

Project Report # 3

PROJECT COMPLETION REPORT OF THE

LAO URBAN FIRE RISK ASSESSMENT MAPPING IN LUANGPRABANG CITY

ການສ້າງແຜນທີ່ປະເມີນຄວາມສ່ຽງໄພຢູ່ເມືອງຫລວງພະບາງ

LAO URBAN DISASTER MITIGATION PROJECT

ໂຄງການຜ່ອນຄາຍໄພພິບັດຢູ່ໃນຕົວເມືອງຢູ່ລາວ

PREPARED BY URBAN RESEARCH INSTITUTE

ໂດຍສະຖາບັນຄົ້ນຄວ້າຜັງເມືອງ

DECEMBER 2004

UNDER THE

ASIAN URBAN DISASTER MITIGATION PROGRAM





PROJECT CONTRACT

For future information about this paper or Lao Urban Disaster Mitigation project,
Please Contact:

Urban research Institute

P.O. Box: 5067, Box Building Donpalane Road, Sisattanak District Vientiane Capital, Lao PDR

Mr. Keophilavanh Aphaylath (Director General)

Mobile: 856-20-5 520 422 (aphatlath@yahoo.com)

Ms. Saykham Thammanosouth (Chief of Cooperation and Information Division of URI)

Mobile: 856-20-5 601 170 (saykhamt@yahoo.com)

Mr. Bouavanh Luangsay (Project Responsibility of URI)

Mobile: 856-20-5 622 373 (luangsay_bv@yahoo.com)

Mr. Phouthala Souksakhone (Assistant Project)

Mobile: 856-20-2 205 116 (phouthala@yahoo.com)

Mr. Vongsack Mixay (Technical Map)

Mobile: 856-20-2 204 996 (vongsack@yahoo.com)

National Disaster Mitigation Office

P.O. Box: 347, Pangkham Road, Chanthabuly District, Vientiane Capital, Lao PDR

Mr. Phetsavang Sounnalath (Director General)

Mobile: 856-20-5 512 931 (ndmo@laopdr.com)

Mr. Thonephokham Inthasone (Coordinator Project)

Mobile: 856-20-2 248 475 (spls_bsh@yahoo.com)

Asian Disaster preparedness Center

P.O. Box: 347, Pangkham Road, Chanthabuly District, Vientiane Capital, Lao PDR

Mr. N.M.S. Arambepola (Program Manager of AUDMP)

Mobile: 00662 2516 900 (adpc@adpc.net)

Mr. Rajesh Charma (Project Manager of LUDMP)

Mobile: 00662 9897 0875 (rajesh@adpc.net)

DESIGN BY: MR. VONGSACK MIXAY	APPROVED BY / DATE: ADPC & URI / J. 2004
CHECKED BY: MR. BOUAVANH LUANGSAY	SCALE: 1:25,000
PROJECT NAME: LAO URBAN DISASTER MITIGATION PROJECT	SHEET: 10
DATE OF THE MAP: FEBRUARY 2004	
FILE NAME: LUA MAP	

Risk category	Value	Period
Very High	36	10
High	60	20
Moderate	219	50
Low	696	100
Total	1013	

No.	Name of Village
1	Xiangthong
2	Khill
3	Phonamoung
4	Vichane
5	Vichang
6	Xiangphouane
7	Choumthong
8	Phoum
9	Houabang
10	Vothai
11	Thongthabane
12	Khamthong
13	Arum
14	Apay
15	Keumne
16	Vixuan
17	Vangkeo
18	Vangay
19	Thailouang
20	Moro
21	Thethest
22	Vangmay
23	Noventham
24	Phongphong
25	Ponphum
26	Phalad
27	Souiem
28	Phay
29	Kongphum
30	Khoi
31	Nongard
32	Ng
33	Loiangon
34	Keamphou
35	Loisongvay
36	Meuang Siga
37	Phouphong
38	Phoussat
39	Xiangkai
40	Xomphong
41	Hongay
42	Khamthong
43	Phoussai

Legend

- Road
- River
- Pond
- Village boundary
- Village number
- Hydrant
- Fire Station
- Hospital

Scale: 1:25,000
0 100 200 300 400 500m

North Arrow

Lao Urban Disaster Mitigation Project (LUDMP) was done in 2002 – 2004 target of project were Urban Disaster Mitigation, as Fire Risk Assessment Mapping, Training, Information and Media, the most activities were implemented by related organization's National Disaster Mitigation Office, Urban research Institute and Fire prevention and protection Police, which project were Implemented in Vientiane Capital, Pakse City and Luangprabang City

Asian Urban Disaster Mitigation Program (AUDMP), launched in 1995 is the largest regional of ADPC. The program, with core funding from the office of foreign Disaster Assistant of the United States Agency for international Development, will ultimately work in ten or more countries of the region. The program was designed to make cities safer from disasters. The goal of the AUDMP is the reduce the disaster vulnerability of urban populations, infrastructure, critical facilities and shelter in target cities in Asia, and to promote republication and adaptation of successful Mitigation measures throughout the region. Towards this end, the program Develops and support national demonstration projects, information Dissemination and networking activities, and policy seminars and professional training in the target countries of the Bangladesh, Cambodia, India, Lao PDR, Nepal, Philippines, Sri Lanka, Thailand and Vietnam

The Asian Disaster Preparedness Center (ADPC) is a regional resource Center dedicated to disaster reduction for safer communities and sustainable development in Asia and the Pacific. Established in 1986 in Bangkok, Thailand, ADPC is recognized as an important focal point for promoting disaster awareness and developing capabilities to safer institutionalized disaster ,management and mitigation policy. For more information, please get in touch us with us at the following address ;

Asian Disaster Preparedness Center (ADPC)
P.O.Box 4, Khongluang, Pathumthani 12120, Thailand
Tel: (66-2) 524-5354
Fax: (66-2) 524-5350, 524-5360
Email: adpc@adpc.net
URL: <http://www.adpc.net>

Acknowledgement

Urban Research Institute would express her sincere thanks and deeply appreciate to all partners for assisting on Fire Risk Assessment Mapping of Luang Prabang District especially namely Asian Disaster Preparedness Center for financial and expertise for mapping, Mr. N.S.M Arambepola AUDMP Team Leader for inspecting and contributed expertise to the project, Mr. Phetsavang Sounnalath General Director of NDMO and colleagues for coordinating with project owner as ADPC, Mr. Latanaxai Khamsida Director General of Social Welfare Department Luang Prabang for contributing information on fire disaster environmental in Luang Prabang and support staff during data collection, Mr. Ju Her Deputy Secretary Office Luang Prabang and colleagues for providing information about demography and general information about Luang Prabang, Mr. Bounpanh from Fire Prevention and Protection Unit Luang Prabang for contributing information on fire disaster environmental in Luang Prabang, Mr. Oune General Director of Heritage Office Luang Prabang for providing management situation and important Housing heritage protection that very helpful for mapping, Mr. Kang Latanakone and Mr. Chanthalangsy Vonglath General Director and Deputy of Luang Prabang Urban Development Administration Authority for providing information on Luang Prabang urban management and administration, 43 head villagers for accurate villages borders.

At last, we would like to express our deeply sincere thanks and high appreciate to Luang Prabang people and local authorities for providing helpful information and assist to successful of this Fire Risk Mapping. We do hope that this document will be basic information to help you on urban fire management work and it would replicable to other towns.

With the Best Regards

Keophilavanh Aphaylath,
Director General, URI

Introduction

Lao Urban Disaster Mitigation Project is a first project that with financial support from ADPC. There are three main organizations involve as 1./ National Disaster Management Office of Ministry of Labor and Social Welfare, 2./ Urban Research Institute, Ministry of Communication Transport Post and Construction (MCTPC), 3./ Police Fire Prevention and Protection Department, Ministry of Public Security. Project's activities are including 3 main parts as: Risk Assessment, Training and Public Awareness. The implementing area was selected of main urban area and high density or fire risk areas, this pilot project implementation was in Vientiane Capital, Champasak and Luang Prabang provinces. The first places was in Vientiane Capital, following with Champasak and lastly at Luang Pra Bang.

Luang Pra Bang is located at the north of Lao, with rapid growth of economic and tourism from benefit of Luang Pra Bang as a world heritage with high values of cultural. Major part of built area in the town is old houses and construct from wood that risky from fire. Currently Luang Pra Bang is rapid growth, increasing of building construction and some built areas is not followed land use plan, therefore the areas is very congested, the major construction is in the heritage zone and it has to follow the protection heritage regulation by keeping same/similar shape, style and material as wood which very risky to fire. Other activities in towns are also risk for fire as Gas shop, Gasoline station and cooking, Candle light for praying and not aware of fire disaster. In the past, there are 1028 fires during 1995-2003 in Lao PDR, its damaged cost was over 11 million USD, for Luang Prabang had 116 fires and its damaged cost was over 700,000 USD.

There are three main organizations involved to risk assessment mapping as 1./ Department of Labor and Social Welfare Luang Prabang, 2./ Urban Research Institute, Ministry of Communication Transport Post and Construction (MCTPC), 3./ Police Fire Prevention and Protection Unit Luang Prabang. It was three months and 4 steps for this mapping as: Step 1./ defined of criteria for fire risk and developed data collection form, Step 2./ collecting data from various organization and Field survey by walking through villages, Step 3./ Analysis data from field and Step 4./ apply data into map procedure to find the fire risk zone and reporting books. These whole set document will be basic information for urban fire risk assessment , It will hand over to 6 organizations involved as following:

- 1./ Department of Labor and Social Welfare Luang Prabang,
- 2./ Police Fire Prevention and Protection Unit Luang Prabang.
- 3./ Luang Prabang Urban Development Administration Authority,
- 4./ Department of Communication Transport Post and Construction Luang Prabang,
- 5./ Heritage Office Luang Prabang.

CONTENTS

1	Luang Pra Bang in general	
1.1	Luang Pra Bang Town in general	04
1.2	Luang Pra Bang Fire Disaster Situation	04
1.3	Objectives for Solving Problems	04
2	Map Defining	
2.1	Data Collection plan	05
2.2	Fire Risk Assessment Map Boundary	06
2.3	Schedule for Mapping	06
2.4	General Problems on Developing Map	07
3	General Situation Study of Luang PraBang	
3.1	Geography	07
3.2	Demography	08
3.3	Towns Activities	08
3.4	Fire Disaster Situation in Towns	09
4	Fire Risk Assessment Map Process	
4.1	Defined and scored to risk criteria	10
4.2	Risk Mapping Types	11
5	Summary	
5.1	Mapping Summarization	20
5.2	Result	20
5.3	Recommendation and Using	20
6	References and Map	
6.1	Documentation for Analysis	20
6.2	Fire Risk Assessment Map of each Criteria	21

1. Luang Pra Bang in general

1.1 Luang Pra Bang in general

Luang Pra Bang is one 18 provinces of Laos, is located at the north of country and as a central of northern part provinces as Luangnamtha, Oudomxai, Phonsaly, Bokeo, Xaiyaboury and Vientiane. Luang Pra Bang is a focus point for the north economic and is a world heritage of town, landscape, culture and Nature. At the present Luang Pra Bang is as tourism town and as center town with rapid growth, which based on town facility location and economic condition are attracting people migrate to the town, town is extended with out following the land use planning regulation and it make high density of population especially on the back of new market, Houses is constructed by wood, in some areas has narrow road which car can not enter, and some activities of town are still risk from fire as: Gasoline station, Cooking Gas and etc..

