risk of Flooding

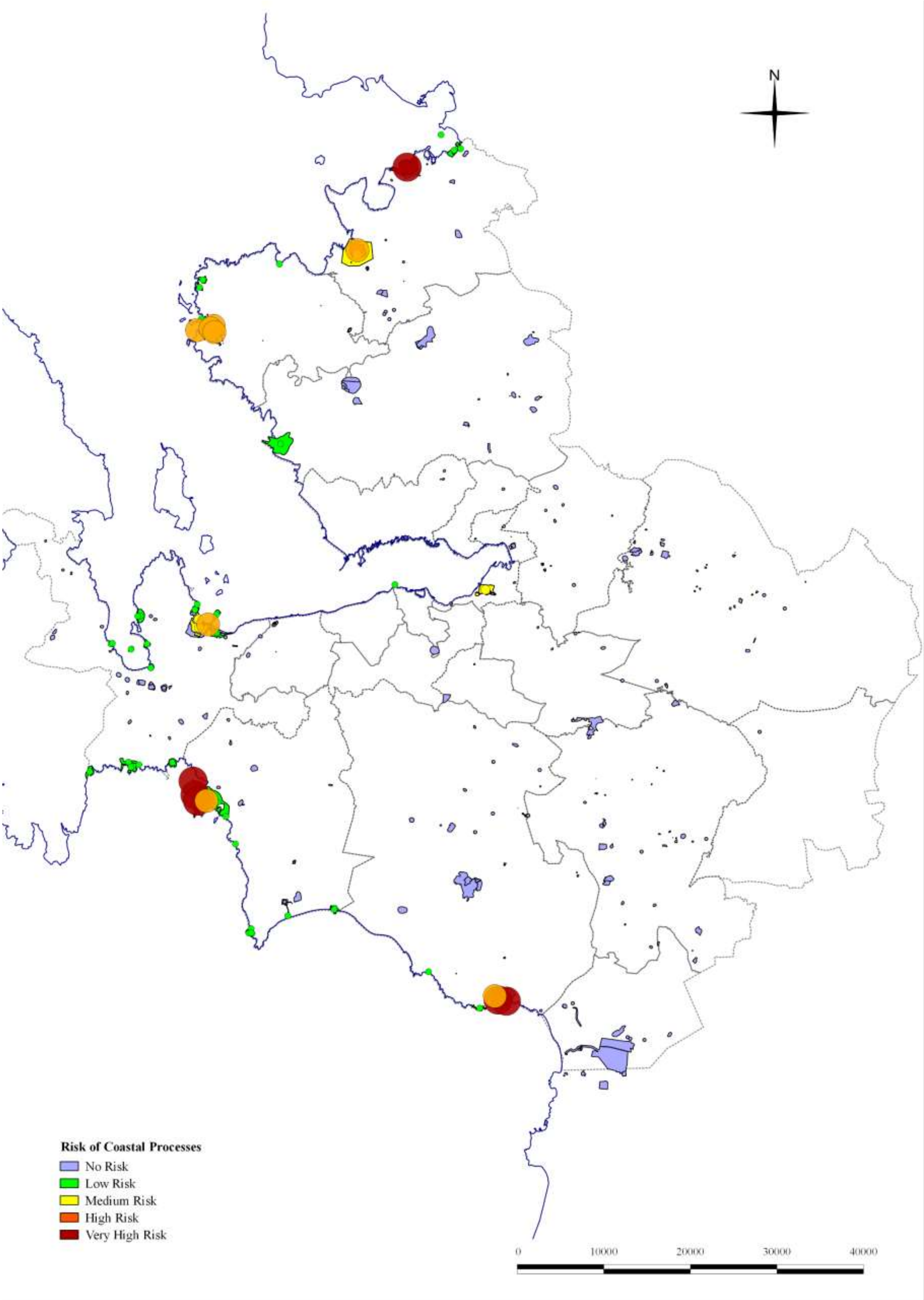

Figure 4.36. Map of Risk of Coastal Processes

Overall Risk of Natural Processes

The Map of Overall risk of Natural Hazards indicates areas at risk. For instance, Larisa and Teos are subject to ‘very high risk’, while Ege Gubre / Kyme, Klaros, Limantepe, Panaztepe, Phokaia, and Teos are at medium level risk. Sites at ‘low level risk’ level include Baspinar, Ege Gubre / Kyme, Kadifekale, Klazomenai, Nemrut, and Phokaia. The other sites for which the risk level could not be identified due to lack of data on their vulnerabilities necessitate further investigation. (See Figure 4.37).

Based on these evaluations, as all sites are located in the first-degree earthquake zone, risk mitigation are critical for archaeological sites that are vulnerable to natural hazards. In addition, the landslide risk for several sites in Kadifekale, Konak necessitates further research on the impact of a possible landslide event on archaeological heritage and accordingly planning for mitigation and preparedness.

In addition, flooding affects particularly sites in Menemen with very high and not identified risk levels, and requires regional programs for prevention and mitigation. Similarly, coastal processes, which is a widespread threat that affects coastal heritage in Aliaga, Foca, Menemen, Balcova, Urla, Seferihisar, Menderes, should be addressed through special maintenance programs. Particularly, Urla and Seferihisar are the most affected districts. In general, there is need for enhancing the system by collecting data through site surveys.

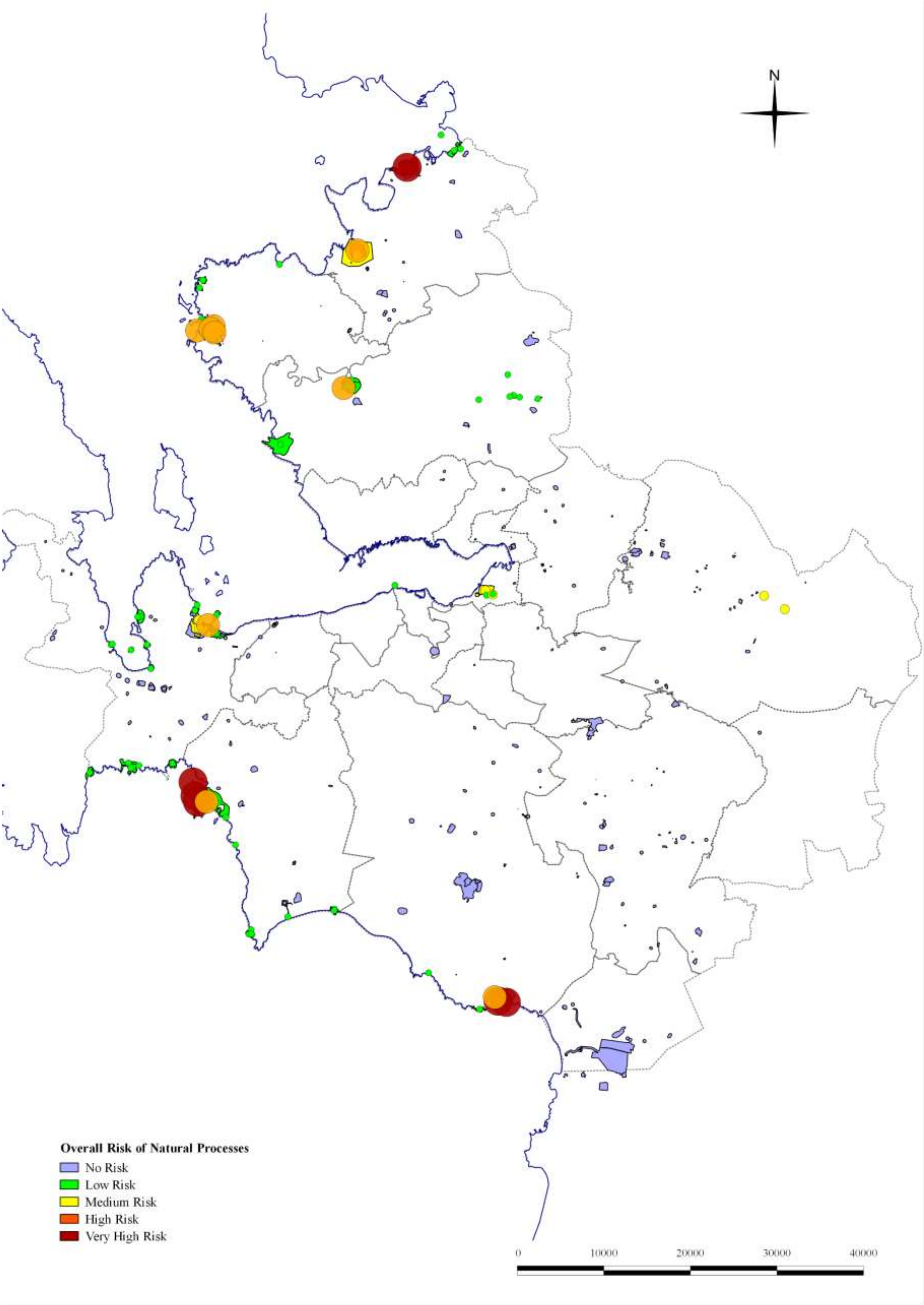

Figure 4.37. Overall Risk of Natural Processes

Risk of New Building Construction

Following the proposed assessment methodology, development risks threatening archaeological assets are assessed though the risk assessment system. One of the development risks is new building construction. Regarding new building construction, the following maps are produced:

- Risk of New Building Construction – Housing
- Risk of New Building Construction – Commercial
- Risk of New Building Construction – Industrial
- Risk of New Building Construction – Tourism
- Risk of New Building Construction – Recreation
- Risk of New Building Construction – Large Urban Facilities

Finally, overall Risk of New Building Construction is assessed.

Risk of New Building Construction – Housing

With respect to housing development, certain sites are located at new development areas, and hence under the risk of new housing construction. Mainly, Urla district, eastern and southwestern parts of the metropolitan area are development areas. Among archaeological sites, particularly, Ozbek/Carpank, and Tepekoy are at very high risk of housing construction. In addition, Clazomenai and Teos are under high risk due to new developments around these sites. Besides, 16 sites fall under medium or low risk category[471] (See Figure 4.38).

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[471] The number of sites represent each polygon in the GIS system.

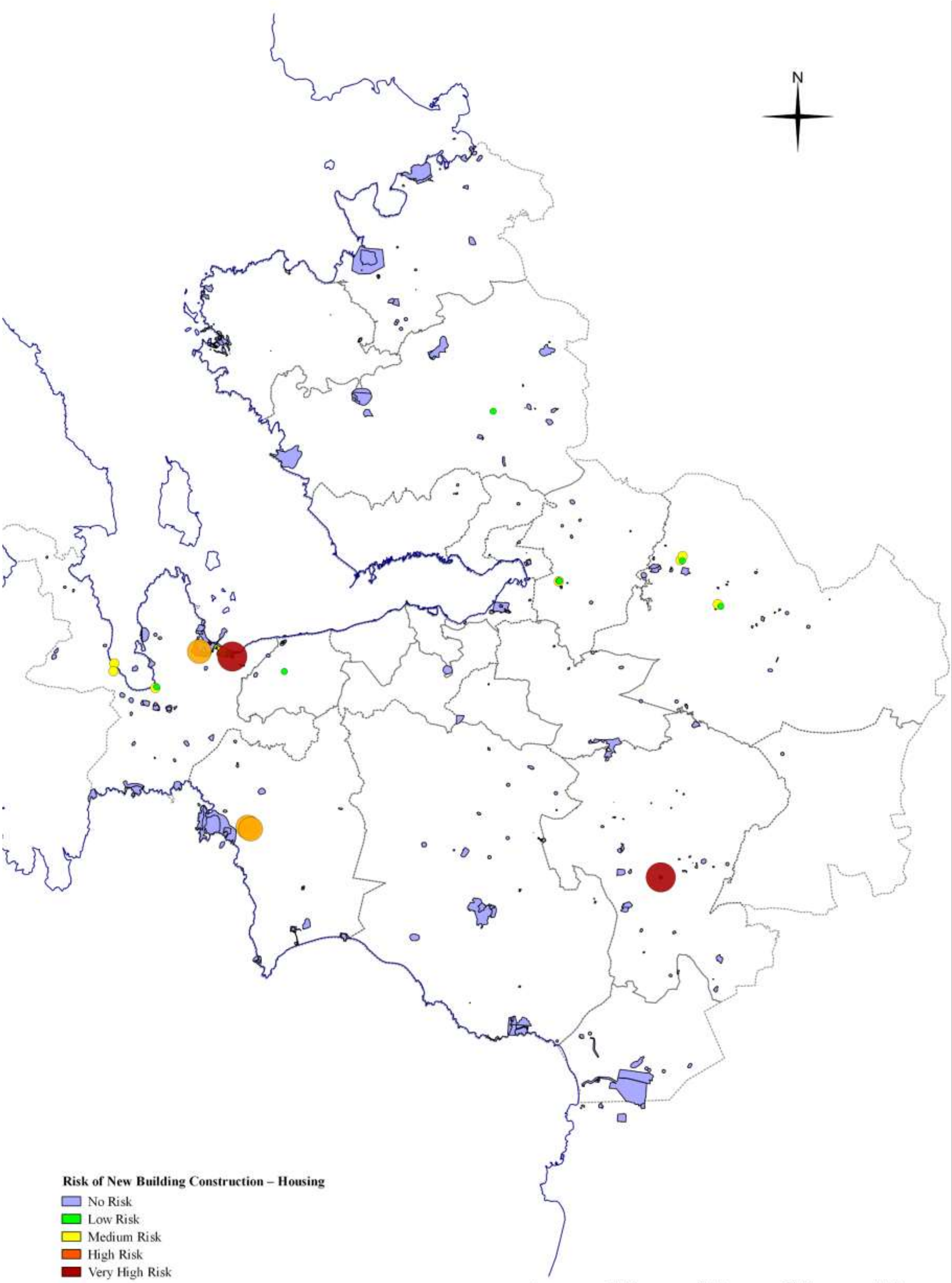

Figure 4.38. Map of Risk of New Building Construction – Housing

Risk of New Building Construction – Commercial

Another aspect of development within the metropolitan area is commercial development. According to the outcomes of the risk assessment, regarding commercial development, central business district in Konak, industrial area in Bornova, and commercial development in Torbali pose risks to ten sites located within these areas. For instance, Tepekoy is under very high risk of commercial development. Ege Gubre /Kyme, Kolophon, Phokaia, and 4 unnamed sites are in the medium level-risk category. Finally, two more sites are under low risk (See Figure 4.39).

Risk of New Building Construction – Industrial

Sites located in certain districts are under the pressure of industrial development. Based on the results of the assessment, industrial development in Kemalpasa, Menemen, and Aliaga create risks for eleven sites in these towns. The risk is at moderate levels for these sites. Four sites including sites of Ege Gubre/Kyme are exposed to medium level risk. The other seven sites are at low-level risks (See Figure 4.40).

