PN-ACE-764
101067

54

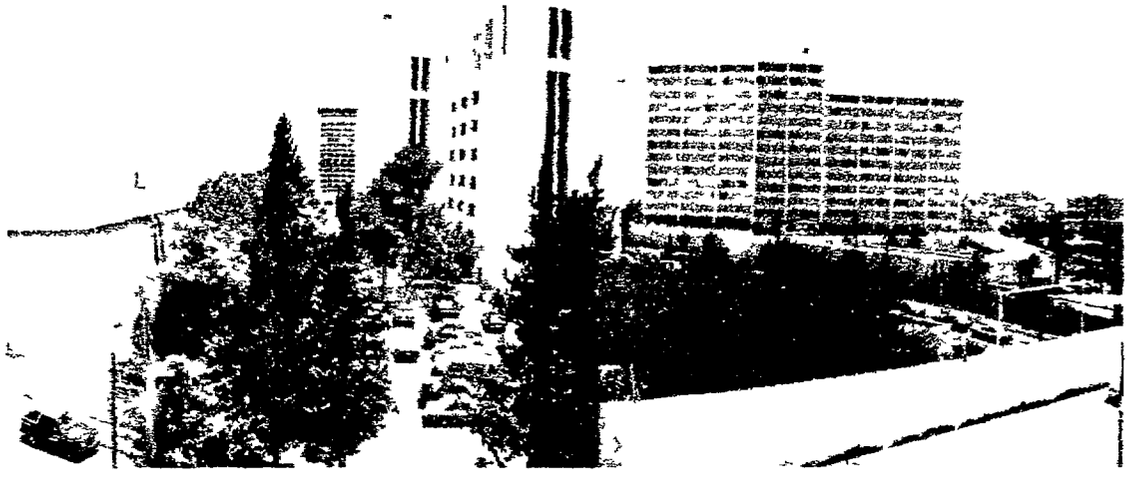
MINISTRY OF WATER AND IRRIGATION

PROPOSAL FOR ASSISTANCE IN DEVELOPMENT OF AN ARCHITECTURAL DESIGN FOR NEW MWI TRAINING CENTER

DAI / WQIC Project Office

RFP JORDAN 95 - 006

Schematic Design Report



Amman Consulting Engineering & Planning Office
Amman - Jordan

October 1995

TABLE OF CONTENTS

Introduction

1. Site/ Space adequacy

1.1 Project Site
1.2 Data Collection
1.3 Official Requirements
1.4 Combining the Existing Land Plots
1.5 Soil Investigation Report

2. Design Program

3. Site & Location Analysis

3.1 Concept Design Analysis & Environmental Aspects
3.2 External Design
3.3 Parking Area
3.4 Landscaping

4. Discussion With DAI / MWI

4.1 Special Aspects
4.1.1 Training Specialist
4.1.2 Telecom & Computer Specialists

5. Materials Equipment & Systems to be used

5.1 Architectural
5.2 Structural
5.3 Mechanical
5.4 Electrical

6. Schematic Design Drawings

7. Cost Estimate

INTRODUCTION

The objective of this project is to provide short-term assistance to DAI in the performance of the requirements under US Agency for International Development (USAID) contract No 278-0288-C-00-4026-00-the Jordan Water Quality Improvement and Conservation Project
Services to be provided under this contract is a schematic design for the MWI office building and an architectural design for the MWI Training Center

This report represents the documents and drawings of phase I- Schematic Design submittal The project comprises three phases
Phase II- Design Development
Phase III- Construction Document

The time frame for phase I is (5 week period) starting from September 2, 1995

Several coordination meetings with DAI/MWI have been held to achieve the agreed - upon program that was the base for the drawings of the schematic design Two presentations were illustrated using the concept of the program and the schematic drawings for DAI/MWI using computer projection for demonstrations

To get a complete and perfect building , we reconfirm our suggestion to develop the design for the total building (8 floors + 2 basements) and to get a license for it in one time

Construction documents could be divided into two phases , one for the completion of the training center (2 basements and 4 floors) and the second for the skeleton or the completion of the total building

1.1 Site / Space adequacy.

Project Site :

The site of the training center is adjacent to the MWI building on the plot No 76 The site is on a residential street 10 m width and an Alley of 4 m width on the east side

In order to utilize the maximum area to accommodate the training center it is necessary to combine the land plots related to MWI land together and also to add the Alley to the site

The maximum space for one floor is about 900 m2 taking into consideration the requirements of Greater Amman Municipality The new building will be linked to the MWI existing one

The design included two basement floors for Car parking (2377 m2) , and four floors for the training center (3622 m2)

1.2 Data Collection :

Available documents at MWI

We collected the available data design drawings from MWI Also we obtained the following information through the site visits and meetings with MWI personnel

- Water supply connections to the new building
- Sanitary connections to the new building
- Water mains and valves connecting the water reservoir and the pumping station
- Adequate access needed to the pumping station
- The existing electrical transformer and the possible new site to replace it
- The existing car park and the landscaping

Topographic Studies

A topography survey for the site and all the existing structures was conducted including existing MWI building pumping station , reservoir , existing car parking and the new site as shown on plans and elevations attached

1.3 Official Requirements :

Municipality and Government regulations and requirements were collected , assessed and compiled

1.4 Combining the Existing Land Plots:

A request for combining the existing land plots including the 4 m width Alley has been presented by MWI to Government Authorities and the combining approval will be issued officially

1.5 Soil Investigation Report :

Attached a copy of the soil investigation report

The report includes the results of the field and laboratory investigations, geotechnical analysis and interpretation of the findings and conclusions and recommendations to aid the design and construction of foundations

The recommended net allowable bearing pressure for the whole site area is 3 3 kg/cm2 Therefore, a total allowable bearing pressure of 4 7 kg/cm2, may be used at the foundation level which is about 7 0 m, below the existing ground surface for the whole site area

2. Design Program:

Several coordination meetings with DAI/MWI were held to discuss the design program The meetings included the Architectural , Mechanical , Electrical and Structural Engineers as well as the Training Export and the Telecommunication and Computer Exports

Following is the agreed upon program that was the base for the design of the training center

Ministry Of Water And Irrigation
Training Center Design
Space Requirements

Floor	No.of Units	Area / Unit m2	Total Area m2
Second Basement			
Car Parkings	25 car	30	750
Stores	1	140	140
			890
Circulation area + Walls			362
Total Area			1252
1st Basement			
Car Parkings	19 car	30	570
Store	1	105	105
Desil Tanks	1	30	30
Mechanical Room	1	48	48
Electrical Room	1	25	25
Guard	1	10	10
			788
Circulation area + walls			337
Total Area			1125
Ground Floor			
Entrance + Lobby	1	150	150
Video Production Room	1	43	43
Store	1	8	8
Projection room	1	25	25
Lecture Room ,	1	136	136
Multi - Perpose Room	1	136	136
Store	1	13	13
Cafe'	1	48	48
W C for Male	1	22	22
W C for Female	1	20	20
W C for Handy-Caped	1	10	10
			610
Circulation area + Walls			246
Total Area			856

Ministry Of Water And Irrigation
Training Center Design
Space Requirements

1 st Floor	No of Units	Area / Unit m2	Total Area m2
Computer Lab	1	50	50
Computer Lab	1	32	32
Equipment	1	24	24
Class Room	1	60	60
Class Room	2	48	96
Class Room	1	42	42
Library	1	140	140
First Aid Room	1	14	14
Prayior	1	30	30
W C for Male	1	28	28
W C for Female	1	14	14
Lobby	1	50	50
			580
Circulation area + walls			375
Total Area			955
2 nd Floor			
General Manager	1	30	30
W C for G M	1	4	4
Secretary	1	28	28
Meeting Room	1	40	40
Store	1	12	12
Administration Manager	1	28	28
Training Manager	1	28	28
Secretary	1	28	28
Filling + Binding + Typing	1	35	35
Offices	6	28	168
Office	1	24	24
MIS	1	104	104
W C for Male	1	28	28
W C for Female	1	14	14
Store	1	20	20
			610
Circulation area + Walls			345
Total Area			955

Ministry Of Water And Irrigation
Training Center Design
Space Requirements

3 rd Floor	No of Units	Area / Unit m2	Total Area m2
Meeting Room	2	55	110
Offices	9	28	252
Office	1	24	24
Office	1	20	20
Office	2	35	70
Store	1	20	20
W C for Male	1	28	28
W C for Female	1	14	14
			540
Circulation area + Walls			406
Total Area			856
4 th Floor			
Office Area		410	410
W C for Males	1	28	28
W C for Females	1	14	14
Store	1	20	20
			472
Circulation area + Walls			293
Total Area			765
5 th Floor			
Office Area		410	410
W C for Males	1	28	28
W C for Females	1	14	14
Store	1	20	20
			472
Circulation area + Walls			293
Total Area			765

Ministry Of Water And Irrigation
Training Center Design
Space Requirements

6 th Floor			
Office Area		330	330
W C for Male	1	28	28
W C for Female	1	14	14
Store	1	20	20
			392
Circulation area + Walls			250
Total Area			642
7 th Floor			
Office Area		330	330
W C for Male	1	28	28
W C for Female	1	14	14
Store	1	20	20
			392
Circulation area + Walls			250
Total Area			642

Summary of Area Requirements
For New Training Center / Consultant Space

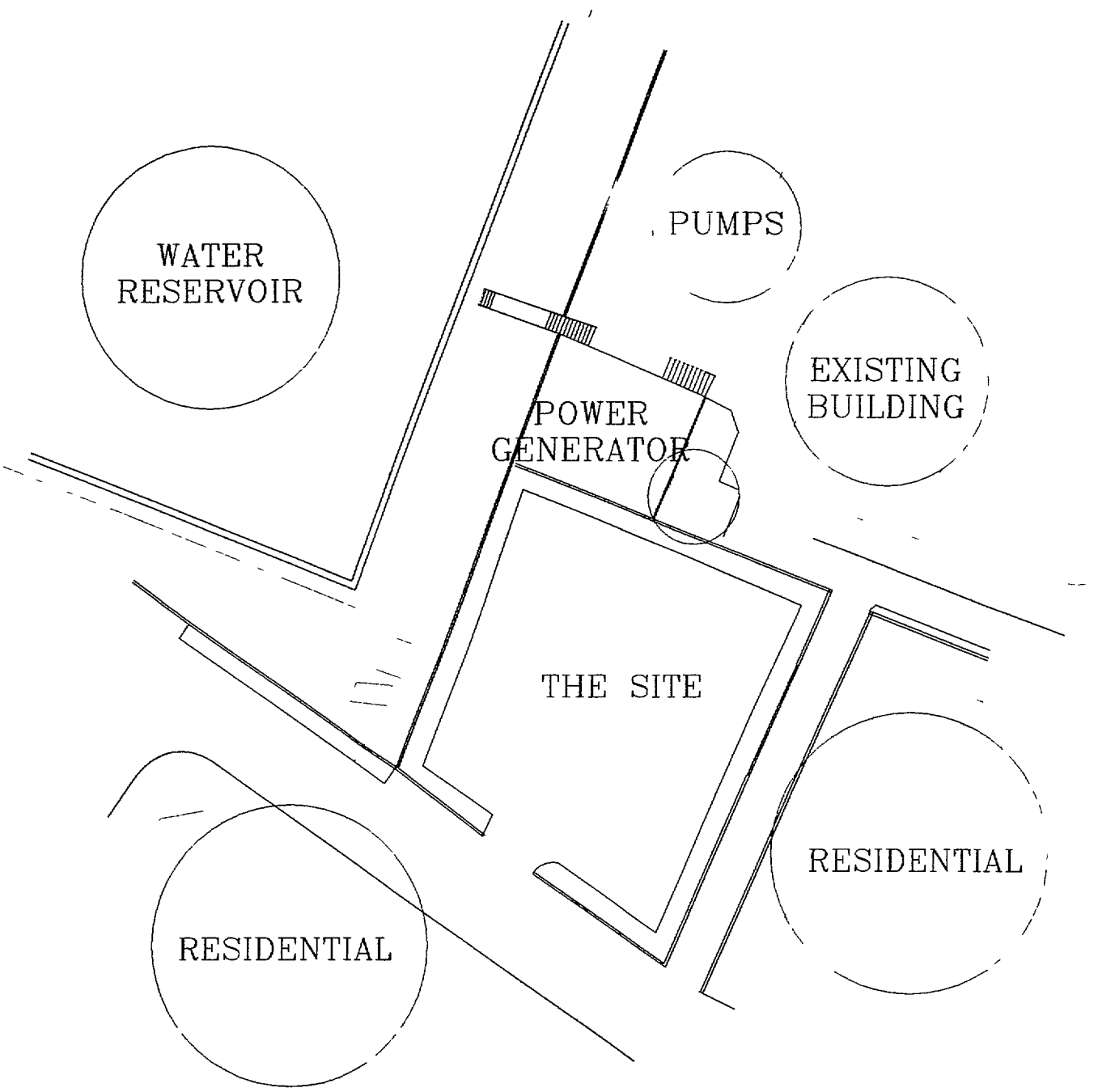
Second Basement	First Basement	Ground Floor	First Floor	Second Floor	Third Floor	Total Area
1252 m2	1125 m2	856 m2	955 m2	955 m2	856 m2	6000 m2

Forth Floor	Fifth Floor	Sixth Floor	Seventh Floor	Roof Floor	Total Area	Grand Total area
765 m2	765 m2	642 m2	642 m2	88 m2	2900 M2	8900 m2

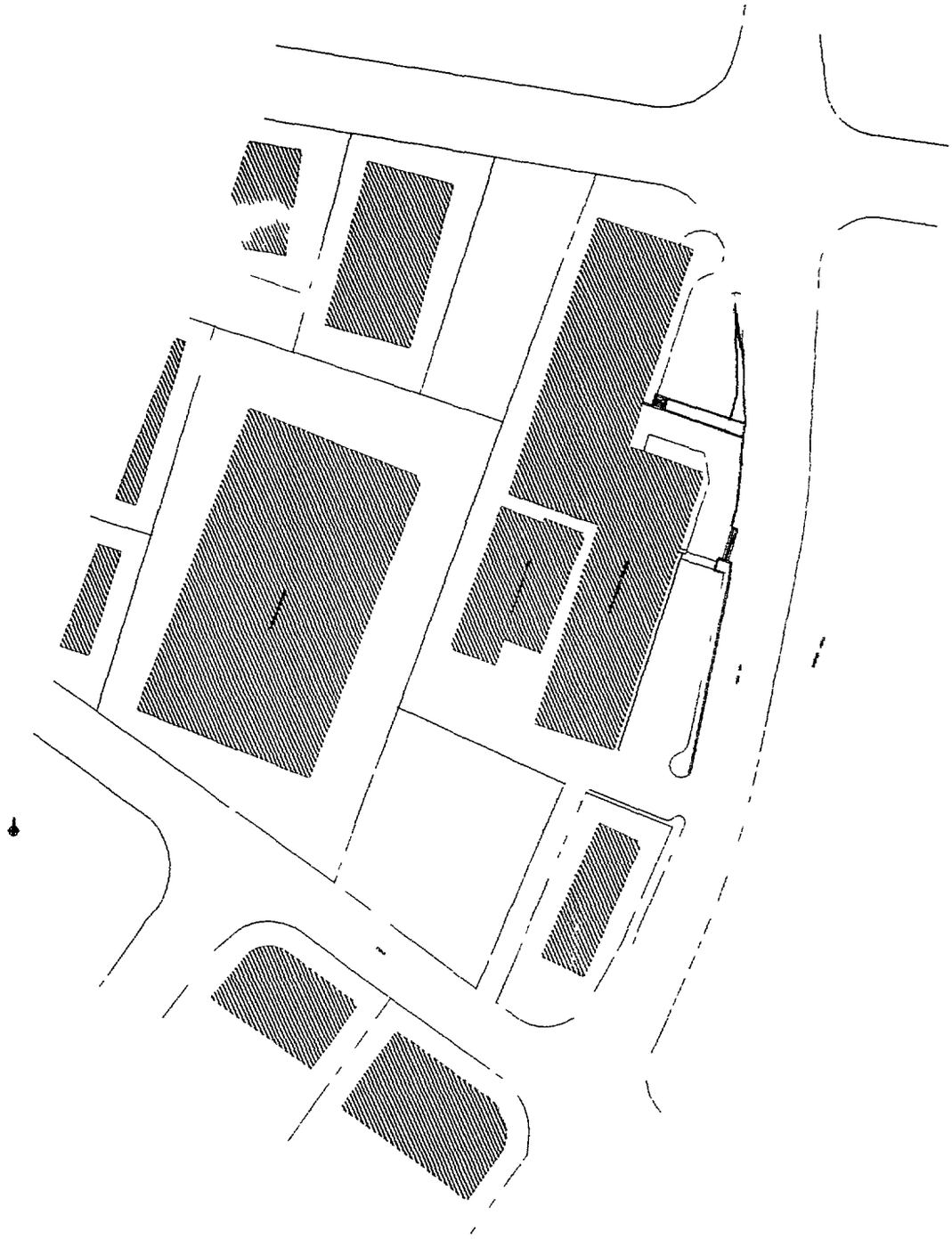
EXISTING FEATURES

This chart shows the existing situation and the surrounding features

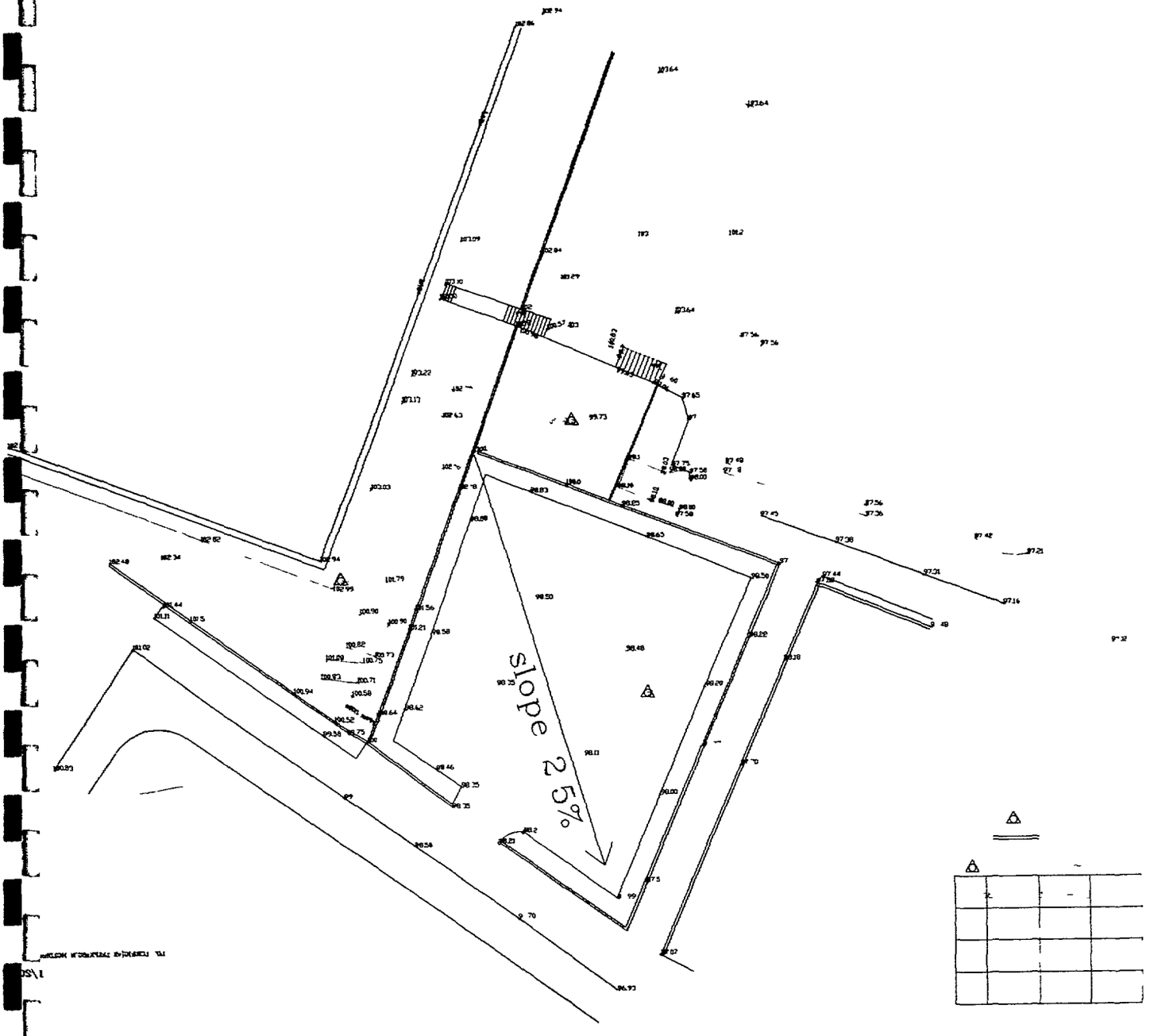
The site is used at present as a parking area for the MWI existing Building, and located on a narrow residential street 10m wide