1.2 Luang Pra Bang Fire Disaster Situation

Luang Pra Bang is ancient city which declare by UNESCO as a World Heritage and at the present Luang Pra Bang is as important tourism town in the north and based on those condition it grow very rapidly on economic and social, and it make high density of population from settlement, and some activities of town are increasing and still risk from fire as: Gasoline station, Cooking Gas, Market, Restaurant and etc..



If compare Luang Pra Bang fire history with other big towns is still low, However because of Luang Prabang is world heritage with fully inventory heritage house with high risk of fire. Therefore it necessary to protect it in the beginning. During 1992 to 2004 there were 116 times and cost damage was about 700,000 USD (Fire Protection Unit LPB Province in 1994). Luang Pra Bang Fire Disaster Problems has very difficulty to solve as: road lane is very narrow in some area, residential houses and public buildings are wooden. Villagers are un aware from cause of fire, fire protection . Now fire fighting equipments and human resource are not enough, Fire hydrants are located outside the prone area. Existing Equipments are stand for whole province as there are five fire trucks but it can use only four.

1.3 Objectives for Solving Problems

Based on the issues mention aboved, Department of Labor and Social Welfare Luang Prabang (DLSW Luang Prabang) requested to URI for develop risk assessment mapping. URI had send a technical team to develop risk assessment mapping, URI had cooperate with organisation involved as NDMO, DLSW Luang Prabang by financial and expertise support from ADPC. ADPC aims to have activities to protect and mitigate urban fire in

Luang Prabang and there are three trends to solve problems in Luang Prabang as following:

- a. develop risk assessment mapping for Luang Prabang
- b. Training for organisation involved to urban management
- c. Community Workshop to raise public awareness on fire protection

For those three activities, URI has done only two activities as 1. develop risk assessment mapping for Luang Prabang, 2. Training for organisations who involved to urban management. For the third activity has respond by NDMO with cooperation DLSW Luang Prabang and Fire Protection Unit Luang Prabang.

2. Map Defining

2.1 Data Collection plan

For develop risk assessment mapping procedure, it had to define the criteria for data collection and source to accurate mapping as following:

Table1: Source of Information

Data Types	Detail Information	Source	Method	Data Show
Town Situation	Road Network Demography Village Boundary Public Office Location Hydrant Urban Management	Geography Dept. URI UDAA Heritage Office Fire Protection Unit Village Office Major Office	Desk Research Interview Survey	Map Picture Document
Building material Type	Material and Building quality	UDAA Heritage Office Sites	Interview Survey Documents	Map Picture Document
Availability of Fire sources	Gas station, Restaurant and activities that use inflaming.	Commercial Division Industry division Site	Interview Survey Documents	Map Picture Document
Fire fighting scenario	Water Source Road	UDAA Heritage Office Sites	Interview Survey Documents	Map Picture Document
Electrical wiring	Connection system No. of unit Area of unit	Electricity province Site	Interview Survey Documents	Map Picture Document
Fire history	Fire place No. of fire Damage cost Fire cause	Fire fighting unit Village office Site	Interview Survey Documents	Map Picture Document
Building Density	Density unit Road system	Geography dept. UDAA District office Heritage Office Village Office	Interview Survey Documents	Map Picture Document

Accessibility	Road type Road width	Geography dept. UDAA District office Heritage Office Village Office	Interview Survey Documents	Map Picture Document
Methodology of data collection is to walk through village and collect from organizations in LPB				



2.2 Fire Risk Assessment Map Boundary

Based on the agreement on defining boundary of mapping that cover 1030 ha and consist of 42 villages between four parties namely: Urban Research Institute, LPB District Office, Fire Prevention and Protection Unit of LPB and Social Welfare Department, This area is



under management of UDAA –LPB and Heritage Office the potential fire hazard ratings have been assessed in relation to criteria or factors namely: Building material type, Availability of fire sources, Fire fighting scenario, Electrical wiring, Fire history, Building Density, Accessibility.

2.3 Schedule for Mapping

Table 2: Schedule for Mapping

No.	Work description	April	May	June	July	Aug.	Sept.
1	Work preparation for Field	=====					
2	Data collection at field		=====				
3	Data tabulate and Analysis			=====			
4	Map drawing			=====	=====		
5	Reporting				=====	=====	
6	Workbook						=====
7	Present to local Authorities and Map Hand over.						=====

2.4 General Problems on Developing Map

To do risk mapping, there are still some factors of risk that can indicate in the map as candle lighting for worship. Beside of that some of information is changing a little that effect face difficulty analysis due to some information is take time to collect and sometime can not get complete information. And some important information as market and temples did not show as risk place, it is needed for local authorities make management plan according to the real situation.

3. General Situation Study of Luang PraBang

3.1 Geography

LPB district is located at the center north of Lao PDR and it as capital of province. LPB district use to be a capital of LPB Kingdom that has a wide area in the history and it share border with Siam and Burma, North with China and East with Vietnam.

LPB district is mountainous and forest area and humidity, characteristic of town is Mekong river and Khan flow through it, major of land is agriculture and forestry, LPB district has average level of 472 m above sea level, highest level is 611 m and lowest 400 m. There are two seasons as dry and rainy season, dry season is begin from October to April, Rainy season begin from May to September. Average rain is 300 cm, Max temperature is 34 C (April 2003), minimum temperature is 10 C (February 2003), average temperature is 24 C (January 2003).

Table 3 : Temperature by year.

	Year	Warmest Temperature	Month	Coldest Temperature	Month
1	1994	39.10	5	10.00	1
2	1995	40.40	4	08.20	12
3	1996	38.40	3	06.90	1
4	1997	38.10	5	10.00	2
5	1998	39.00	3	08.00	12
6	1999	40.50	4	03.50	12
7	2000	39.50	4	10.50	2
8	2001	39.50	4	10.10	11
9	2002	39.50	4	10.00	1

Source: LPB District Master Plan Phase II, 2003

Table 4: Total Rainfall by year.

No.	year	Max rainfall (mm)	month	rainfall (mm)	month
1	1994	67.90	8	0.10	11
2	1995	96.70	9	0.50	1
3	1996	96.00	9	0.30	2
4	1997	50.00	6	0.20	10
5	1998	75.00	9	0.50	11

6	1999	54.00	6	0.50	5
7	2000	85.00	6	0.50	5
8	2001	83.10	7	0.10	5
9	2002	96.70	7	1.10	2

Source: LPB District Master Plan Phase II, 2003

Note: Max rainfall 96.70 mm in August of 2002
Minimum rainfall 0.10 mm in May of 2002

LPB District is wealth of natural resources and numbers of stream and river flow through the town namely: Namdong, Nampa, Namkharn, and Nam khong (Mekong). Those rivers are as resources for agriculture, water way, water consumption and for fire fighting work.

3.2 Demography

LPB district has location along the river which is important to convenience of living life, by that condition people migrant from others place to stay there and population was increase. LPB province has 365 000 persons in 1995 based on its consensus, it comprise 3 main groups of population namely: Lao Loum, Lao Theung and Lao Sung.

At the present, LPB center (municipality) was developed economic as tourist, it integrate population from rural of LPB province and others province which they are looking for work and it effect to increasing of population. In the Center has 70 777 persons in habitant, 35 503 female, 12 704 household with 132 villages. Population in the mapping area is 31 746 persons, 123 families, 42 villages. The present density is 132-140 per hectare.

Table 5 : Number of population by year.

Year	Total Family	Total population	Total Female
1997	3 854	28 553	14 483
1998	3 813	29 212	14 594
1999	3 612	29 502	14 887
2000	3 910	29 543	14 993
2001	3 977	29 354	15 267
2002	3 942	30 147	15 380
2003	4 084	31 746	16 114

Source: LPB District Master Plan Phase II, 2003

3.3 Towns Activities

Population's economic of LPB province is good level if compare with others province in the north. GDP in 2003 is increase 5% from 2002, average income per person is 1,9 million Lak, it is increase 4% from last year. In general GDP of province is growing slow. Major Population in LPB district is commercial and mainly rice farmer, vegetable farmer is only small part. LPB district is a transfer town for the north because Route 13 cut through the town which convenience for town development. After LPB district was declare on World heritage by UNESCO, the economic activities were growing as International Airport, Hotel, Restaurant, Traditional Handicraft and others.

Table 6 : Major Activities in LPB district by year

Activities	1996	1997	1998	1999	2000	2001
Hotel	10	10	11	11	12	13
Guesthouse	13	19	33	64	80	107
Restaurant	13	22	25	34	43	57
7 Gasoline Stations in 2004						

Source: LPB District Master Plan Phase II, 2003

From the figure in 1996-2001, economic town activities are increasing and growing. Hotel was increased 30%, Guest house 723%, Restaurant 338%. And others business was also increase, 4056 business unit.

Table 7: Provincial Business Sectors.

No.	Business Sectors	Number of Business
1	Agriculture	21
2	Industry	27
3	Commercial	127
4	Service	936
Total		1.111

Source: LPB District Master Plan Phase II, 2003

Table 7: Provincial Business District Sectors.

No.	Business Sectors	Number of Business
1	Agriculture	17
2	Industry	186
3	Commercial	1.845
4	Service	897
Total		2 945

Source: LPB District Master Plan Phase II, 2003

No.	Business Sectors	Number of Business
1	Concrete Factory	1
2	Posa Paper Factory	1
3	Sawmill Workshop	6
4	Cotton Workshop	11
5	Sawmill	1
6	Concrete Factory	1
7	Drinking Water Factory	6
8	Rice mill	4
9	Furniture Factory	52

10	Printing Workshop	1
11	Jewelry Workshop	31
Total		125

Source: LPB District Master Plan Phase II, 2003

From the information exist, major part of LPB District population can cover expenditure of their family but some of them have low income. For the low income people, is due to low production and low technique of product and lack of strong support from government. The average income of family is 176 USD per year.

3.4 Fire Disaster Situation in Towns

After LPB district was declare on World heritage by UNESCO, LPB district was rapid growth on socio-economic. At the present, LPB center (municipality) was developed economic as tourist, it integrate population from rural of LPB province and others province which they are looking for work and it effect to more density in some ward and some ward is condense, Road access is also narrow that risk to fire. Major Buildings are old and construct by wood especially in the heritage zone. Beside of that some town activities are risk to fire as Gasoline station, restaurant and repair workshops, Illegal electricity wiring system and worship candle lighting which most risky to fire because this is a major cause to fire.