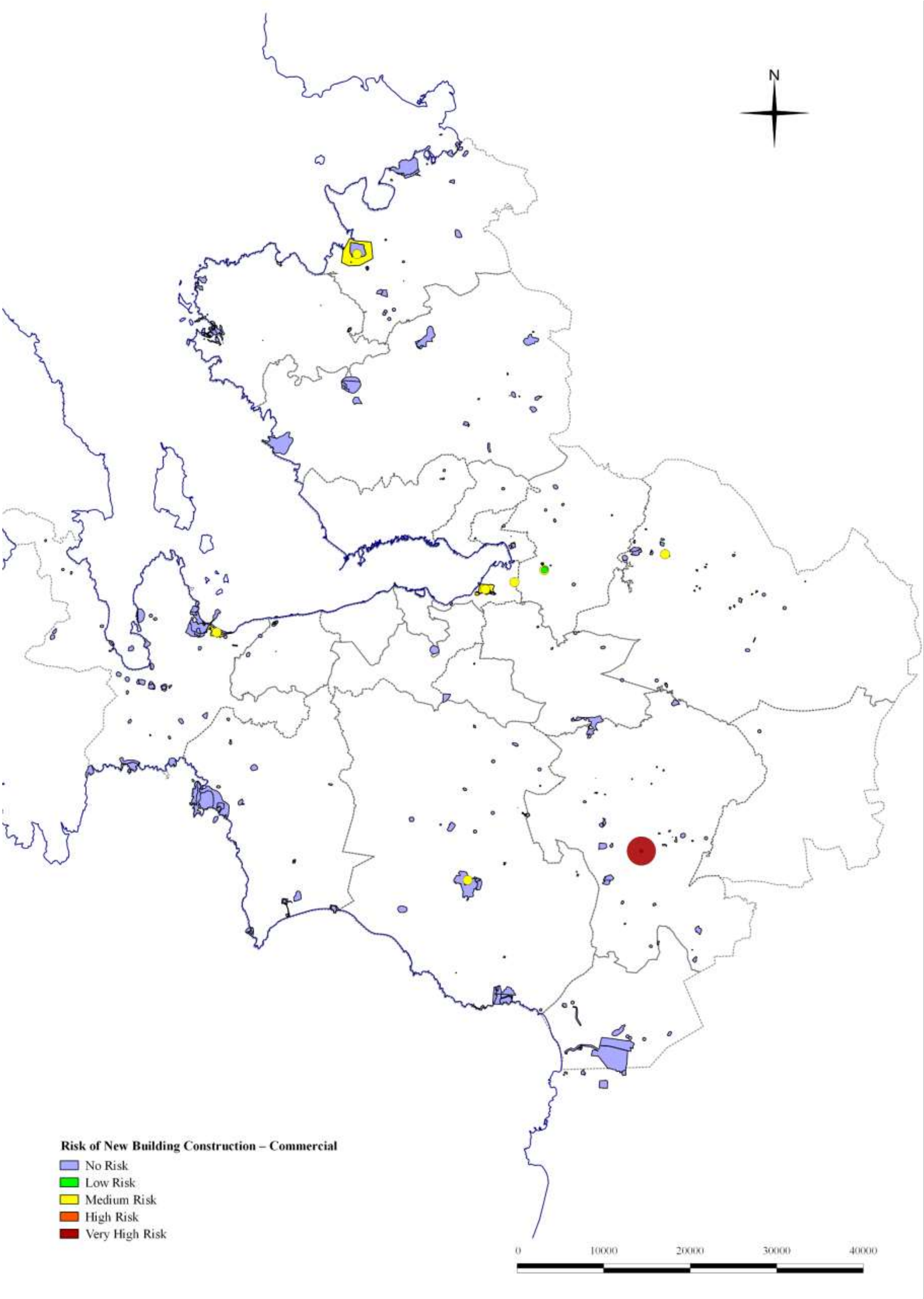

Figure 4.39. Map of Risk of New Building Construction – Commercial

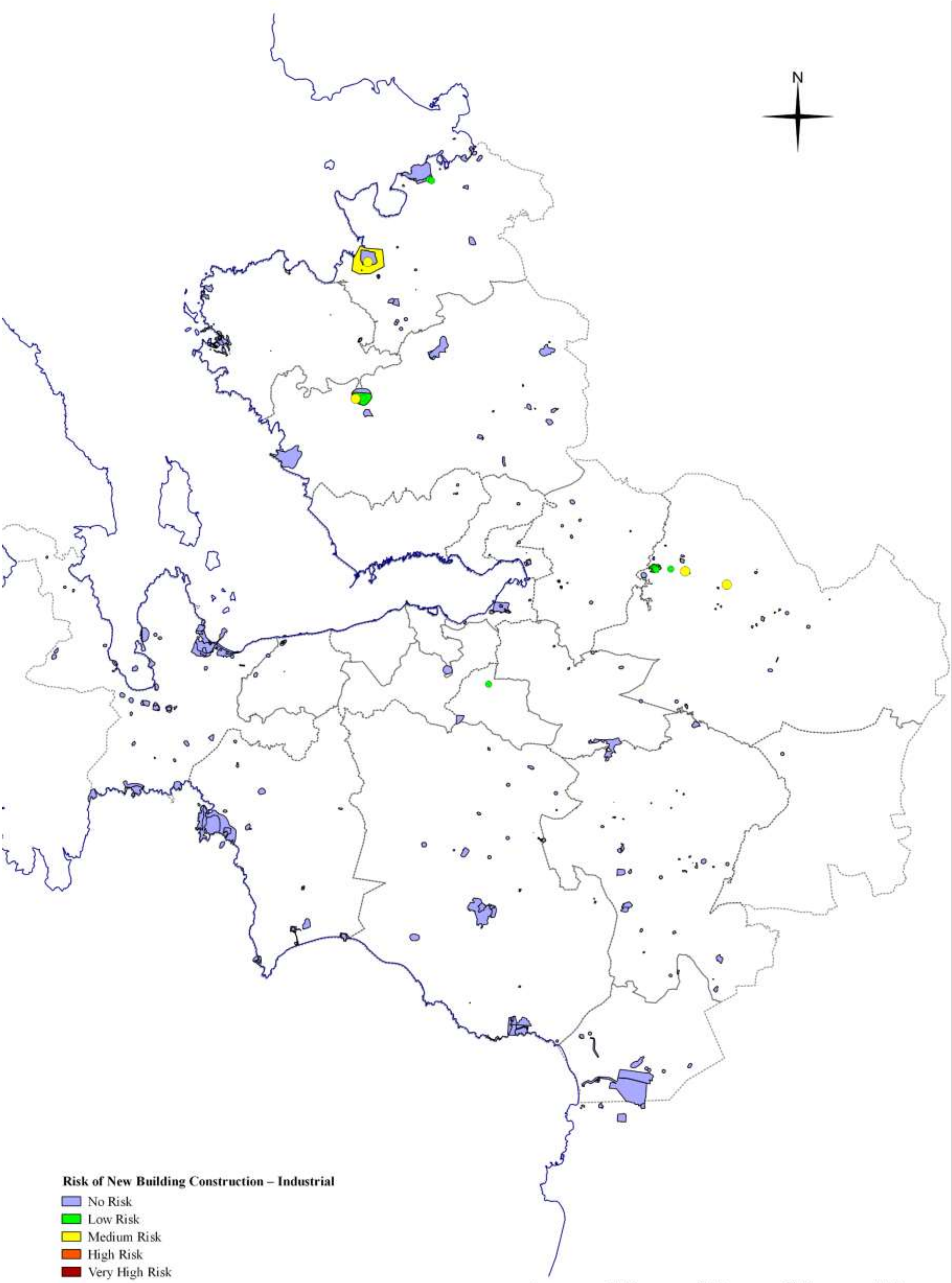

Figure 4.40. Map of Risk of New Building Construction – Industrial

Risk of New Building Construction – Tourism

Tourism development in Seferihisar and Urla may have significant impacts on archaeological values in these towns. Teos, Notion, Yeni Foca and six more sites that could not have been named in Urla and Seferihisar are at risk (See Figure 4.41).

Risk of New Building Construction – Recreation

Recreational developments in Aliaga, Bornova, Foca, Kemalpasa, Konak, Seferihisar, Selcuk, and Urla pose risks to certain archaeological sites in Teos (high risk), Phokaia, Ege Gubre/Kyme and several other unnamed archaeological settlements with medium and low levels of risk. (See Figure 4.42)

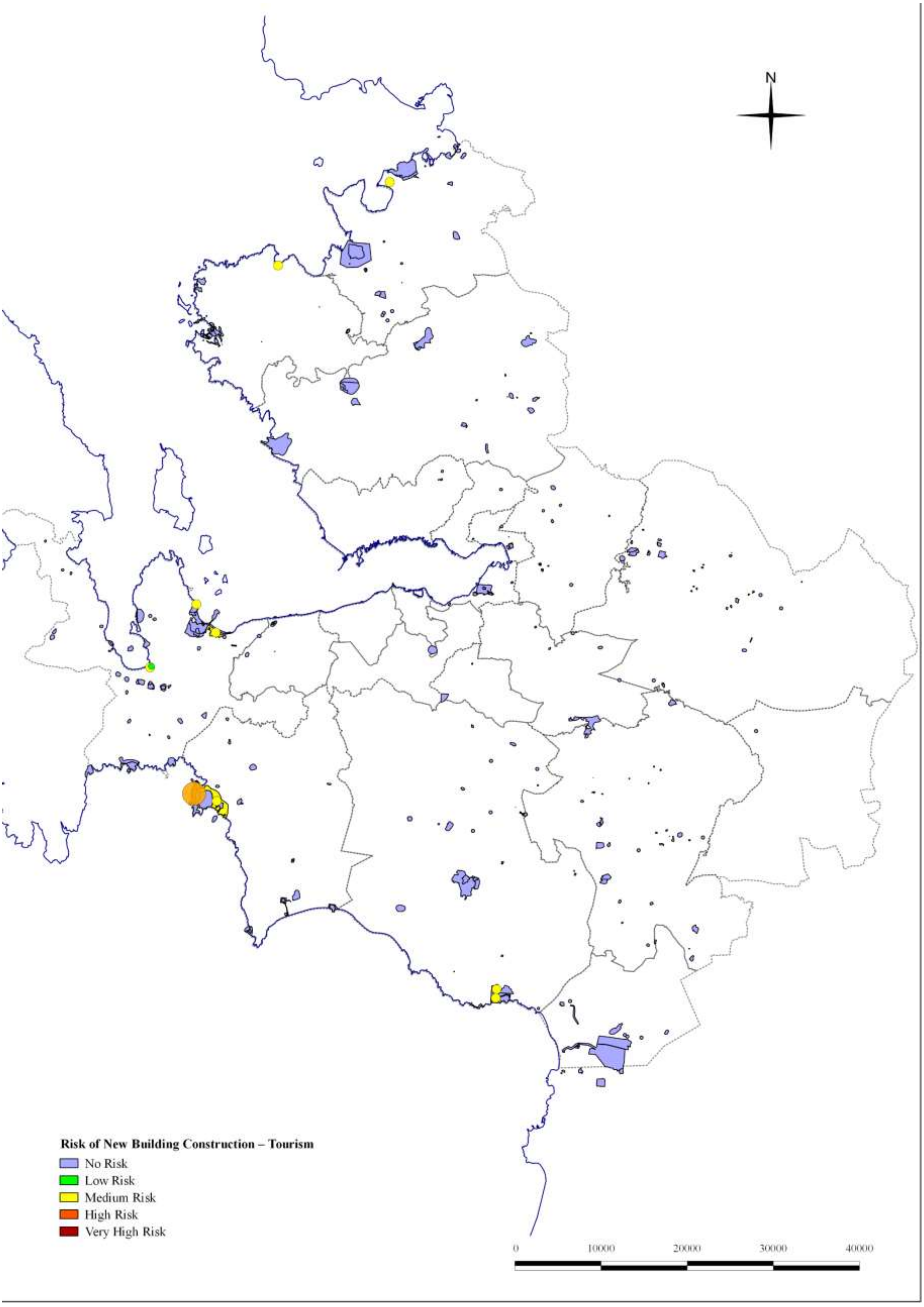

Figure 4.41. Map of Risk of New Building Construction – Tourism

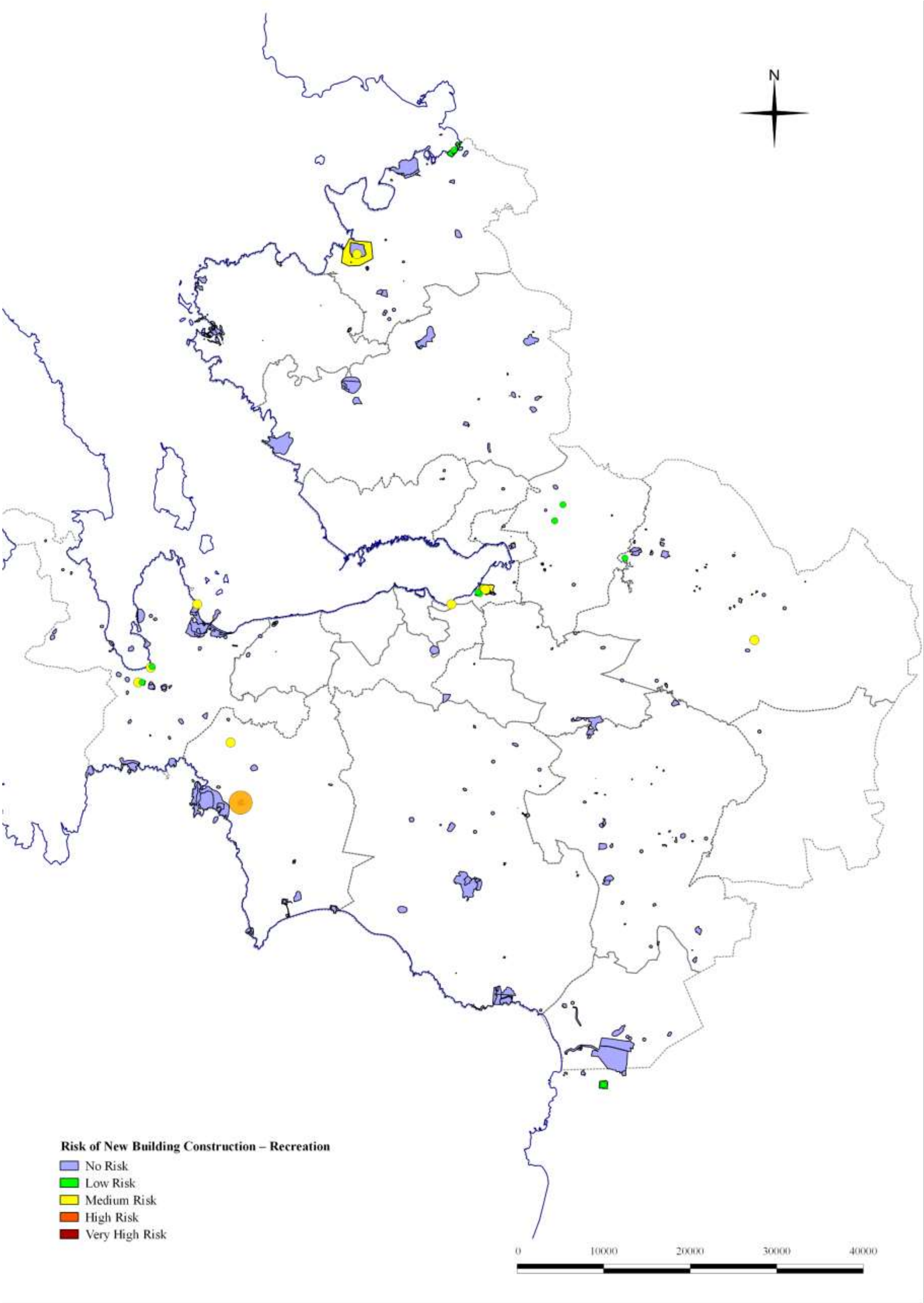

Figure 4.42. Map of Risk of New Building Construction – Recreation

Risk of New Building Construction – Large Urban Facilities

Construction of large urban facilities in Kemalpasa, Bornova, Urla and Menemen increase risks to archaeological settlements including Ozbek / Carpank with very high risk level, and the remaining eleven sites with medium or low levels of risk (See Figure 4.43).

Risk of New Building Construction

Overall, new building developments in Urla and Seferihisar cause very high- or high-level risks to some sites. New building developments in Kemalpasa, Bornova, Konak, Menemen and Aliaga pose risks at low- and medium-levels. In total, 62 sites are affected from new construction development. Six of them are under very high- or high-level risk of development (See Figure 4.44).

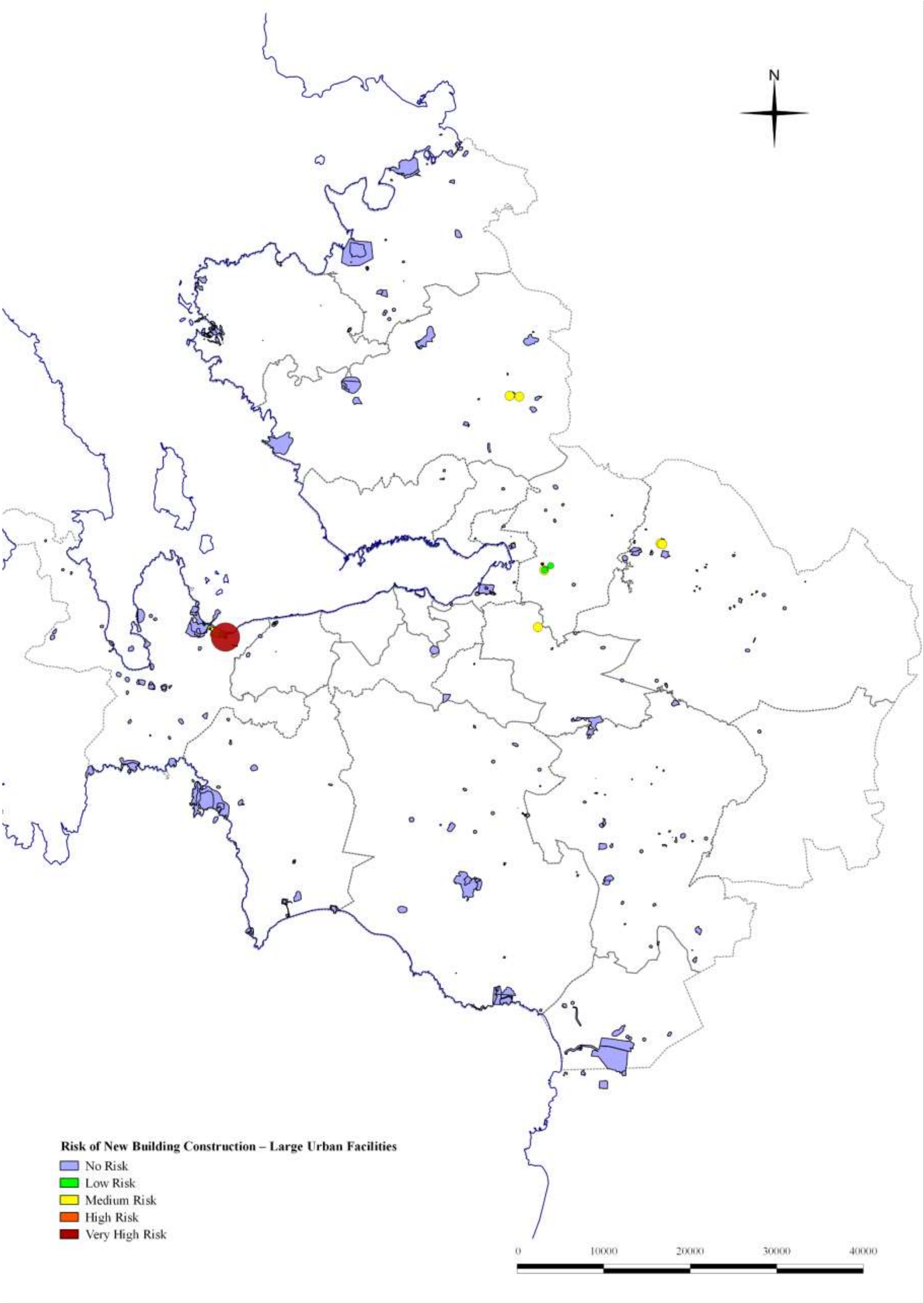

Figure 4.43. Map of Risk of New Building Construction – Large Urban Facilities

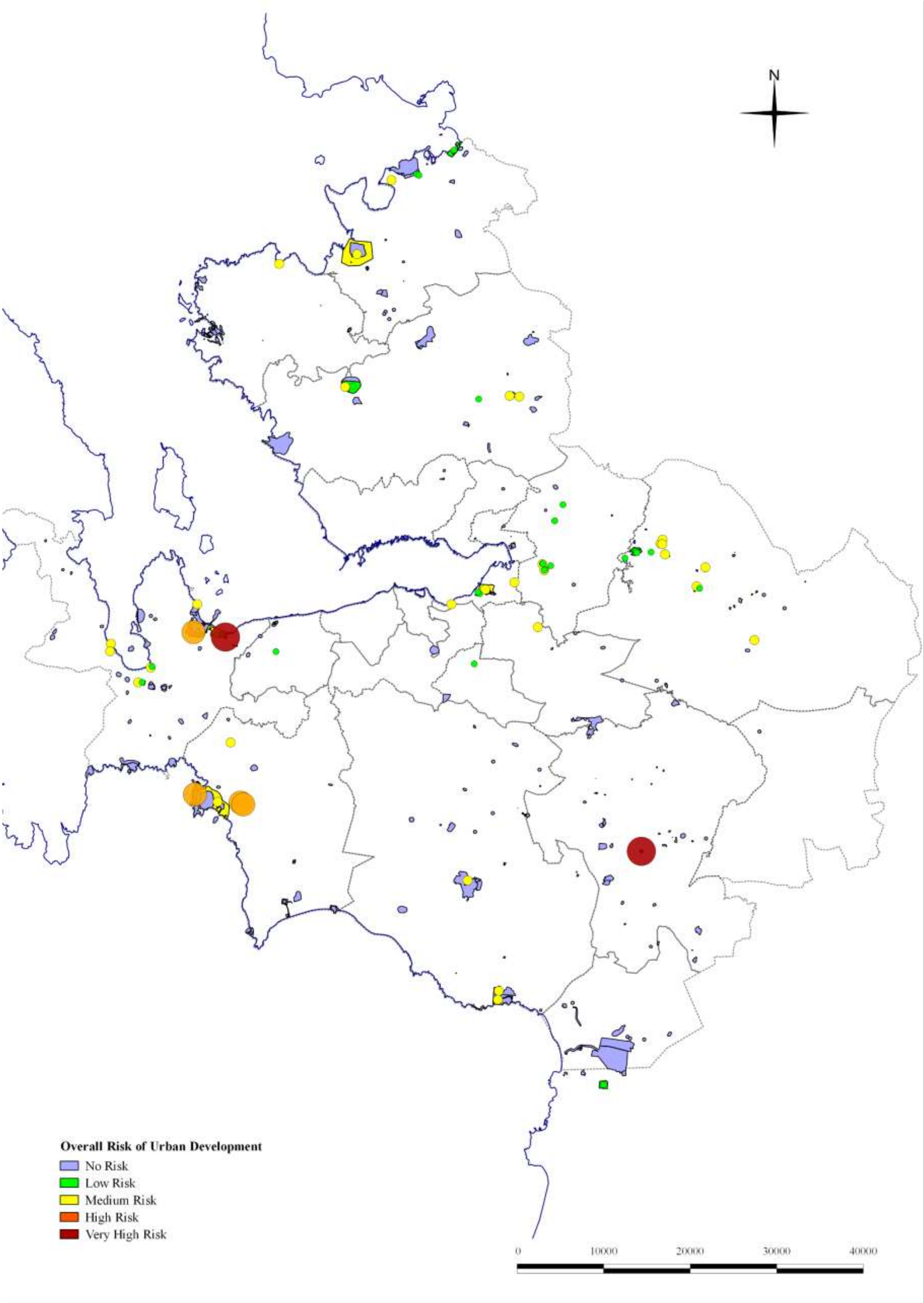

Figure 4.44. Map of Risk of New Building Construction

Risk of Transportation Infrastructure Development

Risk of transportation infrastructure development is assessed under the following categories:

- Risk of Transportation Infrastructure Development – Roads
- Risk of Transportation Infrastructure Development – Railway
- Risk of Transportation Infrastructure Development – Subway
- Overall Risk of Transportation Infrastructure Development

Risk of Transportation Infrastructure Development – Roads

Transportation infrastructure development is a widespread threat that affect many sites. Particularly archaeological assets including Bayrakci 2, Hoyucek 2, Lembertepe, Narlidere, Ozbek / Carpank, and Tepekoy are under very high risk, while Bayrakli, Klazomenai, and Teos are under high risk. Several sites located in Urla, Torbali, Seferihisar, and Menderes are exposed to the risk of road infrastructure development (See Figure 4.45).