SOILD & VOID



TOPOGRAPHY



Climate

This chart shows the climatical aspect of the site

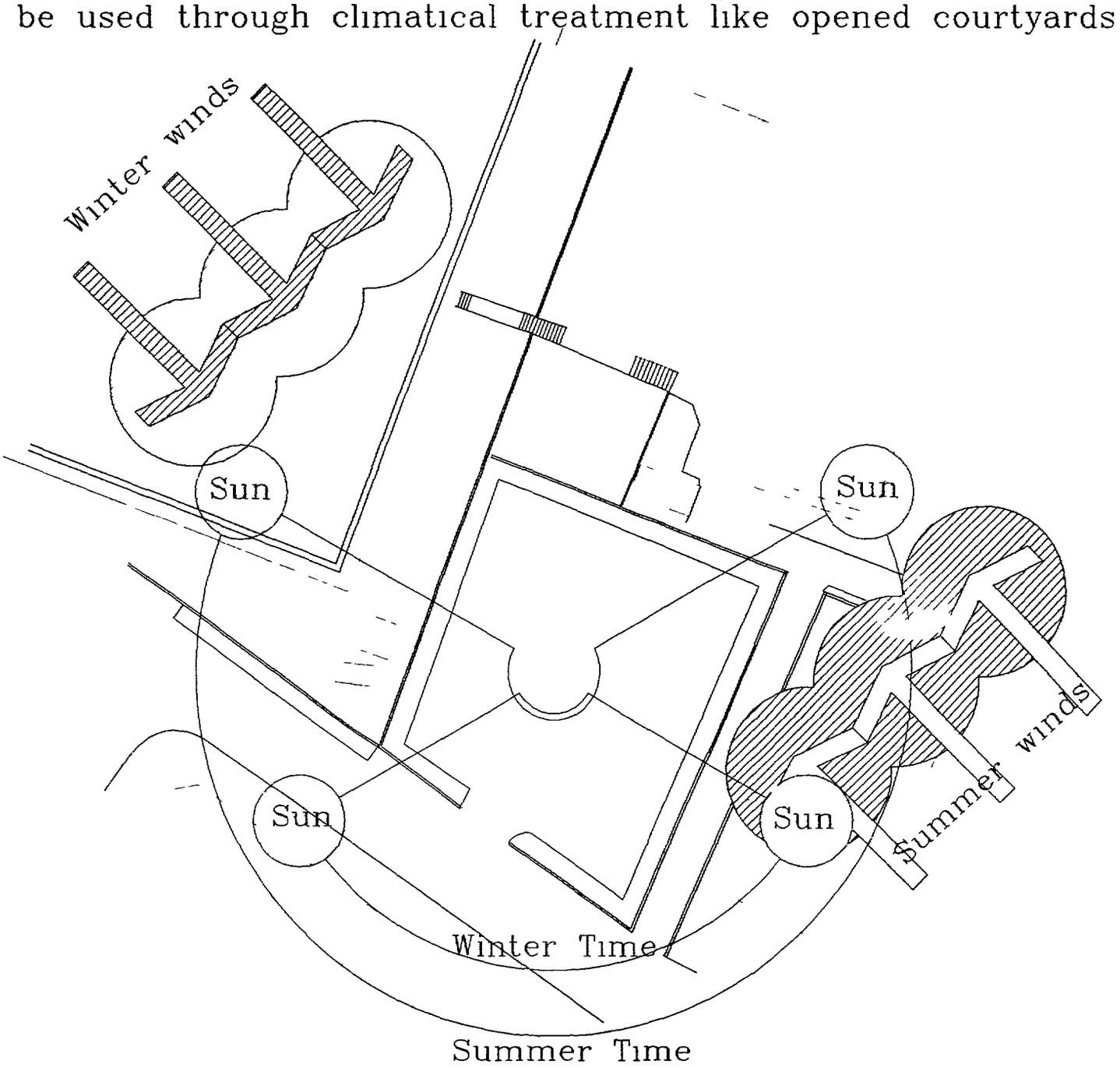
Sun movment

The sun movment during summer and winter time shows there well be sunny offices around the year

Winds

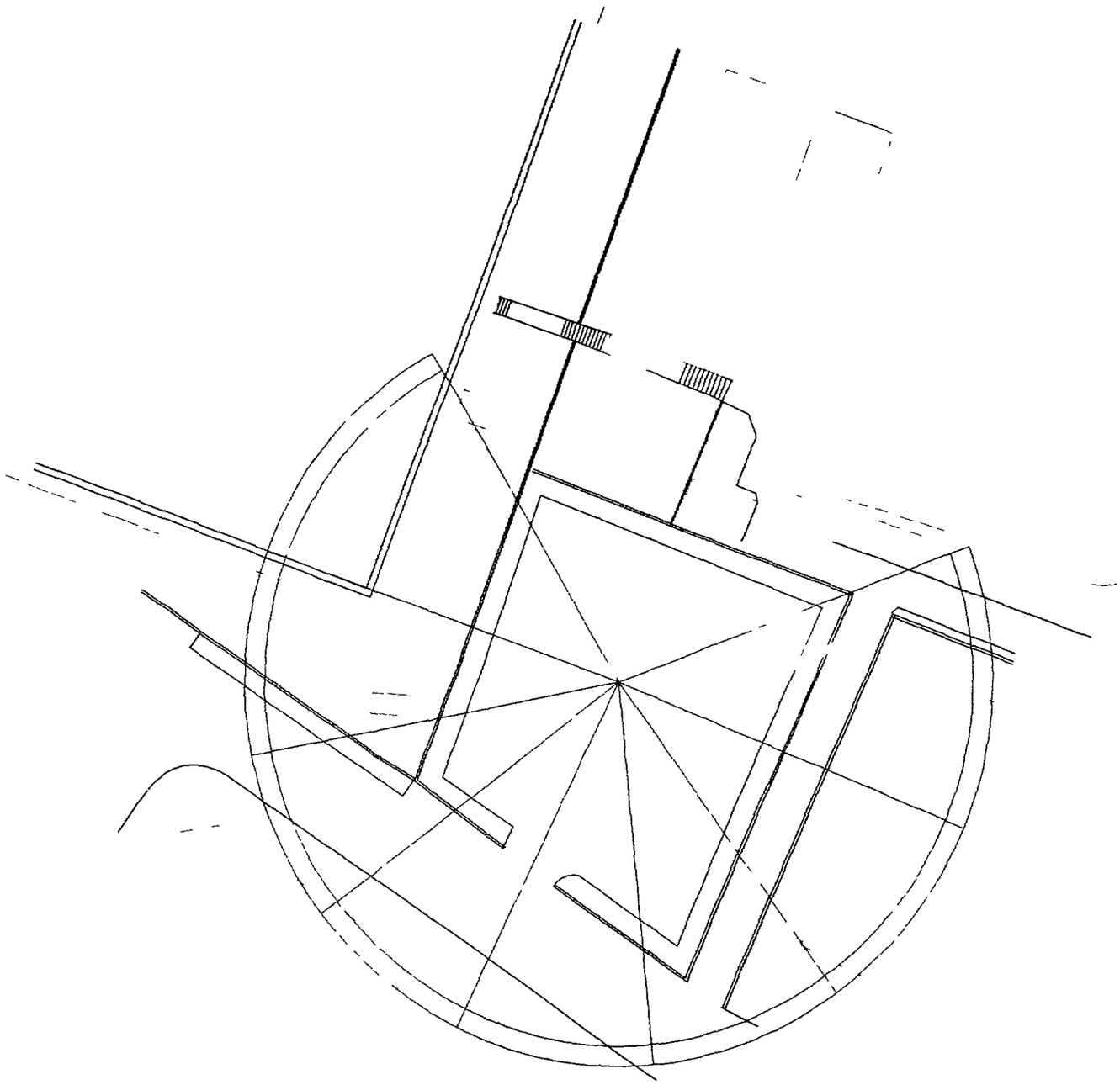
The first two floors are protected by the reservoir from cold winter winds

The summer wind direction provide a gentil breaze that can be used through climatical treatment like opened courtyards



VIEWS

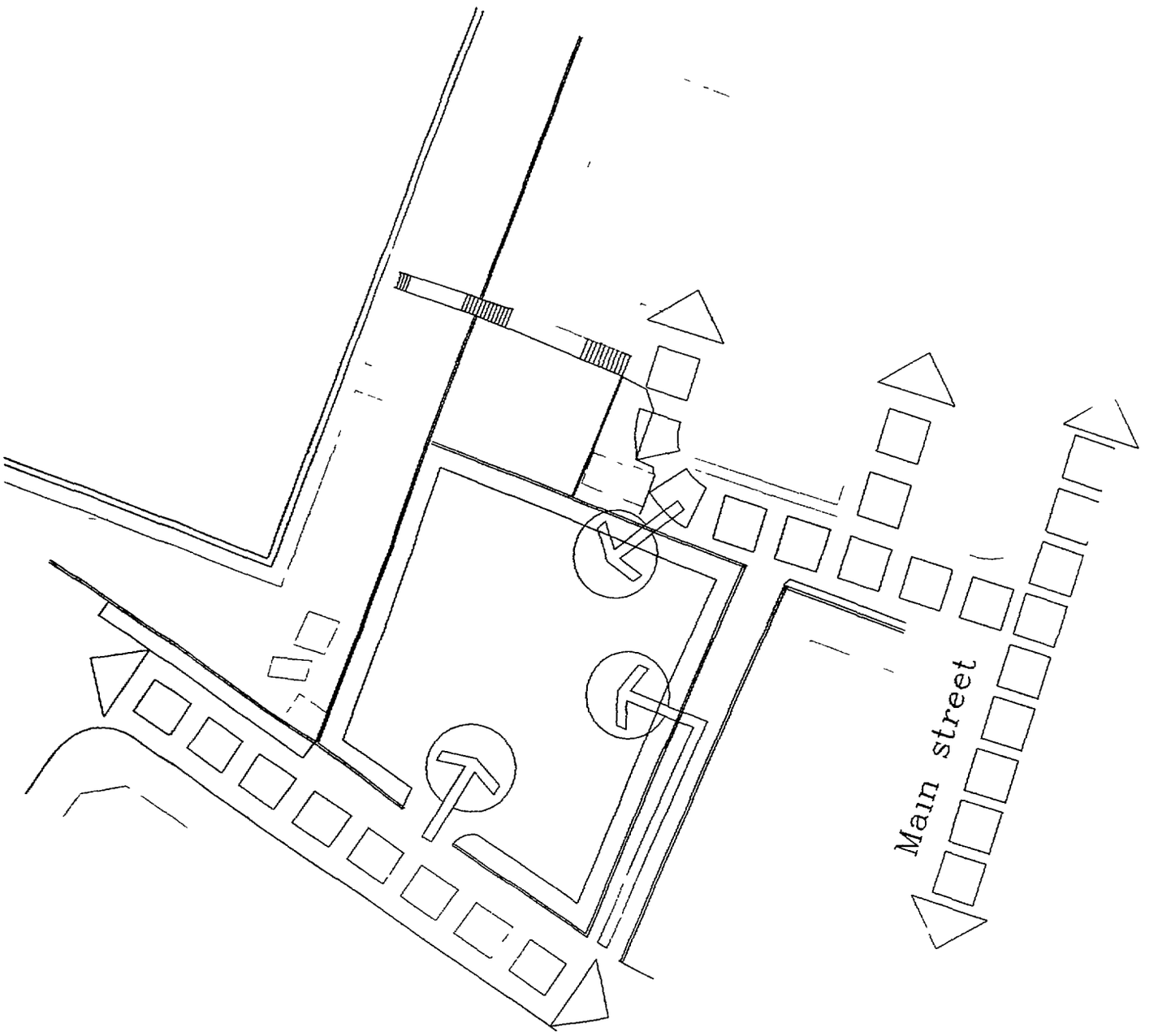
We recommend to have wide openings at these directions to make use of the prevailing views



CIRCULATION

This chart shows circulation and car movment around the site
Heavy traffic in the main street
Light traffic in the residential street and the punping station

It also shows a possible new building entrances and underground parking entrance



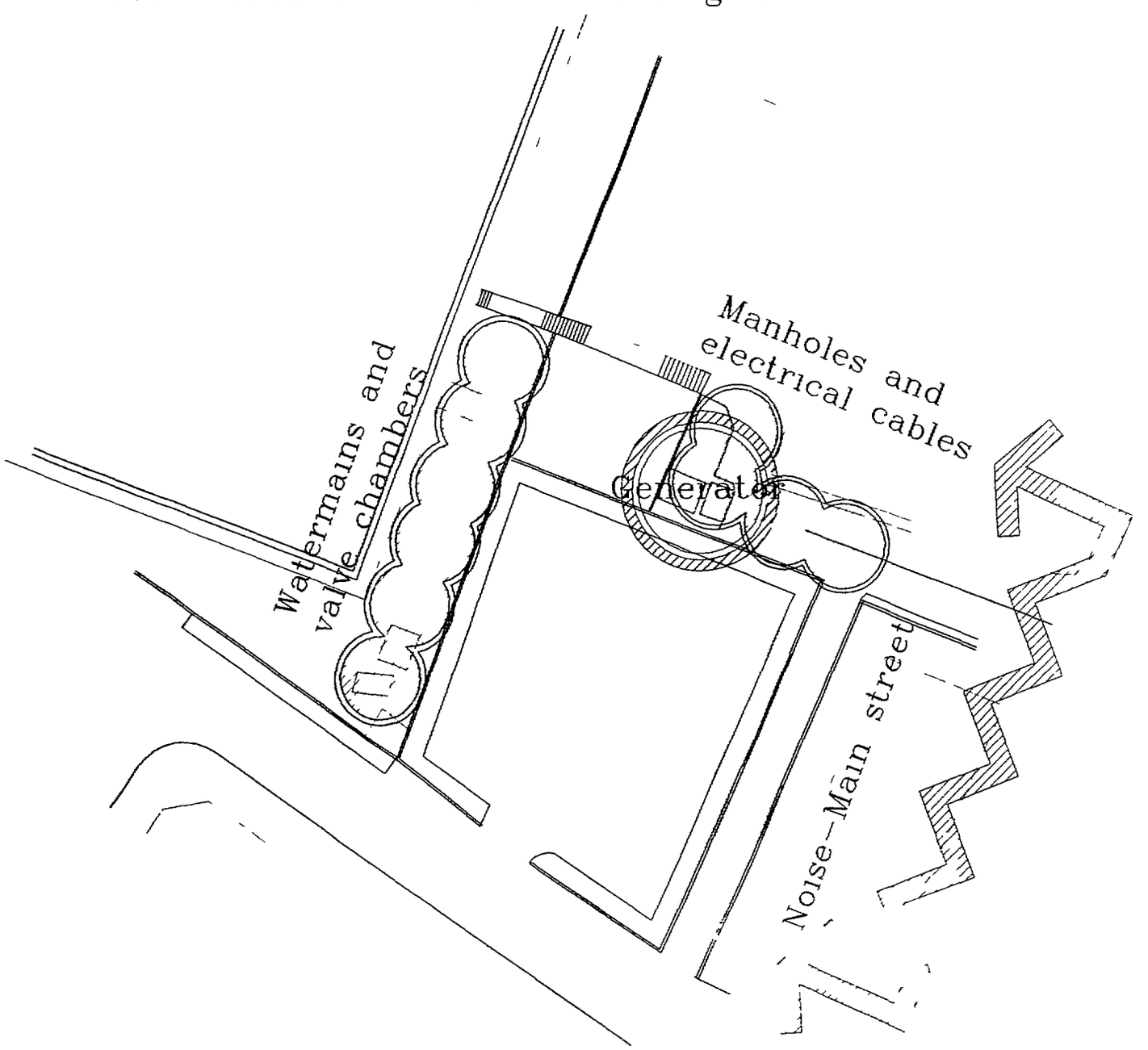
CONES

In this diagram we can see the cones and limitations of the site

The power generator is blocking a possible entance for the new MWI building

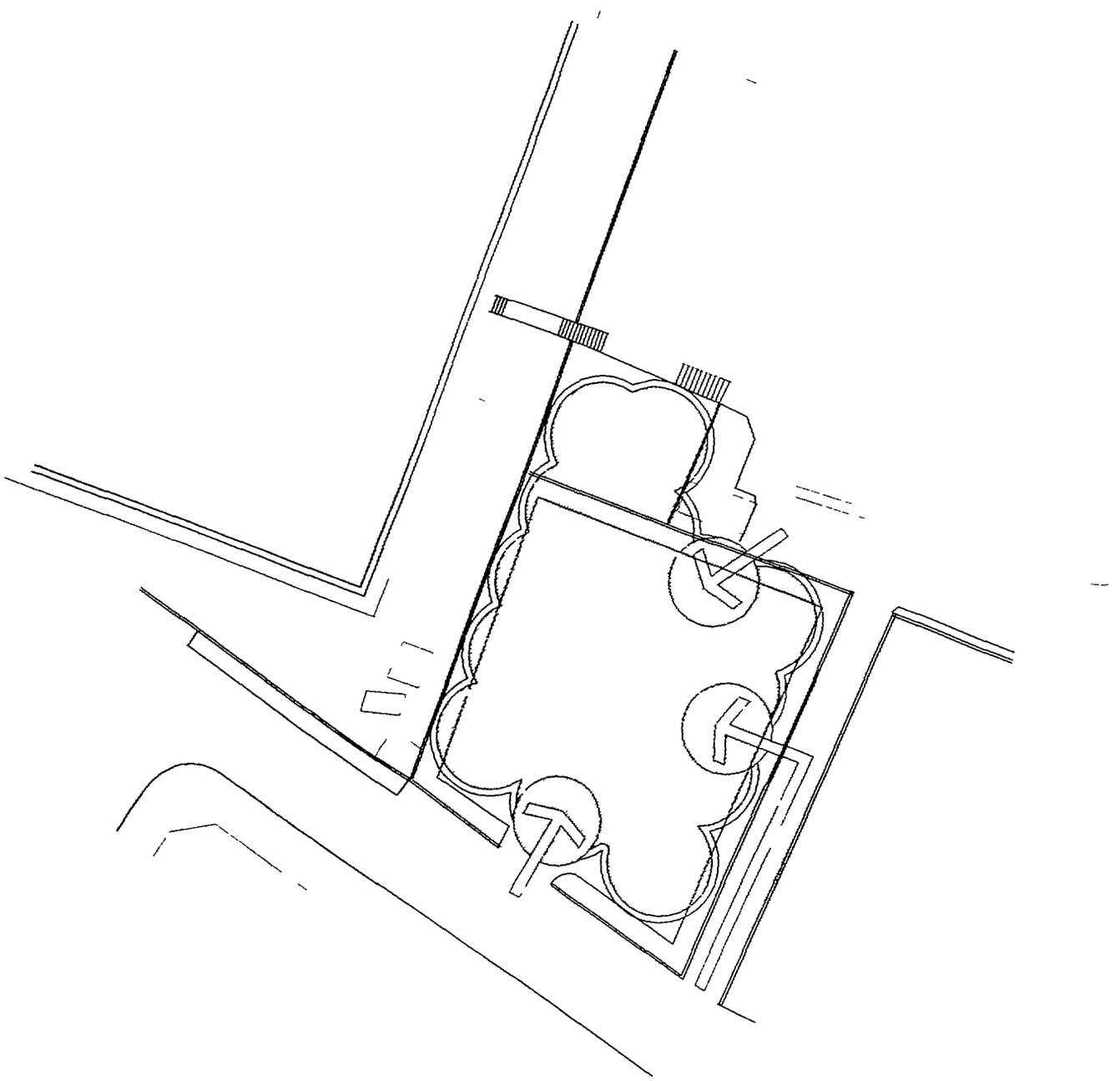
We recomend to move it to another place

Due to the nosie sources, we recomend to avoid locating classes or any teaching units that need quite atmosphere from the easteren elevation and to use an architectural treatment such as double or trible glazed windows

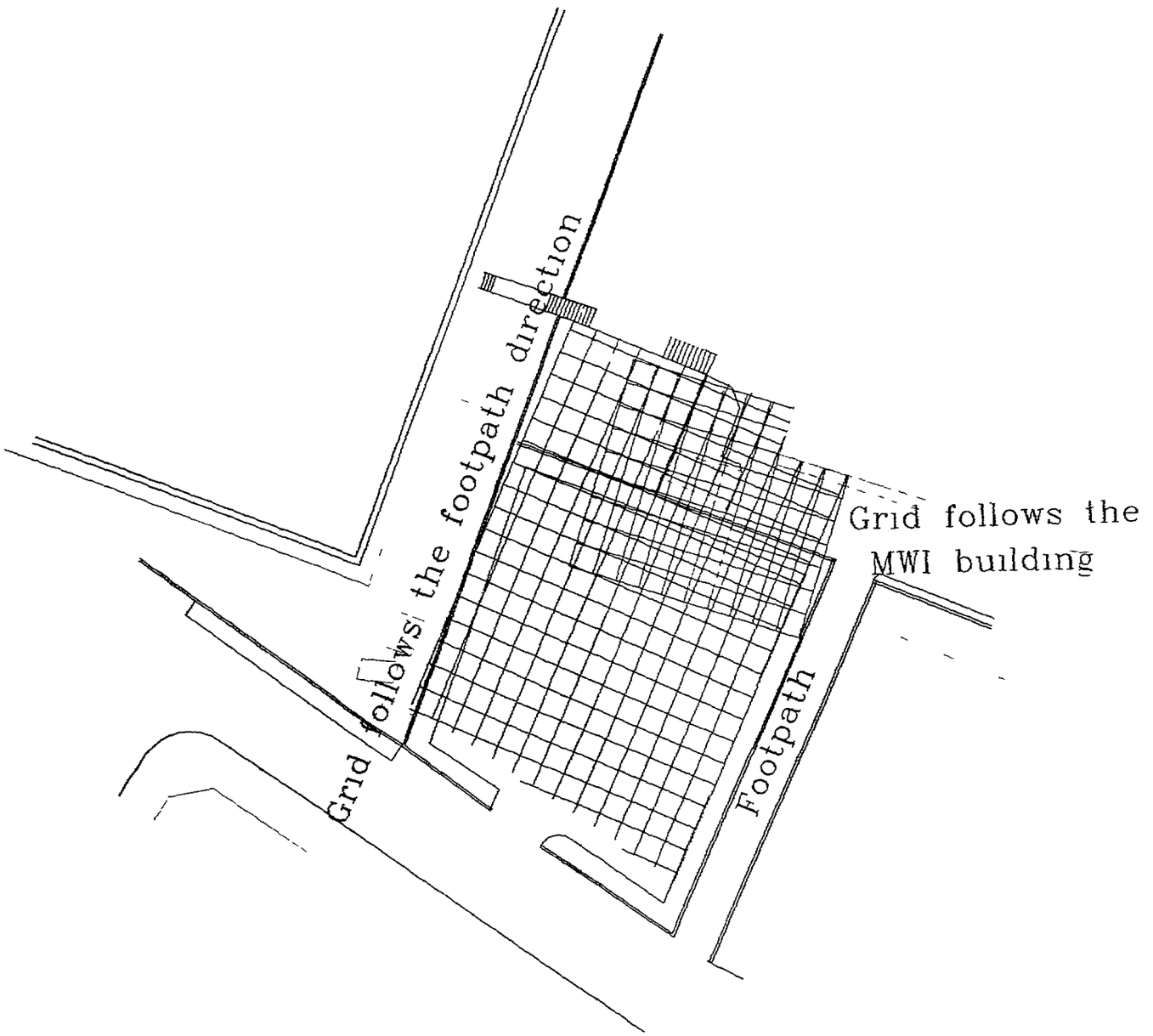


CONCLUSION

The recommended area for construction and possible entrances for the new MWI building