Equipment and tools to prevent and protect fire of Fire Fighting Unit is very limited, there are 6 fire trucks but can use only 5, these 5 trucks were serve whole province. If fire occur in may places in the same time they may not cover all fires. Based on present equipment situation of LPB province Fire Fighting Unit is not enough with fire situation. In 1992 to 2003, there 1028 fires and cost to damage is 11.04 million USD (whole province). LPB District has 3 fires.

4. Fire Risk Assessment Map Process
4.1 Disaster and Risk

Disaster is impact from damage that made by manmade and natural. It could be Taiphoon, Flood, Drought, earthquake, fire. These disasters are made major damage and damage will depend on size of disaster. In Asia, Disaster is always occur, but good luck for Laos we do not have much disaster like others countries in Asia. In Laos has 4 disasters that always occur as flood, fire, drought and Taiphoon. Fire and flood are often occurring.

Risk assessment is to find out the point or risk place that define in the area. For LPB district is made fire risk assessment mapping to find out the fire risk in the area defined in the map with total area 1030 hectare and cover 42 villages.

Risk Formula: Disaster Risk =
$$\frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

4.2 The Criteria for assessment of fire hazard ratings.

LPB fire risk zonation mapping is decided and select the area of high residential area and population, and after that is to define the map units or scale and sharp aerial photo that can delineate the component of attributes to potential fire hazard. Map can obtained from National Geography Department of latest in 2001 of scale 1/2000 to 1/10.000. The potential fire hazard ratings have been assessed in relation to criteria or factors namely: Building material type, Availability of fire sources, Fire fighting scenario, Electrical wiring, Fire history, Building Density, Accessibility.

4.3 Fire Risk Mapping

4.3.1 Building material type

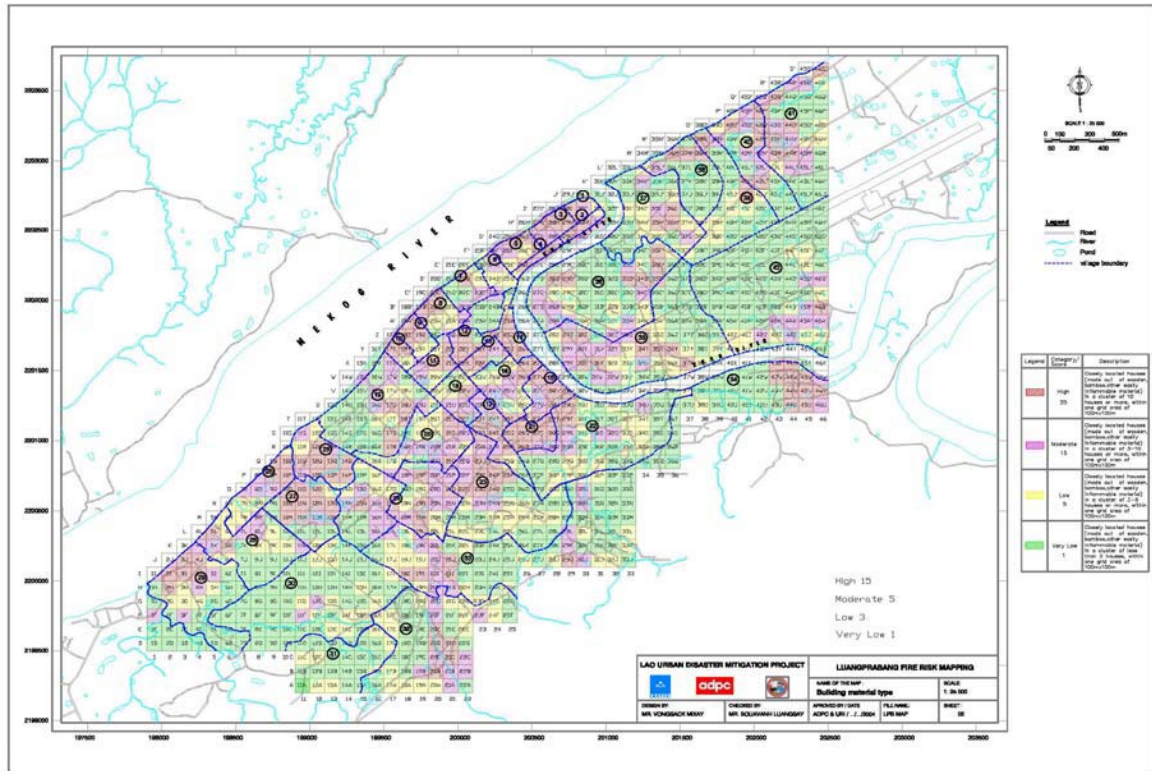
The hazard depends on the quantity of inflammable material, which is a major contributor to the intensity of fire. The contributory factor can be easily evaluated through examination of building typologies, construction material and closeness of location to each other in terms of its effect on initiation of a potential fire .It also relate to the probability of fires being started due to the activities taking place within the location. Those reasons can be can be recreational, negligence, mistakes etc.

Cate gory	Description	Score (Maximum 25)
High	Closely located houses (made out of wooden, bamboo, other easily inflammable material) in a cluster of 10 houses or more, Within one grid area of 100 m x 100m	25
Moderate	Closely located houses (made out of wooden, bamboo, other easily inflammable material) in a cluster of 5-9 houses, Within one grid area of 100 m x 100m	15
Low	Closely located houses (made out of wooden, bamboo, other easily inflammable material) in a cluster of 2-4 houses, Within one grid area of 100 m x 100m	5
Very low	Closely located houses (made out of wooden, bamboo, other easily inflammable material) in a cluster of less than 2 houses, Within one grid area of 100 m x 100m	1



Factors Output:

Building Risk Factor is overall high that we can see from the map, Most of building is old wooden house. The high risk is in a center of the town.



4.3.2 Fire sources

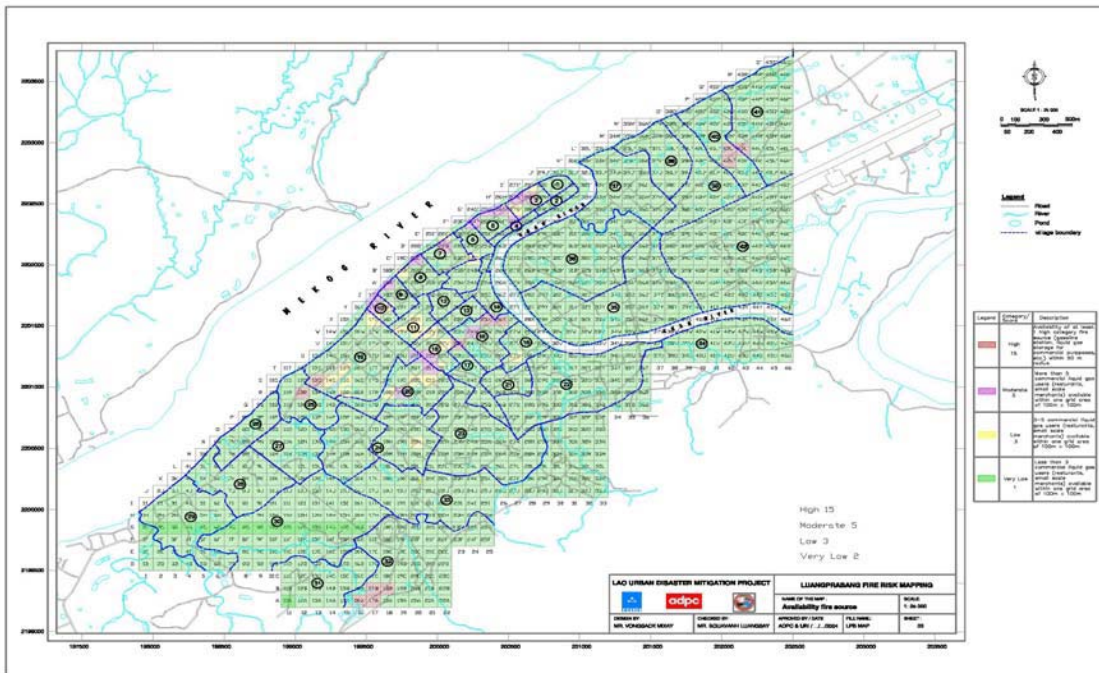
The hazard depends on the quantity of available fuel, which is a major contributory factor as Gasoline station, liquid gas storage, restaurant and others shop that use material easy to fire, Criteria had done in one grid area of 100 m x 100m.

Category	Description	Score (Maximum 15)
High	Availability of at least 01 high category fire source (gasoline station, liquid gas storage for commercial purposes, etc.) within 50 m radius	15
Moderate	More than 3-5 commercial liquid gas users (restaurants, small scale merchants)	5
Low	2-3 commercial liquid gas users (restaurants, small scale merchants)	3
Very low	Less than 2 commercial liquid gas users (restaurants, small scale merchants)	1



Factors Output:

This fire source factor is not much in the center town because of it have not much activities due to small town. LPB has rapid growth since it was declare by UNESCO as world heritage.



4.3.3 Fire fighting scenario

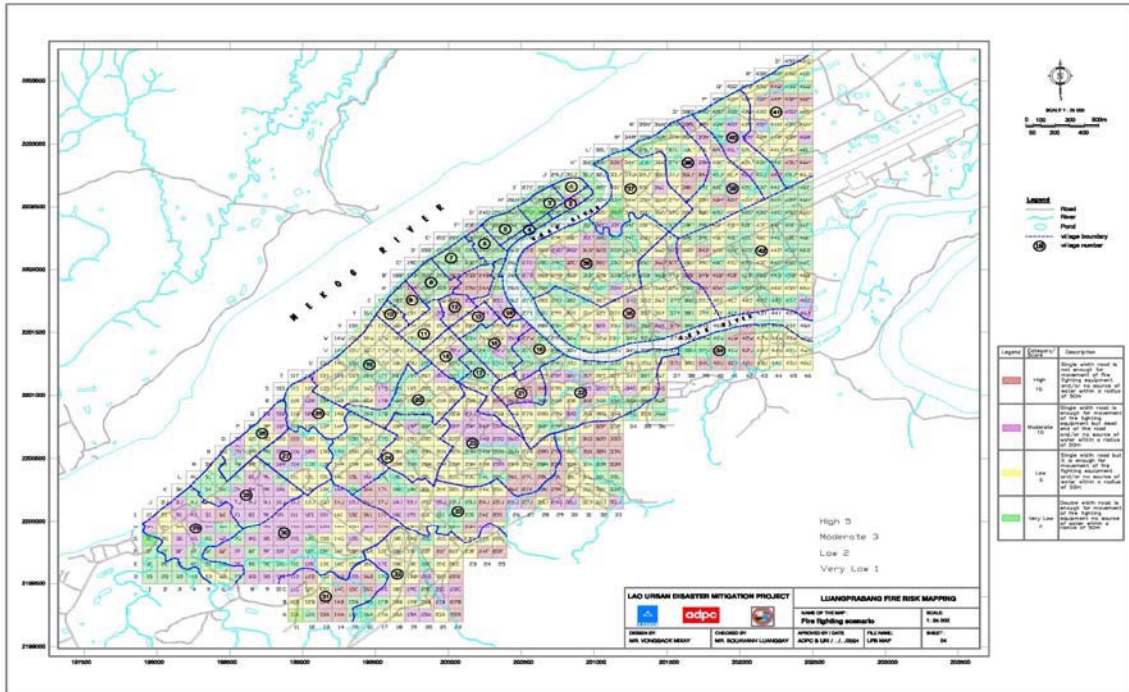
The capability or the effectiveness of fire fighting services within a given location can be determined by the availability of water and available maneuverings space to mobilize the fire fighting team within a fastest time possible to act in an appropriate manner in case of fire. Criteria had done in one grid area of 100 m x 100m.