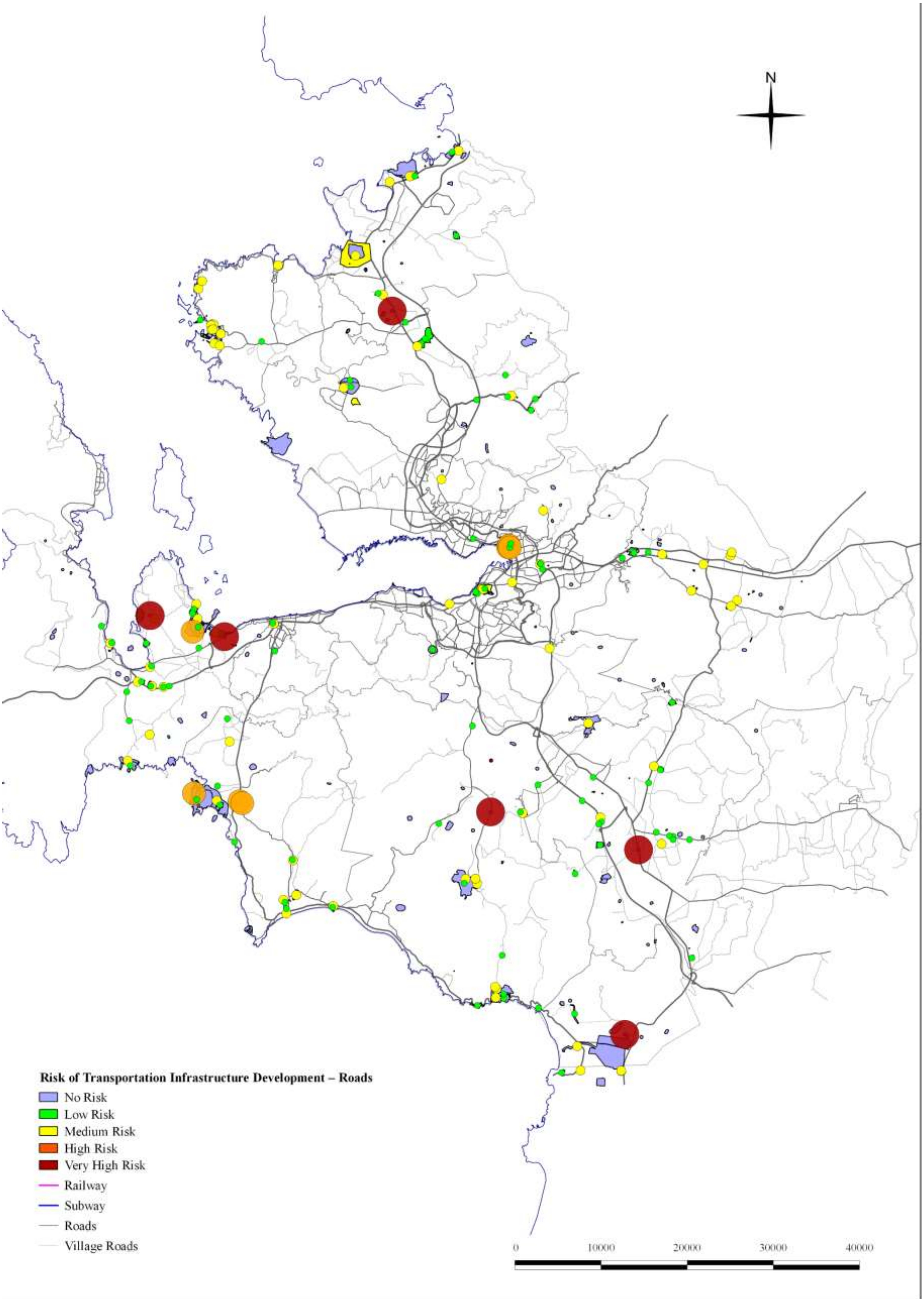

Figure 4.45. Map of Risk of Transportation Infrastructure Development – Roads

Risk of Transportation Infrastructure Development – Railway

Railway construction is a risk factor for certain sites in Aliaga, Torbali, and Menemen. In total 11 sites are under the risk of railway infrastructure (See Figure 4.46).

Risk of Transportation Infrastructure Development – Subway

Archaeological settlements in Menderes, Menemen, Bayrakli, Aliaga and Konak under the risk of subway infrastructure development. Altintepe in Menderes and Bayrakli in Bayrakli are at very high- and high-level risks respectively (See Figure 4.47).

Risk of Transportation Infrastructure Development

Transportation infrastructure development is a widespread threat for archaeological settlements in Izmir Metropolitan Area. Particularly, road transportation development have the highest impacts on the conservation of archaeological properties. Specifically, archaeological assets located in Urla, Torbali, Menderes, Aliaga, and Selcuk are exposed to very high-level risk of transportation infrastructure development. Some of these include Altin Tepe, Bayrakci 2, Hoyucek 2, Lembertepe, Narlidere, Ozbek / Carpank, Sutunlu Magara, and Tepekoy. Besides, certain areas around Bayrakli, Seferihisar, and Urla are under high risk of transportation infrastructure. Many other unnamed that are shown identified on the prepared risk maps are under medium and low-levels of risks (See Figure 4.48).

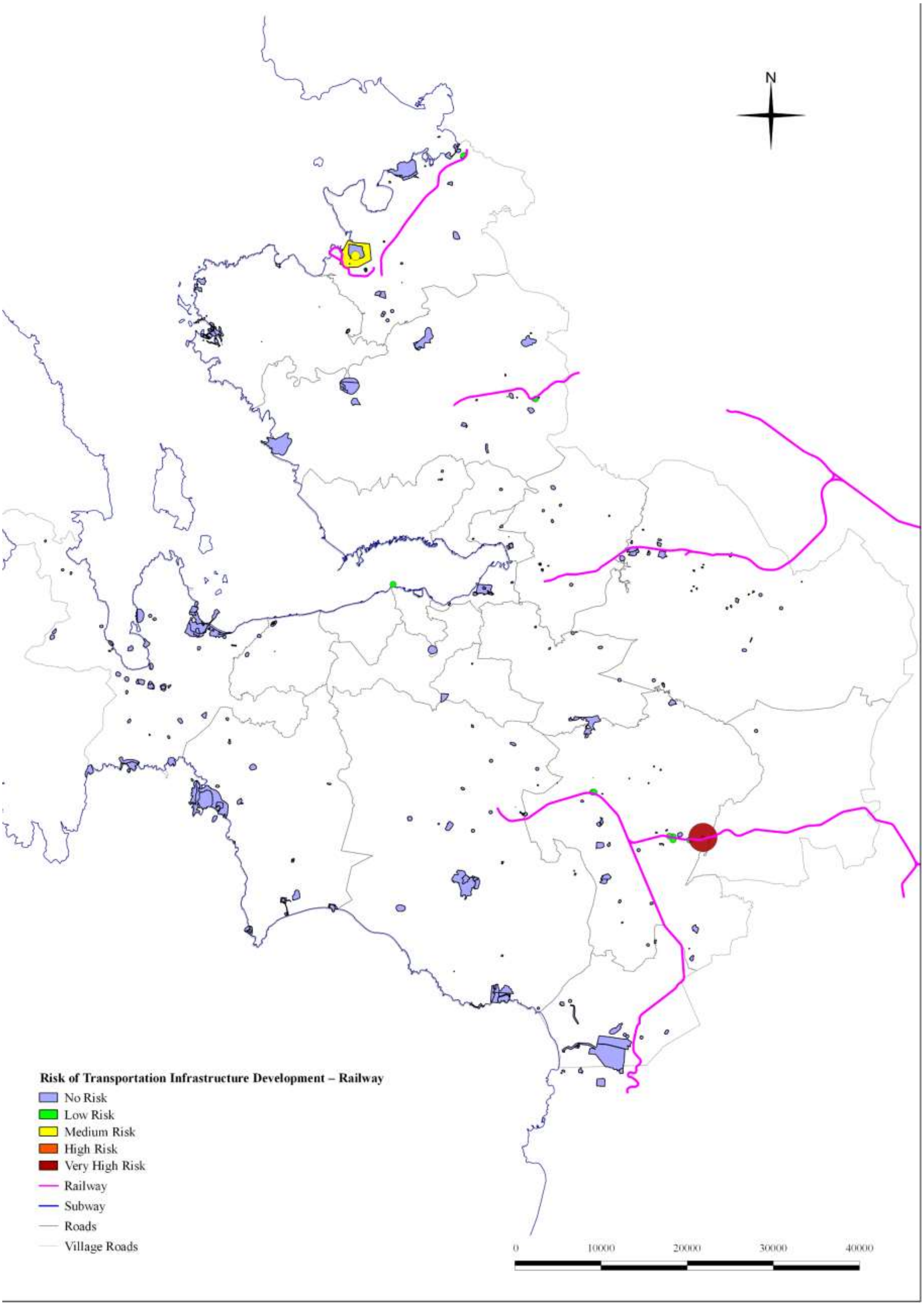

Figure 4.46. Map of Risk of Transportation Infrastructure Development – Railway

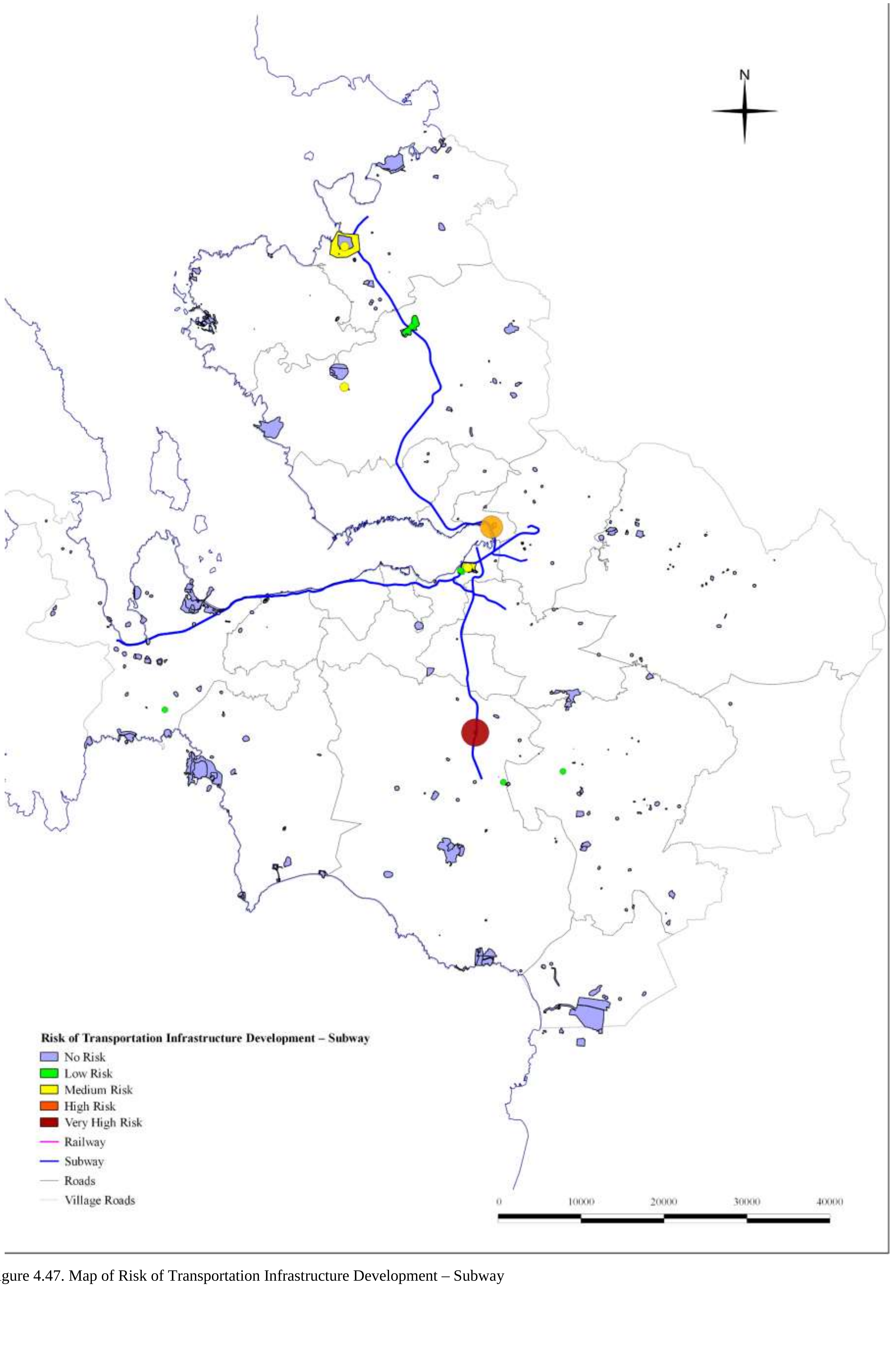

Figure 4.47. Map of Risk of Transportation Infrastructure Development – Subway

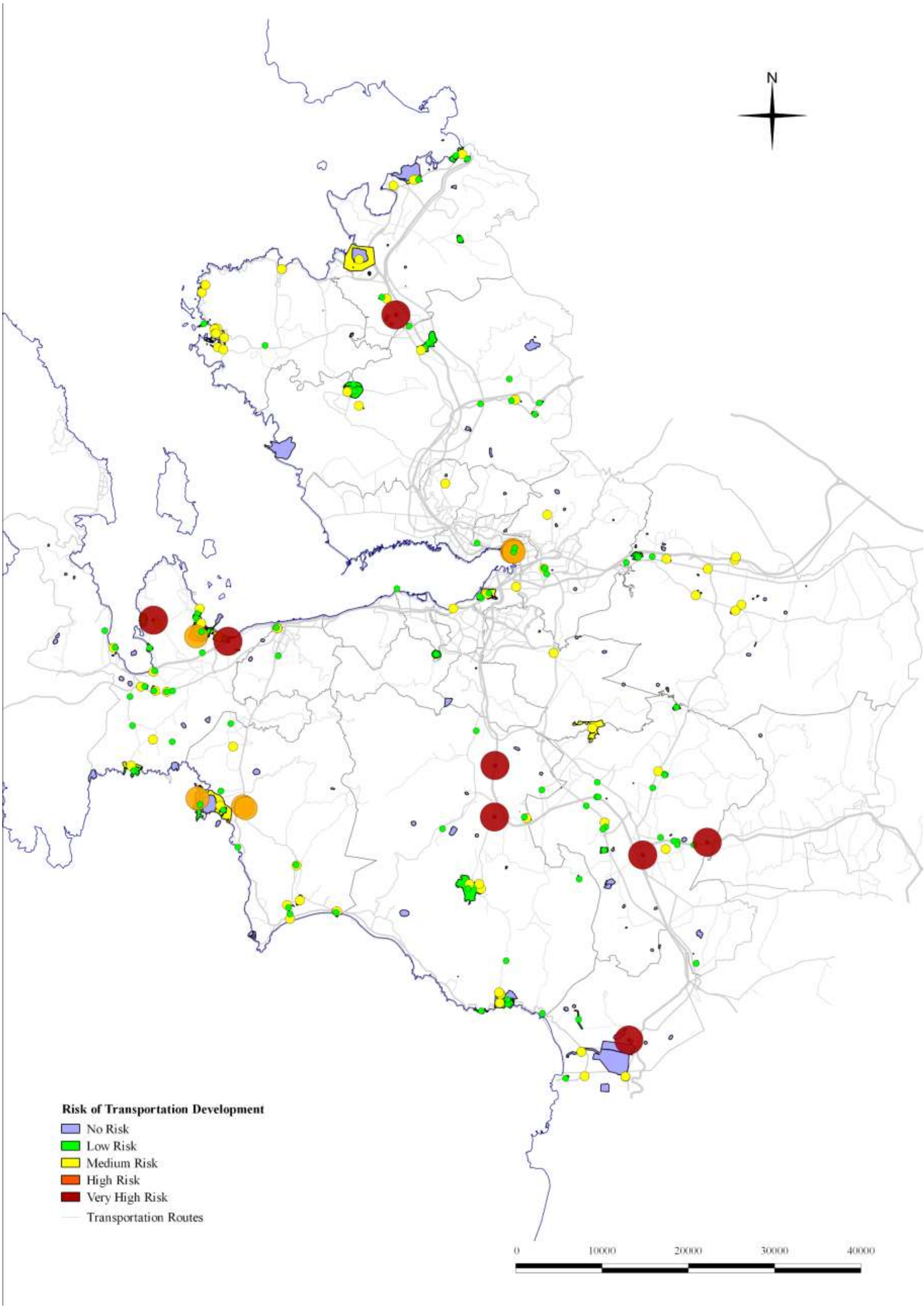

Figure 4.48. Map of Risk of Transportation Infrastructure Development

Risk of Utility Infrastructure Development

Utility infrastructure development is another widespread development activity. In this category, three types of threats are identified for archaeological sites: power lines, natural gas pipe lines and dams. The following maps are generated with respect to this development hazard:

- Risk of Utility Infrastructure Development – Power Lines
- Risk of Utility Infrastructure Development – Natural Gas Pipe Lines
- Risk of Utility Infrastructure Development – Dams
- Overall Risk of Utility Infrastructure Development

Risk of Utility Infrastructure Development – Power Lines

Several sites are under the risk of power utility infrastructure. These sites are mostly on the north-south power transmission axis. Hoyucek 2 in Aliaga is under very high-level risk. Ege Gubre/Kyme and seven unnamed sites are under medium-level risk. Larisa and nine other sites are under low-level risk (See Figure 4.49).