GRIDS


Grid follows the footpath direction
Grid follows the MWI building
Footpath

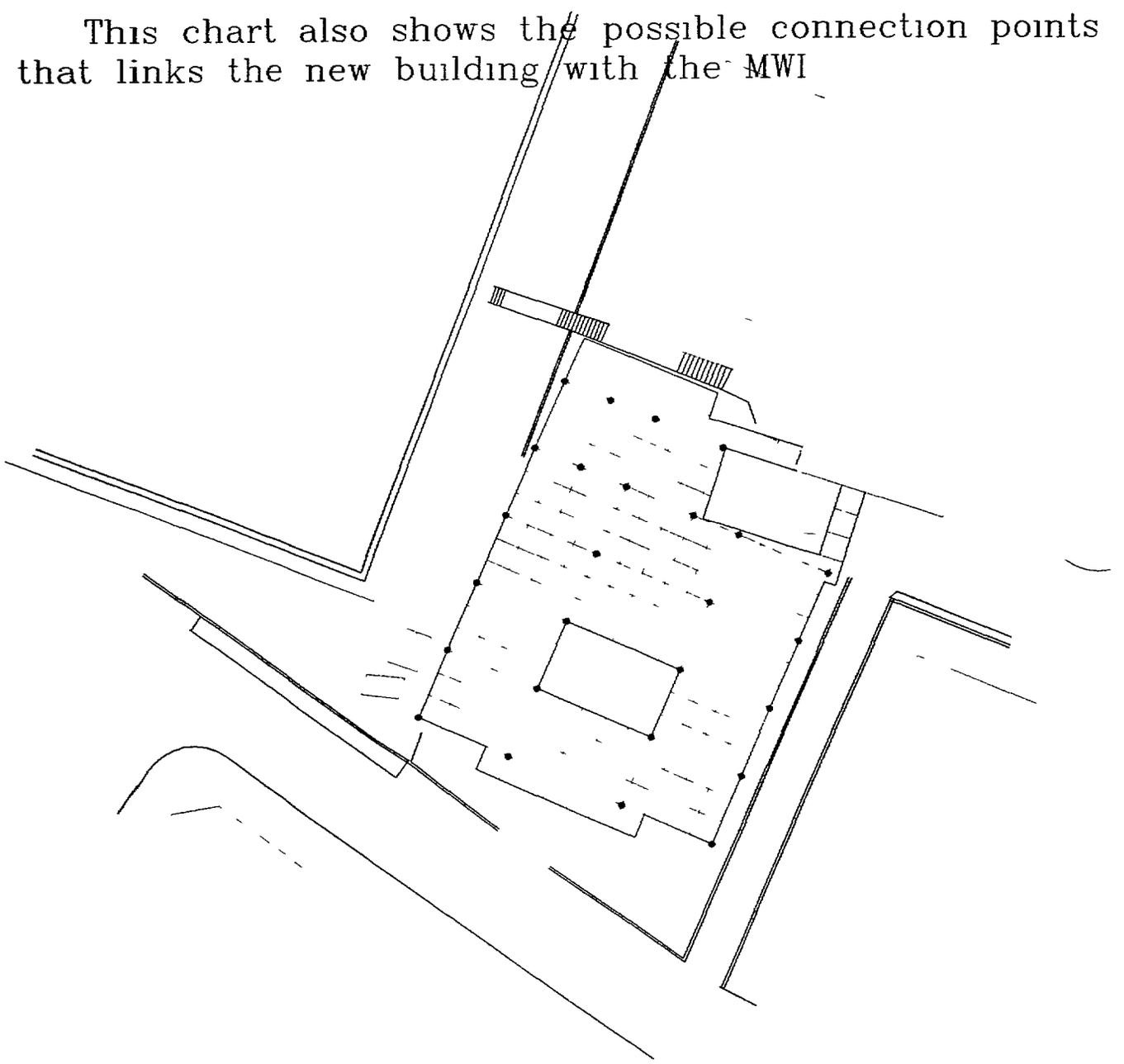
LAYOUT

This chart shows the propoused lavout for the new building that resulted from the integration of the two grids

We created two court yards in the design for the following reasons

- Environmental factors
- To provide natural light for the dark offices located in the centre of the building
- To allow car movement to the pump station

This chart also shows the possible connection points that links the new building with the MWI



3.2 External Design :

Several alternatives have been reviewed for the external design taking into consideration the surroundings and MWI building

Although the main entrance for the new building is from the side street , the external design, matches architecturally the surrounding environment with MWI building and expresses the individuality of the training center

3.3 Parking Areas:

Two underground floors have been allocated for car parking areas covering the needs for the floor 4 but not for the whole building according to the Greater Amman Municipality requirements

3 .4 Landscaping :

After careful consideration of the conceptual landscaping for MWI land we found that

A- The existing parking area north the training center is too small to construct multi floor parking building

B- The valve chambers blocking the area around the reservoir and security for the area create a difficult situation for a linking street between the training center and the north parking area

We propose a total agriculture study for the area surrounding the reservoir to give an Environmental touch to the structures of the total MWI site

4 Discussions with DAI/ MWI :

Several meetings & site visits have been held to agree upon the Design Program and to collect the Data To be familiar with the existing structures & facilities

Beside the architecture designers all of the specialists participate the meetings to cover electrical , mechanical and sanitary works As well as the structural , training & MIS

Two presentations for the concept design were conducted for DAI and MWI including the general secretary of MWI All the comments & remarks were incorporated in the revised concept design

4.1 Special Aspects :

4.1.1 Training Specialist :-

Dr Ahmad Atwan , training specialist , attended a meeting held at MWI with DAI and raised some points which were taken into consideration considering the design of the training center goals and objectives especially the multi - purpose hall, the lecture hall the video production room , the class rooms and the computer rooms
The discussion with Dr atwan were also valuable concerning acoustics, furniture and storage areas

4.1.2 Telecom & Computer Specialists :

Mr Akef Harb,telecom specialist and Eng Othman computer specialist together with our group of Engineers attended a very useful meeting with DAI & MWI specialists where several points were discussed and taken into consideration such as

- The consultant should consider providing space for MIS and communication equipment in the new building In addition the consultant should consider the run-ways for cables in the new building and the connections to the existing building
- Two to three outlets of cables should be considered between the new and existing buildings
- The number of data and communication cable outlets in each room in the new building shall be decided later
- The allocated space of about 100 sq m in the new building to house the MIS and communication equipment is sufficient
- The consultant advised MWI to take into consideration future connections to the Telecommunication Corpration (TCC) network, the National Information Center (NIC) network and the Private Sector data networks

5. Materials Equipment and Systems to be used:

5.1 Architectural :-

A. Internal :

- Floors Ceramic tiles for the public area , entrances , class rooms etc
- Special Floors for MIS & Computer Rooms
- Ceiling Acoustic false ceiling
- Isolated walls with plaster & paint finishes
- Special acoustic treatment for lecture hall , MIS & Computer Rooms
- Doors Same as existing MWI building
- Bathrooms Local manufactured ??

B. External :

- Windows Double glazed and local manufactured aluminum sections ??
- Walls Same finish as the existing MWI building ??

5.2 Structural:-

The structural design system will be based upon the national Jordanian code for construction The code includes the earthquakes parameters as well as the design loads calculations

The ultimate strength design method will be used for designing the reinforced structural elements

The structural calculations will be considered for 2 basements , 8 floors + 9 floor for future expansion

The slab design will be the ribbed slab flooring system and foundation will be determined according to the soil bearing capacity and laboratory recommendations

Almost all the structural materials are local such as
aggregate, cement and high tensile steel G 60

5. 3 Mechanical :-

The mechanical works will be according to Jordanian code, BS and American codes
Air conditioning system will consist of two air cooled chilliers and room fan coil units
Central heating system depends on boilers while hot water depends on solar

Domestic cold water source should be same as the existing building energy system & the system will consist of ground tanks pumping to roof tanks

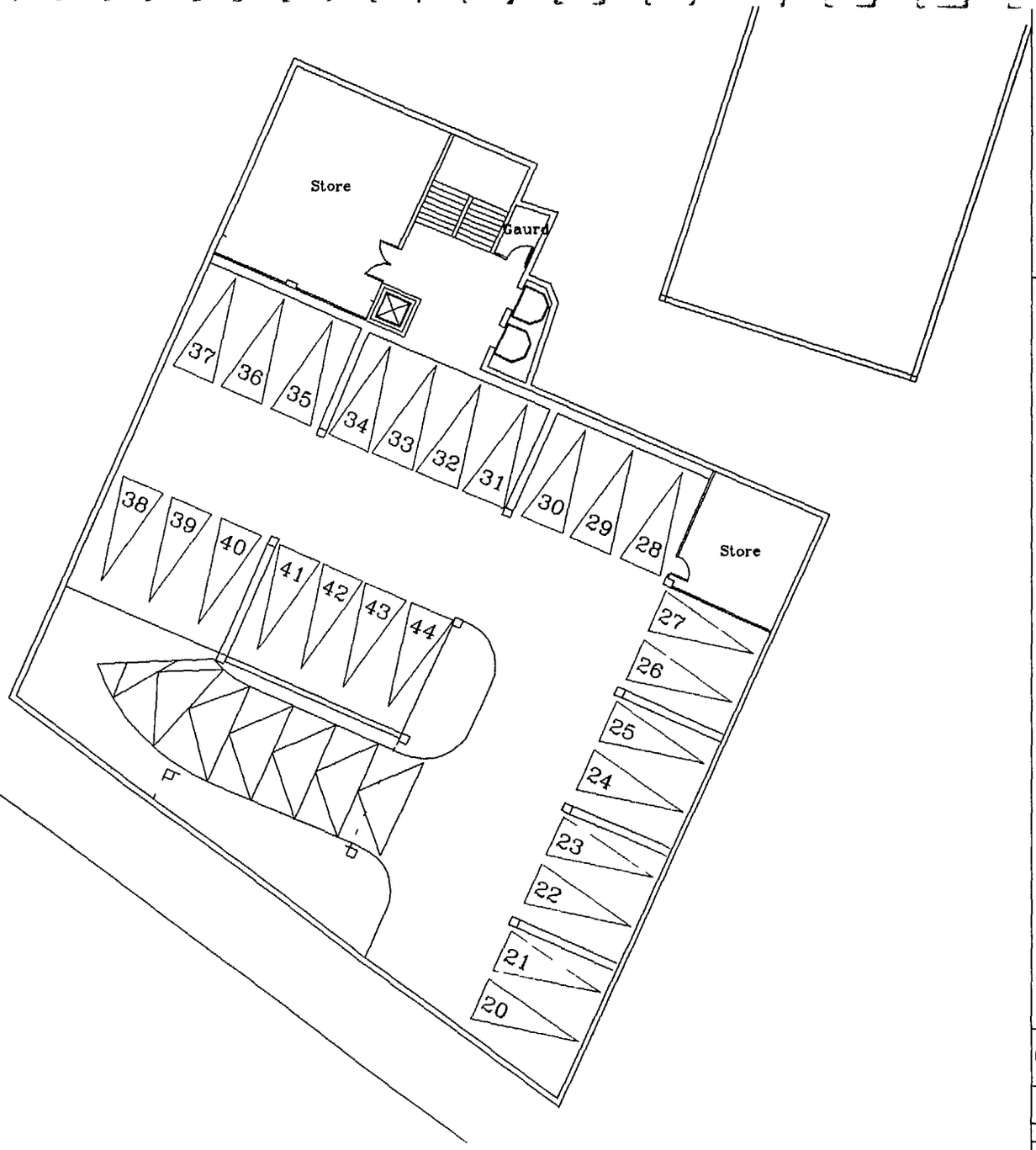
Fire safety and fire protection system will be according to National Fire Protection Association (NFPA) standards with separate pumps

Special fire fighting system and equipment should be considered for MIS area

5. 4 Electrical :-

Electrical works will be designed according to Jordanian code, BSS and IEC standards
All wiring will be loop system for lighting & plugs
All conduits will be PVC heavy gauge The electricity feeding system will be through the transformer of the electricity company to main and sub panels 400/220 V
A standby generator is recommended for the MIS room
An adequate earthling system will be provided for the MIS room separated from the earthling system of the new building
An advanced fire fighting alarm system and emergency light system will be used

6. Schematic Design Drawings



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 1252 sqm

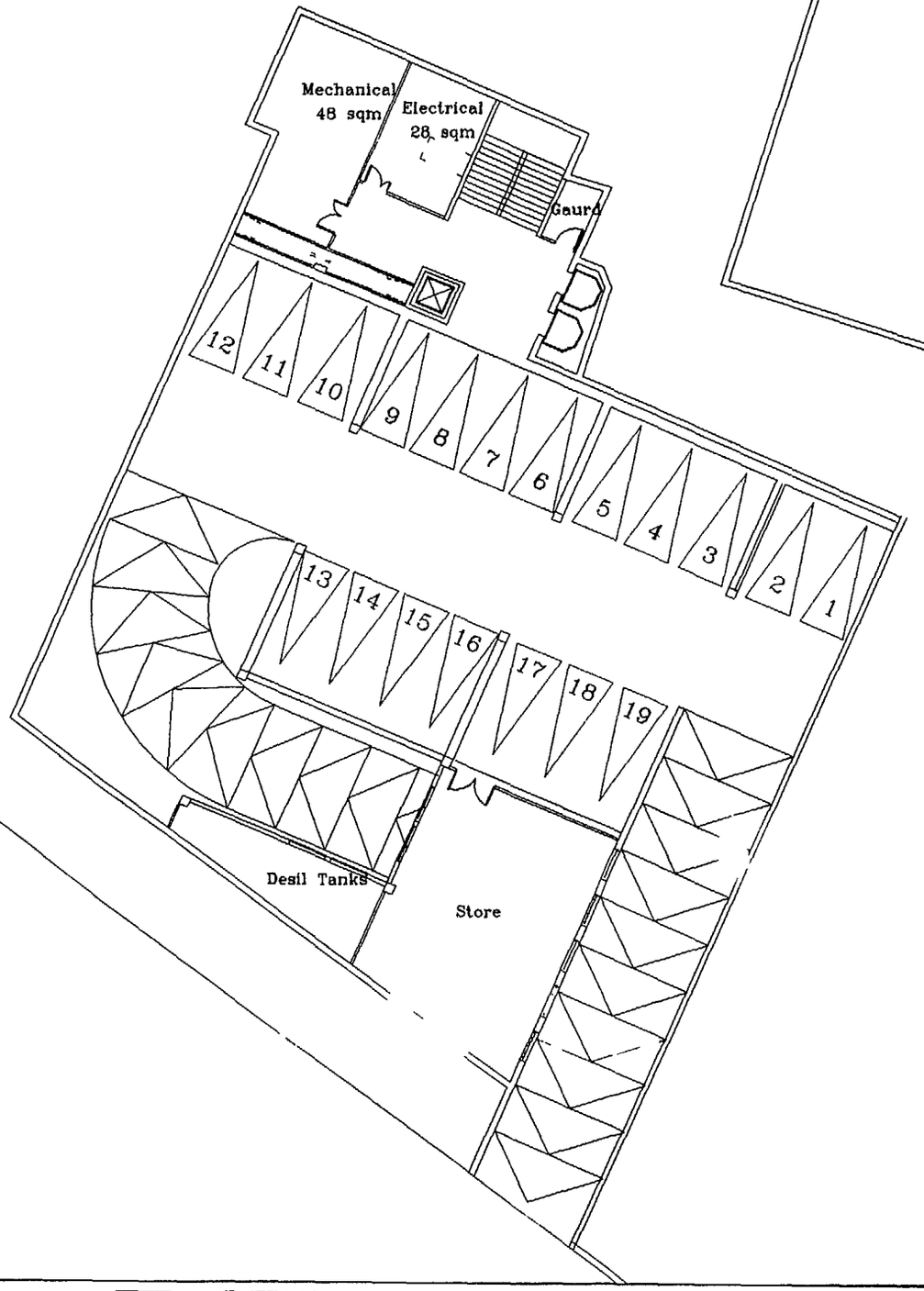
AMMAN CONSULTING ENG & PLANNING OFFICE

P.O.BOX 926946 TEL 66341 662782 FAX 6667

PROJECT: NEW MWI BUILDING

DESIGNED BY	Nuaid Abu-Ghaida Alg Abu-Ghaida	SCALE	
DRAWN BY	Ig Sw Ghaida	SITE NO	LOT NO
CHECKED BY	Lyaw Ag Ghaida	Ma L	
TITLE	Second Basement		DWG NO 2

27



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 1125 sqm

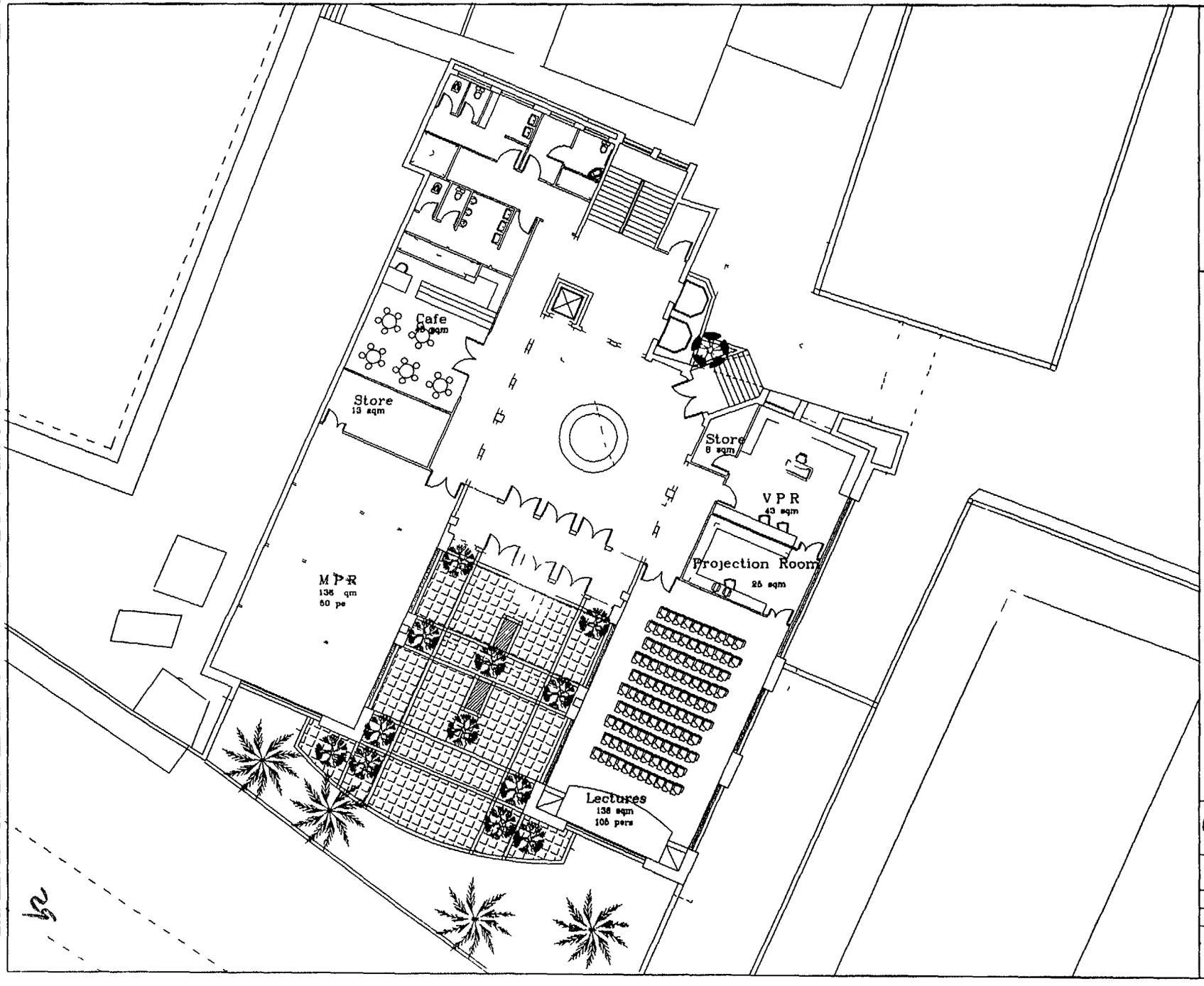
AMMAN CONSULTING ENG & PLANNING OFFICE

PROJECT: NEW MWI BUILDING

DESIGNED BY	Husseni Abu-Ghoshe, Ala'a Abu-Ghoshe	SCALE	
DRAWN BY	Ala' Abu Ghoshe	DATE NO	LOT NO
CHECKED BY	Husseni Abu-Ghoshe	PA 1	

TITLE: First Basement

DWG NO: 3



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 856 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

P.O.BOX [illegible] TEL. [illegible] FAX [illegible]

PROJECT

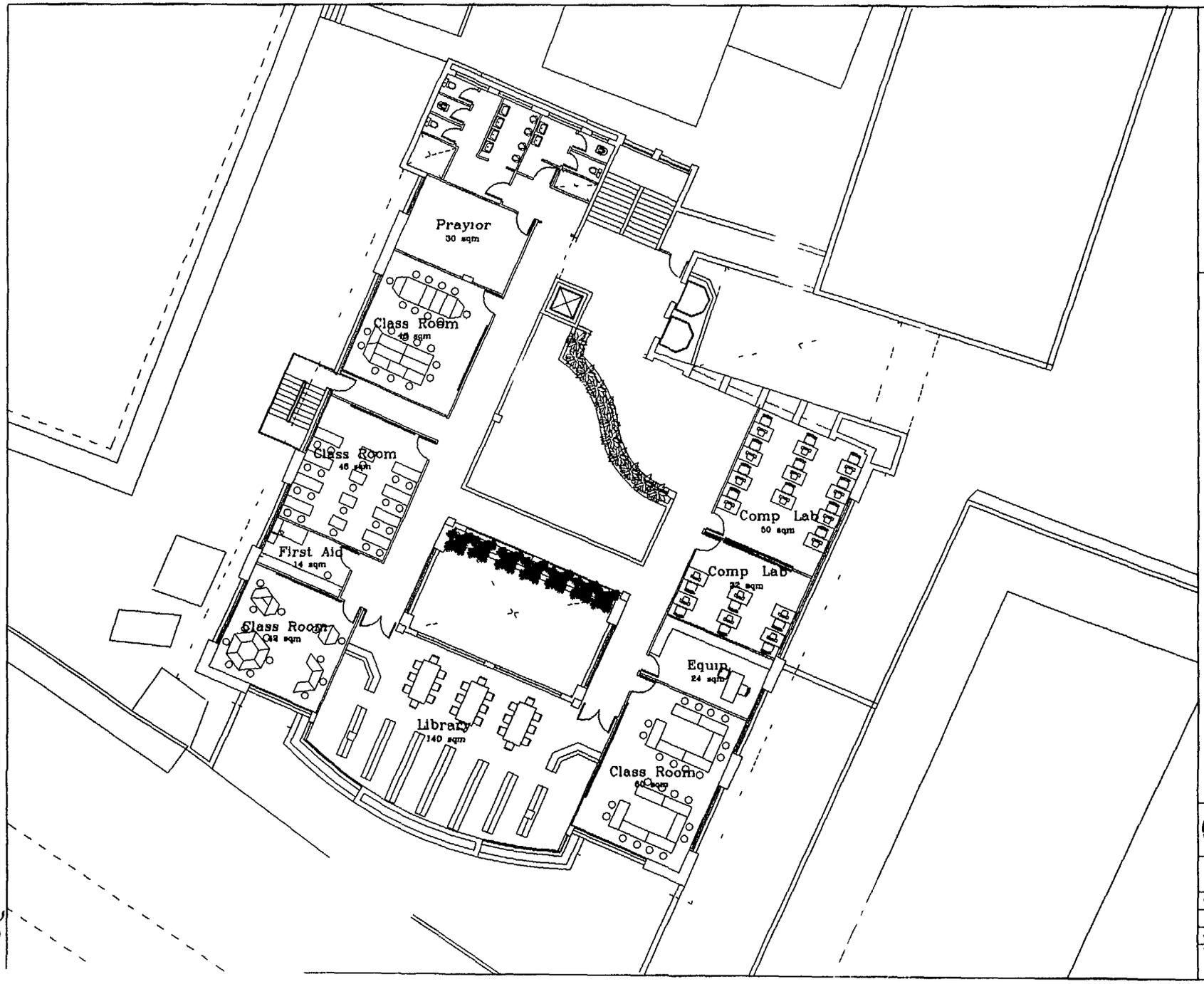
NEW MWI BUILDING

DESIGNED BY	Husni Abu Ghaida / Ala Abu-Ghaida	SCALE	1:100
DRAWN BY	Ala Abu-Ghaida	SITE NO	[illegible] LOT NO [illegible]
CALC LD BY	H Husni Ab Ghaida	DATE	