Category	Description	Score (Maximum 15)
High	Single width road is not enough for movement of fire fighting equipment and/or no source of water within a radius of 50m.	15
Moderate	Single width road is enough for movement of fire fighting equipment but dead end of the road and/or no source of water within a radius of 50m.	10
Low	Single width road but it is enough for movement of fire fighting equipment and/or no source of water within a radius of 50m.	3
Very low	Double width road is enough for movement of fire fighting equipment but no source of water within a radius of 50m.	2



Factors Output:

This fire fighting scenario risk has a lot in the town, due to the town growth very rapid, Urban management is not successful therefore some areas is high density and no access to the main road directly, very rare of fire hydrant.



4.3.4 Electrical wiring system

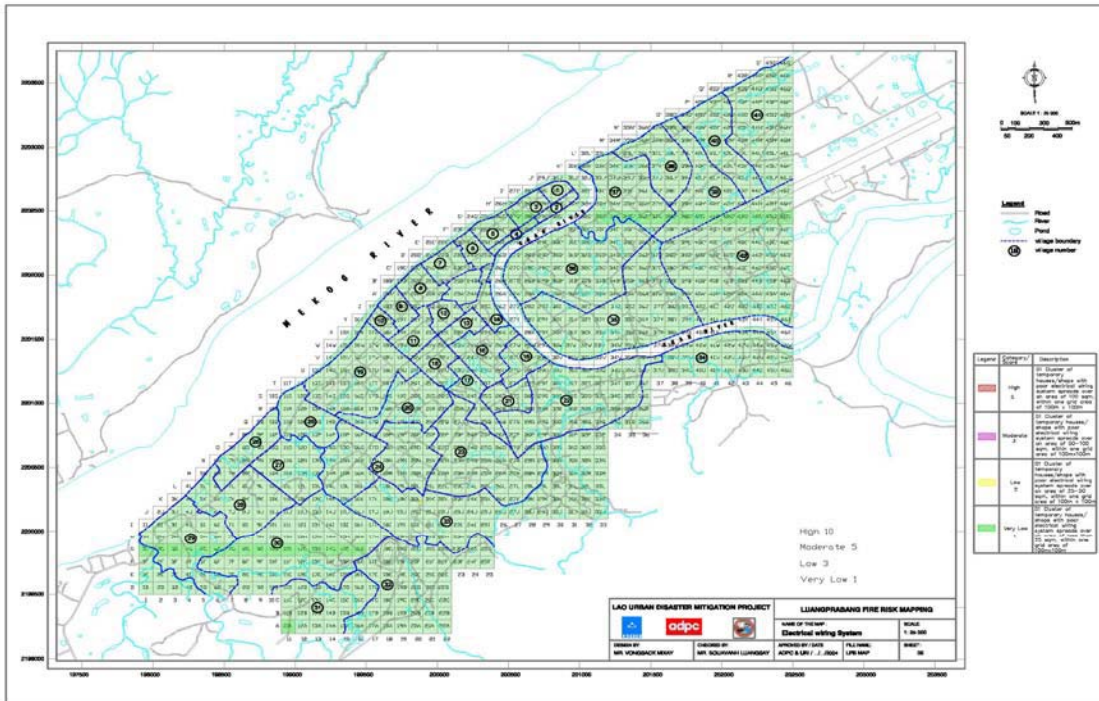
It has been observed that many connections are of temporary nature or due to maintenance of poor standards of wiring. This kind of irregularities can be observed mainly in market areas, open air shopping areas, in areas where underserved communities are located. Some times these are isolated pockets or series of pockets located in close proximity. Criteria had done in one grid area of 100 m x 100m.

Category	Description	Score (Maximum 5)
High	01 Cluster of temporary houses/shops with poor electrical wiring system spreads over an area of 100 m ² ,	5
Moderate	01 Cluster of temporary houses/shops with poor electrical wiring system spreads over an area of 50-100 m ² ,	3
Low	01 Cluster of temporary houses/shops with poor electrical wiring system spreads over an area of 25-50 m ² ,	2
Very low	01 Cluster of temporary houses/shops with poor electrical wiring system spreads over an area of less than 25 m ² ,	1



Factors Output:

This electrical wiring system risk is very rare, only some place therefore in the map will see that it is not risk.



4.3.5 Fire history of the area.

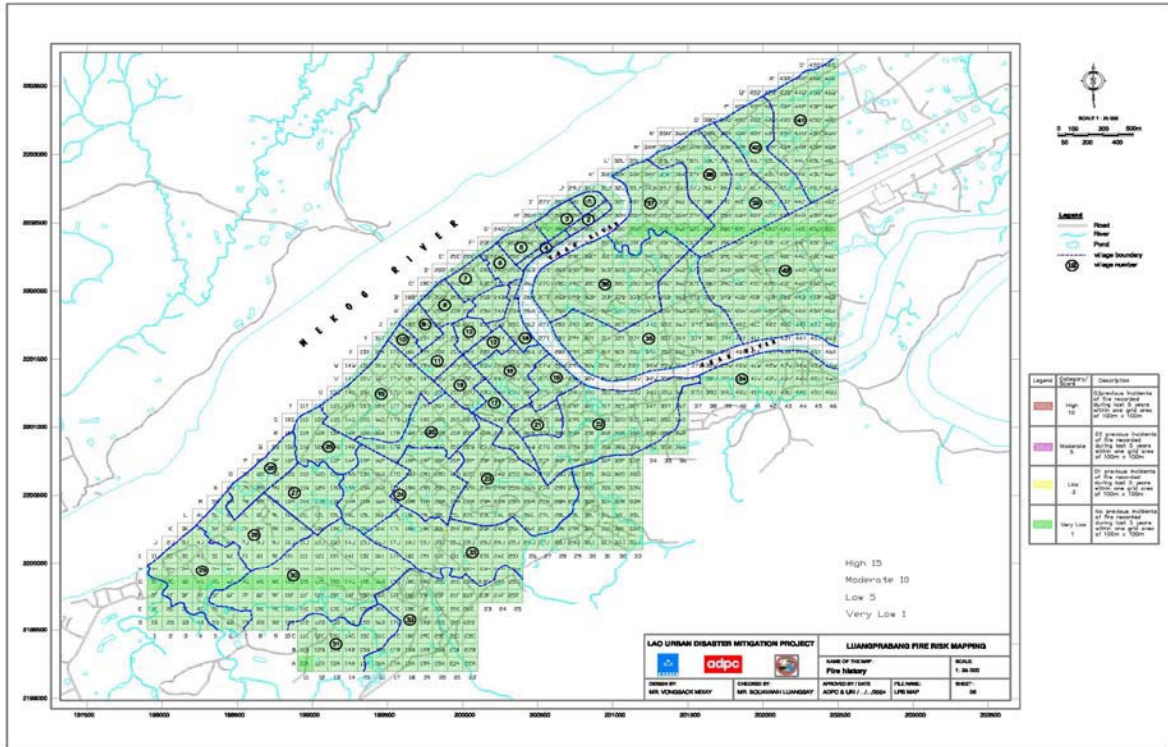
The history refers to the number of fires initiated within an area in the past. Areas, which are known to have been particularly prone to outbreaks of fire due to natural or manmade causes, have been considered in mapping as having high degree of Fire hazard. Criteria had done in one grid area of 100 m x 100m.

Category	Description	Score (Maximum 10)
High	04 previous incidents of fire recorded during last 05 years Within one grid area of 100 m x 100m	10
Moderate	03 previous incidents of fire recorded during last 05 years Within one grid area of 100 m x 100m	5
Low	02 previous incidents of fire recorded during last 05 years Within one grid area of 100 m x 100m	3
Very low	01 previous incidents of fire recorded during last 05 years Within one grid area of 100 m x 100m	1



Factors Output:

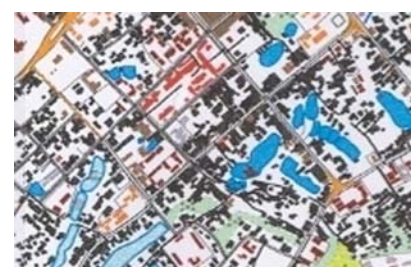
This Fire history risk of the area has not much or none, only some place therefore in the map will see that it is not risk.



4.3.6 Building density

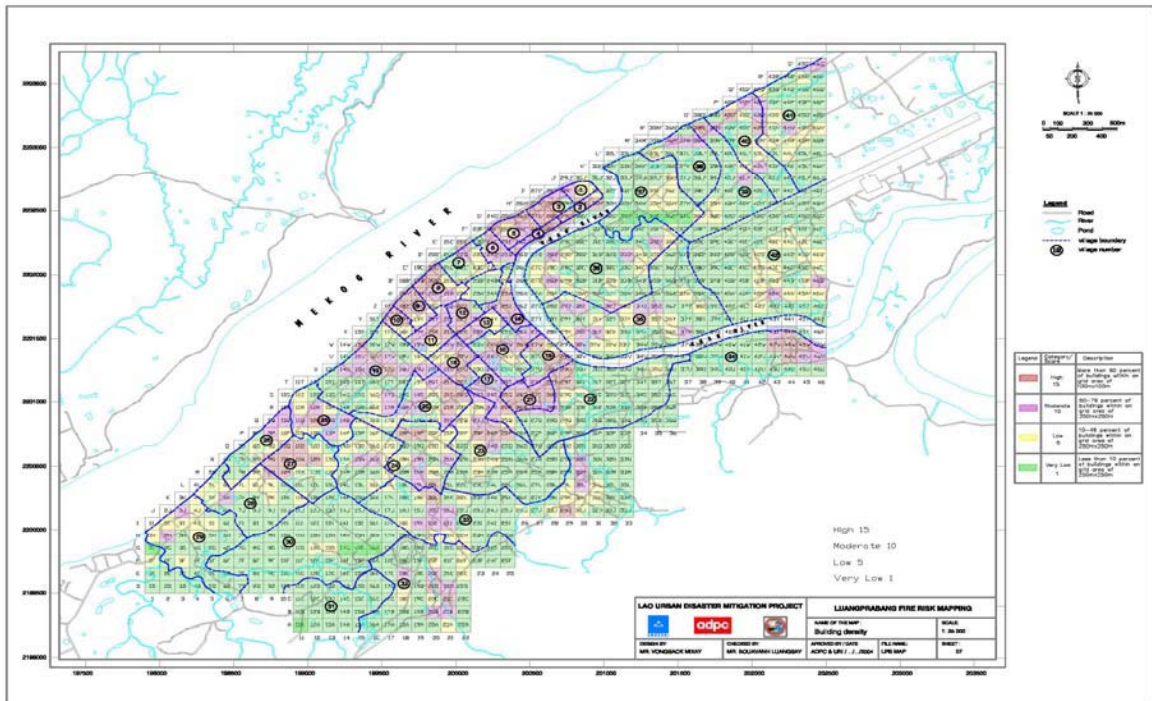
The fire hazard also depends on the density building. The contributory can be evaluated from the city map scale: 1: 2000 to 1:10 000 which is done by National Geographic Department in 2001 latest. Criteria had done in one grid area of 100 m x 100m.