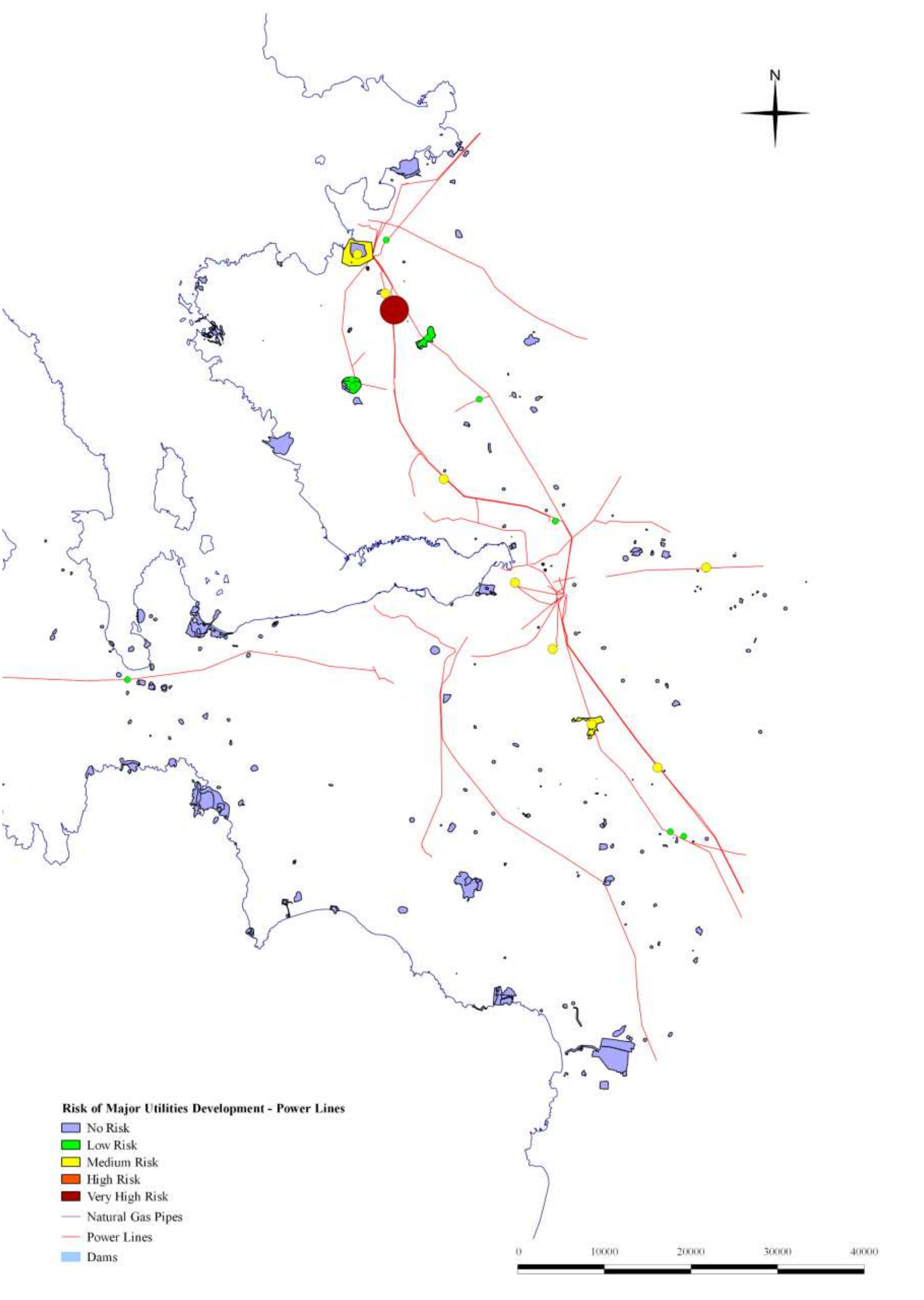

Figure 4.49. Map of Risk of Utility Infrastructure Development – Power Lines

Risk of Utility Infrastructure Development – Natural Gas Pipelines

Natural gas infrastructure development causes a moderate-level risk for archaeological sites. Fourteen sites are under low- and medium-level of risk of natural gas pipeline infrastructure (See Figure 4.50).

Risk of Utility Infrastructure Development – Dams

Dams and dam construction pose risks to some archaeological sites located in Kemalpasa, Selcuk and Seferihisar with varying levels of risks (See Figure 4.51).

Risk of Utility Infrastructure Development

Utility infrastructure is not as impactful as transportation infrastructure. Several sites are affected from utility infrastructure development. Only Hoyucek 2 is under very high risk. The other sites shown on the maps are under medium or low levels of risk (See Figure 4.52).

Briefly, archaeological sites in Izmir Metropolitan area is at risk of development. Particularly, housing developments in Urla, Seferihisar and Torbali (with very high, high, medium levels); tourism and recreational developments in Seferihisar, large urban facilities in Urla may have adverse impacts on the conservation of irreplaceable archaeological values. Transportation infrastructure development is the most widespread and the biggest concern that pose risks at very high, high, medium levels. Specifically, road infrastructure development pose risks in Aliaga, Bayrakli, Urla, Seferihisar, Menemen, Selcuk and Torbali, while subway infrastructure development may have impacts in Menderes, and railway infrastructure in Torbali. Finally, utility infrastructure development such as power lines in Aliaga, dams in Menderes and Aliaga pose risks to certain sites at very high and medium levels.

Particularly, sites that are not registered are at the highest level of risk. Urla, Seferihisar are the most affected districts, followed by Aliaga, Bayrakli, Menemen, Selcuk, and Torbali. Several sites at medium level risk in Kemalpasa, Konak and Menderes. Registering sites that are not protected; prioritizing surveys in these districts is critical. There is also need for reviewing planning decisions and collaboration for prevention and mitigation.

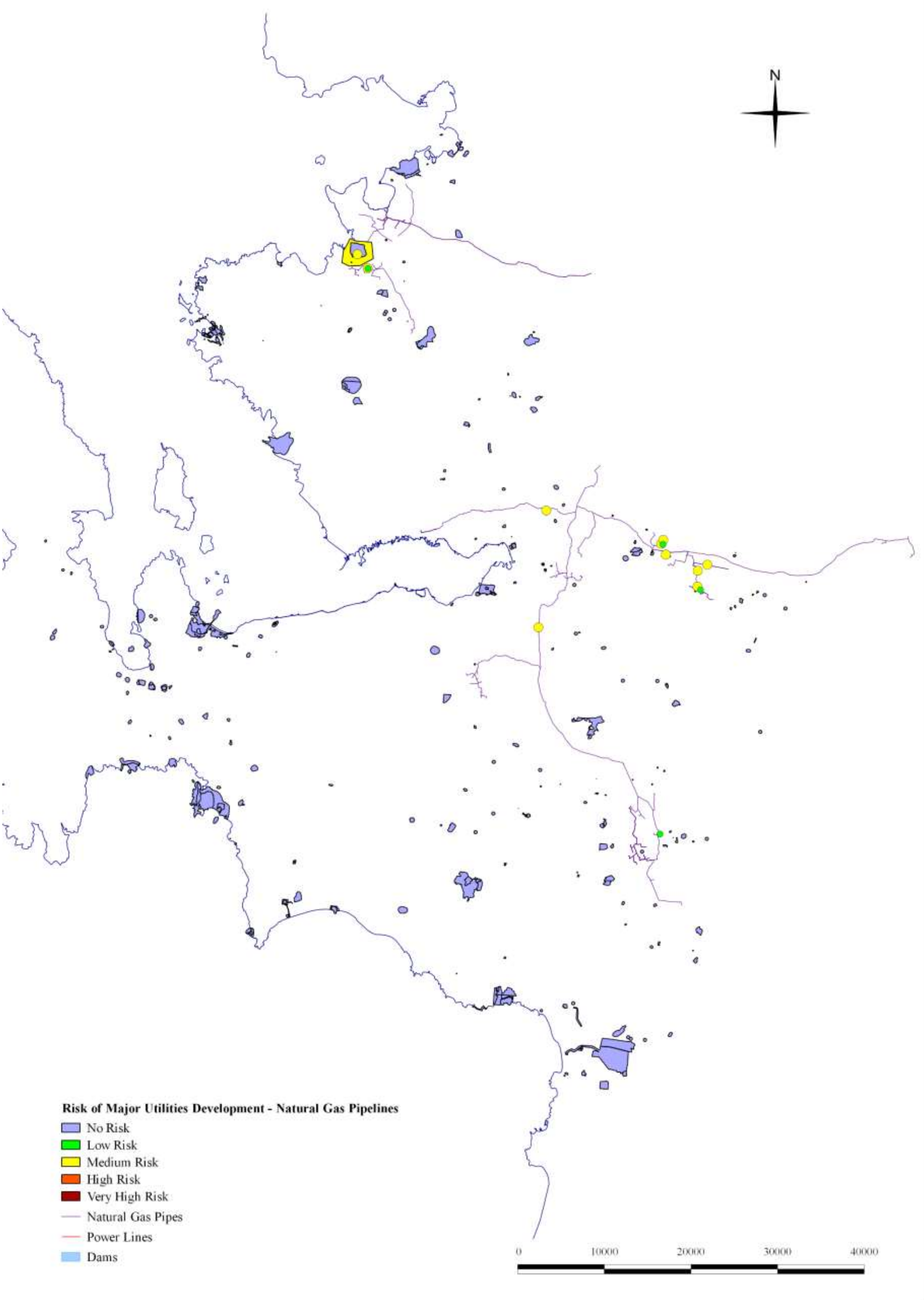

Figure 4.50. Map of Risk of Utility Infrastructure Development – Natural Gas Pipelines

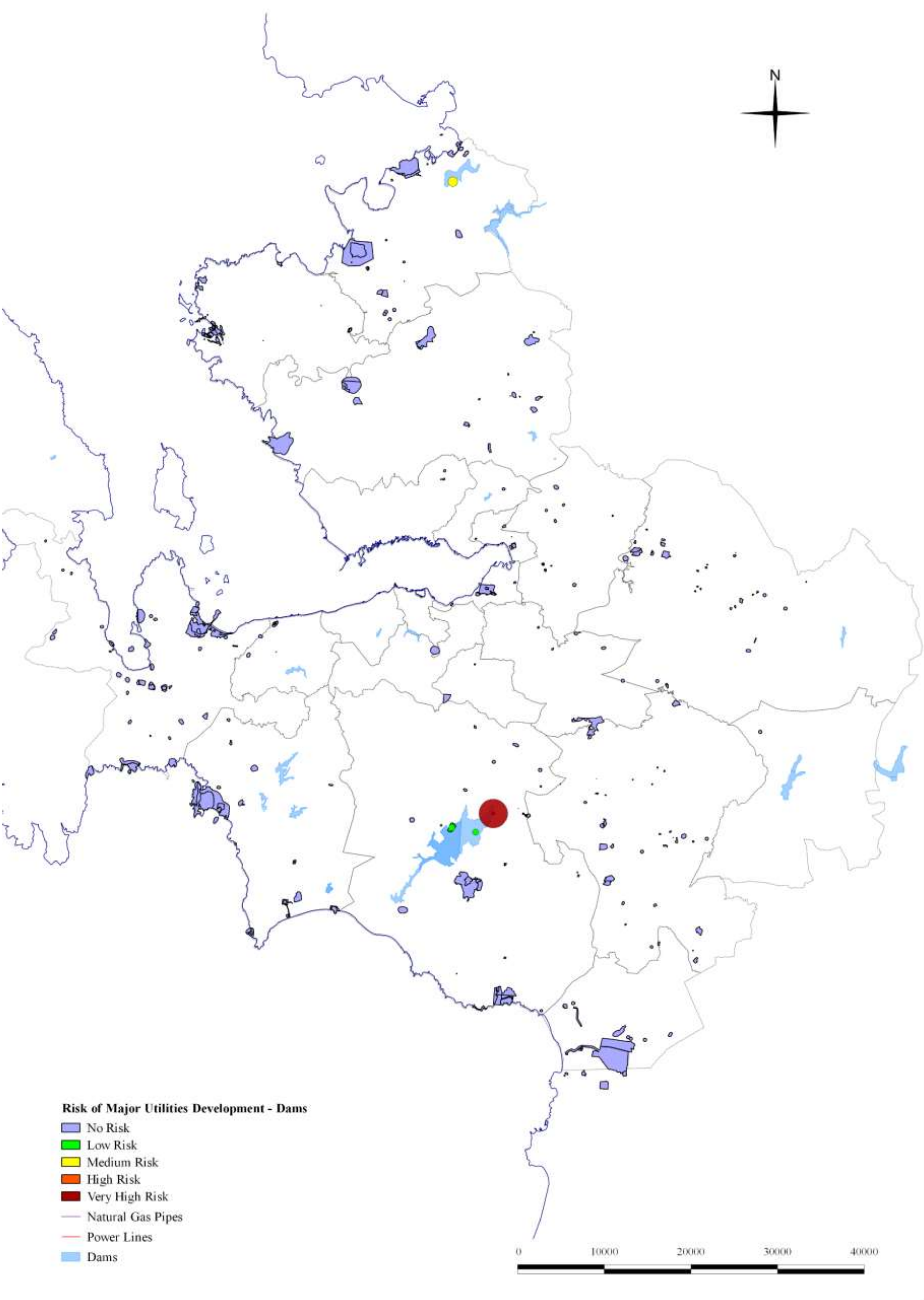

Figure 4.51. Map of Risk of Utility Infrastructure Development – Dams

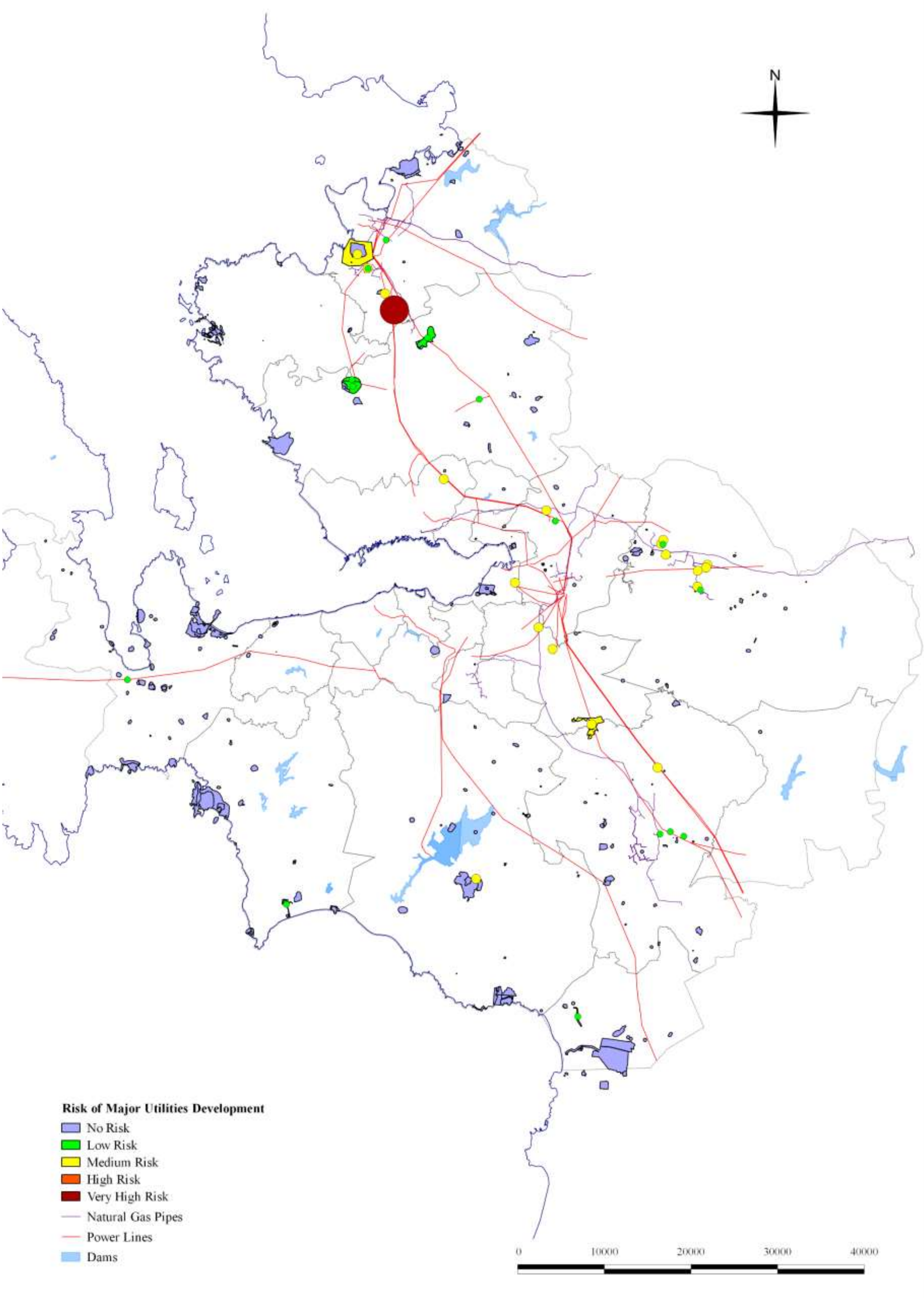

Figure 4.52. Map of Risk of Utility Infrastructure Development

Individual-Induced Hazards

In addition, risks of individual induced hazards are assessed though the system, following the proposed risk assessment framework at territorial scale. Maps are created for the following categories of risks:

- Risk of Individual-Induced Hazards – Agricultural Activities
- Risk of Individual-Induced Hazards – Forest Fires
- Risk of Individual-Induced Hazards (Agriculture and Forest Fires)
- Overall Risks for Archaeological Sites in Izmir Metropolitan Area

Risk of Individual-Induced Hazards – Agricultural Activities

Many sites are located in agricultural areas. Ten of these sites, which are not registered, are under the category of very high risk. Most of these sites are situated in the southern and southeastern parts of Izmir. There are also sites in Seferihisar, Aliaga, Urla and Menderes that are under the low-level risk category, while five sites in Selcuk, Urla, Aliaga and Seferihisar are under high-level risk category (See Figure 4.53).

Risk of Individual-Induced Hazards – Forest Fires

Many sites are located within forest areas and may be subject to the forest fire risk. Three sites in Selcuk are under high-level risk and very high-level risk of forest fires. Five sites in Aliaga, Seferihisar, and Urla are under medium-level risk. The remaining sites are under low-level risk of forest fires (See Figure 4.54). As the kinds of materials are significant, these sites' vulnerability should be evaluated at site level, as the second level of assessment.