TITLE

Ground floor layout

SHEET NO 4



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 955 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

P.O.BOX 926346 TEL. 66861 , 682788 FAX 667144

PROJECT	NEW MWI BUILDING		
DESIGNED B	Mazen Abu-Ghaida / Ala Abu-Ghaida	SCALE	1:100
DRAWN BY	Ali Abu Ghaida	SITE NO	0000 LOT NO 0000
CHEC KD BY	Mazen Abu-Ghaida	DATE	
TITLE	1st Floor layout	DRG. NO	5

THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 955 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

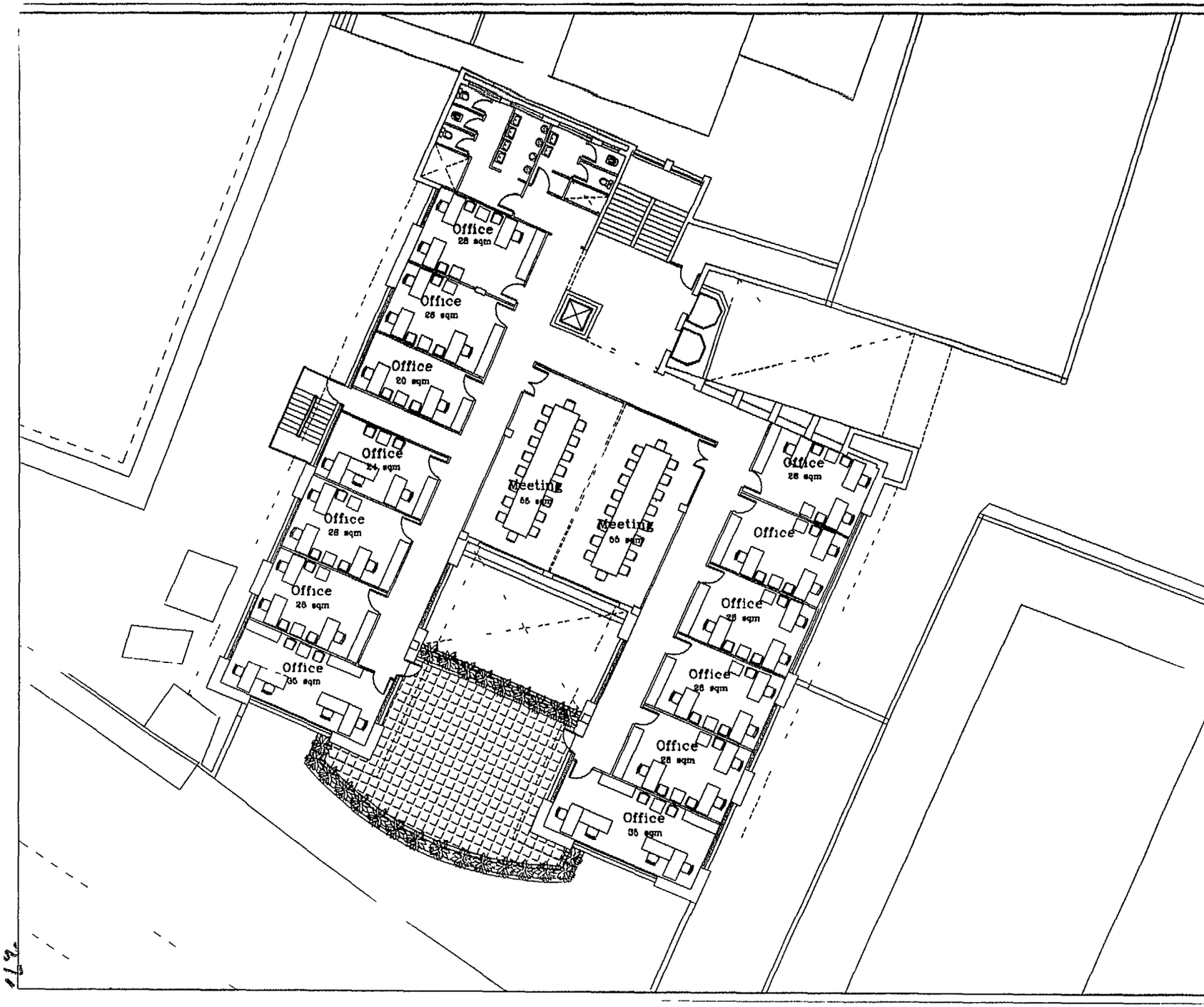
P.O.BOX [illegible] TEL. [illegible] FAX [illegible]

PROJECT: NEW MWI BUILDING

DESIGNED BY	Husni Abu Ghaida / Ali o Abu Ghaida	SCALE	1:100
DRAWN BY	Ala Abu-Ghaida	SITE NO	0000
CHECKED BY	Husni ab Ghaida	DATE	

TITLE: 2nd Floor layout

SHEET NO: 6



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 856 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

P O BOX 9265 6 TEL 66361 682765 FAX 606744

PROJECT

NEW MWI BUILDING

DRAWN

CHECKED BY

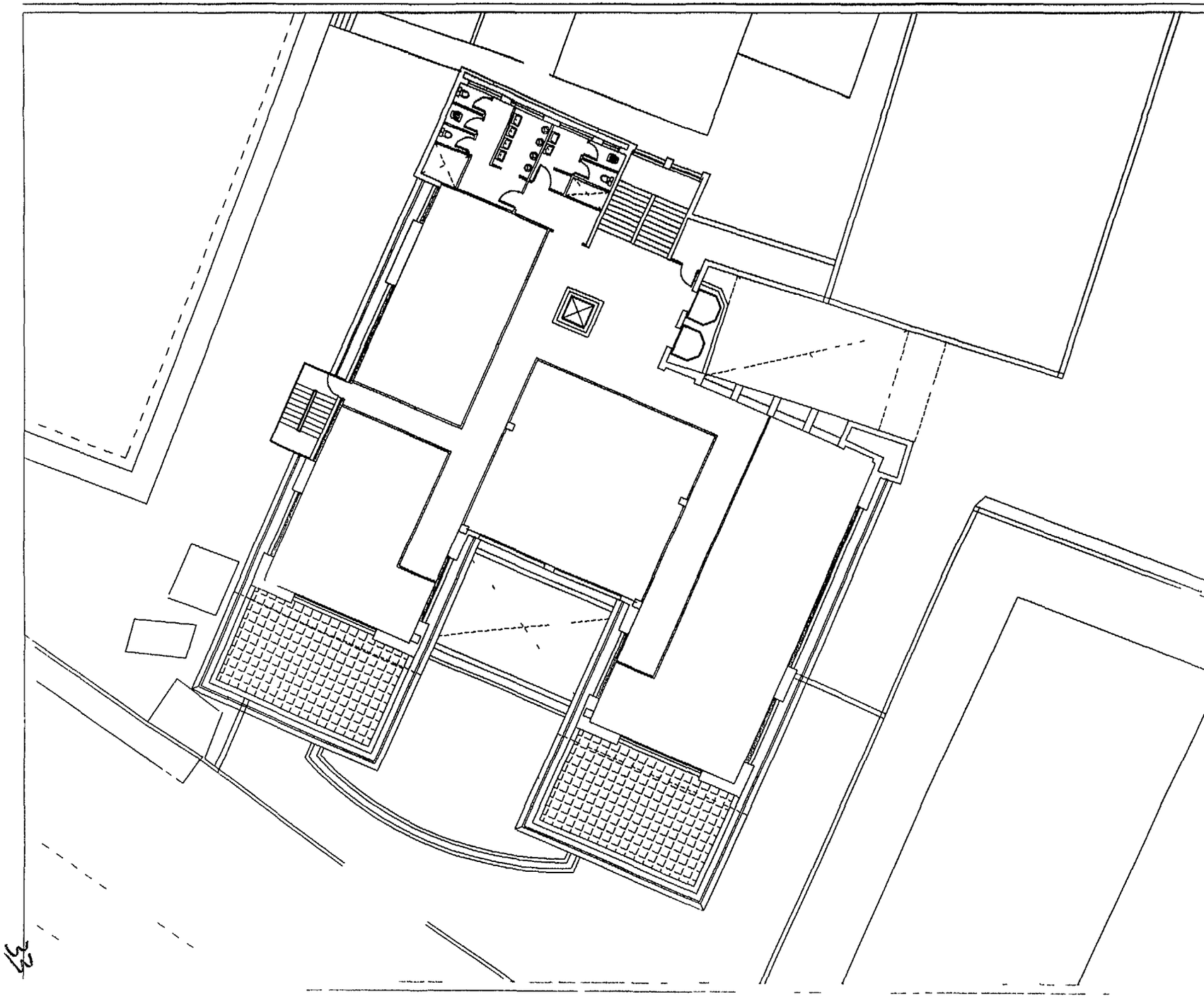
DATE

TITLE

3rd Floor layout

DWG. NO

7



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 765 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

P.O BOX 926346 TEL 6636 1 662785 FAX 606744

PROJECT

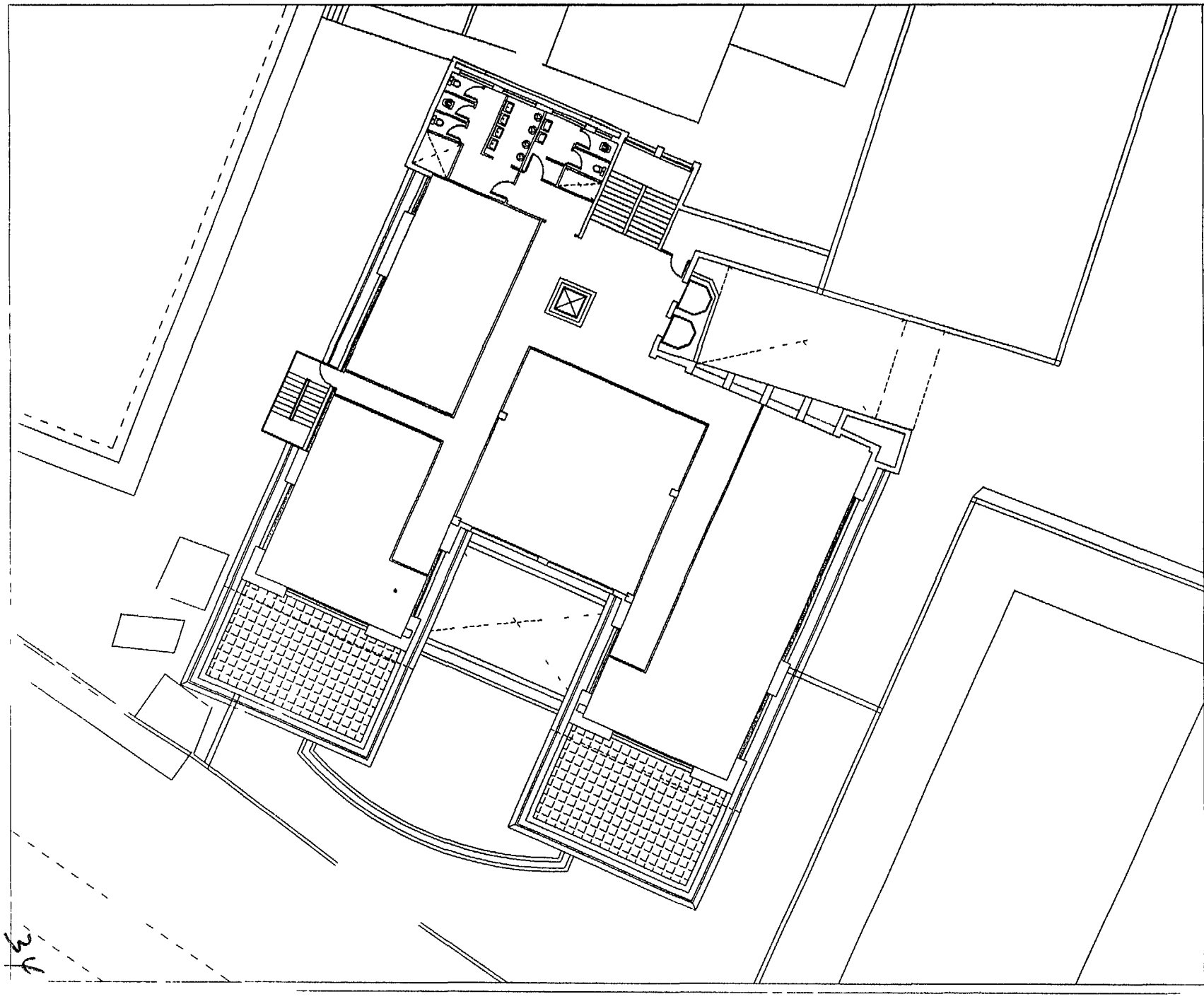
NEW MWI BUILDING

DESIGNED BY	H ml Ab Ch Id Al ll Ab Ch Idg	SC LE	
DR WN B	Al		crt MO
CHECKED BY	Hu I Abu Ch I	D IL	

LE

11th Floor layout

DRG NO 8



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 765 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

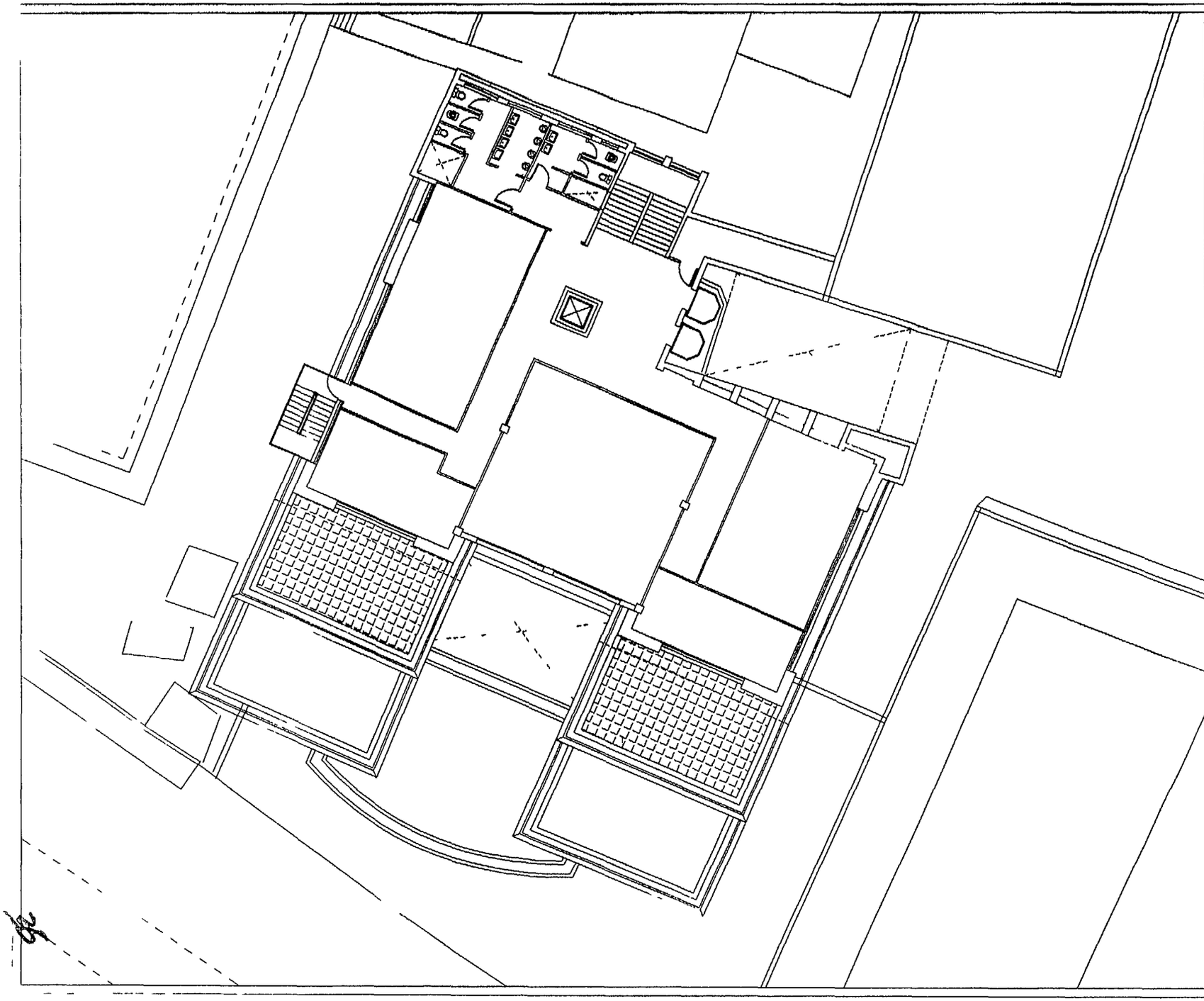
P.O.BOX 926346 TEL. 663611 662783 FAX 606744

PROJECT: NEW MWI BUILDING

DESIGNED BY	Hu I Abu Gh Id Ale a Ab U sida	SCALE	
DRAWN BY	Al Ab r	F D	CT NO
CHECKED BY	Hu I Abu Gh Id	DATE	

TITLE: 5th Floor layout

DRG NO: 9



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 642 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