Category	Description	Score (Maximum 15)
High	More than 80 percent of buildings within on grid area of 100mx100m	15
Moderate	50 - 79 percent of buildings within on grid area of 100mx100m	10
Low	10 - 49 percent of buildings within on grid area of 100mx100m	5
Very low	Less than 10 percent of buildings within on grid area of 100mx100m	1



Factor Output:

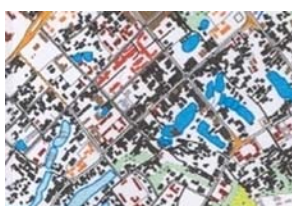
This factor risk has a lot in the town, major part is along the town center due to most of exist and new economic activities are condense in the center.



4.3.7 Accessibility of the area

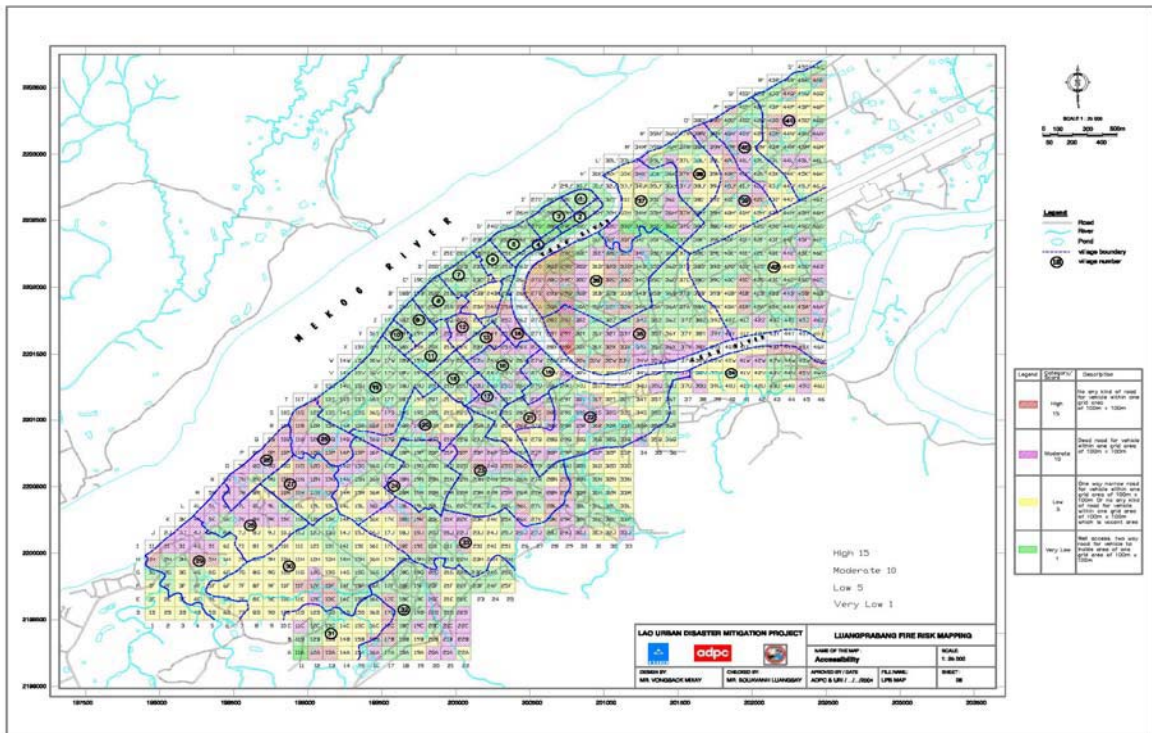
Accessibility of the area relates to the capability or the effectiveness of fire fighting services. Accessibility can be evaluated from the 1:2000 to 1:10 000 city map which is good detailed. Criteria had done in one grid area of 100 m x 100m.

Category	Description	Score (Maximum 15)
High	No any kind of road for vehicle within one grid area of 100mx100m	15
Moderate	Dead road for vehicle within one grid area of 100mx100m	10
Low	One way narrow road for vehicle within one grid area of 100mx100m, which is vacant area. Or no any kind of road for vehicle within one grid area of 100mx100m which is vacant area.	5
Very low	Well access, two way road for vehicle to inside area of one grid area of 100mx100m	1



Factor Output:

This factor risk has a lot in the town, major part is in new village due to town growth and not success in management growth.



4.4 Fire hazard Zonation.

The fire hazard map will be prepared through integration of individual attributes through overlay process. Since URI does not possess the GIS capacity integration will be done through manual method. The zonation will be done through identification of areas having relatively uniform characteristics from the fire hazard attribute viewpoints through clustering according to the total fire hazard rating.

Total fire hazard rating.

Total integrated score	Fire hazard rating	Legend
More than 50	Very high	
30-50	High	
15-30	Moderate	
5-15	Low	
Less than 5	Very low	

5. Summarization

5.1 Summarization

From the field data collection and map analysis of Fire Risk Assessment Mapping of LPB district show that LPB district has risk to fire of 11 villages but fire risk is spread whole town but the high risk area will be at the old ward in the center because it has old building, high density and others activities relevance to fire are there. Therefore 12 villages are high risk to fire namely:

- | | |
|--------------------|-------------------|
| 1. Barn Xiengthong | 2. Barn Khily |
| 3. Barn Aphy | 4. Barn Muang Gha |
| 5. Barn Kham Yong | 6. Barn ThaBosot |
| 7. Barn Vieng xai | 8. Barn Pha Bat |
| 9. Barn Phosy | 10. Barn Saylom |
| 11. Barn Watthat | 12. Barn Hoixiang |

5.2 Output

Fire Risk Assesment mapping is a first mission for Lao PDR, for LPB is a third town that done by URI. To do this kind of mapping is very important because it is a tool to manage the town on fire especially it will be help information for Fire Fighting Unit and it will help town planning sector to plan for unit.

5.3 Recommendations and Map Using

After Fire Risk Assesment Mapping complete, it was hand over to organization involved to fire manage in LPB province as : Department of Labor and Social Welfare LPB Province, Police Fire Prevention and Protection Unit, World Heritage Office, Department of Communication Transport Post and Construction, Urban Development Administration Authorities. Fire Risk Assesment Mapping can usefull for those organizations to be a basic information of fire risk to prevent and protect fire of LPB district. How ever it is only basic information but all organization can use those map in their daily work as:

Police Fire Prevention and Protection Unit know about the high risk in documentary by collect the real data from field. After that Fire fighting unit can have a plan to prevent and protect the right point by set up fire hydrant or organize training fire protection and other activities to prevent fire for risk area people.

Department of Communication Transport Post and Construction and Urban Development Administration Authorities can use those maps to define the special regulation to building plot, building, road access, activities risk to fire.

World Heritage Office can use those maps to making plan of protect the old building heritage in the high risk zone.

Department of Labor and Social Welfare LPB Province can use those map to make their own plan to prevent fire by cooperate with all parties by create activities to mitigate the fire.

6. References

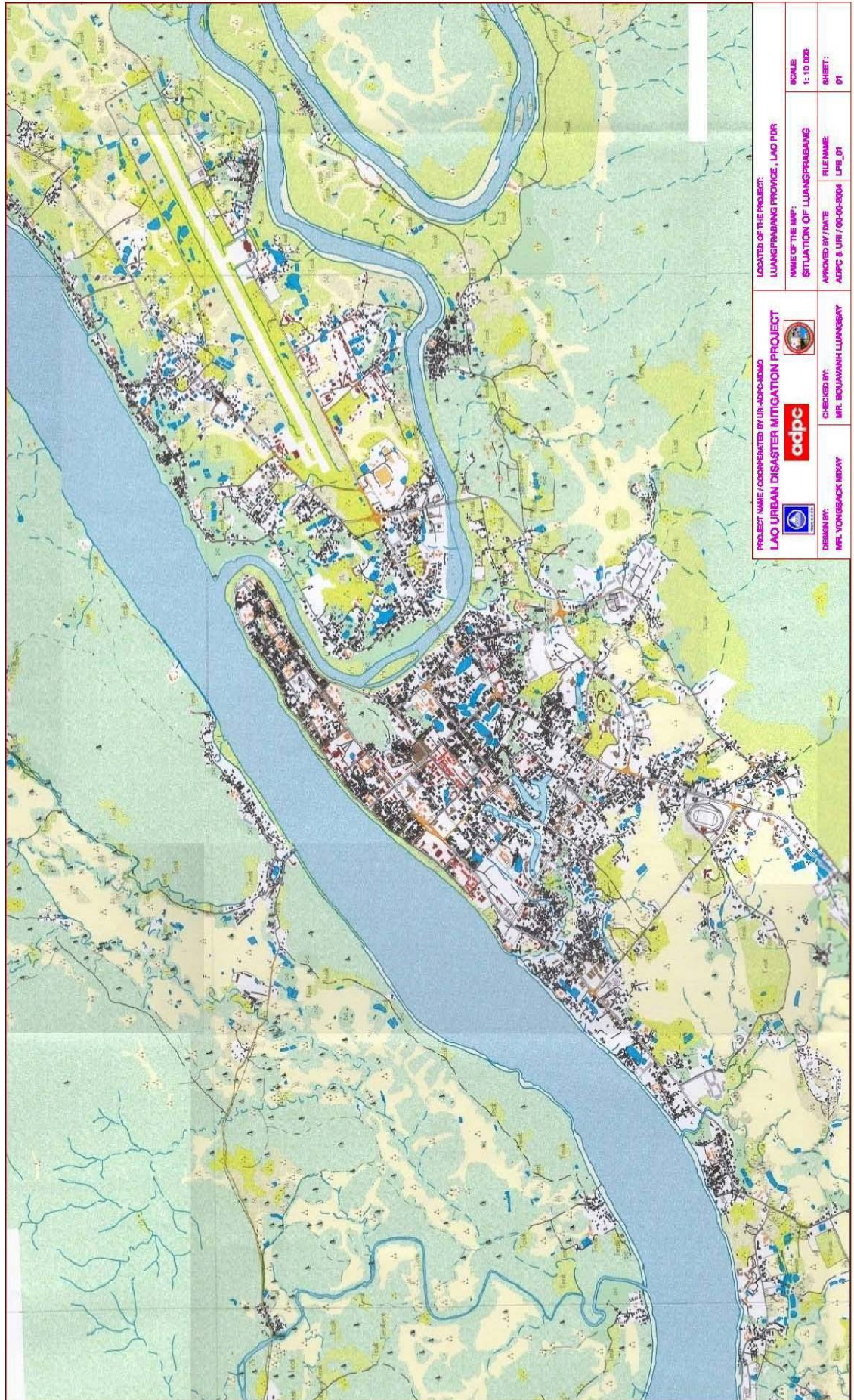
6.1 List of document that use to analys the risk assessment