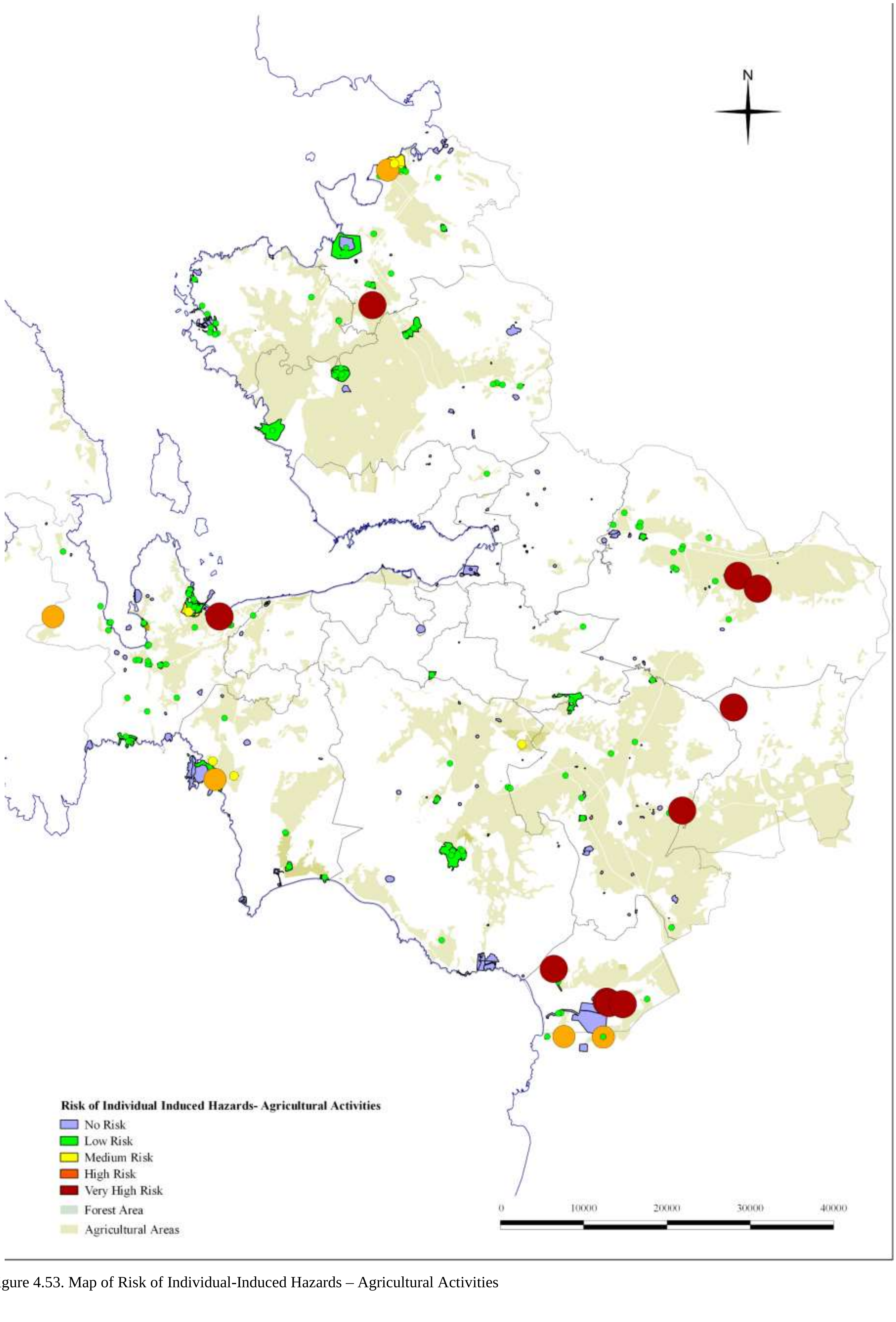

Figure 4.53. Map of Risk of Individual-Induced Hazards – Agricultural Activities

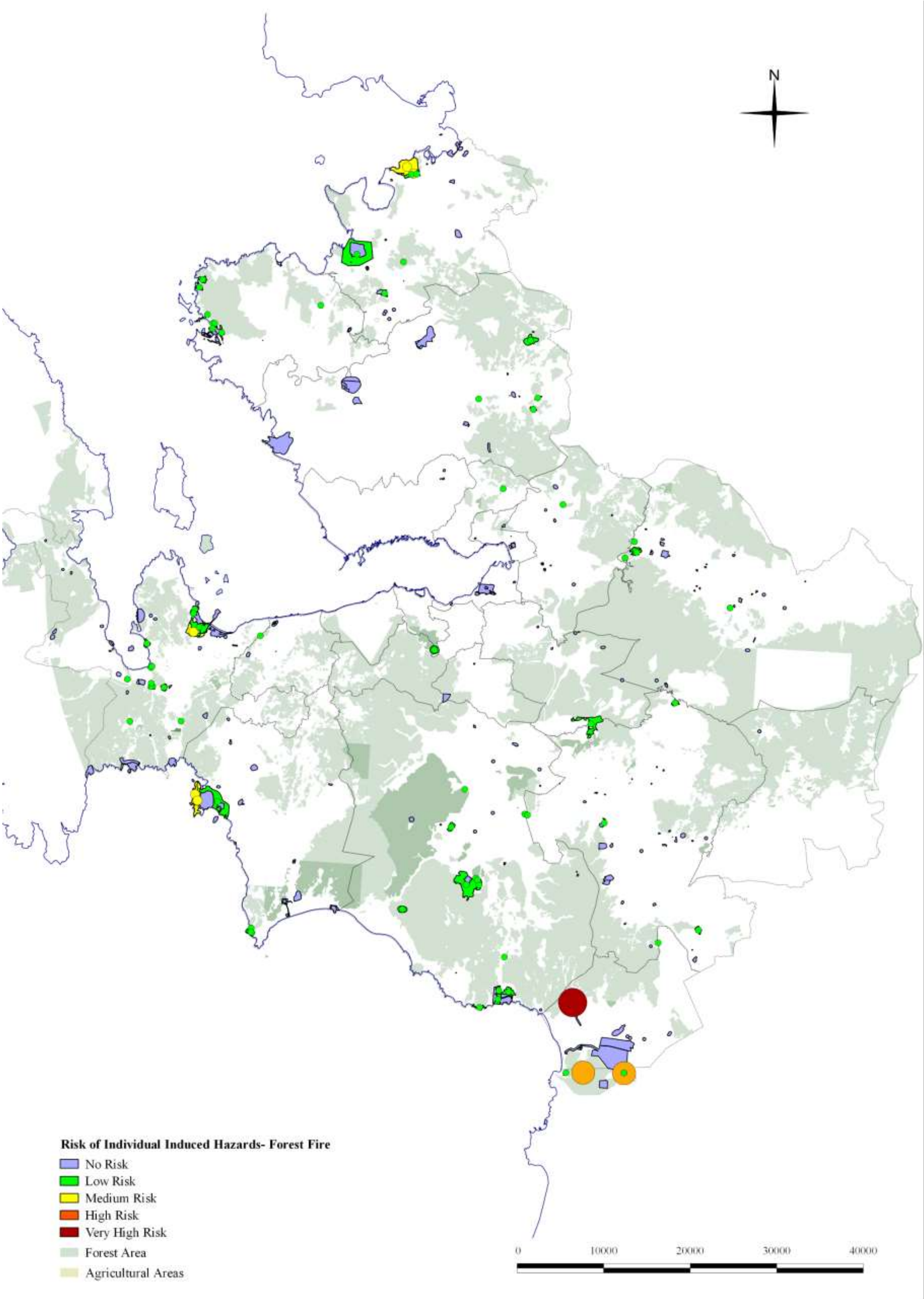

Figure 4.54. Map of Risk of Individual-Induced Hazards – Forest Fires

Risk of Individual-Induced Hazards (Agriculture and Forest Fires)

When both risks of agriculture and forest fires are examined together, 171 sites are under the risk of these human-induced hazards. While 10 sites are under very high risk, 5 sites are under high risk, and 8 sites are under medium risk categories. The remaining sites are under low risk category (See Figure 4.55).

Agricultural Activities is widespread in several districts including Selcuk, Torbali, Bayindir, Kemalpasa, Bornova, Seferihisar, Urla and Aliaga, while forest fires risk, which is at very high and medium levels may have impacts in Selcuk and Seferihisar. There is need for strategies for prevention regarding agricultural interventions. Besides, illicit digging is a widespread threat and necessitates security measures at vulnerable archaeological sites.

Overall Risks for Archaeological Sites in Izmir Metropolitan Area

Overall, 294 sites are at risk of at least one type of hazard and with varying levels. 166 sites are under low-level risk. 91 sites are under medium risk, 17 sites are under high risk and finally 20 sites are under very high risk (See Figure 4.56). When the overall risks are compared with risk of natural hazards, it can be seen that only 5 out of 20 sites at risk of natural hazards and within the category of very high level risk. Similarly, 6 of 17 sites are at risk of natural hazards and within the category of high level risk.

Development has been assessed in three components: urban development, transportation development, and utility development. Among these, transportation infrastructure development has the highest impacts on archaeological sites. 16 sites are under high or very high risk of transportation infrastructure development. Urban development poses risks to six sites with high or very high levels of risk. Lastly, utilities infrastructure affects only one site significantly. Overall, 16 of 37 sites with high or very high overall risk are at risk due to urban development, while 15 out of 37 sites with high or very high overall risk levesl are at risk of individual-induced risks of agricultural activities and forest fire. These evaluations reveal that institutional (development) and individual-induced risks are equally threatening for archaeological heritage.

Finally, Teos in Seferihisar, Ozbek/Carpank in Urla are rated as high or very high risk in three out of following five classes of risks of natural processes, urban development, transportation infrastructure, utility infrastructure, and human induced hazards. Besides, Bayrakci 2, Hoyucek 2, Klazomenai, Sutunlu Magara, Tepekoy are rated as at high or very high level of risk in two out of five abovementioned categories of risks. The remaining sites are rated as high or very high level risk in one of these five classes.

The proposed risk assessment methodology, applicability of which is tested through the case of Izmir has the capacity to empower decision makers and help them align their decision-making with preventive conservation and risk management strategies by providing precisely the information they need at territorial scale. The system developed for the Assessment of Risks at Territorial Scale (ARTS) in Izmir Metropolitan Area provides information about the kinds of threats, factors affecting vulnerabilities of sites to these threats, sites that are vulnerable to a specific kind of hazard, as well as sites at risk. Outcomes of the system help identify priorities and develop strategies to prevent and mitigate risks. Accordingly the system proves its capacity to contribute to the effective management of archaeological heritage, with a capacity to guide lower scale conservation and planning decisions.

This assessment methodology enables decision-makers see the big picture regarding the priorities at territorial level. Besides, providing information about the presence, level and geographical distribution of various risks increases the effectiveness of the decision maker, who have the authority to direct financial flows towards conservation measures. In addition, database constructed for the assessment allows users select the most appropriate management strategies specific to the kind of threat in order to reduce risks through territorial and site-level strategies. Decreasing the level of vulnerability of sites at risk can be possible by looking at what makes them vulnerable to a specific hazard. Likewise, sites at risk of natural hazards necessitate developing strategies for mitigation, and preparedness, while sites with low vulnerability may require focusing more on monitoring. Finally, this methodology enables producing relevant strategies for each hazard and shows priorities in managing risks at territorial scales.

According to the outcomes of the assessment, 37 sites which are rated as at high and very high risk should be prioritized in management decisions. Besides, strategies can be developed based on the hazard. Sites at risk of geological hazards, which is identified as Kadifekale, which has been already within the programs of the Metropolitan Municipality, should be considered in terms of mitigation and preparedness, after a thorough analysis at site level by specialists. With respect to flooding risk, sites at risk of flooding should be investigated in terms of possibility of prevention and preparedness. Besides, factors affecting their vulnerability should be examined. Similarly, sites at risk of development requires first strategies developed in terms of prevention through revision of development plans in collaboration with the planning authority, which is Metropolitan Municipality. Besides, it is important to prioritize archaeological assets located within development areas within the processes of survey, registration to ensure if there is any site not registered, planning, excavation/research, conservation and restoration if applicable to minimize the possible impacts of development. In addition, in relation to individual induced hazards, security and monitoring of sites should be considered, especially focusing on damage through agricultural activities and illicit digging, both of which are the most severe threats. Sites located in forest areas and at risk of forest fire should be investigated in terms of their vulnerability, focusing on strategies for mitigation, prevention and preparedness.

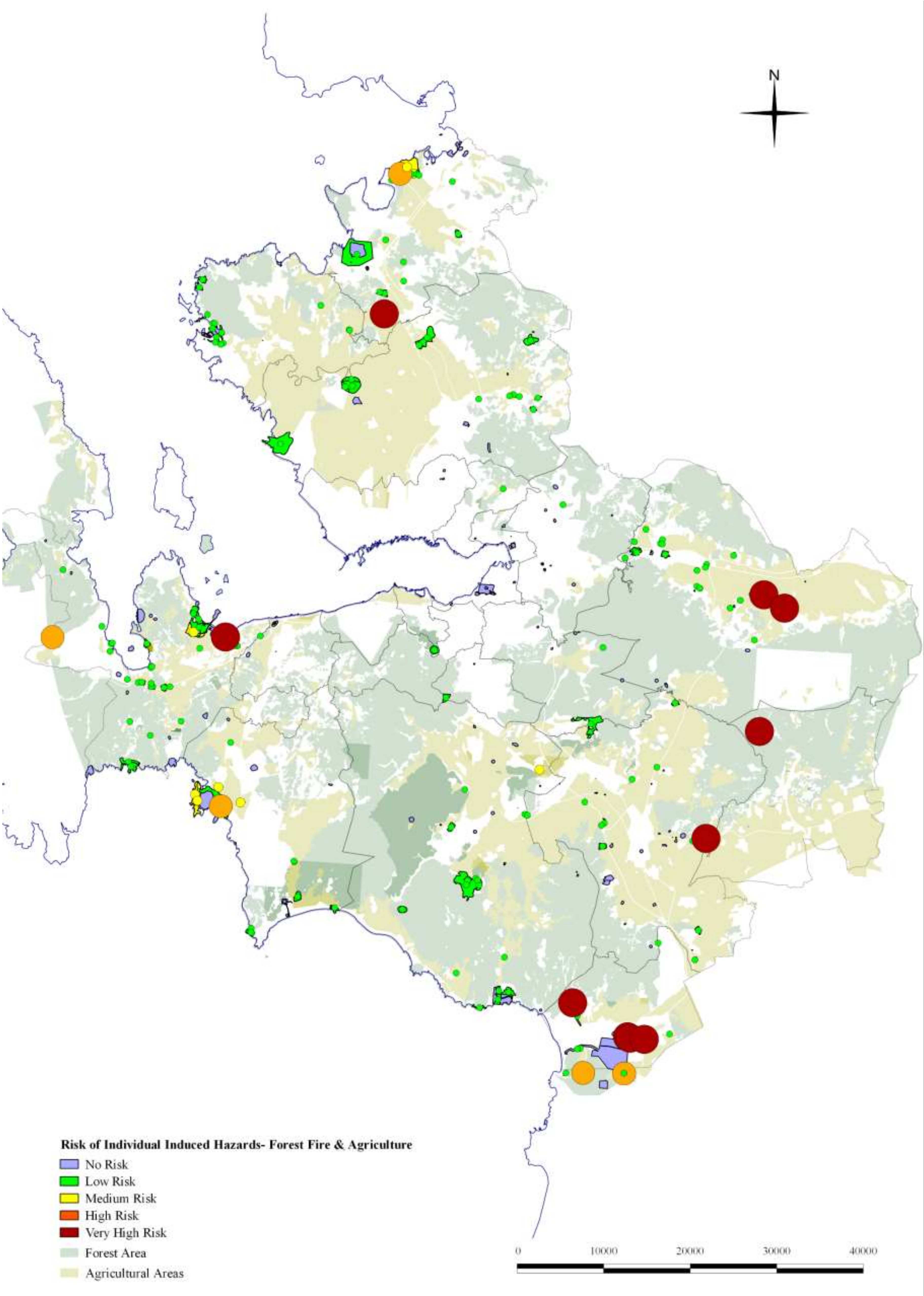

Figure 4.55. Map of Risk of Individual-Induced Hazards (Agriculture and Forest Fires)

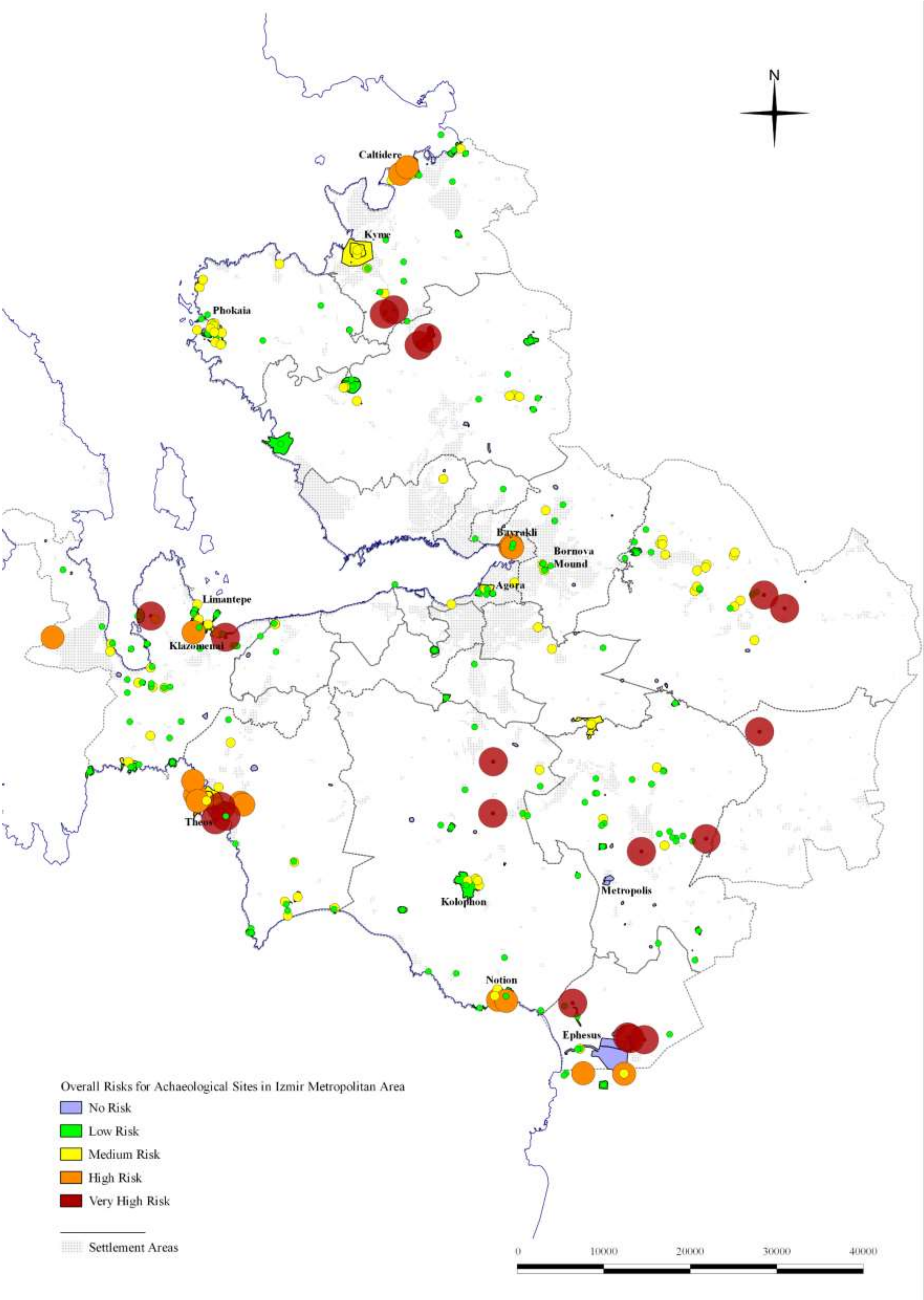

Figure 4.56. Map of Overall Risks for Archaeological Sites in Izmir Metropolitan Area

CHAPTER 5

CONCLUSION

For present as well as future generations, what has reached today from previous societies is very precious and delicate cultural heritage. Archaeological heritage, which is extremely significant for the humankind in understanding past societies, and identifying its cultural and social roots, constitutes an important part of world's cultural heritage, and hence merits to be conserved. When it is not protected properly, it is lost forever. On the other hand, there is no doubt that archaeological assets have been increasingly facing **severe natural and human-induced hazards** that impend their conservation. Quite a lot of archaeological sites are continuously exposed to endless number of dangers. ICOMOS International Committee for Archaeological Heritage Management (ICAHM) also underlines that much of the World's archaeological heritage is at risk. ICOMOS Heritage at Risk Reports show the critical numbers of archaeological heritage at risk in different parts of the World. The consequence in any case is loss of irreplaceable archaeological values.