P. BOX 9263 6 TEL. 6636 6 2 85 FAX 606744

PROJECT

NEW MWI BUILDING

DESIGNED BY Al h

DR B Al & C

CHECKED BY Hu I Abu Ghel

S F

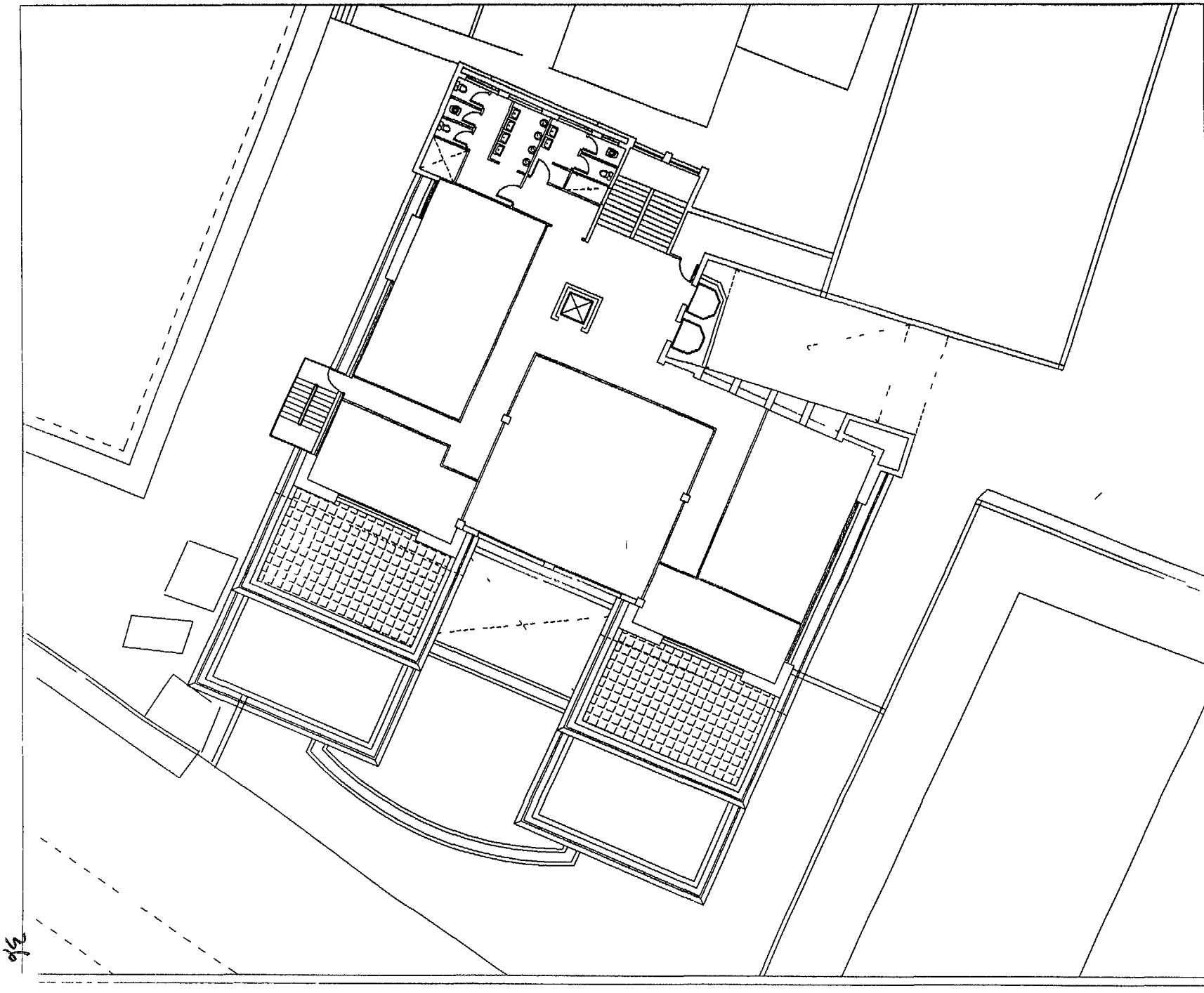
D TE

TITLE

6th Floor layout

DRG NO

10



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 642 sqm

AMMAN CONSULTING ENG & PLANNING OFFICE

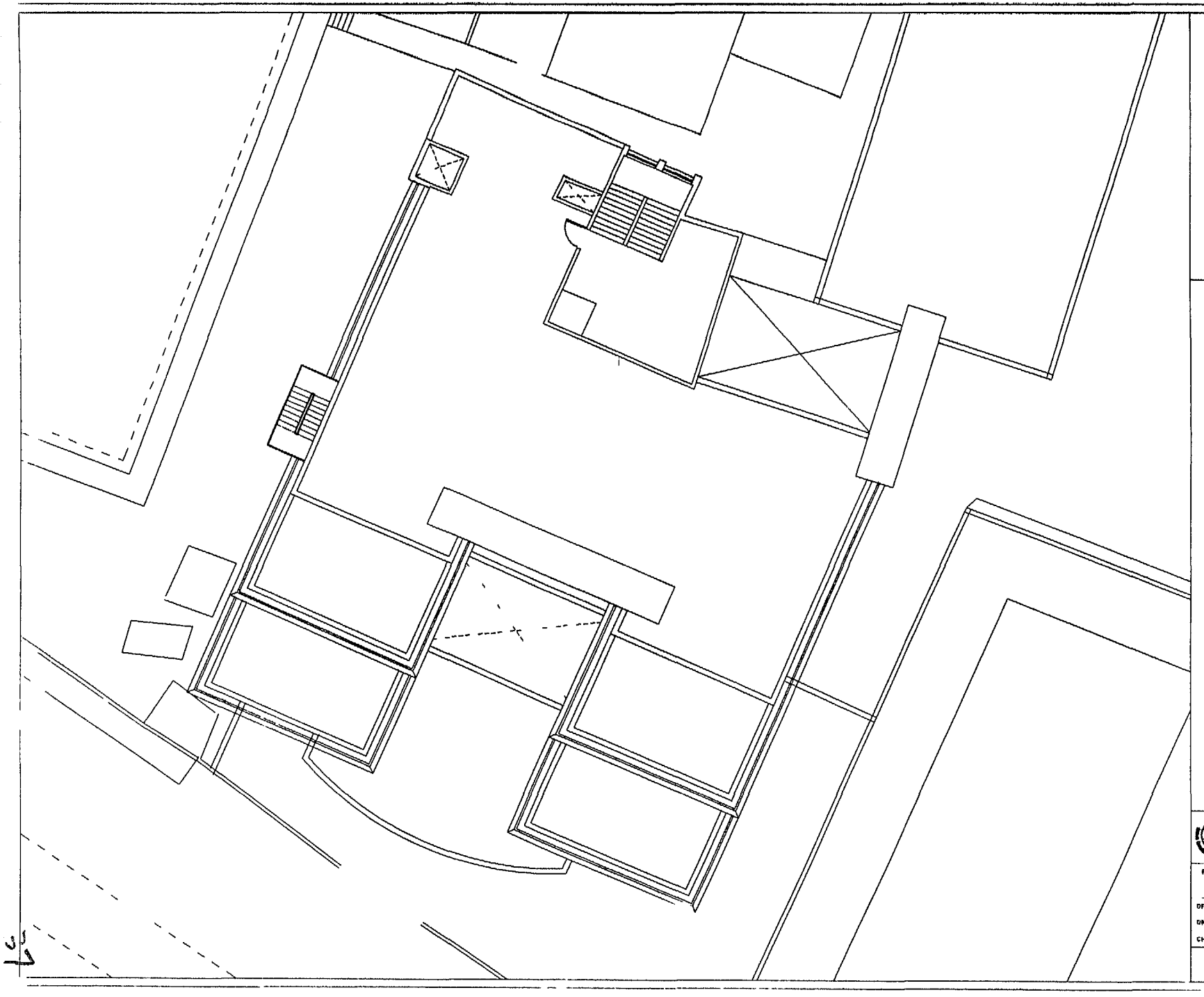
P O BOX 926346 TEL 663611 662783 FAX 606744

PROJECT – NEW MWI BUILDING

DESIGNED BY	Al b G Id	SCALE	1:100
DRAWN BY	Al b G Id	S E D	LOT NO
CHECKED BY	Mu I Abu Gheid	DATE	

TITLE 7th Floor layout

DRG NO 11



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

Notes

Area 88 sqm

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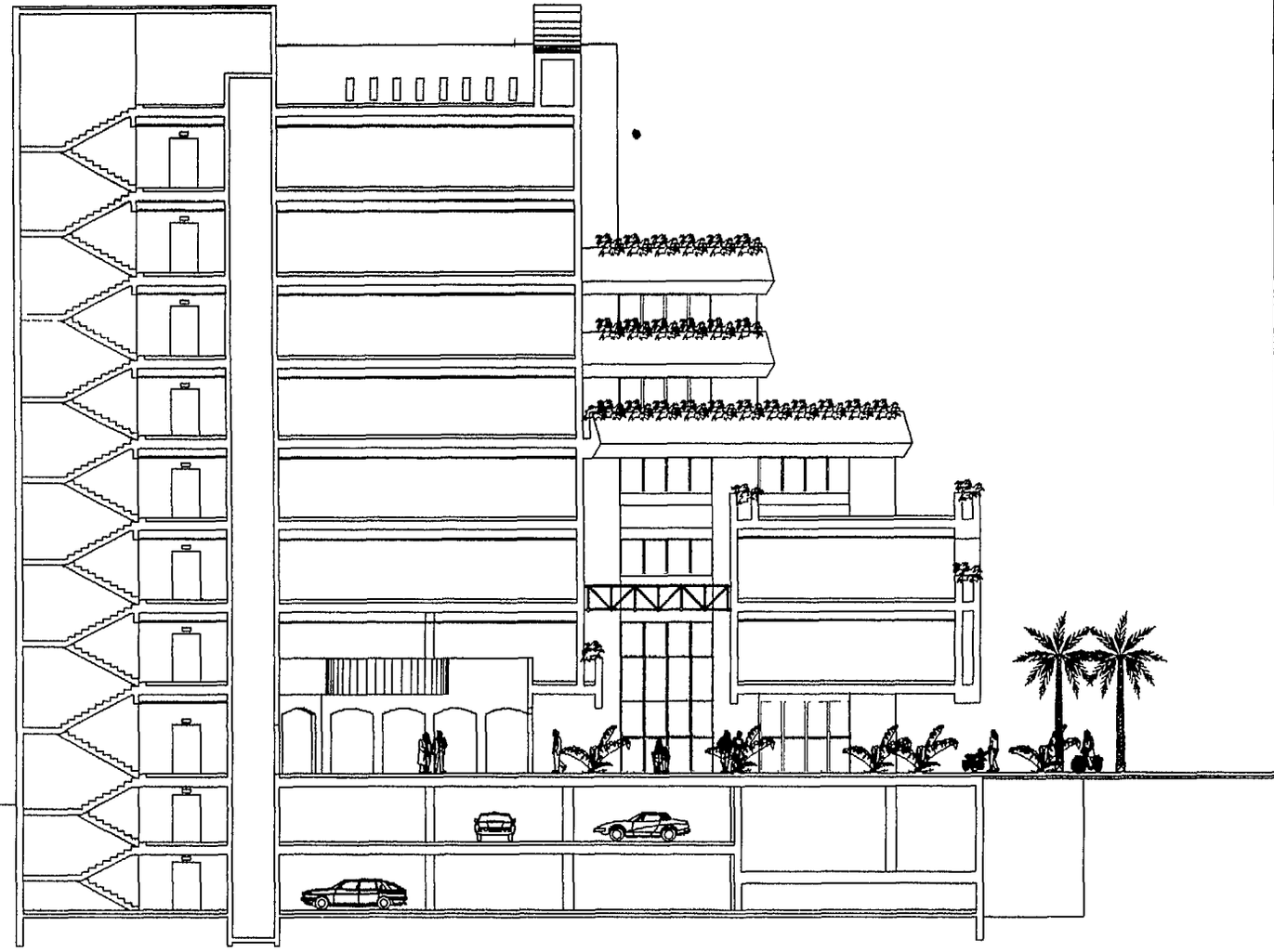
PROJECT – NEW MWI BUILDING

DESIGNED BY
DRAWN BY
CHECKED BY
DATE

TITLE: Roof layout

DRG NO 12



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P O BOX 9263 6 TEL 665611 662 85 FAX 606744

PROJECT

NEW MWI BUILDING

DR WN BY

CHECKED B

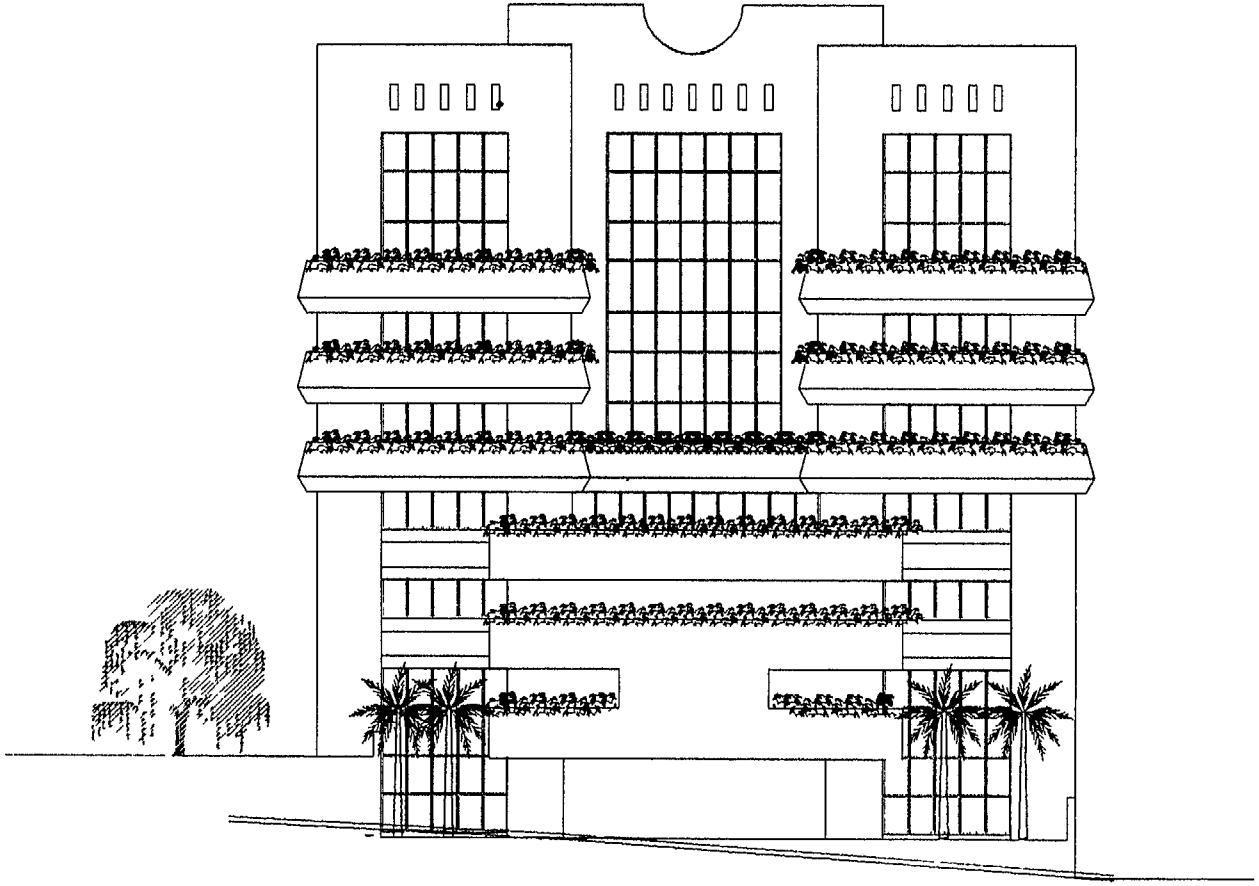
DATE

TLE

Section

DRG NO

13



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PROJECT

NEW MWI BUILDING

DRAWN BY

CHECKED B

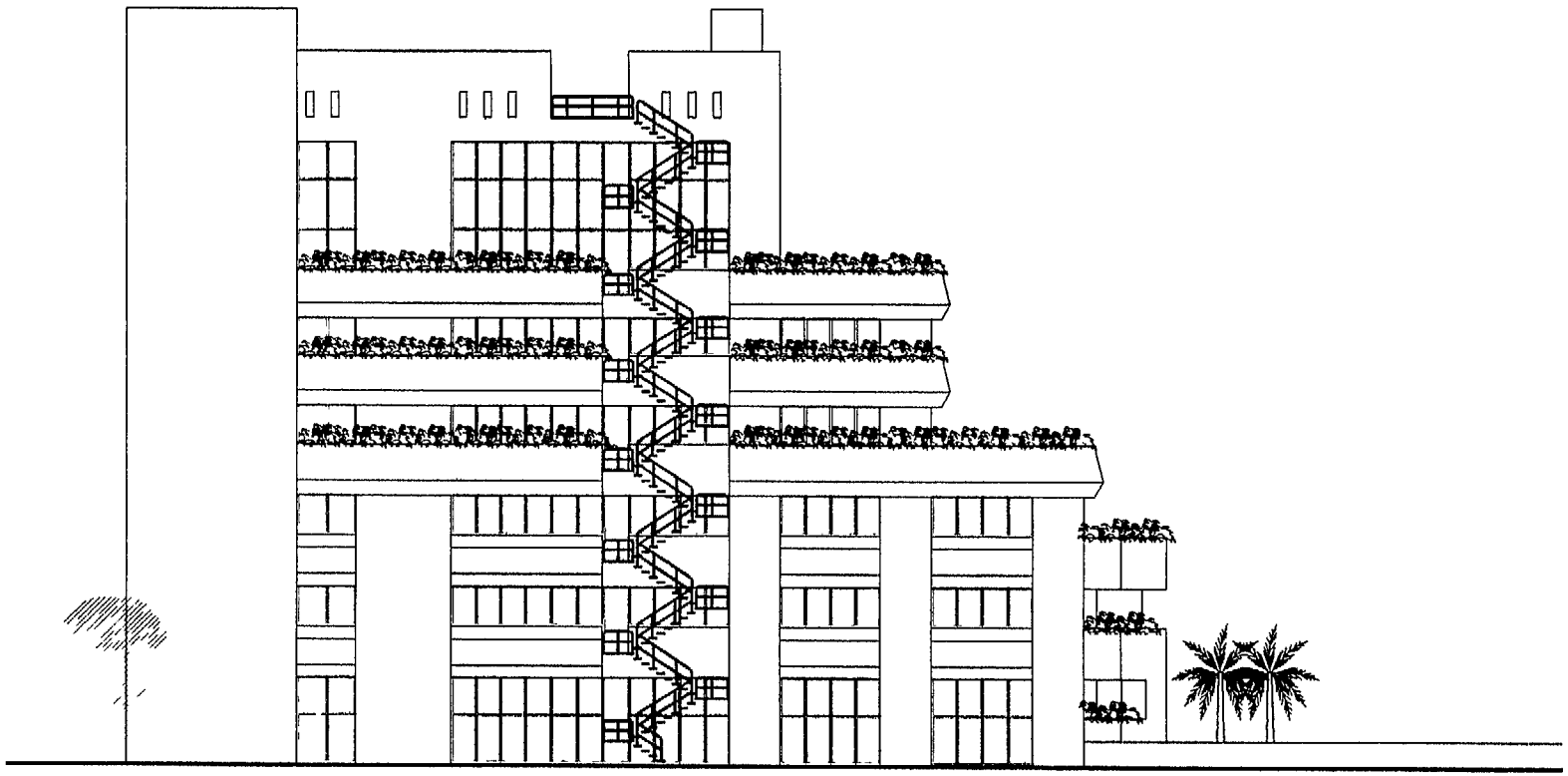
TLE

SOUTH ELEVATION

DRG NO

14

39



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

AMMAN CONSULTING ENG & PLANNING OFFICE

P O BOX 9263 6 TEL 66361 662783 FAX 606744

PROJECT

NEW MWI BUILDING

CHECKED BY

DATE

TLE

WEST ELEVATION

DRG NO

17

THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

AMMAN CONSULTING ENG & PLANNING OFFICE

P O BOX 9283 0 TEL 0381 X 88 FAX 609744

PROJECT

NEW MWI BUILDING

DESIGNED BY

DRAWN BY

CHECKED BY

SCALE

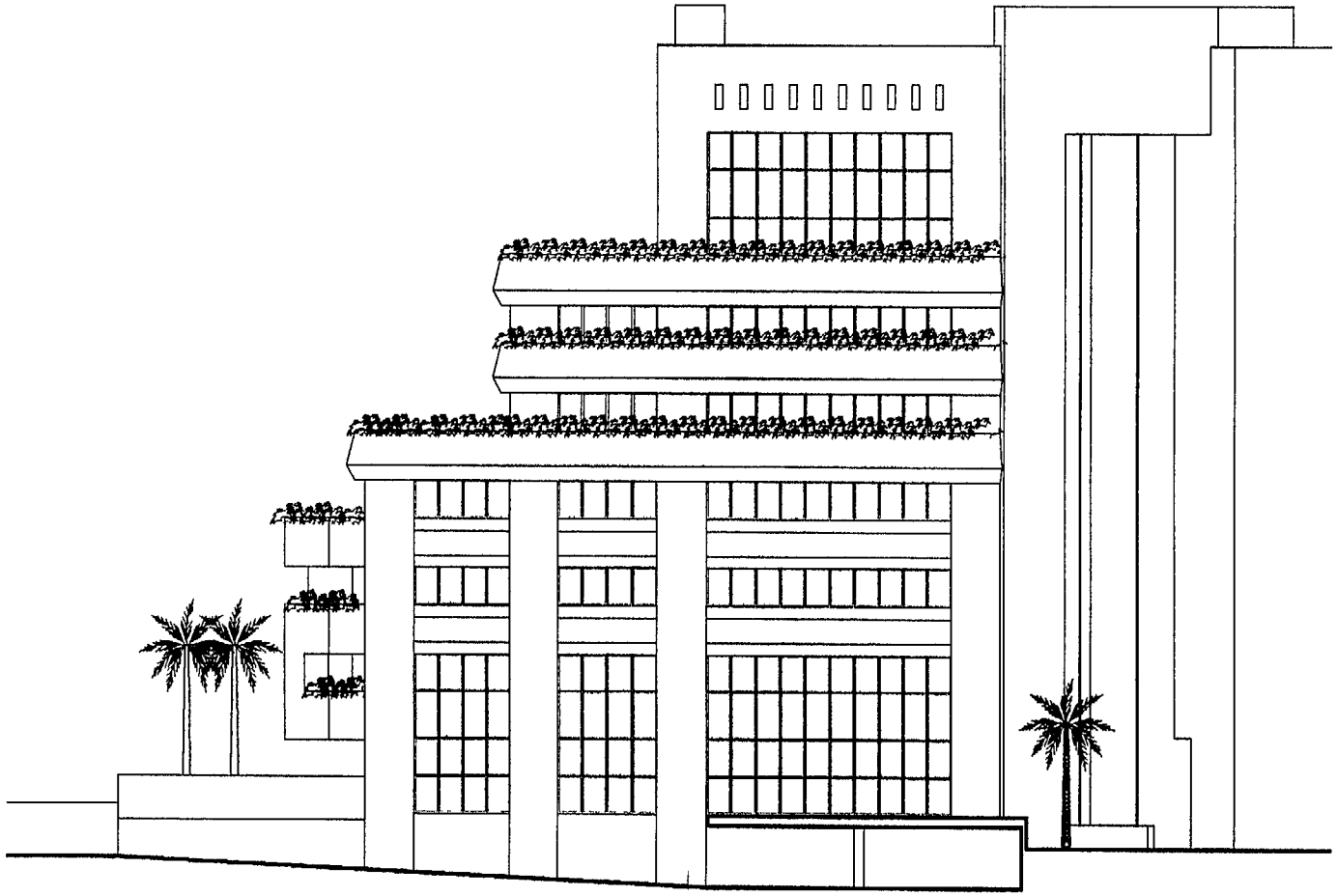
DATE

TITLE

NORTH ELEVATION

DRG NO

16



THE HASHEMITE KINGDOM OF JORDAN

MINISTRY OF WATER AND IRRIGATION

AMMAN CONSULTING ENG & PLANNING OFFICE

P O BOX 926346 TEL. 663611 662783 FAX 606744

PROJECT: NEW MWI BUILDING

DESIGNED BY	H ni Abu Ghaida Ala a Abu Ghaida	SCALE	
DRAWN BY	Ala Ab G Ida	SITE NO	LOT NO
CHECKED B	H ni Abu Ghaid	DATE	

TLE: EAST ELEVATION

DRG NO: 15

7. Cost Estimate :-

A- Training Center :

Our preminelary construction cost estimation for the 6 floor building (2 basements + 4 floors) will be based on area

- **Basements:**
  Area 2377 m2
  Cost for one sq m = 200 JD
  Cost for basements 2377 * 200 = 475 400 JD

- **Floors :-**
  Area 3622 m2
  Cost for one sq m = 300 JD
  Cost for floors 3622 * 300 = 1 086 600 JD
  Total Estimated Cost = 1 562 000 JD

B- MWI Offices :

Our preminelary construction cost estimation for the top 4 floors will be also based on area which is 2900 m2

- **Skeleton**
  2900 * 120 = 348 000 JD

- **Finishes:**
  2900 * 180 = 522 000 JD
  Total Estimated Cost = 870 000 JD

المركز العربي للدراسات الهندسية

ARAB CENTER FOR ENGINEERING STUDIES

SITE INVESTIGATION
FOR
PROPOSED NEW MWI TRAINING BUILDING
PLOTS 75, 76, BASIN 12 AL-WATPDA AL-SHAMALI

AL-APDALI
GREATER AMMAN

S 93148

FOR
AMMAN CONSULTING ENGINEERING & PLANNING OFFICE
AMMAN - JORDAN

SEPT 1993

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40

المركز العربي للدراسات الهندسية
ARAB CENTER FOR ENGINEERING STUDIES

Messrs Amman Consulting Engineering & Planning Office
Amman, Jordan

Sept 26, 1995
S 95148

Subject Site Investigation for
Proposed New MWI Training Building
Plots 75 & 76
Basin 12 Al-Waibdah Al-Shamali
Al-Abdali
Greater Amman

Dear Sirs,

The Arab Center For Engineering Studies is pleased to submit this report of the geotechnical i stigation for the above subject site of the proposed building in Al-Abdali, Greater Amman This investigation was carried out according to our proposal No PS 95140 dated Sept 7, 1995

This report includes the results of the field and laboratory investigations, geotechnical analysis and interpretation of the findings and conclusions and recommendations to aid the design and construction of foundations

In the event that additional information or clarifications are required, please contact our office at your convenience We would like to take this opportunity to thank you for your confidence and look forward to be of service to you in the near future