1. Heritage Zone Management Report from Heritage Office
2. Fire History from Fire Fighting Unit.
3. Demography information from District office.
4. Intervie and field data

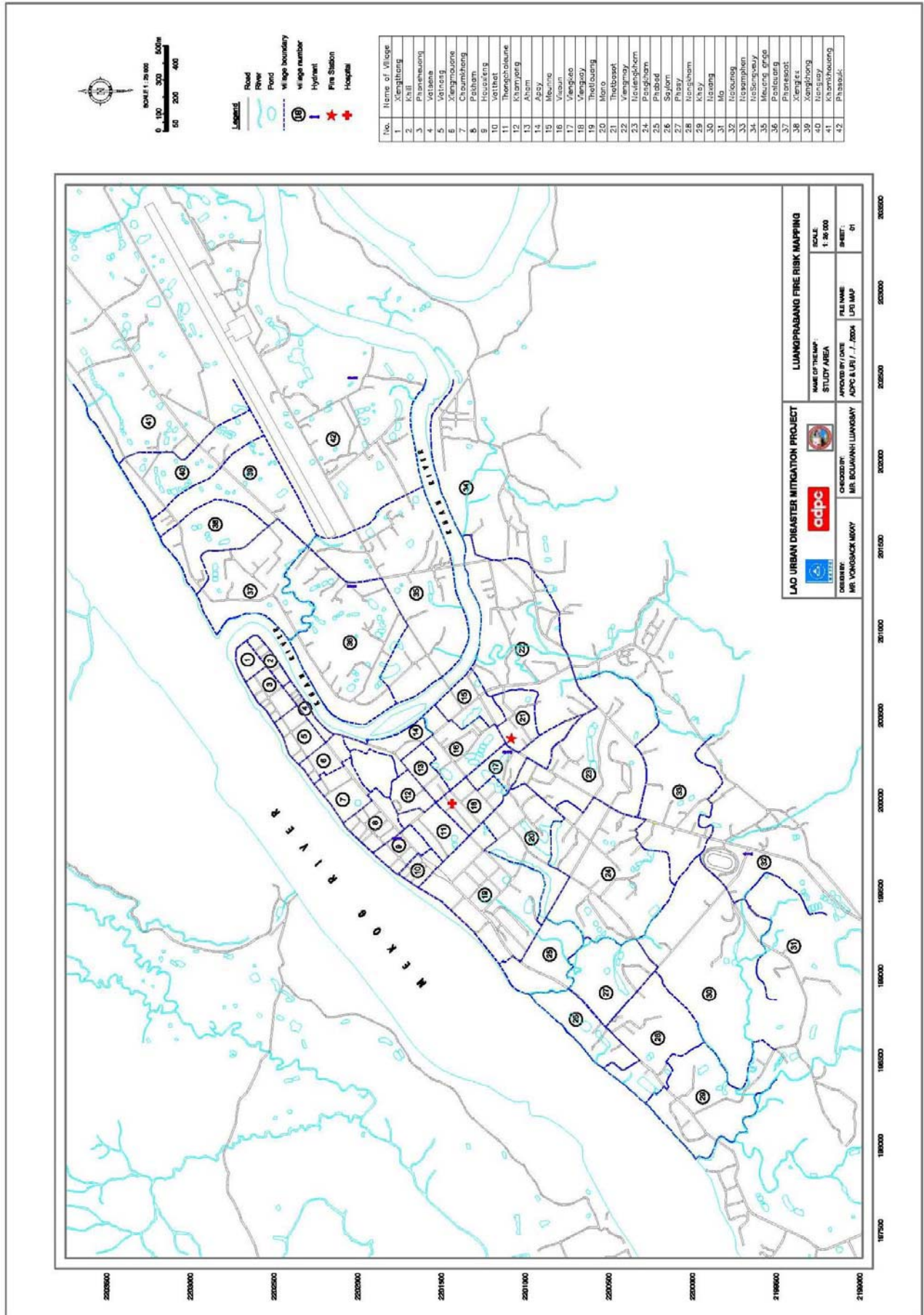
6.2 Risk Map by seven criteria.

1. Existing Land Use Map
2. Risk Map Boundary
3. Building material type Map
4. Availability of fire sources Map
5. Fire fighting scenario Map
6. Electrical wiring Map
7. Fire history Map
8. Building Density Map
9. Accessibility Map
10. Risk Zoning Map by Village