Managing the complexity of issues surrounding the heritage is quite challenging for many places, considering the scarcity of funds available as opposed to the vast number and variety of the components of this heritage. The lack of ownership of the community is usually another impediment. Therefore, there is still a long way to go before achieving the intended results in archaeological heritage management. How well resources are used, and how well natural and human-caused risks are managed and mitigated, are critical factors to ensure conservation and protection of invaluable heritage. Lessons learnt after hazardous events prove that it is very late, ineffective, inefficient, and costly to intervene after a hazardous event has occurred at a heritage site. Therefore, success of efforts to conserve cultural assets depends on effective proactive conservation and management strategies that take into account **management of a wide range of natural and human-induced risks**.

However, managing risks is a challenging task. **Risk assessment** and management has been in the agenda of **different disciplines dealing with** various types of risks (such as risk in investment and operational decisions, environmental damage, fire or natural hazards) especially since 1980's due to the need to prevent and mitigate undesired consequences. With respect to disaster risks, and possibly as a response to increasing impacts of disasters on communities, Disaster Risk Management has lately emerged as an applied interdisciplinary field[472]. Managing risks, particularly of disasters, has also found its reflection in the conservation studies especially after 1990's.

The gradually increasing importance of risk management is seen in the cultural and natural heritage conservation field through many international meetings on this subject and publication of manuals for managing World Heritage. Based on principles developed through the efforts of international nongovernmental and intergovernmental organizations like ICOMOS, ICCROM, IUCN and UNESCO, integration of heritage-at-risk framework into archaeological heritage management policies becomes a vital task for countries including Turkey, which has rich and diverse archeological values. However, managing risks necessitates an informed judgment about risks, and requires strategies at all levels of decision-making. Especially, for territories with dense and rich archaeological setting, the conservation of archeological heritage necessitates strategies at territorial scale, due to the necessity of dealing with complex and multi-dimensional factors **concerning both natural and human-induced dangers as well as vulnerabilities** deriving from physical characteristics of cultural assets as well as legal, administrative, and socio-economic circumstances.

[472] Van der Waldt, 2013

5.1. The Proposed Risk Assessment Methodology for Assessment of Risks at Territorial Scale

The relation between the concept of risk and management makes measurement of risk essential to ensure the effectiveness of required decisions and actions to manage risk. A comprehensive and thorough assessment of risks is the key for making an informed judgment on nature of risks, and subsequently for achieving proper conservation and effective management of cultural heritage. Risk assessment is a process that includes collection, analysis, evaluation, presentation and continuous revision of data so that it can be used in the most efficient way for understanding extent and level of risks and accordingly for making decisions within the process of risk management. At that very point, **methodology for assessment of risks through utilizing information about factors contributing to the occurrence and level of various risks** comes up as an important issue, which encompasses proper, systematic and efficient processing and evaluation of complex and multi-dimensional data.

Risk assessment is still a new subject in the conservation field and not advanced enough to be practically used within various contextual and organizational frameworks. General concepts have to be developed into substantial applicable methodologies tailored to specific categories of heritage, considering the scale of assessment. Specifically, with respect to assessing risks threatening multiple archaeological sites located in the same territory, a special risk assessment approach taking into account hazards some of which are particular to this heritage category and characteristics of sites is essential. Moreover, risk assessment at territorial scale is critical for decision-makers to develop strategic tools such as policies, strategies, and planning based on priorities to manage risks to the properties. Seeing the big picture through a large-scale assessment also enables to assess risks of development as well as enables to better deal with most hazards that have impact on large areas rather than a single site. Hence, **this dissertation research proposes a methodology for assessing risks to archeological heritage at territorial scale**.

Focusing on providing a methodology for the assessment of risks to archaeological heritage at territorial scale, and elucidating theories of archaeological heritage management and risk management as well as realities of legal and administrative contexts that govern decision-making processes; this thesis proposes a **methodology especially set up according to the requirements of scale and heritage category**. Territorial scale not only determines the kinds of indicators for measuring level of vulnerability, but also necessitates utilizing Geographical Information Systems (GIS) so as to manage information on multiple hazards and multiple sites as much as possible and integrating it to the various decision-making processes in order to contribute to the risk management of archaeological assets.

Within the framework of the theoretical discussions, the proposed methodology contributes to the current theories of risk assessment of cultural heritage through **enhancing the theory and practices of assessment at territorial level** and elaborating on the significance of tailoring assessment methodologies to the **needs and characteristics of heritage category** by focusing on **archaeological heritage**. Besides, the proposed methodology adopts a holistic approach in **addressing all kinds of risks** including 'development', and further **develops the vulnerability assessment methodologies** by analyzing not only intrinsic/physical but also institutional and social/physical surrounding factors of vulnerability.

Following a **comprehensive and holistic approach**, the thesis addresses **all categories of risks** that derive from natural events and processes, from institutional activities for development and conservation, and finally from actions of individuals and groups. In view of that, the **proposed methodology offers terminological definitions and three categories of hazards and vulnerabilities** (natural, institutional, individual-induced) based on an extensive research and with methodical purposes. Following a uniform assessment approach to all kinds of hazards, the proposed assessment methodology is based on verifying the presence of all spectrum of hazards, which are mostly spatial problems, through

identifying, categorizing and mapping hazards in order to examine their spatial distribution. This allows for the most fundamental criterion/standard for such territorial assessment: **precise corroboration between the individual site and concrete locations** of hazards.

With an analytical approach, the **proposed methodology further brings a unique approach to the assessment of vulnerabilities** of archaeological heritage with respect to abovementioned three categories of hazards. Referring to rationality and terminology of the 'Logical Framework Approach', a management tool used for design, monitoring and evaluation of development programmes/projects, the proposed methodology facilitates the vulnerability assessment in four stages. These include **cause-affect analysis** for analyzing factors that affect vulnerability through 'problem tree model'; **developing indicators** that are specific, measurable, attainable, relevant, and time-bound (SMART); **identifying means of verification** for grounding the assessment framework in the realities of a particular setting and considering how data will be obtained, and **measuring level of vulnerability.** As a result, a set of vulnerability indicators including physical, institutional (legal and managerial) and social factors is developed for each hazard category of natural, institutional and individual-induced. At the final stage, level of vulnerability is evaluated through **determining relative significance and effect of each indicator to the level of vulnerability to a specific hazard**, and subsequently defining various levels of vulnerabilities (within a logical framework in the form of a series of connected prepositions) that necessitate expert judgments.

Finally, the **proposed methodology elaborates on the risk evaluation**, as the last stage of risk assessment. Presence and geographical locations of hazards together with results of vulnerability assessment -revealing different levels of vulnerability for each site - allow evaluating risks to archeological heritage at territorial scale. First, sites at risk can be identified through overlapping two basic components of the assessment: archaeological sites and hazards. This enables producing risk maps for all kinds of hazards, based on the simple 'discriminant “presence/absence” of hazard for each site. Second, the level of risks can be calculated for each site with respect to various hazards. This derives from overlapping of two information: presence of hazard and level of vulnerability of each site to that specific hazard. Here, if the site is exposed to the given hazard, its vulnerability level determines its level of risk to the hazard. Besides, **the overall risk can be presented by using the highest level of risk identified for each site in any one of the hazard categories.** Finally, cartographic presentations of different type of risks and the summarized maps of risks are produced through GIS.

It is also significant to point out certain aspects regarding the **practically and use of the proposed methodology**. Risk assessment has to be a continuous process due to the changing dynamics affecting risks. This necessitates **continuous monitoring of risks (using the established indicators) and updating the risk assessment database**. In order to adopt a preventive approach within an existing administrative and management system, it is important to **provide a system for collecting and updating of data with certain standards** regarding hazards and archaeological heritage, monitoring their level of vulnerabilities. Setting up a system at local, regional, and national levels is essential for the creation, arrangement, and revision of all the information about multiple hazards and vulnerabilities of heritage within a single system feeding all the levels of archaeological heritage management decision-making process. The proposed approach enables the creation of such system within administrative systems. It also allows the production and interpretation of information on risk, which are changeable due to dynamic processes of physical and social territories, at various stages of decision-making processes. Due to the flexibility of the GIS, **new parameters of analysis can be added**, and the databank can easily be updated once the database is constructed. Besides, the proposed system should be maintained regularly through periodic monitoring, and enhanced through providing data about state of condition of the properties.

Another advantage of the proposed approach is that territorial scale risk assessment not only enables managing risks through territorial level decisions but also allows the **integrity and continuity of information on hazards and vulnerabilities through guiding smaller scale decisions**, based on identified priorities at larger scales. Likewise, data and analysis on smaller scales (site-scale) should be carried to the larger ones (territorial scale) to support upper level assessment. This is particularly significant considering ineffectiveness of the site-based, small-scale conservation planning, which is limited in addressing and assessing larger-scale natural and institutional risks, as in the case of Turkey. It is also significant to underline that a 'territory' with aggregates of sites is limited to neither administrative boundaries nor specific dimensions. In other words, this methodology can be adopted to any scale of assessment. Ideally, identifying management and accordingly assessment boundaries by looking at both similarities in characteristics and vulnerabilities of heritage properties and common problems regarding conservation, management and/or natural/human-induced hazards could enhance effectiveness and efficiency of risk assessment and management of cultural heritage. Besides, 'risk assessment methodology' proposed within this thesis especially for multiple archaeological sites in a territory can also be **applied to other kinds of cultural heritage sites with different characteristics**. As the units of assessment are determined at the very beginning of the risk assessment method, based on the typology of the assessment unit, indicators of vulnerability can be defined accordingly.

Since **risk is a complex concept** that results from the togetherness and complex interaction of physical, institutional and social features of archaeological heritage each of which are formed through dynamic processes and external factors of hazards, **variety, availability, quality and standardization of information** is the biggest challenge of risk assessment at territorial scale. Especially, it becomes quite hard to define standards for information concerning indicators of vulnerability. That challenge also stems from the fact that **the kinds of indicators depend on the context of the given territory under examination and characteristics of heritage located in it**. Within this study, the embraced approach is to define a set of physical, institutional, and social (i.e. surrounding context) indicators that can verify vulnerability of a site to each category of hazard, and to use the best available data and triangulation, i.e. the use of multiple sources[473]. Reliability of data can be enhanced through utilizing primary sources of information[474]. It is also expected that the **methodology will facilitate the identification of kind of data needed for the assessment**, and to come up to a data standardization in time, owing to the flexibility anticipated while constructing the theory of vulnerability and vulnerability assessment.

The proposed risk assessment methodology, applicability of which is tested through the case of Izmir Metropolitan Area, **aims to empower decision makers and help them align their decision-making with preventive conservation** and risk management strategies by providing precisely the information they need at territorial scale. The system developed for the **Assessment of Risks at Territorial Scale (ARTS) in Izmir Metropolitan Area** provides information about the kinds of threats, factors affecting vulnerabilities of sites to these threats, sites that are vulnerable to a specific kind of hazard, as well as sites at risk. Outcomes of the system help identify priorities and develop strategies to prevent and mitigate risks. Accordingly, the system proves its capacity to contribute to the effective management of archaeological heritage, with a capacity to guide lower scale conservation and planning decisions.

This assessment methodology enables decision-makers see the big picture regarding the priorities and for the setting up of conservation policies at national, regional and local levels. Besides, providing information about the presence, level and geographical distribution of various risks increases **the effectiveness of the decision maker**, who have the authority to direct financial flows towards conservation measures. In addition, database constructed for the assessment allows users select the most appropriate management strategies specific to the kind of threat in order to reduce risks through territorial and site-level strategies.

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[473] For information on 'triangulation' see: ICCROM 2010: 24
[474] See Chapter 3 for more information about sources of information.

Decreasing the level of vulnerability of sites at risk can be possible by looking at what makes them vulnerable to a specific hazard. Likewise, sites at risk of natural hazards necessitate developing strategies for mitigation, and preparedness, while sites with low vulnerability may require focusing more on monitoring. Finally, this methodology enables **producing relevant strategies for each hazard and shows priorities** in managing risks at territorial scales.

Besides, **the proposed comprehensive and holistic approach suggests and helps to integrate three spheres of management systems** that affect conservation of archaeological heritage against various risks: archaeological heritage management, territorial development planning and management, and disaster risk management (See Figure 5.1). Achieving a closely-knit cognitive integration between all physical and anthropic aspects of the territory, such as natural hazards, physical-morphological characteristics, degree of urbanization and infrastructures, planning instruments, etc., and the characteristics and the state of conservation of cultural properties is fundamental for managing both the territory and the cultural heritage[475]. Hence, risk assessment tool at territorial scale also has the capacity to be used as an instrument to mainstream conservation of archaeological heritage into development planning as well as disaster risk management for balanced and controlled territorial development. It has the capacity to support policies through identification of risks with well-defined orders of priority.

[475] Baldi, Cordaro and Vaccaro 1987: 67

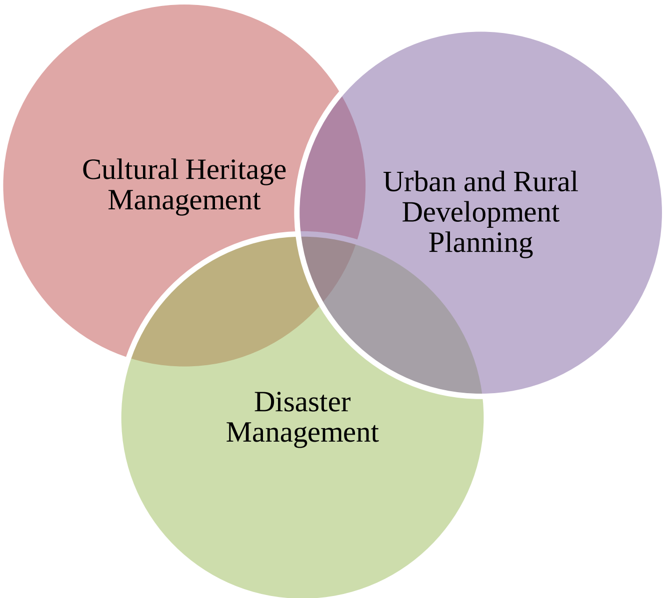

Figure 5.1. Mainstreaming cultural heritage management into both urban and rural development planning and disaster management

Finally, it is significant to highlight certain considerations on how the proposed methodology can be developed further. First, together with the parameters of 'hazard' and 'vulnerability', 'value' of the assessed unit (e.g. the cultural heritage site) can be added as the third parameter of assessment. Assessing the value of each heritage property is a challenging task due to the reality of changing perceptions in time (i.e. what is considered insignificant today may be valuable for future generations) and inevitably inherent subjective nature of such assessment. Keeping these critical aspects in mind, the level of 'value' can be assessed for each property based on scientific criteria and through a participatory process with the involvement of experts of related fields as well as local communities. Then, the third parameter of 'value' can be added to the risk evaluation stage of the proposed methodology by overlapping three parameters (hazard, vulnerability, value) to identify various combinations of sites with the same level of value, hazard and vulnerability. Again, the comparative judgments of experts can help identify the levels of risks for each category.

In addition, assessing the level of each hazard both natural and human-induced can lead to a more sophisticated risk assessment. This necessitates a detailed analysis of each kind of hazard based on data regarding intensity, frequency / probability of hazards as well as information about their impacts on cultural properties. With respect to impacts, nature of hazards in terms of occurrence and duration of impact with a temporal/time perspective as well as connections between hazards (i.e. one may be triggering or accelerating the other) can add another level of sophistication to the methodology. Hence, interdisciplinary research on hazard assessment is highly significant to advance risk assessment methodology.

5.2. Proposals for Archaeological Heritage Management in Turkey

Effectively using limited financial and human resources for managing vast number of archaeological sites is very critical for the conservation of the irreplaceable archaeological heritage in Turkey. Effective management necessitates taking into account risks threatening the conservation of archaeological heritage. However, in Turkey, archeological heritage management is not based on rational analytical approaches that consider priorities.

Reviewing the archaeological heritage management process in Turkey with **a preventive and proactive conservation perspective reveals that** management process consists of various ‘decision-making processes’, all in which ‘**information about risks**’ is of vital importance. This once more **reveals** the role and importance of **assessment of risks in different levels of decision-making** process, and hence, the necessity of integrating risk assessment into the current archaeological heritage management system. Decision makers who are involved within these processes include:

- at site level: excavation directors, site managers and their teams;
- at city/provincial level: mayors, and units of municipalities as well as provincial administrations of culture and tourism, museum directorates, conservation councils working in the fields of cultural heritage

conservation, development planning and disaster risk management, and

- at national level: public institutions that have the responsibility and authority regarding heritage conservation and management.

Existing archaeological heritage management context of Turkey is not effective in managing risks threatening archaeological heritage. Hence, policies necessitate revisions toward a proactive and preventive approach with an emphasis on risk assessments of archaeological heritage at all levels of decision-making processes. Similarly, risk management strategies should be developed at national, regional and local levels to guide all stages of risk management activities.

In Turkey, in order to achieve effective management of archeological heritage, which is significant for present as well as future generations and for enhanced sense of cultural identity and continuity in a rapidly changing World, two goals should be targeted:

- Reform in conservation policies, institutional structure and systems of the Ministry of Culture and Tourism to ensure effective and efficient planning, implementation, monitoring and evaluation of comprehensive and continuous risk management programs
- Mainstreaming archeological heritage conservation into city planning/development processes.