Sincerely yours,
ARAB CENTER FOR ENGINEERING STUDIES

Dr Omar Abdulhadi
Director & Partner
Reg No 3424

المركز العربي للدراسات الهندسية
ARAB CENTER FOR ENGINEERING STUDIES

TEL. 810777 Fax 812777 P O Box 5504 - Amman 11183 Jordan تلفون ٨١٠٧٧٧ - فاكس ٨١٢٧٧٧ - ص ب ٥٥٠٤ - عمان ١١١٨٣ الاردن

46

TABLE OF CONTENTS

		Page
LETTER OF TRANSMITTAL		I
TABLE OF CONTENTS		II
1.0	INTRODUCTION	1
1.1	Purpose Of Study	1
1.2	Scope Of Work	1
2.0	PROJECT DESCRIPTION	1
3.0	SITE DESCRIPTION	2
4.0	FIELD EXPLORATION AND LABORATORY TESTING	2
4.1	Field Exploration	2
4.1.1	Drilling	2
4.1.2	Sampling	4
4.2	Laboratory Testing	4
5.0	SURFACE AND SUBSURFACE CONDITIONS	11
5.1	Ground Materials	11
5.2	Material - Physical & Mechanical Properties	11
5.3	Ground Water And Cavities	11
6.0	CONCLUSIONS AND RECOMMENDATIONS	19
6.1	Foundation Depth And Type	19
6.2	Allowable Bearing Pressure	19
6.3	Foundation Settlement	19
6.4	Excavation Method	20
6.5	Excavation Side Slopes	20
6.6	Drainage	20
6.7	Backfill Material And Compaction Criteria	20
6.8	Earth Pressure	20
6.9	Important Notes	21
6.10	Foundation Excavation Inspection	22
APPENDIX A	Logs Of Borings	23
APPENDIX B	Method Of Calculation	24

LIST OF FIGURES

Figure No. 1	Site Plan	3
Figure No. 2	Generalized Subsurface Profile AA'	12
Figure No. 3	Generalized Subsurface Profile BB'	13
Figure No. 4	Textural Classification Chart	14
Figure No. 5	Casagrande Plasticity Chart	15
Figure No. 6	Modified Chart of Expansiveness	16

LIST OF TABLES

Table No. 1	Laboratory Test Results	5-10
Table No. 2	Material Types and Properties	17-18

47

1 0 INTRODUCTION

This report presents the results of the geotechnical investigation for the proposed site in Al-Abdali, Greater Amman

1 1 Purpose Of Study

The purpose of this study is to determine the surface and subsurface conditions at the building site and the physical and mechanical properties of the foundation ground in order to provide the structural engineer with sufficient information for the design of most suitable and safe foundations

1 2 Scope Of Works

The scope of work consists of the following

1 Collecting information and maps particular to the building site such as public services, site plan and land use maps

2 Making visits to the site to collect information about present land use, surface topography, geological features and surface drainage

3 Drilling of five boreholes and sampling of disturbed and undisturbed samples

4 Carrying out the necessary laboratory tests

5 Performing engineering analysis of field and laboratory findings

6 Developing conclusions and recommendations for foundation design and construction

2 0 PROJECT DESCRIPTION

The proposed building is intended to be used as a training center for Ministry of Water and Irrigation (MWI) It consists of two basements, ground, first, second, third, fourth, fifth, sixth, and seventh floors with an approximate area of 1000m^2 for the first and second basement and 950 m^2 for each of the remaining floors

3.0 SITE DESCRIPTION

The site lies in plots 75 and 76, basin 12 Al-Waibda Al-Shamali, Al-Abdali, Greater Amman It is bordered by a paved road from the South side, and by retaining walls from the remaining sides

The site is relatively flat The site is utilized as a parking area covered by asphalt layer followed by a basecourse layer

No electrical or telephone poles or pipes were observed within the site area However, electricity, telephone and water services are provided for the area

According to the geological maps for Amman area, the site belongs to Belqa Group, Amman Silicified Limestone and Wadi umm Ghdran Formations (B1/2) which is mainly formed of chert beds of various thickness intercalated with marls and limestone no faults or other special geological features were observed at the site

A general site plan showing the location of the building and boreholes is presented in figure no 1

4 0 FIELD EXPLORATION AND LABORATORY TESTING

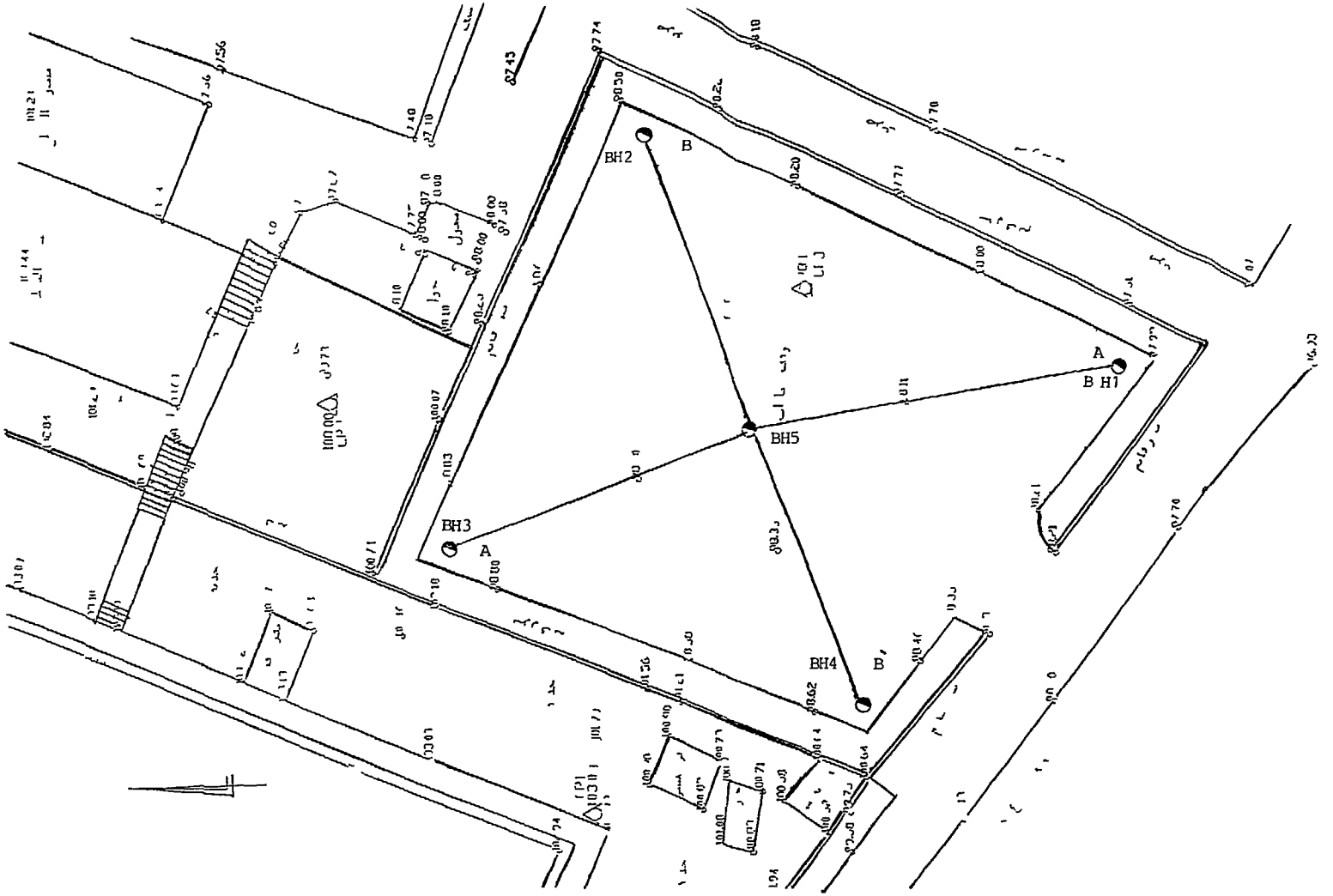
4 1 Field Exploration

4 1 1 Drilling

During the period between Sept 16 through 19, five boreholes were drilled at the site The boreholes are numbered 1, 2, 3, 4 and 5 and they were drilled to a depth of 18 0, 23 0, 18 0, 18 0 and 23 0 m, respectively below the existing ground surface The locations of the boreholes are shown in figure no 1

The drilling was executed with Pilcon Traveller 30 type drill rig using the rotary air flush drilling method The logs of the boreholes are presented as Appendix A to this report

49



General Site Plan
Scale (1 25o)

Finished Floor Level of the Second Basement +92 5

Figure No 1

S95148

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4 1 2 Sampling

Samples were obatained from the boreholes wherever possible, throughout the drilled depths, using double tube core barrel 76 mm diameter The samples recovered were examined, described and classified by our geotechnical engineers, placed in proper sequence in wooden boxes and taken to our laboratories for testing The moist samples were placed in waterproof plastic bags before placing in wooden boxes

Dow nthe hole hammer was used at materials of low engineering interest and where the hard and intercalated nature of the materials did not allow for coring

4 2 Laboratory Testing

In order to determine the physical and mechanical properties of the ground materials, laboratory tests were performed on selected samples from the boreholes The following tests were performed according to American Society For Testing And Materials (ASTM) Standards

1 ASTM D 2216-92, "Laboratory Determination Of Water (Moisture) Content Of Soil, Rock And Soil Aggregate Mixtures"

2 ASTM D 4318-93, "Test for liquid limit, Plastic Limit and Plasticity Index of Soil"

3 ASTM D 422-63 (1990), "Particles Size Analysis Of Soils"

4 ASTM D 2938-86, "Test For Unconfined Compressive Strength Of Intact And Rock Core Specimens"

5 ASTM D 2166-91, "Test For Unconfined Compressive Strength Of Cohesive Soil"

The results of all the tests are summarized in Table No 1

51

TABLE No 1

LABORATORY TEST RESULT

BN	S NO	D (m)	Bd g/cm^3	M/C (%)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				UNCONFIN TEST		TRIAXIAL TEST	
					LL (%)	PL (%)	PI (%)	GRVL (%)	SAND (%)	SILT (%)	CLAY (%)	qu kg/cm^2	F St (%)	C kg/cm^2	Q ( )
1	825	0.5		3 2											
	826	1 5		1 9											
	827	2 5		2 5											
	828	3 5		3 7											
	829	4 5		2 0											
	830	5 5		2 6											
	831	6 5		3 7											
	832	7 5		2 7											
	833	8 5		0 4											
	834	9 5		0 4											
	835	10 5		2 3											
	836	11 5		2 6											
	837	12 5	2 047	0 5								38 3	—		
	838	13 5		1 3											
	839	14 0	2 106	1 2								44 0	—		
	840	15 5		2 2											
	841	16 5		1 3											
	842	17 0	2 018	0 6								24 9	—		
	843	17 5		3 7											

	Boring Number	LL	Liquid Limit	C	Cohesion
S No	Sample Number	PL	Plastic Limit	Q	Friction Angle
	Depth	PI	Plasticity Index		
	Bulk Density	qu	Compressive Strength		
M/C	Moisture Content	F st	Failure Strain		

SV

TABLE No 1

LABORATORY TEST RESULT

BN	S NO	D (m)	Bd g/cm^3	M/C (%)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				UNCONFIN TEST		TRIAXIAL TEST	
					LL (%)	PL (%)	PI (%)	GRVL (%)	SAND (%)	SILT (%)	CLAY (%)	qu kg/cm^2	F St (%)	C kg/cm^2	Q ( )
2	844	0 5		3 8											
	845	1 5		4 8											
	846	2 5		—											
	847	3 5		—											
	848	4 5		—											
	849	5 0		—											
	850	6 5		2 0											
	851	7 5		1 3											
	852	8 5		2 1											
	853	9 5		1 3											
	854	10 5		1 7											
	855	11 5		2 7											
	856	12 0	2 130	1 2								47 2	—		
	857	13 5	2 074	1 1								39 6	—		
	858	14 5		1 2											
	859	15 0	2 040	0 6								27 1	—		
	860	16 5		1 3											
	861	17 5		1 6											
	862	18 5		1 2											
	863	19 5		1 1											

N Boring Number
No Sample Number
D Depth
Bd Bulk Density
M/C Moisture Content

LL Liquid Limit
PL Plastic Limit
PI Plasticity Index
qu Compressive Strength
F st Failure Strain

C Cohesion
Q Friction Angle

53

TABLE No 1

LABORATORY TEST RESULT

BN	S NO	D (m)	Bd g/cm^3	M/C (%)	ATTFRBERG LIMITS			PARTICLE SIZE DISTRIBUTION				UNCONFIN TEST		TRIAXIAL TEST	
					LL (%)	PL (%)	PI (%)	GRVL (%)	SAND (%)	SILT (%)	CLAY (%)	qu kg/cm^2	F St (%)	C kg/cm^2	Q ( )
2	864	20 5		2 3											
	865	21 5		1 1											
	866	22 5		1 2											
3	867	0 5		6 3											
	868	1 5		7 7											
	869	2 5		3 6											
	870	3 5	2 239	3 6								51 6	—		
	871	4 5		3 8											
	872	5 5		2 4											
	873	6 5		2 4											
	874	7 5		2 5											
	875	8.5	2 022	12 4	35 4	13 7	21 6		19 4	52 3	28 3	3 19	4.60		
	876	9 5	2 044	9 3	35 6	14 6	21 0					4 33	4 80		
	877	10 5		4 4											
	878	11 0		25 2											
	879	12 5		23 1											
	880	13 5		24 1											
	881	14 5		20 3											
	882	15 5		21 3											
	883	16 5		23 1											

N Boring Number
S No Sample Number
D Depth
d Bulk Density
M C Moisture Content

LL Liquid Limit
PL Plastic Limit
PI Plasticity Index
qu Compressive Strength
F st Failure Strain

C Cohesion
Q Friction Angle

54

TABLL No 1

LABORATORY TLST RESULT

BN	S NO	D (m)	Bd g/cm^3	M/C (%)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				UNCONFIN TEST		TRIAXIAL TEST	
					LL (%)	PL (%)	PI (%)	GRVL (%)	SAND (%)	SILT (%)	CLAY (%)	qu kg/cm^2	F St (%)	C kg/cm^2	Q ( )
3	884	17 5		21 2											
4	885	0 5		2 1											
	886	1 5		4 5											
	887	2.5		4 0											
	888	3 5		1 8	22 9	16 0	7 0		26 8	61 6	11 6				
	889	4 5		0 3											
	890	5 5		1 4											
	891	6 5		0 3											
	892	7 5		3 1											
	893	8 5		5 1	33 2	11 8	21 5		22 0	56 2	21 8				
	894	9 5		2 4											
	895	10 5		2 9											
	896	11 5		3 5											
	897	12 5	2 243	6 2								45.1	—		
	898	13 5		4 7	28 7	12 9	15 8								
	899	14 5	2 143	4 5								36 2	—		
	900	15 5	2 248	5 1								38 5	—		
	901	16 5		6 3											
	902	17 5		8 1											
5	903	0 5		2 7											

BN Boring Number
S No Sample Number
D Depth
Bd Bulk Density
M/C Moisture Content

LL Liquid Limit
PL Plastic Limit
PI Plasticity Index
qu Compressive Strength
F st Failure Strain

C Cohesion
Q Friction Angle

55

TABLE No 1

LABORATORY TEST RESUL

S95 48

BN	S NO	D (m)	Bd g/cm^3	M/C (%)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				UNCONFIN TEST		TRIAXIAL TEST	
					LL (%)	PL (%)	PI (%)	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	qu Kg/cm^2	E St (%)	C Kg/cm^2	Q (°)
5	903	0 5		2 7											
	904	1 5		2 3											
	905	2 5		3 2											
	906	3 5		1 4											
	907	4 5		1 8											
	908	6 5		1 1											
	909	6 5		1 2											
	910	7 5		1 7											
	911	8 5	1 971	10 5	35 4	14 4	21 0					3 21	4 60		
	912	9 5		3 8											
	913	11 5		3 0											
	914	12 5	2 209	2 6								46 2	—		
	915	13 5	2 116	4 6								39 2	—		
	916	14 5		1 1											
	917	15 5	2 303	12 3								30 2	—		
	918	16 5		12 2											
	919	17 5	2 390	13 1								46 5	—		
	920	18 5	2 105	13 4								48 3	—		
	921	19 5		17 1											

N Boring Number
No Sample Number
Depth
d Bulk Density
/C Moisture Content

LL Liquid Limit
PL Plastic Limit
PI Plasticity Index
qu Compressive Strength
E St Failure Strain

C Cohesion
Q Friction Angle

56

TABLE No 1

LABORATORY TEST RESULT

S95148

BN	S NO	D (m)	Bd g/cm^3	M/C (%)	ATTERBERG LIMITS			PARTICLE SIZE DISTRIBUTION				UNCONFIN TEST		TRIAXIAL TEST	
					LL (%)	PL (%)	PI (%)	GRVI (%)	SAND (%)	SILT (%)	CLAY (%)	qu kg/cm^2	F St (%)	C kg/cm^2	Q ( )
5	922	20 5	2 255	12 1								34 2	—		
	923	21 5		17 1											
	924	22 5		12 3											

N	Boring Number	LL	Liquid Limit	C	Cohesion
S No	Sample Number	PL	Plastic Limit	Q	Friction Angle
	Depth	PI	Plasticity Index		
d	Bulk Density	qu	Compressive Strength		
M/C	Moisture Content	F st	Failure Strain		

57

5.0 SURFACE AND SUBSURFACE CONDITIONS

5.1 Ground Materials

The five boreholes drilled show that there are general similarities and continuities of the subsurface materials, in spite of some local variations.

Generalized Sub-surface Profile AA' and BB' are presented in figures no. 2 & 3. The location of the lines AA' and BB' are shown on figure no. 1. The profiles were constructed by direct interpolation between the materials encountered in the boreholes. The lines connecting the various ground strata are made for illustration purposes only and are not to be considered as actual field conditions.

The geologic description of the ground materials at the site and the approximate average depth at which they were encountered in the boreholes are presented in Table No. 2.

Further information about the materials encountered can be obtained from the logs of borings, Appendix A.

5.2 Materials Physical and Mechanical Properties

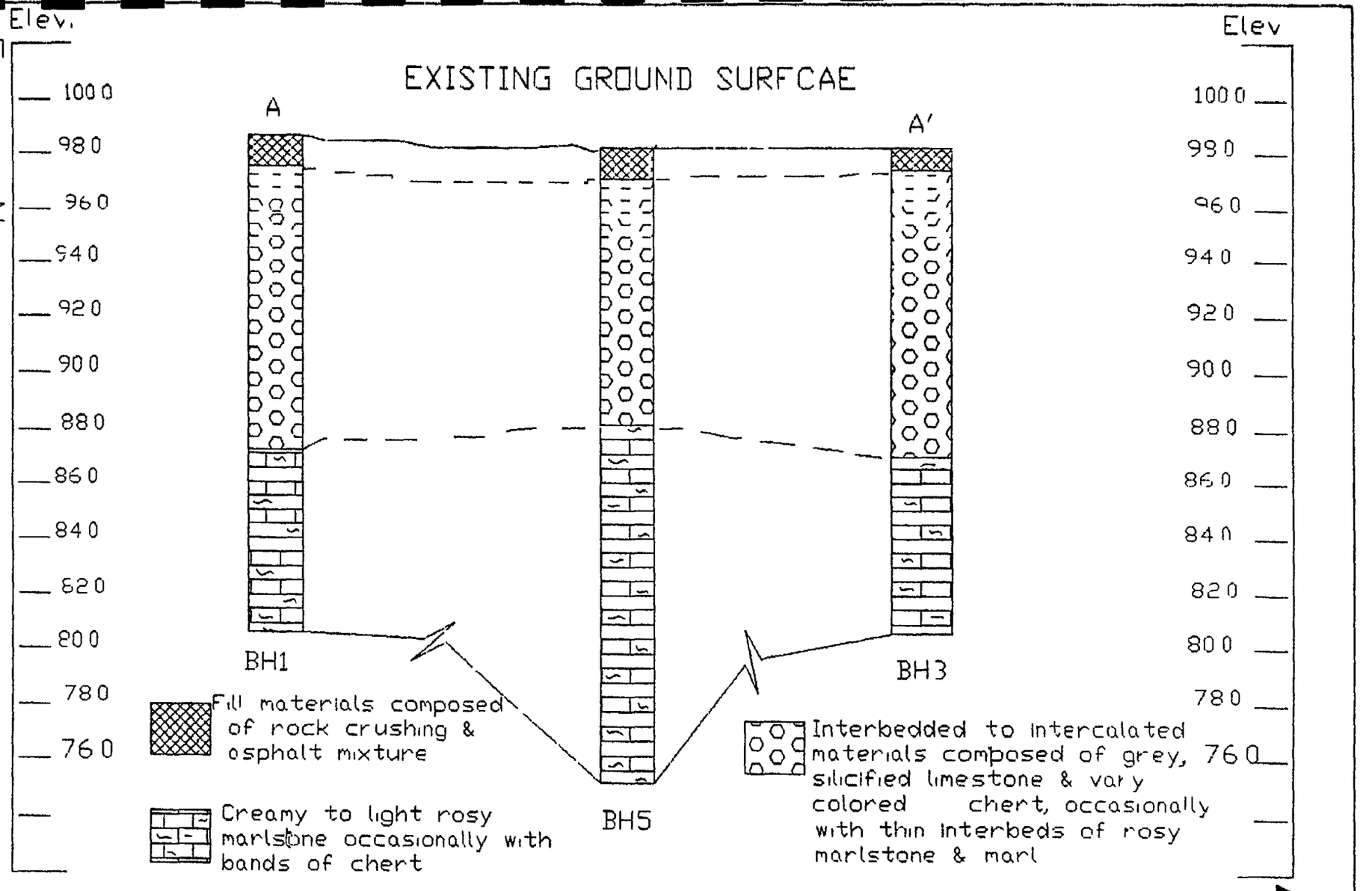
The field and laboratory tests results as well as the corresponding material classification were summarized for the various ground materials and are also presented in Table No. 2. The results obtained from the particle size analysis tests were used to obtain the textural classification of the soils as shown on figure no. 4 whereas Atterberg limits tests results were plotted on Casagrande Plasticity Chart, figure no. 5, to obtain the plasticity of the soils. In order to obtain the degree of potential expansiveness, the percentage of clay fractions for the tested samples were plotted against the plasticity index for the same samples on the chart for the degree of potential expansiveness (Williams and Donaldson, 1980), figure no. 6. The tables given in the legend to boring logs, Appendix A were used to describe the quality, and strength of the rock.

Further information about the materials encountered and their physical and mechanical properties can be obtained from Table No. 1.

5.3 Ground Water And Cavities

No cavities were encountered in the boreholes to the depths drilled. However, friable and loose materials were observed in borehole 2 at depth ranging from 2.5 to 5.0 m, while ground water was observed in boreholes 3 at depth from 11.0 m to the end of boring and wet samples were obtained from borehole 5, at depth from 15.5 to the end of boring. The source of ground water is suspected to be lealage and/or seepage from the adjacent water tank.