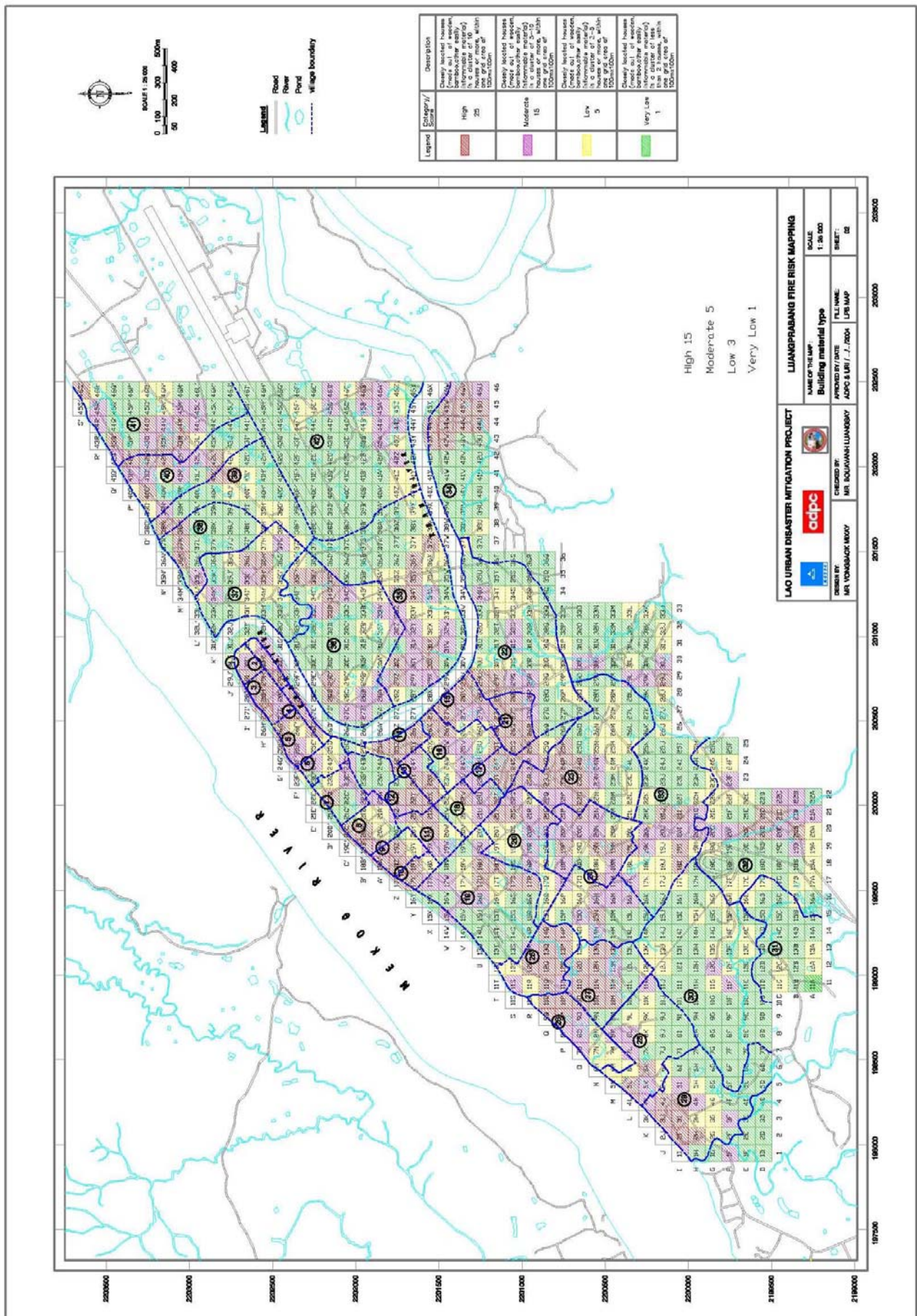
1. Existing Land Use Map



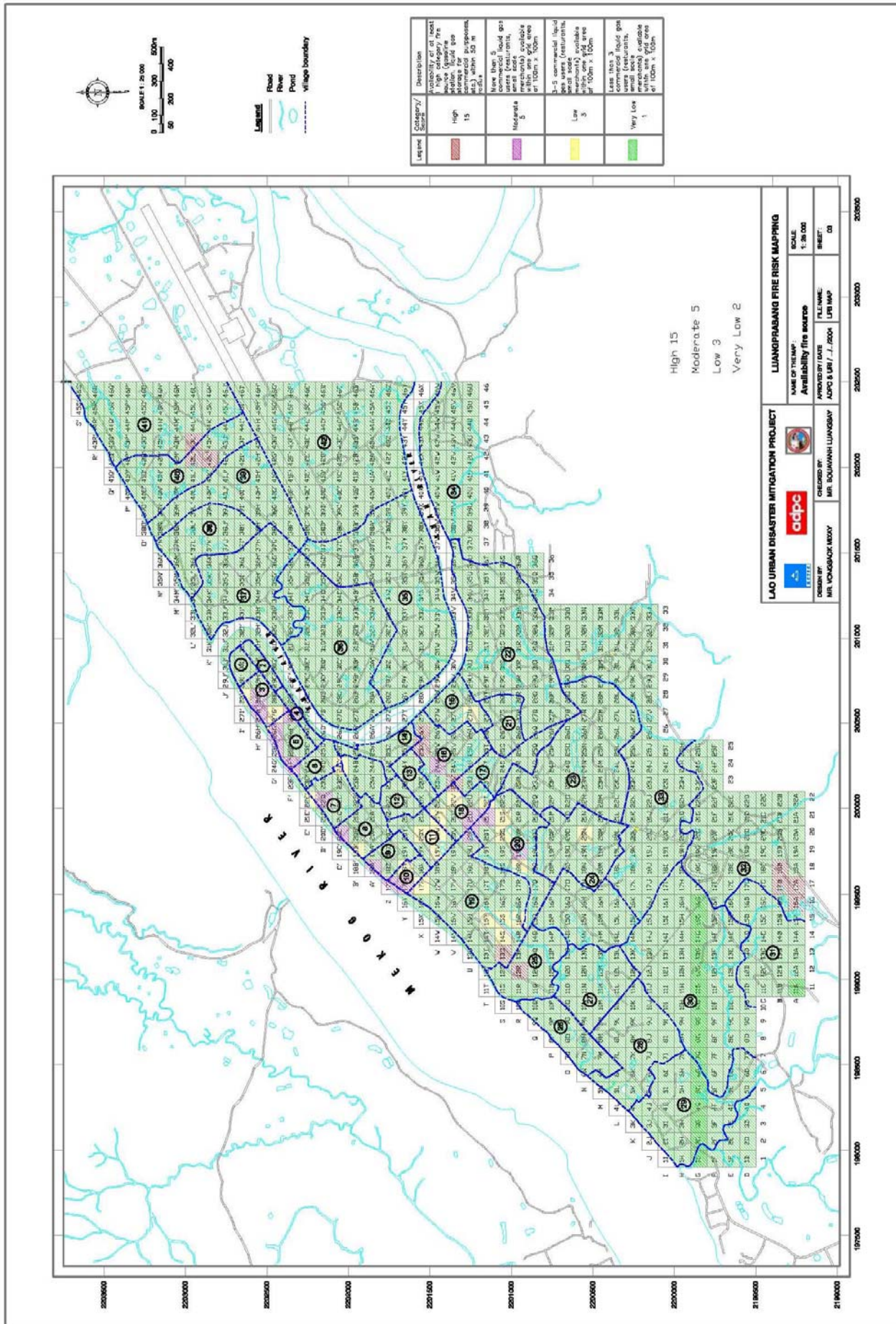
2. Risk Map Boundary



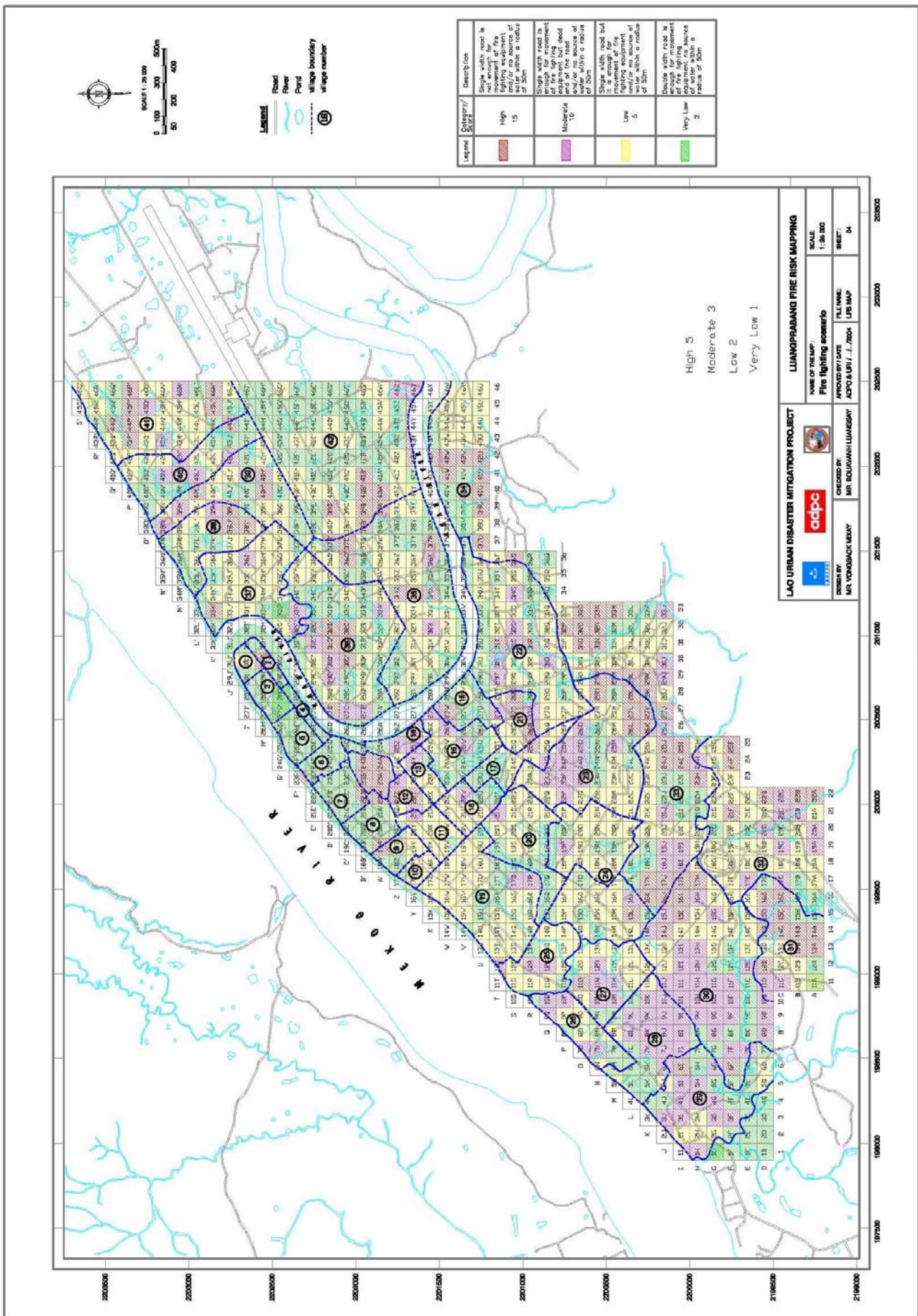
3. Building material type Map



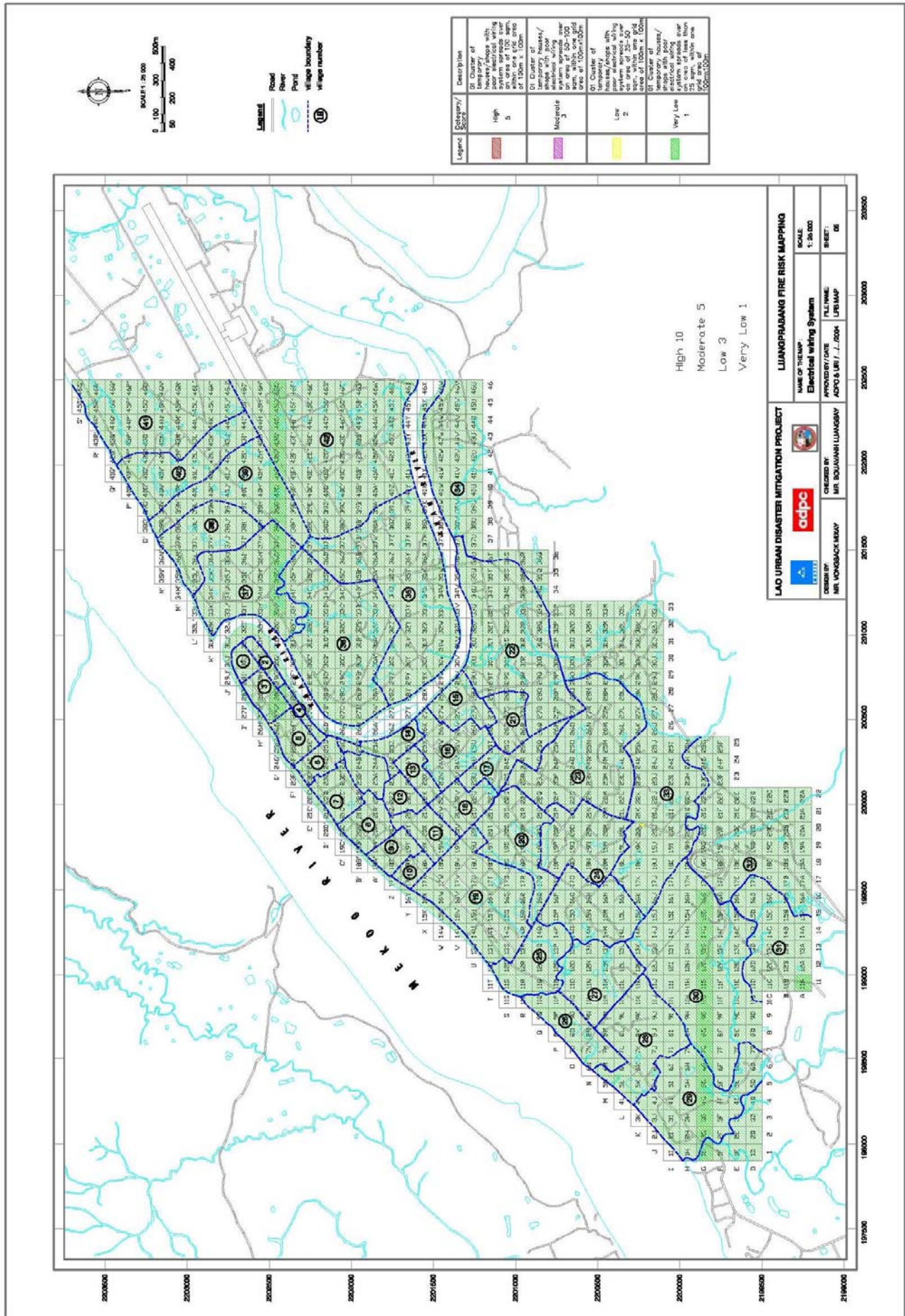
4. Availability of fire sources Map