First, conservation policies, institutional structure and systems of the Ministry should be reformed through policies on preventive conservation and risk management. Risk management programs supported by comprehensive risk assessments should be developed at all levels of management (i.e. central, territorial, and site levels). Prioritization based on risks should be the key in all levels of management decisions, especially in those that relate to using financial and human resources. Accordingly, there should be regional programs to cope with hazards that have impacts on large areas. These policies and programs should be strengthened by allocating sufficient budget for preventive conservation, mitigation, and inventory works; by using risk assessment in decision-making processes regarding archeological heritage conservation (e.g. selection of sites to be excavated); and increasing number and capacity of staff involved in inventory and risk management programs. Completing the inventory through systematic surveys should be one of the priorities. The cultural heritage inventory administered by the Ministry of Culture and Tourism is incomplete as well as limited in that there is no data about typologies, periods, methods of investigation, completed/ongoing excavation studies, the date of being registered, previous restorations etc. of the registered sites in the current system. Establishing and maintaining a more developed inventory management system is critical for effective and proper management of archaeological heritage. Likewise, there is not a database about the impacts of hazards on archaeological assets. The national archive of natural disasters provides data only on the number of events, number of people died/injured/affected, while it lacks data on damaged cultural assets. So, establishing a national system for recording impacts of hazards on archaeological heritage is another urgent need. This system should be integrated with local systems, which should be established at provincial level, through the proposed methodology and system for the Assessment of Risks at Territorial Scale.

With respect to administrative system, at the national level, the Directorate of Cultural Properties and Museums is structured in departments, each carry out tasks that relate to a specific aspect of archaeological heritage management such as identification/registration, expropriation, excavation, or responsible from a group of sites such as sites currently excavated, sites open to public as 'site museums'. Within the fragmented system of administration, lack of a national archaeological heritage management strategy as well as an administrative unit that that deals with the management of the entire archaeological heritage, addressing priorities and processes of management with a holistic and preventive approach under the Ministry of Culture and Tourism is another impediment. At central level under the General Directorate of Cultural Properties and Museums, an administrative unit should be established to coordinate, monitor and evaluate nationwide preventive conservation and risk management programs implemented at local (provincial) levels.

At provincial level, Provincial Directorships of Culture and Tourism, which operate under Governorships, and have coordination responsibilities among various central and local units of the Ministry of Culture and Tourism, should be reformed to have systems, procedures, capacities and competencies to plan, implement, and monitor preventive conservation and risk management programs within the province. Accordingly, human, technical and financial capacities of the Provincial Culture and Tourism Offices should be enhanced to make them capable of developing database for the entire province to carry out risk assessments in collaboration with related public institutions and non-governmental stakeholders, and with the financial support of the General Directorate of the Cultural Properties and Museums. As a result, these provincial authorities should be able to use these risk assessment methodologies and systems to create, update, and process data within a homogenous system.

In addition, Regional Conservation Councils have critical roles and responsibilities in conservation of cultural assets including archaeological heritage. Therefore, it is important to ensure that conservation councils are effective, independent and capable of making sound decisions that prevent destruction of archeological sites through new developments. Involvement of specialists such as archeologists, conservation architects, conservation planners, etc. in decision-making processes is important for technically sound decisions that enable conservation of irreplaceable heritage values. Besides, Directorships of Regional Conservation Councils should have procedures, systems, capacities and competencies to support Conservation Councils with scientific and thorough information on the level and extent of archaeological values of sites as well as possibilities of wide range of risks threatening them. Therefore, staff of related Directorships should have the capacities to use and analyze hazard and vulnerability databases to carry out risk assessments for archaeological heritage under their responsibilities. In addition, procedures or guidelines can be developed to ensure that risk assessments are taken into account during the decision-making processes. Developing ICT infrastructure is also needed in the Directorships of Regional Conservation Councils to carry out abovementioned tasks.

Municipalities are the authorities that are responsible for preparing and approving development plans for settlements. Collaboration with local administrations is critical for the achievement of preventive conservation objectives. Policies should be developed to empower municipalities to mainstream preventive conservation of cultural heritage into city planning processes. First, participation of specialists from the conservation fields within the planning processes is also highly important to balance conservation and future development needs. Besides, municipalities should be capable of using risk assessment databases to take into account risks during the planning processes. Based on risk assessment results, development plans should be re-evaluated to prevent any possible losses of heritage values due to planned developments.

The management and effectiveness of a system of risk analysis and assessment of archaeological assets are based on the capacity of the offices of the Ministry of Culture and Tourism, both central and local ones, and of the local administrations including provincial administrations and municipalities. The Ministry should also take the lead to involve other national agencies, which are in some measure responsible for the management and the programming of the territorial resources, in the identification of the parameters of various hazards, and in providing and supporting the data banks of the risk assessment system. Collaboration with other public institutions and local administrations related to development planning and disaster risk management from central to local levels is very critical for the success of conservation efforts. In order to integrate conservation of archaeological heritage into planning, two major authorities responsible from conservation and planning – Ministry of Culture and Tourism and Ministry of Environment and Urbanization- have to collaborate at all levels of management. Just like Environmental Impact Assessment, Archaeological Impact Assessment should be devised and utilized as a technical tool to protect conservation of archaeological heritage against developments (industry, tourism, infrastructure, etc.). The proposed risk assessment methodology at territorial scale should be integrated into these lower and upper scale assessments, with essential adjustments according to the context and scale.

Briefly, a preventive conservation approach through legislative and institutional arrangements is critical for Turkey to effectively manage the archaeological heritage in forthcoming years.

5.3. Further Research Topics

This study also reveal need for further researches on risk assessment and management of cultural heritage. As risk assessment methodologies are not commonly used in the conservation field and they call for further examinations and experimentations. Hence, the proposed risk assessment methodology should be applied on different cases so as to increase the experience which may help the progression of the methodology.

As risk assessment is based on collecting and processing extensive amount of quantitative, qualitative and spatial data, the methodology can further be developed parallel to the development of databases regarding hazards and factors affecting vulnerabilities of archaeological assets. For a more detailed analysis of hazards, methodologies and data on intensity, frequency / probability of hazards, as well as statistical information about impacts of various hazards on cultural properties is needed. Hence, interdisciplinary research on hazard assessment is highly significant to advance risk assessment methodology. In addition, typology of the site is another factor that affect vulnerability of archaeological heritage to various kinds of hazards. Therefore, research on different typologies of archaeologies in terms of their susceptibility to different kinds of hazards should be investigated.

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APPENDIX A

GLOSSARY

- Archaeological Site Museum	Orenyeri
- Archeological Site	Arkeolojik Site Alani
- Vulnerability	Hasar Gorebilirlik
- Immovable Cultural Asset	Tasinmaz Kultur Varligi
- Development Plan	Imar Plani
- Regional Plan	Bolge Plani
- Territorial Development Plan	Cevre Duzeni Plani
- Master Plan	Nazim Imar Plani
- Implementation Plan	Uygulama Imar Plani
- Special Development Plan	Mevzii Imar Plani
- Expropriation	Kamulastirma
- Exchange	Takas
- Allowance	Tahsis
- Provincial Local Administration	Il Ozel Idaresi
- Conservation Plan	Koruma Amacli Imar Plan
- Preventive Conservation	Onleyici Koruma
- Risk Assessment	Risk Degerlendirmesi
- Vulnerability	Tahribata Acik Olma
- Culture and Tourism Coservation and Development Areas	Kultur ve Turizm Koruma ve Gelisim Bolgesi

- Conservation, Implementation and Control Offices	Koruma Uygulama ve Denetim Burosu – KUDEB
- Regional Councils of Conservation for Cultural and Natural Assets	Kultur ve Tabiat Varliklarini Koruma Bolge Kurulu (KTVKBK)
- High Council of Conservation for Cultural and Natural Assets	Kultur ve Tabiat Varliklarini Koruma Yuksek Kurulu
- Directorate of Revolving Fund, MoCT	KTB, Doner Sermaye Isletmesi Merkezi Mudurlugu (DOSIMM)
- Organized Industry Zone	Organize Sanayi Bolgesi
- Free Trade Zone	Serbest Bolge
- Urban Working Area out of Housing	Konut Disi Kentsel Calisma Alani
- Agricultural Commerce	Tarimsal Ticaret
- Site Management Directorate	Alan Yonetim Baskanligi
- Disaster and Emergency Management Presidency	Afet ve Acil Durum Yönetim Başkanlığı
- Archaeological Settlements of Turkey Project	Turkiye Arkeolojik Yerlesmeleri (TAY) Projesi
- Disaster and Emergency Manag. Presidency	Afet ve Acil Durum Yonetimi Baskanligi

APPENDIX B

ARCHAEOLOGICAL HERITAGE INVENTORY OF IZMIR METROPOLITAN AREA

Town	Type	Site ID
ALİAĞA	ARCHAEOLOGICAL SITE	1.NOLU ALTERNATİF ALANI (1.DERECE ARKEOLOJİK SİT ALANI)
ALİAĞA	ARCHAEOLOGICAL SITE	1.VE 3.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	2.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	BOZ HÖYÜK 1.DERECE ARKEOLOJİK SİT ALANI *ÇEVRESİ 3.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	ÇALTIDERE HÖYÜĞÜ (2.DERECE ARKEOLOJİK SİT ALANI)
ALİAĞA	ARCHAEOLOGICAL SITE	GRYNEON ANTİK KENTİ (1. VE 3. DERECE ARKEOLOJİK SİT ALANI)
ALİAĞA	ARCHAEOLOGICAL SITE	HİSARLIK TEPE 1. DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	OTHER	I.DERECE DOĞAL VE III.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	III.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	KYME ANTİK KENTİ 1. VE III. DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	MYRİNA ANTİK KENTİ (1.DERECE ARKEOLOJİK SİT ALANI)
ALİAĞA	RUINS	PİŞMİŞ TOPRAK,SU HATLARI
ALİAĞA	ARCHAEOLOGICAL SITE	SARISEKİTEPE (1.DERECE ARKEOLOJİK SİT ALANI)

Town	**Type**	**Site ID**
ALİAĞA	ARCHAEOLOGICAL SITE	SU KEMERİ 1.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	TÜMÜLÜS
ALİAĞA	ARCHAEOLOGICAL SITE	TÜMÜLÜS ALANININ ETRAFINDA 1.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	ARCHAEOLOGICAL SITE	TÜMÜLÜS 1.DERECE ARKEOLOJİK SİT ALANI
ALİAĞA	MASELEOUM	GEÇ ANTİK DÖNEM ODA MEZARLARI
BAYRAKLI	ARCHAEOLOGICAL SITE	3. DERECE ARKEOLOJİK SİT ALANI
BAYRAKLI	OTHER	BAYRAKLI HÖYÜĞÜ (SMYRNA ANTİK KENTİ) *KENTSEL+3.DERECE ARKEOLOJİK SİT ALANI (ÖNCESİ 1.,2.,3.DERECE ARKEOLOJİK SİT ALANI)
BAYRAKLI	ARCHAEOLOGICAL SITE	BÜYÜK VE KÜÇÜK KALE (1.DERECE ARKEOLOJİK SİT ALANI)
BAYRAKLI	ARCHAEOLOGICAL SITE	KALE (ARKEOLOJİK SİT)
BAYRAKLI	ARCHAEOLOGICAL SITE	KALE KAYASI TEPESİ 1.DERECE ARKEOLOJİK SİT ALANI
BAYRAKLI	ARCHAEOLOGICAL SITE	TANTALOS MEZARI (1.VE 3. DERECE ARKEOLOJİK SİT ALANI)
BORNOVA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
BORNOVA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI ÖNCESİ 3.DERECE ARKEOLOJİK SİT ALANI İPTAL EDİLİYOR.
BORNOVA	OTHER	1.DERECE DOĞAL SİT+1.DERECE ARKEOLOJİK SİT ALANI
BORNOVA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
BORNOVA	OTHER	ARKEOLOJİK VE DOĞAL SİT ALANI
BORNOVA	ARCHAEOLOGICAL SITE	BORNOVA HÖYÜĞÜ 1.DERECE ARKEOLOJİK SİT ALANI
BORNOVA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI

Town	Type	Site ID
BORNOVA	RUINS	SU KANALI VE DÖŞEME KALINTISI
BORNOVA	ARCHAEOLOGICAL SITE	YASSITEPE HÖYÜĞÜ 1.DERECE ARKEOLOJİK SİT ALANI
BORNOVA	ARCHAEOLOGICAL SITE	YEŞİLOVA HÖYÜĞÜ 1.DERECE ARKEOLOJİK SİT ALANI
BUCA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
BUCA	ARCHAEOLOGICAL SITE	ANTİK KALE ŞEHİR KALINTILARI (KALETEPE) 1.DERECE ARKEOLOJİK SİT ALANI
ÇİĞLİ	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
ÇİĞLİ	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI ANKİT SU KAYNAĞI İLE ARK.MALZEMENİN BULUNDUĞU TEPE)
FOÇA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
FOÇA	ARCHAEOLOGICAL SITE	2.DERECE ARKEOLOJİK SİT ALANI
FOÇA	OTHER	2.DERECE DOĞAL VE 3.DERECE ARKEOLOJİK SİT ALANI
FOÇA	RUINS	ANTİK DUVAR
FOÇA	ARCHAEOLOGICAL SITE	ANTİK PHOKAİA KENTİ İLK YERLEŞİM YERİ 2.DERECE ARKEOLOJİK SİT ALANI (1.DERECEDEN ÇEVRİLİYOR*)
FOÇA	RUINS	HAMAM KALINTISI
FOÇA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
FOÇA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
FOÇA	OTHER	I.DERECE ARKEOLOJİK SİT VE I.DERECE DOĞAL SİT ALANI
FOÇA	ARCHAEOLOGICAL SITE	II. DERECE ARKEOLOJİK SİT ALANI
FOÇA	ARCHAEOLOGICAL SITE	II.DERECE ARKEOLOJİK SİT ALANI (ANTİK SU KEMERLERİNİN BULUNDUĞU ALAN)

Town	Type	Site ID
FOÇA	ARCHAEOLOGICAL SITE	III. DERECE ARKEOLOJİK SİT ALANI
FOÇA	ARCHAEOLOGICAL SITE	III.DERECE ARKEOLOJİK SİT ALANI
FOÇA	ARCHAEOLOGICAL SITE	KENTSEL VE ARKEOLOJİK SİT ALANI
FOÇA	RUINS	KİLİSE KALINTISI
FOÇA	ARCHAEOLOGICAL SITE	NEKROPOL ALANI
FOÇA	ARCHAEOLOGICAL SITE	PERS MEZAR ANITI (1.DERECE ARKEOLOJİK SİT ALANI)
FOÇA	RUINS	TAŞ EV (PELEKİTİ-YONTULMUŞ KAYA)
FOÇA	ARCHAEOLOGICAL SITE	YEL DEĞİRMENLERİ (1.DERECE DOĞAL VE ARKEOLOJİK SİT ALANI)
GÜZELBAHÇE	ARCHAEOLOGICAL SITE	3. DERECE ARKEOLOJİK SİT ALANI
GÜZELBAHÇE	ARCHAEOLOGICAL SITE	III. DERECE ARKEOLOJİK SİT ALANI
GÜZELBAHÇE	ARCHAEOLOGICAL SITE	TÜMÜLÜS (1.DERECE ARKEOLOJİK SİT ALANI)
KEMALPAŞA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
KEMALPAŞA	ARCHAEOLOGICAL SITE	1.VE 3.DERECE ARKEOLOJİK SİT ALANI
KEMALPAŞA	ARCHAEOLOGICAL SITE	3. DERECE ARKEOLOJİK SİT ALANI
KEMALPAŞA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
KEMALPAŞA	ARCHAEOLOGICAL SITE	ANTİK NYMHAİON KALESİ (1.DERECE ARKEOLOJİK SİT ALANI)
KEMALPAŞA	ARCHAEOLOGICAL SITE	KALINTILAR 1.VE 3.DERECE ARKEOLOJİK SİT ALANI
KEMALPAŞA	ARCHAEOLOGICAL SITE	KİREÇ TEPE (TAŞLI TEPE) 1.DERECE ARKEOLOJİK SİT ALANI
KEMALPAŞA	ARCHAEOLOGICAL SITE	KUTSAL ALAN VE SUR DUVARLARI 1.DERECE ARKEOLOJİK SİT ALANI
KEMALPAŞA	ARCHAEOLOGICAL SITE	LASKARİSLER SARAYI YAPISI (KORUMA ALANI 3.DERECE ARKEOLOJİK SİT ALANI)

Town	**Type**	**Site ID**
KEMALPAŞA	RUINS	TONOZLU YAPI KALINTISI
KEMALPAŞA	ARCHAEOLOGICAL SITE	TÜMÜLÜS (1.DERECE ARKEOLOJİK SİT ALANI)
KEMALPAŞA	ARCHAEOLOGICAL SITE	ULUCAK HÖYÜK (1.DERECE ARKEOLOJİK SİT ALANI)
KONAK	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
KONAK	ARCHAEOLOGICAL SITE	AGORA 1.DERECE ARKEOLOJİK SİT VE 2.DER. ARK. SİT ALANI * (ÇEVRESİ 3.DERECE ARKEOLOJİK SİT ALANI)
KONAK	ARCHAEOLOGICAL SITE	ANTİK TİYATRO 1.DERECE ARKEOLOJİK SİT (ÇEVRESİ 3.DERECE ARKEOLOJİK SİT ALANI)
KONAK	RUINS	ANTİK YOL VE KALINTILARI - 1. DERECE
KONAK	OTHER	BAHRİ BABA PARKI VARYANT-CİCİ PARK (2.DERECE DOĞAL SİT VE 2.DERECE ARKEOLOJİK SİT ALANI)
KONAK	ARCHAEOLOGICAL SITE	DİANA HAMAMI KALINTILARI (3.DERECE ARKEOLOJİK SİT ALANI)
KONAK	ARCHAEOLOGICAL SITE	II. DERECE ARKEOLOJİK SİT ALANI
KONAK	ARCHAEOLOGICAL SITE	II.DERECE ARCHAEOLOGICAL SITE
KONAK	ARCHAEOLOGICAL SITE	III. DERECE ARKEOLOJİK SİT ALANI
KONAK	ARCHAEOLOGICAL SITE	KADİFEKALE 1.DERECE ARKEOLOJİK SİT ALANI (ÇEVRESİ 2.DERECE ARKEOLOJİK SİT ALANI)
KONAK	RUINS	KARAKAPI (DIŞ SUR)
KONAK	KENTSEL SİT	KENTSEL SİT ALANI (ANTİK STADYUMUN YERALDIĞI ALAN)
KONAK	RUINS	KİLİSE KALINTISI
KONAK	KENTSEL SİT	KORUNACAK SOKAK
KONAK	ARCHAEOLOGICAL SITE	ROMA ANTİK YOLU (ALTIN YOL) 1.DERECE ARKEOLOJİK SİT ALANI (ÇEVRESİ İLE BİRLİKTE)
KONAK	RUINS	SUR DUVARI