58



Generalized Subsurface Profile AA'
Scale Horizontal 1/ 400
Vertical 1/ 200

Figure No. 2

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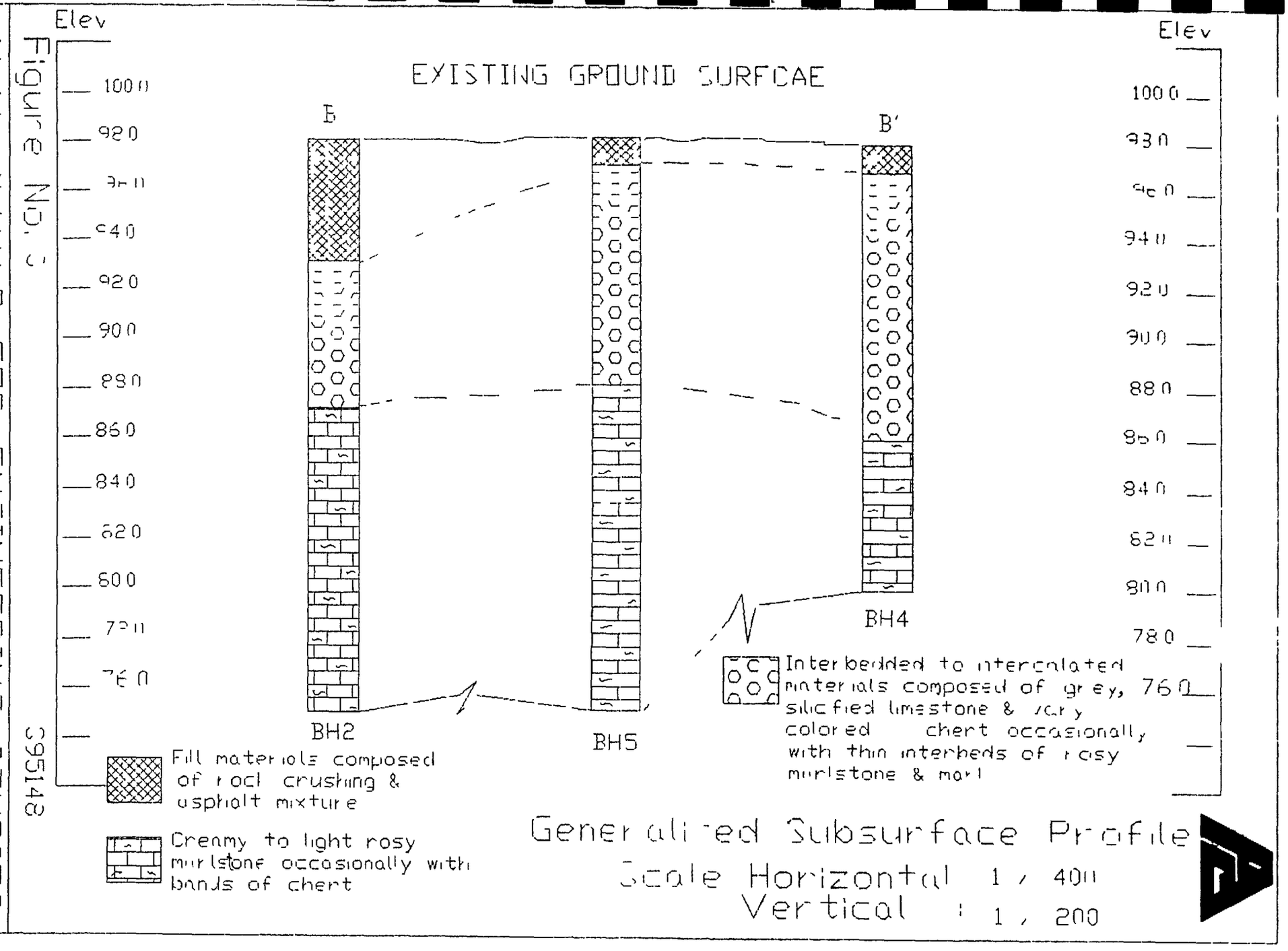
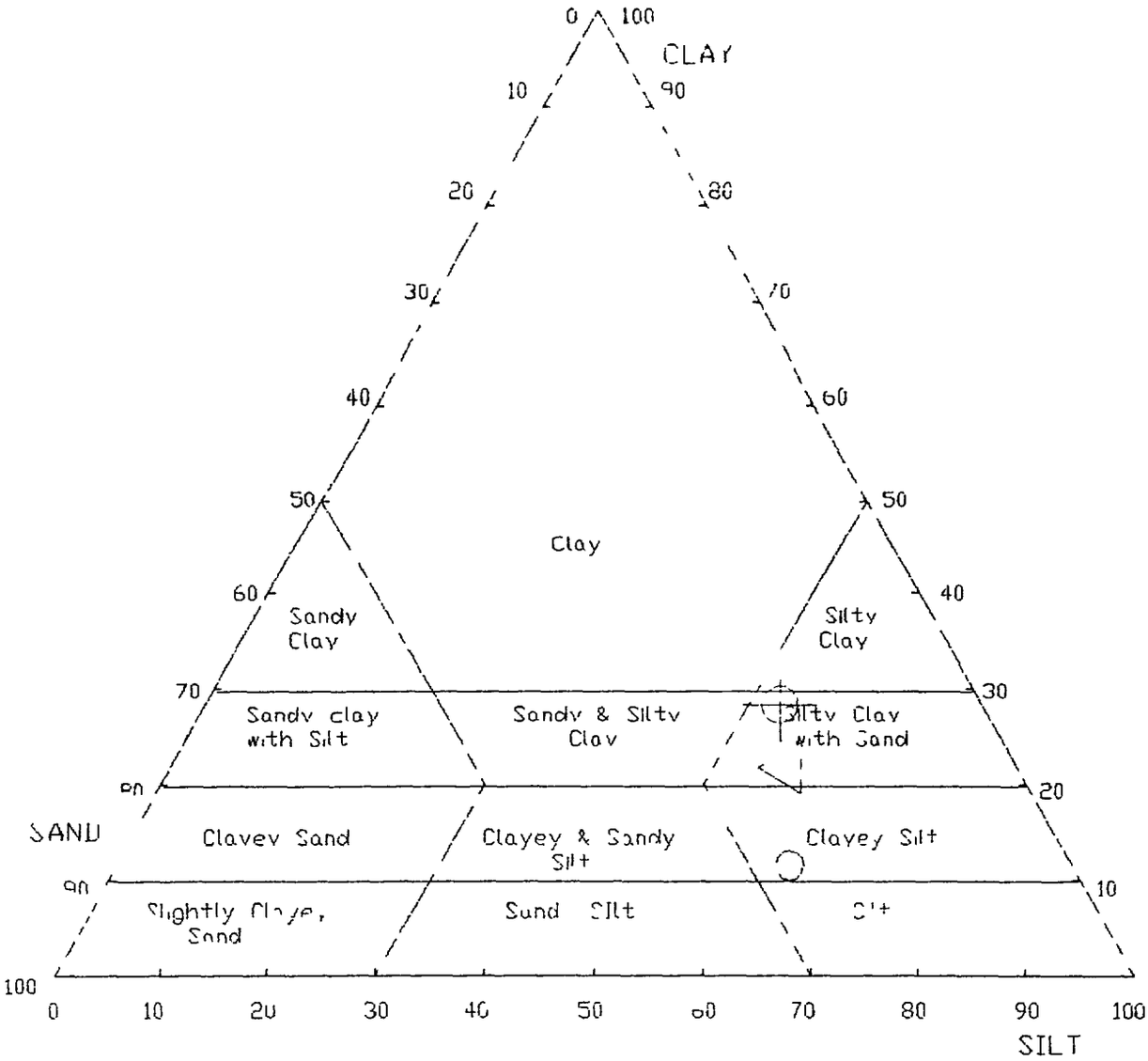

ARAB CENTER FOR ENGINEERING STUDIES
Figure No. 3
Elev
EXISTING GROUND SURFCAE
B
B'
BH2
BH5
BH4
Fill materials composed of rock crushing & asphalt mixture
Creamy to light rosy marlstone occasionally with bands of chert
Interbedded to intercalated materials composed of grey, silicified limestone & varry colored chert occasionally with thin interbeds of rosy marlstone & marl
Generalized Subsurface Profile
Scale Horizontal 1 / 400
Vertical 1 / 200

TEXTURAL CL SIFICATION CHART



Symbol	Borehole No	Depth (m)	Classification
⊕	3	8.5	Silty clay with sand
○	4	3.5	Clayey silt
◁	4	8.5	Silty clay with sand

FIGURE NO 4 S95148

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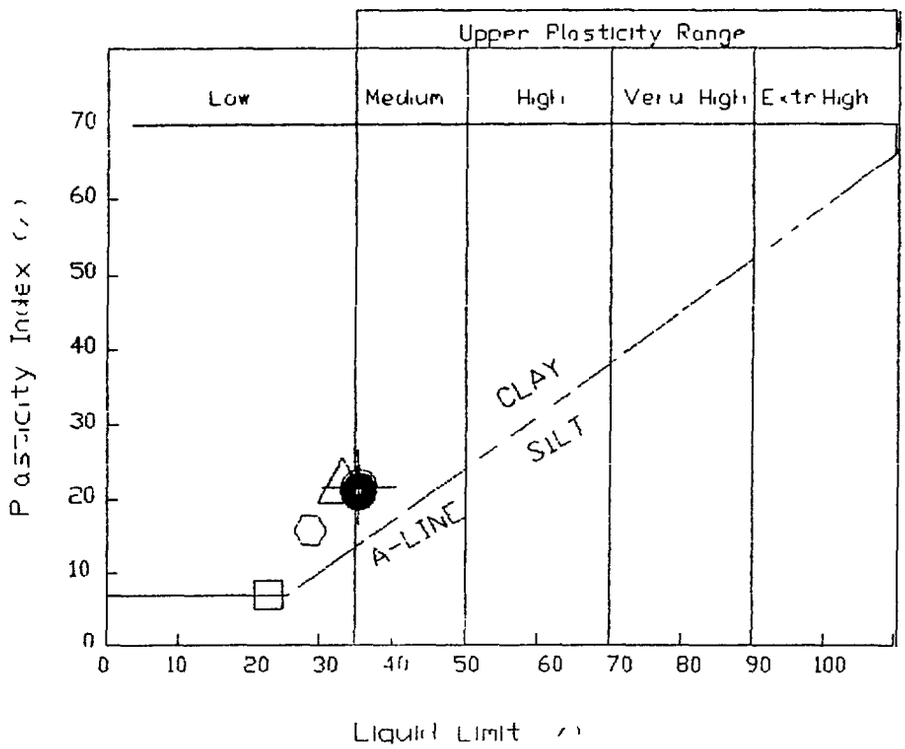
61

CASAGRANDE PLASTICITY CHART
(A-LINE)



Symbol	Borehole No	Depth (m)	Materials Type	Plasticity
	3	8.5	Marl	Medium
	3	9.5	Marl	Medium
	4	3.5	Marl	Low
	4	8.5	Marl	Low
	4	13.5	Marl	Low
	5	8.5	Marl	Low

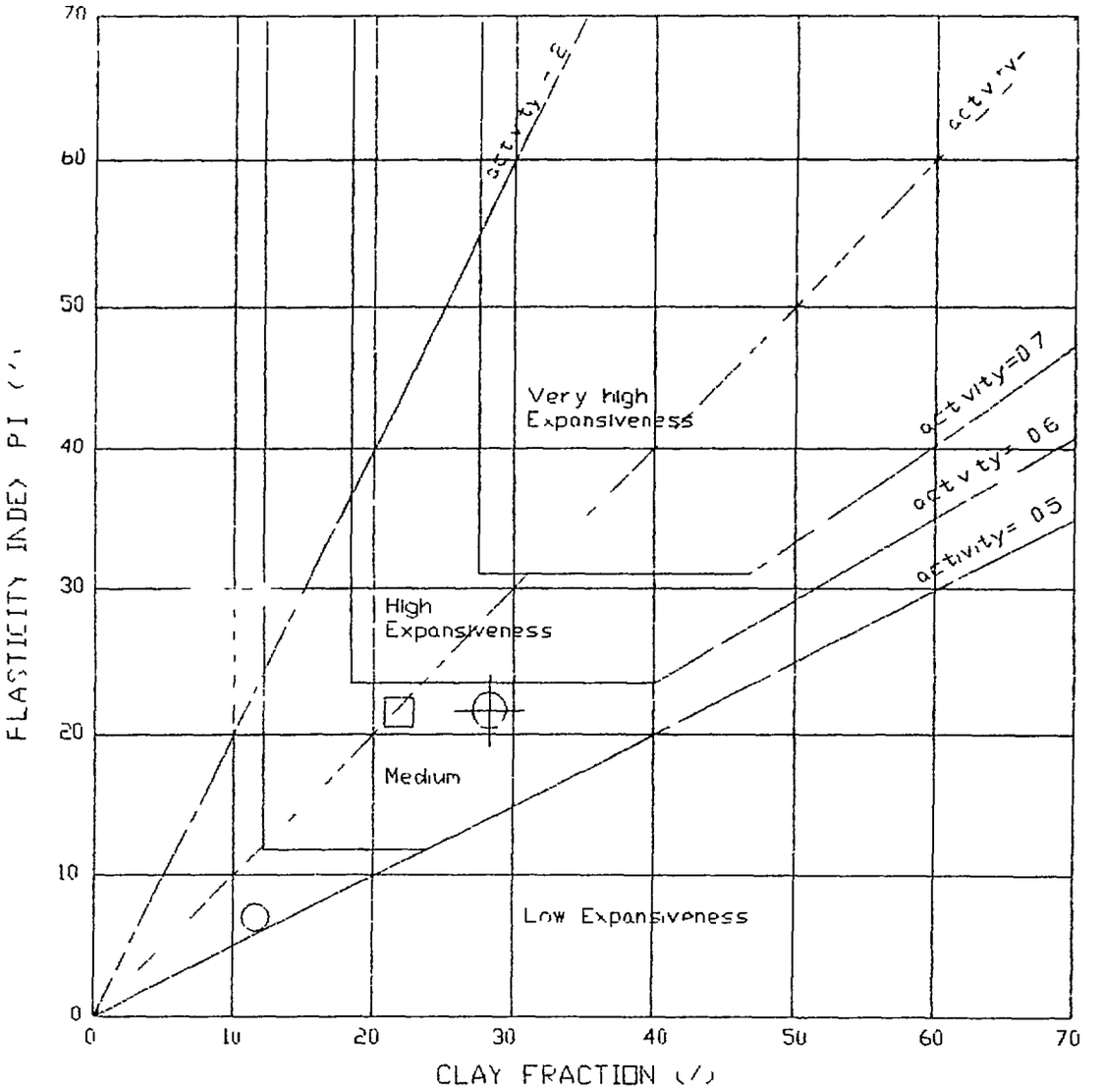
FIGORE NO 5

395148

ARAB CENTER FOR ENGINEERING STUDIES

62

MODIFIED CHART OF EXPANSIVENESS
(WILLIAMS AND DONALDSON 1980)



Sympol	Borhole Nu	Dept (m	Material Type	Potential Of Expansiveness
⊕	3	8.5	Marl	Medium
○	4	3.5	Marl	Low
□	4	8.5	Marl	Medium

FIGURE NO 6 S95148

ARAB CENTER FOR ENGINEERING STUDIES

63

Table No 2

Material Types and Properties

Approximate Depth (m)	Geologic Description	Summary of Tests Results	Material Classification
From 0 0 to 0 7, 5 0, 0 5, 1 0, & 1 0 m, in boreholes 1 through 5, respect	Fill materials composed of rock crushing and asphalt mixture	M/C 2 1-6 3%	
From 0 7, 5 0, 0 5, to 11 0 in boreholes 1, 2 and 3 From 1 0 m - m, and 10 0 m in boreholes 4 & 5 respect	Interbedded to intercalated materials composed of grey silicified limestone and vary colored of chert, occasionally with thin interbeds of rosy marlstone and marl	M/C 0 3-12 9% LL -22 9-35 6% PL -11 8-16 0% PI -7 0-21 6% S -19 4-26 8% M -32 3-61 6% C -11 6-28 3% qu -51 6 kg/cm2 (for marlstone beds only) qu -3 19-4 33 kg/cm2 (for marl beds only) RQD 0 - 25%	TC Clayey silt to silty clay with sand P Low to medium PI Low to medium St very weak marlbeds only) St Moderately weak (marlstone) D Very poor

M/C Moisture Content
S Sand
M Silt
C Clay
LL Liquid Limit
PL Plastic Limit
PI Plasticity Index
q_u Unconfined Compressive Strength
RQD Rock Quality Designation

TC Textural Classification (fraction passing no 10 sieve)
P Plasticity (fraction passing sieve no 10)
PI Potential for Expansiveness
St Strength
D Rock Quality Description

* See Legend to Boring Logs, Appendix A

64

Table No 2 (Cont'd)

Material Types and Properties

Approximate Depth (m)	Geologic Description	Summary of Tests Results	Material Classification
From 11 0m, to the end of boring in boreholes 1,2 & 3 From 12 0 m 10 0 to the end of boring in boreholes 4 & 5 resp	Creamy to light rosy marlstone occasionally with thin bands of chert	M/C 0 6-23 2% LL 28 7% PL 12 9% PI 15 8% qu 24 9-48 3 kg/cm2 RQD 0-40%	P low St Weak* D Very poor to poor *

M/C Moisture Content
S Sand
M Silt
C Clay
LL Liquid Limit
PL Plastic Limit
PI Plasticity Index
q_u Unconfined Compressive Strength
RQD Rock Quality Designation

TC Textural Classification (fraction passing no 10 sieve)
P Plasticity (fraction passing sieve no 40)
PE Potential for Expansiveness
St Strength
D Rock Quality Description

* See Legend to Boring Logs, Appendix A

65

6 0 CONCLUSIONS AND RECOMMENDATIONS

According to field and laboratory investigations, subsurface conditions, engineering analysis and practical experience, it can be concluded that the proposed building can be satisfactorily supported by the ground at the site, provided that the following recommendations are followed

6 1 Foundation Depth And Type

The finished level of the second basement floor is planned to be at elevation of (92 5) This indicates that the approximate foundation level will be at elevation of (+91 5) Therefore, it is recommended that foundations be laid on the interbedded to intercalated materials composed of grey silicified limestone and vary colored chert, occasionally with thin interbeds of rosy marlstone and marl

The foundation depth may vary according to the architectural requirements but should not be less than 1 2 m below the finished level of ground surrounding the building

This foundation ground is suitable to support the building loads on individual footings with tie beams Strip footings and/or raft foundation may also be used if required

6 2 Allowable Bear Pressure

Limited number of undisturbed samples can be obtained at foundation level for strength testing because of the hard and intercalated nature of the materials encountered However, the allowable bearing pressure was estimated based on our previous experience with similar materials and according to the calculatios obtained from the unconfined compresion test results using Terzaghis bearing capacity equation considering a factor of safety of three for the marl, whereas Goodman's (Tomlinson 95) equation was used for the marlstone considering a factor of safety of ten A range from 2 73 to 3 71 kg/cm^2 was obtained for the marl and a range from 3 38 to 6 42 kg/cm^2 was obtained for the marlstone

Accordingly, the recommended net allowable bearing pressure for the whole site area is 3 3 kg/cm^2 Therefore, a total allowable bearing pressure of 4 7 kg/cm^2, may be used at the foundation level which is about 7 0 m, below the existing ground surface for the whole site area

6 3 Foundation Settlement

With the foundation designed and constructed in accordance with the above recommendations, the settlement of foundations laid on the interbedded to intercalated rock materials is estimated to be negligible and within tolerable limits

6 4 Excavation Methods

It is expected that the excavation will be through fill materials and interbedded to intercalated materials of silicified limestone and chert Therefore, pneumatic and mechanical equipment such as jack hammers and rock breakers will be required, in addition to the conventional excavation equipment such as loaders and bulldozers

6 5 Excavation Side Slopes

To minimize the instability problems, the excavation sides should be cut at a face inclination not steeper than one horizontal to three vertical (1H 3V) for interbedded to intercalated materials of chert and silicified limestone and not steeper than one horizontal to one vertical (1H 1V) for fill materials

If these recommended side slopes can not be achieved for insufficient lateral distance or for any other reason, lateral support (shoring) system will be necessary and should be considered in the structural design in order to protect the excavation sides and the adjacent structures and roads

6 6 Drainage

It is recommended to protect the foundation ground and excavation from surface water both during and after construction by providing proper drainage and protection system

6 7 Backfill Material And Compaction Criteria

The crushings of silicified limestone and, chert, marl and marlstone are considered suitable for backfilling purposes However, the final decision shall be taken during construction

The materials to be used for backfilling purposes under bottom slab, behind underground walls and around foundations shall be a soil or soil-rock mixture which is free from organic matter or other deleterious substances It shall not contain rocks or lumps over 15 cm in greatest dimension, and not more than 15 percent larger than 7 cm The plasticity index for the backfill material shall not be more than 15 percent It shall be spread in lifts not exceeding 25 cm in uncompacted thickness, moisture conditioned to its optimum moisture content, and compacted to a dry density not less than 95 percent of the maximum dry density as obtained by standard proctor compaction test (ASTM D 698)

The backfill materials immediately behind the retaining walls, if any, shall consist of filter materials composed of clean coarse sand and gravel or crushed stone conforming to the following grading requirements

Sieve Size	Percentage Passing By Weight
2 1/2"	100
1 1/2"	80- 100
3/4"	60- 95
No 4	35- 65
No 8	25- 50
No 30	5- 25
No 200	0- 3

6 8 Earth Pressure

The underground walls of the buildings which are supported at intermediate supports, drained and backfilled as recommended above, shall be designed for an equivalent fluid pressure of 0 7 gm/cm^3 (700 kg/m^3)

The cantilever retaining walls, drained and backfilled as recommended above, shall be designed for an equivalent fluid pressure of 0 55 g/cm^3 (550 kg/m^3)

Additional lateral pressures exerted on the underground walls from slabs and footings at higher elevations and/or from surcharge loads shall be considered in the structural design

6 9 Important Notes

The following important points should be taken into consideration at the design stage and during construction

- Lateral support (shoring system) may be required and shall be considered if the recommended side slopes in item 6 5 not be achieved for insufficient lateral distance or for any other reason especially at the sides adjacent to the existing roads and structures

- Supporting the adjacent roads and structures should be considered and the method and sequence of support should be studied and ensured prior to commencement of excavation