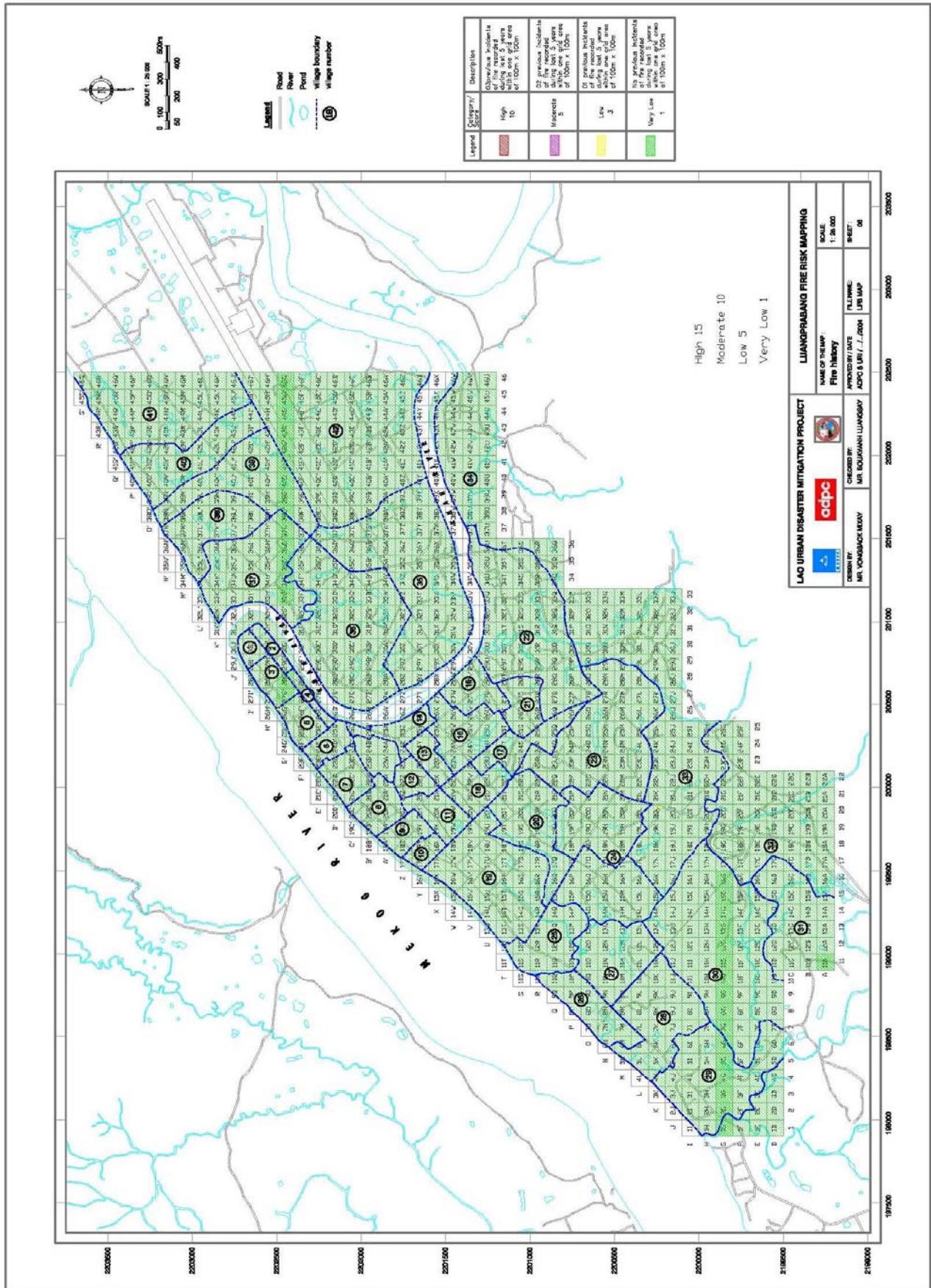
5. Fire fighting scenario Map.



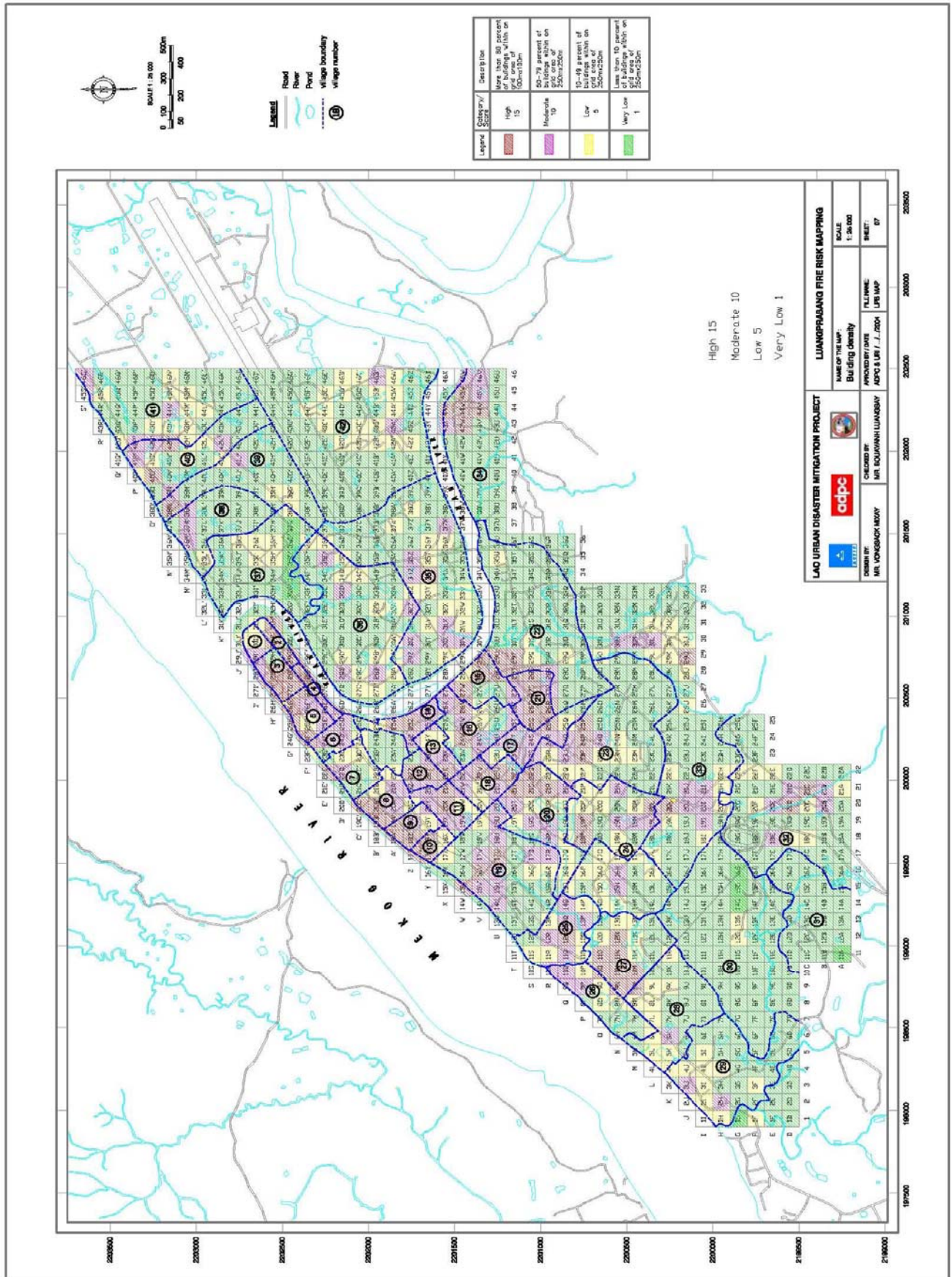
6. Electrical wiring Map



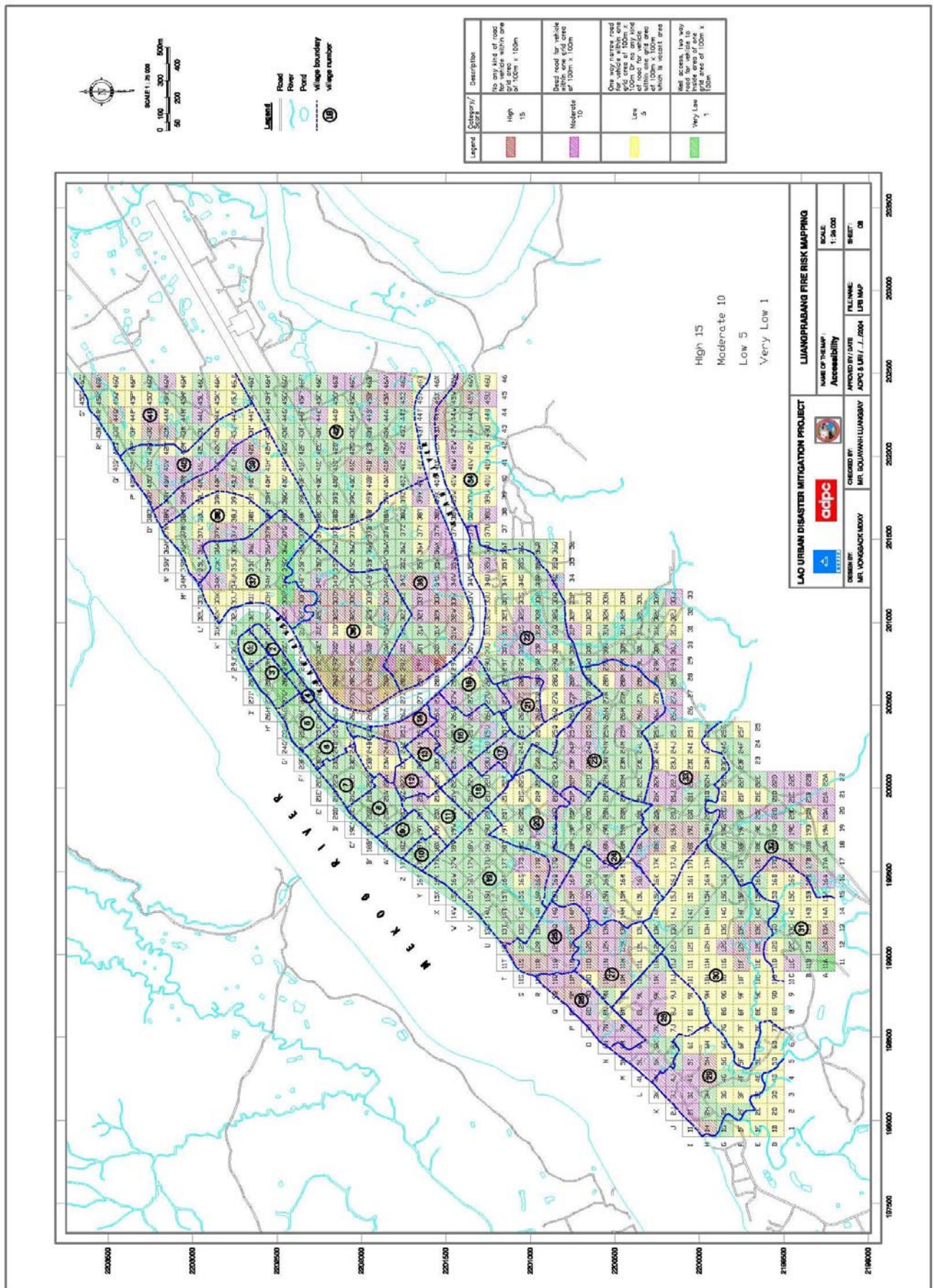
7. Fire history Map



8. Building Density Map



9. Accessibility Map



10. Risk Zoning Map by Village