Town	**Type**	**Site ID**
KONAK	RUINS	SUR KALINTISI
KONAK	OTHER	SUSUZ DEDE 1. ARKEOLOJİK VE DOĞAL SİT ALANI
KONAK	OTHER	TARİHİ SİT VE 2.DERECE DOĞAL SİT ALANI
KONAK	RUINS	TONOZLU ANTİK YAPI KALINTISI
KONAK	RUINS	TONOZLU GİRİŞLİ YAPI
MENDERES	ARCHAEOLOGICAL SITE	1. VE 3.DERECE ARKEOLOJİK SİT ALANI
MENDERES	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
MENDERES	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
MENDERES	OTHER	3.DERECE ARKEOLOJİK VE 1. DERECE DOĞAL SİT ALANI
MENDERES	ARCHAEOLOGICAL SITE	BAKLATEPE HÖYÜĞÜ (1.DERECE ARKEOLOJİK SİT ALANI)
MENDERES	ARCHAEOLOGICAL SITE	NOTİON ANTİK KENTİ (1.DERECE ARKEOLOJİK SİT ALANI)
MENDERES	ARCHAEOLOGICAL SITE	NOTİON ANTİK KENTİ 1. VE III.DERECE ARKEOLOJİK SİT ALANI
MENDERES	ARCHAEOLOGICAL SITE	ROMA KAPLICALARI (1.DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
MENEMEN	ARCHAEOLOGICAL SITE	ANTİK GÖLET ALANI 1.DERECE ARKEOLOJİK SİT ALANI
MENEMEN	ARCHAEOLOGICAL SITE	ANTİK LARİSSA KENTİ (1.VE 3.DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	BOZTEPE KALE (1.DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	DİKENTAŞTEPE (2.DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	NEKROPOL (1.DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	NEONTEİKHOS KENTİ (1.DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	PALAMUT TEPE (3.DERECE ARKEOLOJİK SİT ALANI)

Town	Type	Site ID
MENEMEN	ARCHAEOLOGICAL SITE	PANAZTEPE (1.VE 3. DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	TAŞINMAZLAR (3.DERECE ARKEOLOJİK SİT ALANI)
MENEMEN	ARCHAEOLOGICAL SITE	TÜMÜLÜS (1.DERECE ARKEOLOJİK SİT ALANI)
MERKEZ	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
MERKEZ	OTHER	ARKEOLOJİK VE DOĞAL SİT ALANI
MERKEZ	ARCHAEOLOGICAL SITE	1. VE 3.DERECE ARKEOLOJİK SİT ALANI
MERKEZ	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
MERKEZ	ARCHAEOLOGICAL SITE	III.DERECE ARKEOLOJİK SİT ALANI
MERKEZ	RUINS	KİLİSE KALINTISI
MERKEZ	ARCHAEOLOGICAL SITE	TÜMÜLÜS (TÜMÜLÜSÜN ÇEVRESİ 1.DERECE ARKEOLOJİK SİT ALANI)
NARLIDERE	ARCHAEOLOGICAL SITE	YENİ KALE (1.DERECE ARKEOLOJİK SİT ALANI)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	1. VE 3.DERECE ARKEOLOJİK SİT ALANI (1 ADET PAFTA SINIRLARI GÖSTERİLEN)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
SEFERİHİSAR	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI (5 ADET PAFTA SINIRLARI GÖSTERİLEN)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	2.DERECE ARKEOLOJİK SİT ALANI
SEFERİHİSAR	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
SEFERİHİSAR	ARCHAEOLOGICAL SITE	ANTİK HAMAM KALINTILARI VE ARKEOLOJİK BULUNTULAR (1. VE 3.DERECE ARKEOLOJİK SİT ALANI)
SEFERİHİSAR	RUINS	ANTİK YAPI KALINTISI (AYAZMA)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	DOĞANBEY ILICASI ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	EPHESOS ARKEOLOJİK SİTİ

Town	Type	Site ID
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KADIKALESİ ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KALINTILAR (3.DERECE ARKEOLOJİK SİT ALANI)
SEFERİHİSAR	OTHER	KARAGÖL VE ÇEVRESİ (1.DERECE ARKEOLOJİK VE 2.DERECE DOĞAL SİT ALANI)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KARAKOÇ ILICASI ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KARAKÖSE HARABELERİ (1.VE 3.DERECE ARKEOLOJİK SİT ALANI)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KARAKÖSE HARABELERİ ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KISIK TEPE VE ADACIK TEPESİ (1.DERECE ARKEOLOJİK SİT)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KLAROS ANTİK KENTİ 1. VE III.DERECE ARKEOLOJİK SİT ALANI
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KLAROS ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KOLOPHON ANTİK KENTİ ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	KUŞANİ MERMER OCAĞI ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	LEBEDOS ANTİK KENTİ (1.VE 3.DERECE ARKEOLOJİK SİT)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	MYONNESOS ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	NATİON ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	NEOPOLİS ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	PANİONİON ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	PYGELA ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	SIĞACIK ARKEOLOJİK SİTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	SIĞACIK KALESİ (3.DERECE ARKEOLOJİK SİT ALANI)

Town	Type	Site ID
SEFERİHİSAR	ARCHAEOLOGICAL SITE	TARLA (3 ADET) (1.DERECE ARKEOLOJİK SİT ALANI)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	TEOS ANTİK KENTİ
SEFERİHİSAR	ARCHAEOLOGICAL SITE	TÜMÜLÜS (1.DERECE ARKEOLOJİK SİT)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	TÜMÜLÜS (1.DERECE ARKEOLOJİK SİT)
SEFERİHİSAR	ARCHAEOLOGICAL SITE	TÜMÜLÜSLER (1.DERECE ARKEOLOJİK SİT ALANI)
SELÇUK	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
SELÇUK	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI (262 VE 1704 ZAYILI KARARLARLA BELİRLENEN ARKEOLOJİK SİT SINIRLARI DIŞINDA KALAN ALAN)
SELÇUK	ARCHAEOLOGICAL SITE	1.VE 3. DERECE ARKEOLOJİK SİT ALANI
SELÇUK	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
SELÇUK	RUINS	ALT YAPI
SELÇUK	ARCHAEOLOGICAL SITE	ANTİK KALINTILAR (1.DERECE ARKEOLOJİK SİT ALANI)
SELÇUK	RUINS	ARKADİAN CADDESİ
SELÇUK	ARCHAEOLOGICAL SITE	ARKEOLOJİK KALINTILAR 2.DERECE ARKEOLOJİK SİT ALANI
SELÇUK	OTHER	AYASULUK (1.VE 3. DERECE ARKEOLOJİK SİT) +KENTSEL SİT ALANI
SELÇUK	ARCHAEOLOGICAL SITE	BELEVİ TÜMÜLÜSÜ (1.DERECE ARKEOLOJİK SİT ALANI)
SELÇUK	RUINS	ESİ YAPI KALINTISI
SELÇUK	ARCHAEOLOGICAL SITE	GÖZETLEME KULESİ VE KATRANCI TEPESİ- ANTİK DÖŞEME YOLU (1.DERECE ARKEOLOJİK SİT ALANI)
SELÇUK	RUINS	HAMAM KALINTISI
SELÇUK	RUINS	HAPİSHANE+ SUR DUVARI+ ROMA DÖNEMİNE AİT MEZAR
SELÇUK	ARCHAEOLOGICAL SITE	HÖYÜK (1.DERECE ARKEOLOJİK SİT ALANI)

Town	Type	Site ID
SELÇUK	ARCHAEOLOGICAL SITE	KONYALI TEPESİ (1.DERECE ARKEOLOJİK SİT ALANI)
SELÇUK	RUINS	MANTARTEPE (HELLENİSTİK GÖZETLEME YAPISI)
SELÇUK	RUINS	MERMER CADDE
SELÇUK	OTHER	MERYEM ANA TAPINAĞI 1.DERECE ARKEOLOJİK SİT ALANI (ÇEVRESİ 1.DERECE DOĞAL SİT ALANI)
SELÇUK	ARCHAEOLOGICAL SITE	MEZAR (3 ADET) (TÜMÜLÜSLER 1.DERECE ARKEOLOJİK SİT)
SELÇUK	ARCHAEOLOGICAL SITE	ORMAN KAMPI TÜMÜLÜSÜ
SELÇUK	RUINS	SUR DUVARI
SELÇUK	RUINS	TONOZLU YAPI
SELÇUK	ARCHAEOLOGICAL SITE	YAPI KALINTISI (1.DERECE ARKEOLOJİK SİT SINIRLARI YAPININ KORUMA ALANI OLARAK BELİRLENİYOR)
SELÇUK	RUINS	YUVARLAK YAPI
SELÇUK	MASELEOUM	ANTİK MAGNESİA MEZARI (MOUSELA)
SELÇUK	MASELEOUM	ANTİK NOGNESİA KAPISI YAKININDAKİ ANTİK MEZAR(MAUSOLEUM)
TORBALI	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
TORBALI	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI (METROPOLİS ANTİK KENTİNE İLAVE OLARAK)
TORBALI	ARCHAEOLOGICAL SITE	1.NOLU ALAN 1.DERECE ARKEOLOJİK SİT ALANI
TORBALI	ARCHAEOLOGICAL SITE	2.NOLU ALAN 1.DERECE ARKEOLOJİK SİT ALANI
TORBALI	ARCHAEOLOGICAL SITE	4.NOLU ALANDAKİ KÜLT MAĞARASI 1.DERECE ARKEOLOJİK SİT ALANI
TORBALI	ARCHAEOLOGICAL SITE	ANTİK MERMER OCAĞI (1 NOLU) (5 ADET) (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	ANTİK MERMER OCAĞI (5 ADET) (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	ANTİK MERMER OCAĞI (CÜLİN ADINDA) (1.DERECE ARKEOLOJİK SİT ALANI)

Town	Type	Site ID
TORBALI	ARCHAEOLOGICAL SITE	ARAPKAVE HÖYÜĞÜ (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	ARKEOLOJİK SİT ALANI
TORBALI	ARCHAEOLOGICAL SITE	ASLANLAR HÖYÜĞÜ (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	HÖYÜK
TORBALI	ARCHAEOLOGICAL SITE	HÖYÜK (2.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	İNPINARI ANTİK BÖLGESİ (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	KÜÇÜKTEPE HÖYÜĞÜ VE ÇİFTLİK YERLEŞİMİ 1. VE 3.DERECE ARKEOLOJİK SİT ALANI
TORBALI	ARCHAEOLOGICAL SITE	KÜLT ALANI (ANTİK YERLEŞİM ALANI, NEKROPOL, VE KAN ÇUKURLARI
TORBALI	ARCHAEOLOGICAL SITE	METROPOLİS ANTİK KENTİ (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	ROMA DÖNEMİ ANTİK YERLEŞİMİ (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	SİNEKTEPE HÖYÜĞÜ (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	TULUMTAŞATACAK TEPE (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	TÜMÜLÜS (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	TÜMÜLÜSLER (1.DERECE ARKEOLOJİK SİT ALANI)
TORBALI	ARCHAEOLOGICAL SITE	ÜÇLER TEPE TÜMÜLÜSÜ 1.DERECE ARKEOLOJİK SİT ALANI
URLA	ARCHAEOLOGICAL SITE	1.DERECE ARKEOLOJİK SİT ALANI
URLA	OTHER	2 ADET TÜMÜLÜS (1.DERECE ARKEOLOJİK VE DOĞAL SİT ALANI)

Town	Type	Site ID
URLA	OTHER	2.DERECE DOĞAL VE 1.DERECE ARKEOLOJİK SİT ALANI
URLA	OTHER	2.DERECE DOĞAL VE 3.DERECE ARKEOLOJİK SİT ALANININ DEVAMI KARARI
URLA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
URLA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI
URLA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI (6.10.1995-5932 SAYILI KARA İLE 1.DER.ARK.SİT OLARAK TESCİLLENEN ALANIN SINIRLARININ DEVAMININ UYGUN OLDUĞU)
URLA	ARCHAEOLOGICAL SITE	3.DERECE ARKEOLOJİK SİT ALANI *8415 SAYILI KARARLA GENİŞLETİLİYOR
URLA	OTHER	ANTİK AİRAİ KENTİ VE NEKROPOL ALANI (1.VE 3.DERECE ARKEOLOJİK - VE 1.DERECE DOĞAL SİT ALANI) (4473 VE 6913 SAYILI KARARLARI İLE) **
URLA	OTHER	ANTİK KLAZOMANAİ KENTİ (1. VE 3.DERECE ARKEOLOJİK SİT VE DOĞAL VE TARİHİ SİT ALANI)
URLA	ARCHAEOLOGICAL SITE	ANTİK LAGÜN VE NEKROPOL ALANI (3.DERECE ARKEOLOJİK SİT ALANI)
URLA	ARCHAEOLOGICAL SITE	DEĞİRMENTEPE TÜMÜLÜSÜ (1.DERECE ARKEOLOJİK SİT ALANI)
URLA	ARCHAEOLOGICAL SITE	DUBATEPE TÜMÜLÜSÜ (1.DERECE ARKEOLOJİK SİT ALANI)
URLA	ARCHAEOLOGICAL SITE	NALBANTTEPE TÜMÜLÜSÜ (1.DERECE ARKEOLOJİK SİT ALANI)
URLA	ARCHAEOLOGICAL SITE	TÜMÜLÜSLER 1.DERECE ARKEOLOJİK SİT ALANI)

APPENDIX C

ATTRIBUTE DATA REGARDING INDICATORS OF VULNERABILITY

Spatial Data (Layer): **Archaeological Sites** Spatial Object: **Polygon**	
Attribute Data:	**Attribute Data:**
SITE SURVEY (survey)	SECURITY
0. Not Surveyed	1. Low: Sites located out of settlements
1. Surveyed by the Author	2. Medium: Sites located in settlement areas
2. Surveyed by TAY	3. High : Sites with security / personnel
REGISTRATION DEGREE (tescil)	CONDITION (phy_cond)
0. Not Registered	0. Not surveyed / Not applicable (2nd and 3rd Degree; not excavated)
1. First Degree Archaeological Site	1. Good: Good condition or only minor material problems, need for monitoring
2. Second Degree Archaeological Site	2. Fair: Material problems; ongoing erosion of a site due to human actions and/or weathering, need for material conservation
3. Third Degree Archaeological Site	3. Poor: Both material and structural problems that need interventions
4. Urban Archeological Site	
	TYPE OF PAST DAMAGES
INVESTIGATION/EXCAVATION/VISITATION (Excavation)	0. Not Surveyed / Unknown
0. Not registered	1. Surveyed & not identified
1. Investigated through Regional Survey and Registered	N. Natural
2. Excavated in the Past	N1. Geological Hazard (Landslide-Rockfall)
3. Ongoing Excavation and not Open to Visitors	N2. Flood
4. Ongoing Excavation and Open to Visitors	N3. Coastal Processes
5. Not identified / No Data	D1. Urbanization (Contemporary Settlements)
	D2. Construction of Roads
PRESENCE OF SITE MANAGEMENT	D3. Construction of Dams
0. Not on-site management	H1. Mining
1. Managed as excavation site and/or site museum (orenyeri)	H2. Agricultural Interventions
	H3. Illicit Digging
ACCESSIBILITY	
0. Located in settlement areas	
1. Located off-settlement areas	

CURRICULUM VITAE

PERSONAL INFORMATION

Name: Sibel YILDIRIM ESEN

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EDUCATION

PhD in Conservation and Restoration, 2007 – 2014 - METU, Ankara - Turkey

Master of Science in Restoration, 2002 – 2007, METU, Department of Architecture

> *Dissertation:* "Interpretation of Cultural Heritage Sites. The Case: Boston National Historical Park in the U.S.A."

Master of Architecture, 2005 – 2006, METU Department of Architecture

> *Dissertation:* "Revitalization of Historic Commercial Areas through the Main Street Program in the U.S.A.: A Case Study from the Boston Main Streets Program"

Bachelor of Architecture, 1994 – 1998, METU Department of Architecture

WORK EXPERIENCE & PROJECTS

MINISTRY OF CULTURE AND TOURISM - Ankara, Turkey

> **Conservation Architect & Culture and Tourism Expert**
> **Jan. 2009 – Present**

SAYKA Construction, Architecture, Engineering, Ltd. - Ankara, Turkey

> *Type of Business*: Design, implementation and management services for conservation and rehabilitation of historic buildings and sites
>
> **Chief Conservation Architect**
>
> **Sept. 2007 – Jan. 2009**

MOB Architecture, Furniture & Interiors Inc. - Ankara, Turkey

> *Type of Business:* Custom Interiors Contractor
>
> **Architect**

Mar. 2000 – Oct. 2002

ANTS Co. Ltd., Ankara - Turkey

Type of Business: Design services for architectural projects.

Architect
Mar. 1999 – Feb. 2000

Projects:

Megaron Architecture. Co. Ltd., Ankara, Turkey

Type of Business: Design services for architectural projects.

Architect
July 1998 – Mar. 1999

OTHER TRAINING

- UNESCO Chair on Cultural Heritage and Risk Management, International Training Course on Disaster Risk Management of Cultural Heritage, 8-22 September 2012, Ritsumeikan University, Kyoto, Kobe, Tohoku, Japan
- International Summer School on Cultural Heritage, University of Rome "Tor Vergata", July – August 2010, Rome, Italy
- "Strategic Management in Design and Construction" given by John D. Macomber in Spring 2005 at Harvard University, Graduate School of Design, Boston, MA

PUBLICATIONS/RESEARCH

- **Yıldırım Esen, S.**, Bilgin Altinoz, A. G., 2013. 'Risk Analysis as a Support for Conservation Decision-Making Process: The Case of Archaeological Sites in Turkey', Seventh World Archaeological Congress, Dead Sea/Jordan, 14-18 January 2013
- **Yıldırım Esen, S.**, 'Doğal Afetler ve Arkeolojik Alanlar' (in Turkish), Expertise Thesis, The Directorate of Cultural Properties and Museums, Ministry of Culture and Tourism, Ankara, 2012
- **Yıldırım Esen, S.**, Tunç, N., Telatar, S., Tavukçuoğlu, A., Caner Saltık, E., Demirci, S., 2004. 'Material Studies Supporting the Conservation Project of Çukur Hamam' 2nd National Congress on Construction Materials, Proceedings, İstanbul / Turkey, October 6-8 2004.
- **Yıldırım Esen, S.**, Tunç, N., Telatar, S., Şahlan, K., Temizsoy, A., 2004. 'Original Water Supply and Heating Systems in a 14th Century Bath: Çukur Hamam in Manisa, Turkey', 30th International Symposium on Water Supply and Drainage for Buildings, Paris/France, September 16-17 2004.

AWARDS

- Erasmus IP scholarship to participate in the International Summer School on Cultural Heritage in Rome, Italy in 2010
- 2004 Course Performance Award given by Graduate School of Natural and Applied Sciences at Middle East Technical University

- Recorded to honor list of Middle East Technical University in Fall 1995, Spring 1996, Spring 1997, Fall 1997 and Spring 1998 semesters