- Thorough inspection of the adjacent roads and structures and documentation's of any existing distortions, cracks, etc should be carried out prior to any commencement of work on the site

- Methods for protection of the site area from surface water coming form the adjacent roads and structures must be studied Any water, sewer or service pipes or manholes must be diverted from the plot if exists Methods for water drainage from the plot during excavation and construction must be studied and provided

- The type of foundation and its method of construction should be carefully studied if all area of plots in intended for utilization as built area

- Extreme care must be taken during excavation which should be carried out under close supervision Over excavation of the sides should be totally avoided and the effect of vibration or impact during excavation should be avoided

- The scheduling of excavation and construction should be provid maximum safety

All the above notes are outside the scope of this investigation and can be furnished upon your request

6 10 Foundation Excavation Inspection

The recommendations given in this report are based on the assumption that the subsurface materials and conditions do not deviate appreciably from those disclosed in the borings

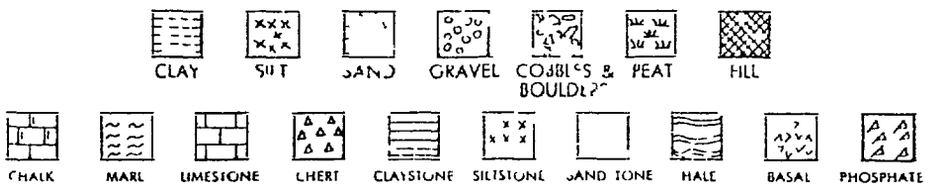
Our office should be notified, in writing, immediately after foundation excavation and before foundation construction to inspect the excavations and confirm that the required ground is reached and all the undesirable and loose materials are removed

APPENDIX A

LOGS OF BORINGS

LEGEND TO BORING LOGS

SYMBOLS FOR COMMON SOIL AND ROCK TYPES



SAMPLER TYPE

	HAMMER	CORE BARREL	AUGER	SHELBY TUBE	DRIVE CYLENDER (Manual)	DRIVE BARREL	DRIVE SPLIT SPOON (S P T)
Sample Disturbance	Disturbed	Relatively Undisturbed	Disturbed	Undisturbed	Relatively Undisturbed	Relatively Undisturbed	Disturbed

S P T (Blows/30 cm) The number of blows in the Standard Penetration test required to drive a five centimeter diameter split tube sampler a distance of thirty centimeters using sixty five kilograms weight falling seventy six centimeters

Fine Grained Soils

S P T (blows/ 30 cm)	Consistency	Field Identification	Unconfined Compressive Strength (kg/cm²)
0-2	Very soft	Easily penetrated several cms with fist	<0.25
2-4	Soft	Easily penetrated several cms with thumb	0.25–0.5
4-8	firm	Penetrated several cms by thumb with moderate effort	0.5–1.0
8-15	Stiff	Readily indented by thumb but penetrated only with great effort	1.0–2.0
15-30	Very Stiff	Readily intented by thumb nail	2.0–4.0
≥ 30	Hard	Indented with difficulty by thumb nail	> 4.0

Coarse Grained Soils

S P T (Blows/ 30 cm)	Description	Field Identification	Relative Density (%)
0-4	Very loose	Easily indented with finger thumb or fist	0–20
4-10	loose	less easily indented with fist but easily shoveled	20–40
10-30	Medium dense	Shoveled with difficulty	40–60
30-50	Dense	Requires pick to loosen for shoveling by hand	60–80
> 50	Very dense	Requires blasting or heavy equipment to loosen	80–100

Recovery The percentage of length of core recovered in each run to the total length of the core run

R.Q.D The Rock Quality Designation is the percentage of the sum of lengths of infact core pieces ten centimeters or longer to the total length of the core run

Point Load Strength and Unconfined Compressive Strength

In the point load test a rock core is loaded between two steel cones and failure occurs by tensile splitting A point load strenght index I_s is calculated as the ratio of the applied load P at rupture to the square of the distance H between the loading points $I_s = P/H^2$

A correlation that is commonly used between the point load index and the unconfined compressive strength q_u of a cylender with a length to diameter ratio of 2 to 1 is $q_u = 24\ I_{s(50)}$

where $I_{s(50)}$ is the point load strength corrected to a diameter of 50 mm (Brock and Franklin 1972)

Rock Quality

Rock Quality Designation RQD (%)	Rock Quality Description
0–25	Very Poor
25–50	Poor
50–70	Fair
70–90	Good
90–100	Excellent

Rock Strength

Description	Point Load strength (for 50 mm diameter sample) $I_{s(50)}$ (kg/cm²)	Unconfined Compressive strength (kg/cm²)
Very Weak	<0.5	<12.5
Weak	0.5–2	12.5–50
Moderately Weak	2–5	50–125
Moderately Strong	5–20	125–500
strong	20–40	500–1000
Very strong	> 40	> 1000

ARAB CENTER FOR ENGINEERING STUDIES

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 1 (Cont'd)

LOCATION AL-Abdali (S95148) **ELEVATION** 98 54

DRILLING DATE 17/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 18 0m

Depth (m)	S T	REC (%)	RQD (%)	S.P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-								-
-11								
-						Creamy to light rosy weak to moderately weak marlstone , occasionally with thin bands of chert.		-
-12								-
-							38 3	2 037
-13		90	30					-
-								-
-14							44 0	2 081
-		90	40					-
-15								-
-								-
-16		80	15					-
-								-
-17							24 9	2 006
-		80	20					-
-18								
-								-
-19								-
-						End Of Boring		
-20								
							2	2

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N.E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 2

LOCATION AL-Abdali (S95148) **ELEVATION** 98 28

DRILLING DATE 16/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 23 0m

Depth (m)	S T	REC (%)	RQD (%)	S.P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-						Fill materials composed of rock crushing and asphalt mixture		-
-1								–
-								-
-2								–
-								-
-3								–
-								-
4								–
-						* From 2 5 m to 5 0 m no sampels could be obtained due to loss of air circulation which indicate that fraible and loose materials are encountered		-
-5								
-								-
-6								–
-								-
-7								–
-		50	0					-
-8								–
-								-
-9								–
-								-
-10								–
							1	3

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 2 (Cont'd)

LOCATION AL-Abdali (S95148) **ELEVATION** 98 28

DRILLING DATE 17/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 23 0m

Depth (m)	S T	REC (%)	RQD (%)	S P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-11								
-12		90	35			Creamy to light rosy weak to moderately weak marlstone , occasionally with thin bands of chert	47 2	2 105
-13								
-14		90	30				39 6	2 051
-15		80	10				27 1	2.030
-16								
-17		60	0					
-18								
-19								
-20								
							2	3

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 3

LOCATION AL-Abdali (S95148) **ELEVATION** 98 18

DRILLING DATE 19/9/1995 **GROUND WATER DEPTH** 11 0

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 18 0m

Depth (m)	S T	REC (%)	RQD (%)	S.P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-						Fill materials composed of rock crushing and asphalt mixture		
-1						Interbedded to intercalated materials composed of grey, fractured , moderately strong silicified limestone and vary colored , fractured moderately strong chert and occasionally with thin interbeds of rosy marlstone and marl		
-2								
-		85	20				51 6	2 140
-3								
-						*From 8 0 to 10 0 m thickly bedded with light rosy very weak marl		
4								
-5		80	0					
-6								
-7								
-8								
-							3 19	1 799
-9		85	25					
-							4 33	1 789
-10								
							1	2

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT . New MWI Training building **BORING NO** 3 (Cont'd)

LOCATION AL-Abdali (S95148) **ELEVATION** 98 18

DRILLING DATE 17/9/1995 **GROUND WATER DEPTH** 11 0

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 18 0

Depth (m)	S T	REC (%)	RQD (%)	S P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-				W				-
-11								
-								-
-12		70	0			Creamy to light rosy , weak to moderately weak marlstone , occasionally with thin bands of chert		-
-								-
-13						*From 11 0 to the end of boring wet samples were obtained		-
-		40	0					-
-14								-
-								-
-15		50	0					-
-								-
-16								-
-		50	0					-
-17								-
-		40	0					-
-18								
-						End Of Boring		-
-19								-
-								-
-20								-
							2	2

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 4

LOCATION AL-Abdali (S95148) **ELEVATION** 97 99

DRILLING DATE 16 and 17/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 18 0 m

Depth (m)	S T	REC (%)	RQD (%)	S.P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-						Fill materials composed of rock crushing and asphalt mixture		-
-1						Interbedded to intercalated materials composed of grey fractured , moderately strong silicified limestone and vary colored , fractured moderately strong chert and occasionally with thin interbeds of rosy marlstone and marl		
-								-
-2								–
-								-
-3						*From 2 5 to 4 0 m thickly bedded with creamy moderately weak marlstone	39 3	2.085
-		90	40					-
-4						*From 8 0 to 9 0 m, thickly bedded with light rosy,weak marl		–
-								-
-5								–
-								-
-6								–
-								-
-7								–
-								-
-8								–
-		90	20				4 21	1 792
-9								–
-								-
-10								–
							1	1

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 4 (Cont'd)

LOCATION AL-Abdali (S95148) **ELEVATION** 97 99

DRILLING DATE 17/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 18 0m

Depth (m)	S T	REC (%)	RQD (%)	S.P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-								-
-11								-
-								-
-12								
-						Creamy to light rosy , weak to moderately weak marlstone , occasionally with thin bands of chert	45 1	2 112
-13		90	30					-
-								-
-14								-
-		85	35				36 2	2 012
-15								-
-							38 5	2 101
-16		90	10					-
-							-	-
-17								-
-		70	0					-
-18								
-						**End Of Boring**		-
-19								-
-								-
-20								-
							2	2

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 5

LOCATION AL-Abdali (S95148) **ELEVATION** 98 31

DRILLING DATE 18/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 23 0m

Depth (m)	S T	REC (%)	RQD (%)	S.P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-						Fill materials composed of brown silty clay crushed limestone		-
-1						Interbedded to intercalated materials composed of grey fractured moderately strong silicified limestone and vary colored fractured moderately strong chert and occasionally with thin interbeds of rosy marlstone and marl		
-								-
-2								–
-						*Existance of brown stiff to very stiff silty clay		-
-3						*Thin to medium beds of marlstone		–
-						*From 8 0 to 9 5 m, thickly bedded with rosy very weak marl		-
4								–
-		50	0					-
-5								–
-								-
-6								–
-								-
-7								–
-								-
-8								–
-							3 21	1 789
-9		90	15					–
-								-
-10								–
							1	3

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 5 (Cont'd)

LOCATION AL-Abdali (S95148) **ELEVATION** 98 31

DRILLING DATE 18/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 23 0m

Depth (m)	S T	REC (%)	RQD (%)	S P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-						Creamy to light rosy weak to moderately weak marlstone , occasionally with thin bands of chert		-
-11								–
-								-
-12								–
-						* I rom 15 5 m to the end of boring , very moist samples were obtained	46 2	2 1.2
-13		90	40					–
-							39 2	2 031
-14								–
-		85	30					-
-15								–
-							30 2	2 05.
-16		85	35					–
-								-
-17								–
-		80	20				46 5	2 113
-18								–
-							48 3	2 121
-19		80	15					–
-								-
-20		70	0					–
							2	3

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

LOGS OF BORING

PROJECT New MWI Training building **BORING NO** 5 (Cont'd)

LOCATION AL-Abdali (S95148) **ELEVATION** 98 31

DRILLING DATE 17/9/1995 **GROUND WATER DEPTH** N E

DRILLING METHOD ROTARY AIR FLUSH **TOTAL BORING DEPTH** 23 0m

Depth (m)	S T	REC (%)	RQD (%)	S P T (N)	SYM BOL	DESCRIPTION	qu (kg/cm^2)	Dd (gm/cm^3)
-							34 2	2 012
-21		70	15					–
-								-
-22								–
-		60	0					-
-23								
-								-
-24						End Of Boring		–
-								-
-25								–
-								-
-26								–
-								-
-27								–
-								-
-28								–
-								-
-29								–
-								-
-30								–
							3	3

1	S T	Sampler Type	4	SPT	Standard Penetration Test
2	REC	Core Recovery	5	qu	Unconfined Comp Str
3	RQD	Rock Quality Designation	6	Dd	Dry Density
7	N E	Not Encountered			

APPENDIX B

METHOD OF CALCULATIONS

82

APPENDIX B

METHOD OF CALCULATIONS

1 The bearing capacity of the soil is calculated with accordance of the Jordanian National Code for Footings, Foundations and Retaining Structures, clause 3/2/2, using Modified Terzaghi's Bearing Capacity Equation

$$qu = c\ ScNc + Pc\ SqNq + \frac{1}{2} S\gamma\ \gamma BN\gamma$$

$$qun = c\ ScNc + PcSq\ (Nq - 1) + \frac{1}{2} S\gamma \gamma BN\gamma$$

(used in case if the excavated soil is backfilled in its place after the constructing of the foundations)

$$qa = \frac{qun}{F\ S}$$

$$qtot = qa + \gamma oD$$

(used in case if the excavated soil is not backfilled in its place but the excavation is used to build a basement)

where

qu, qun and qa are bearing capacities (ultimate, net ultimate and net allowable, respectively)

F S is factor of safety

Sc, Sq & Sγ are shape factors

Nc, Nq & Nγ are bearing capacity factors

Pc is effective unit weight of the soil at the foundation level

γ is bulk density of the foundation ground

γo is bulk density of the overburden

D is height of overburden

Assuming quick failure, i e $\emptyset = 0$ thus Nc = 5 14, $N\gamma = \emptyset$ Nq = 1 and $C = \frac{quncon}{2}$

(where quncon is unconfined compression test result)

In this case the net allowable bearing pressure is

$\frac{1}{6}$ quncon x 5 14 for the strip footings, assuming B = 1m

(In normal circumstances for small buildings the allowable bearing capacity for a rectangular footing is taken as 1 2qa where qa is the allowable bearing capacity for a strip footing)

2 The bearing capacity of the rock is calculated with accordance of the Jordanian National Code for Footings, Foundations and Retaining Structures, clause 3/7, considering that the bearing capacity of the rock is equal to the uniaxial test result performed on the rock sample with a minimum diameter of (b = 50mm) and a height of (h = 2b) If the height of the rock sample (h < 2b), the bearing capacity will be calculated as follows

$$C = Ca/[0\ 88 + 0\ 24\ (\frac{b}{h})]$$

where

C is uniaxial pressure for the rock sample with b $\geq$ 50 mm and h = 2b which is equal to the bearing capacity of the rock

Ca is uniaxial compression test result performed on the rock sample

b is the diameter of the sample

h is the height of the sample

The net allowable bearing capacity of the rock is defined as

$$qa = \frac{C}{F\ S}$$

where

F S is a factor of safety which is varied from 5 (for the RQD $\geq$ 75%) to 20 (for the RQD $\leq$ 25%)

3 The immediate (short term) settlement of the soil is calculated using the settlement equation based on the theory of elastic presented in Foundation Analysis and Design by Joseph L Bowels Fourth Edition 1988, immediate settlement ΔH is estimated as

$$\Delta H = qa\ B\ \frac{1-\mu^2}{Es}\ I$$

where

qa is net allowable bearing capacity

B is foundation width

μ is Poisson's ratio ($\mu \approx 0\ 3$ for silty clay and marl)

I is combined shape and rigidity factor ($I \approx 1\ 33$)

Es is modulus of elasticity obtained from the stress-strain relationship

المملكة الاردنية الهاشمية

امانة عمان الكبرى

منطقة العبدلي

رقم الوارد

رقم الصادر ٢٠٢٤

رقم الوصول

التاريخ

مخطط موقع تنظيمي

اسم المالك

اسم الاستعمال: وزارة المياه والري / سلطة المياه

رقم القطعة: ٧٥-١-٢١-٨ ٦-٦١٢-٦٢٩-٦٨٢ / ٥٩٢

اسم الحوض: اللويبدة الشمالي رقم ١١

رقم الحوض: ١٢

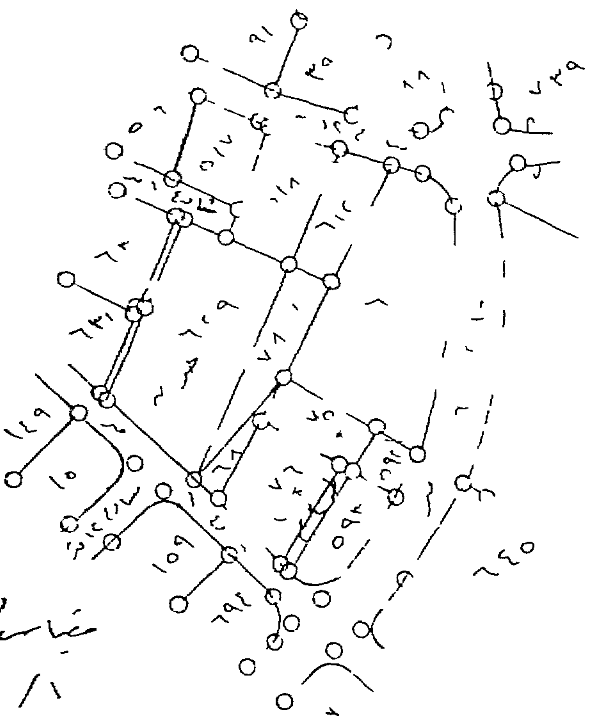
مساحة القطعة: / حيازة حيازة

صفة الاستعمال: "سكن ج ومصلحة [illegible]"

الاحكام	سكن ب		
الامامي	٤,- م		
جانبي	٤,- م		
خلفي	٦,- م		
نسبة البناء	٤٢٪		
نسبة الطوابق	/		
	٤ ادوار		
	١٥ متر		
	٧٥٠ م٢		
	١٨ متر		

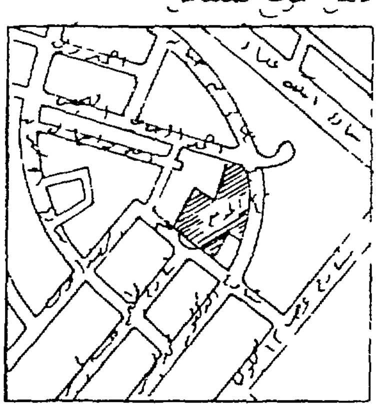
مخطط رقم: ٢٢ - ٧
تاريخ الاعداد: ١٩٨٧/٦/٢٥
تاريخ التصديق: /
المخطط: تحديث / مصدق نهائيا

ملاحظات: القطعة رقم ٦٢٩ مخصصة حرانية ما



مقياس الرسم ١/ ٥٠٠

دليل موقع مقياس ١ / ٣١



لوحة (   )

رسم عبدالله ابو حماموس ١٩٩٥/٤/١٢	مدقق مهندس التنظيم (عبدالكريم الوري)	موافقة رئيس القسم الهندسي م. زياد الريحاني

ملاحظة ١ - مخطط الموقع صالح لمدة سنة واحدة من تاريخ صدوره.

٢ - يعتبر هذا المخطط لاغياً اذا صدرت عليه اية معلومات او بيانات خلافاً لاي مخطط تنظيمي.

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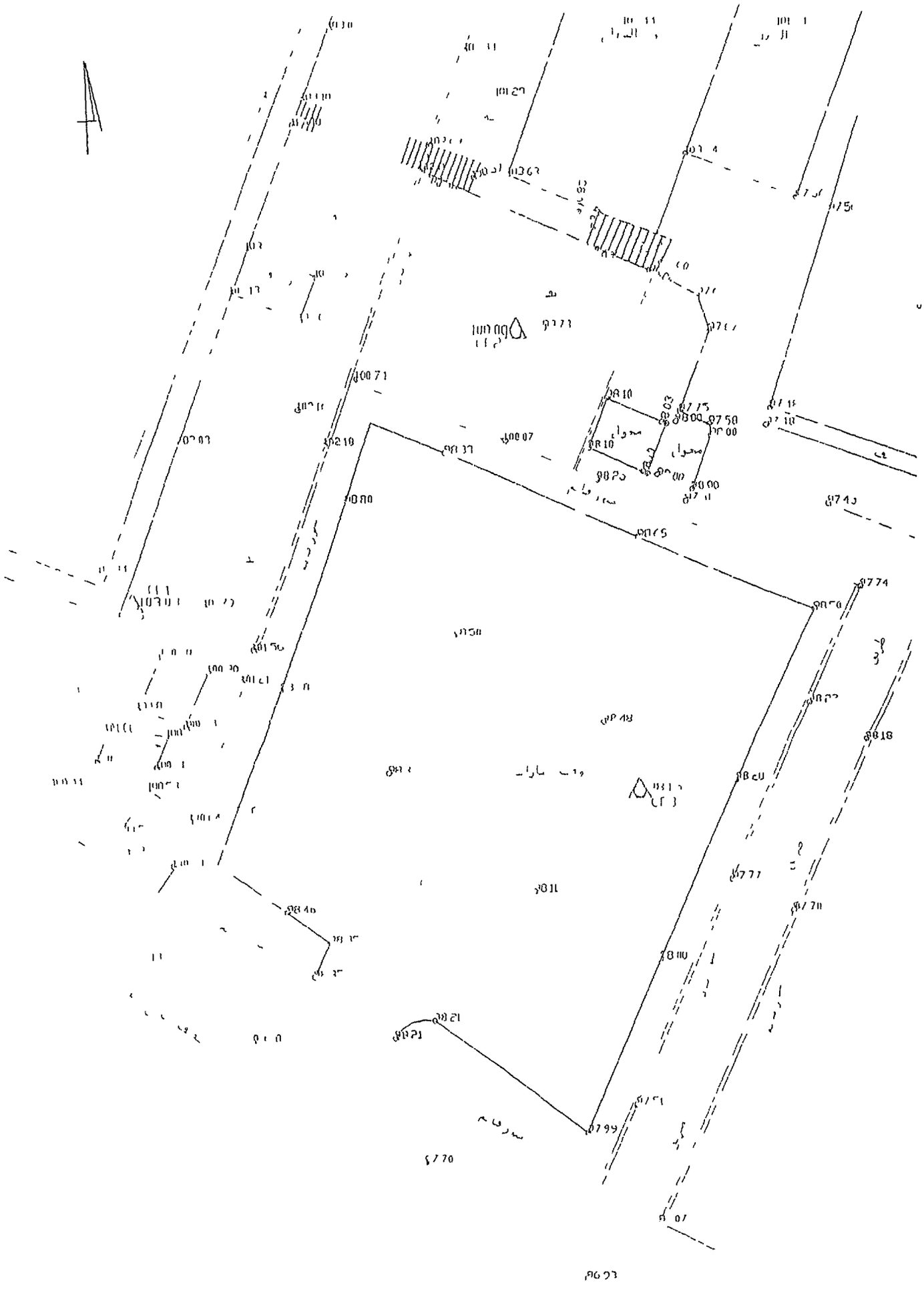

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