

**GROUNDWATER QUALITY OF
BOREHOLES USED FOR DOMESTIC
CONSUMPTION IN PERLIS**



**INSTITUT PENGURUSAN PENYELIDIKAN
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR
MALAYSIA**

BY:

**JAZURI ABDULLAH
AHMAD KAMAL MD ISA
AZURA AHMAD**

APRIL 2009

TABLE OF CONTENTS

CHAPTER	PAGE
<i>Letter of Research Letter of Report Submission Project Team Members Acknowledgement</i>	
<i>List of Figures</i>	<i>vii</i>
<i>List of Tables</i>	<i>ix</i>
<i>List of Abbreviations</i>	<i>x</i>
<i>Abstract</i>	<i>xi</i>
1.0 INTRODUCTION	
1.1 Background of Study	1
1.2 Problem Statement	3
1.3 Objective	4
1.4 Significance of Study	5
1.5 Scope of Study	6
2.0 LITERATURE REVIEW	
2.1 Introduction	8
2.2 Groundwater Zone	9
2.3 Type of Aquifer	10
2.3.1 Unconfmed Aquifer	10

2.3.2 Confined Aquifer	11
Perlis Geology	12
2.4.1 Setul Limestone Formation	12
2.4.2 Kubang Pasu Formation	12
2.4.3 Chuping Limestone Formation	13
2.4.4 Tertiary Bukit Arang Formation	13
Previous Groundwater Study	13
Groundwater Usage	15
2.6.1 Usage for Domestic Water Supply	15
2.6.2 Usage in Industrial	15
2.6.3 Usage in Irrigation Area	16
Groundwater Quality	16
2.7.1 Silica	17
2.7.2 Iron	18
2.7.3 Manganese	18
2.7.4 Calcium	18
2.7.5 Magnesium	19
2.7.6 Sodium	19
2.7.7 Sulphate	19
2.7.8 Chloride	20
2.7.9 Fluoride	20
2.7.10 Nitrate	20
2.7.11 Dissolve Solid	21
2.7.12 pH	21
2.7.13 Hardness	21

2.8	Pollution of Groundwater	22
	Water Treatment	22
2.9.1	Aeration	24
2.9.2	Coagulation	25
2.9.3	Flocculation	26
2.9.4	Sedimentation	26
2.9.5	Filtration	27
2.9.6	Disinfection	27
2.9.7	Iron and Manganese Removal	28
2.9.8	Water Softening	28
2.9.9	Reverse Osmosis	29
	Current Treatment	29
	Conclusion	31

3.0 METHODOLOGY

3.1	Introduction	32
3.2	Data Collection	32
3.3	In-situ Test	34
3.4	Sampling	35
3.5	Preservation	36
3.6	Labelling	37
3.7	Laboratory Test	37
3.8	Spectrophotometer	38
	3.8.1 Determination of COD	38
	3.8.2 Determination of Chromium	39
3.9	Pal instest Interface Photometer	39

3.9.1	Determination of Ammonia	40
3.9.2	Determination of Copper	40
3.9.3	Determination of Hardness	41
3.9.4	Determination of Iron LR	41
3.9.5	Determination of Iron HR	42
3.9.6	Determination of Manganese	42
3.9.7	Determination of Nitrate	43
3.9.8	Determination of Sulphate	43
3.9.9	Determination of Zinc	44
3.9.10	Determination of Colour	44
3.10	ELE Paqualab System	45
3.11	Turbidity Meter	46
3.12	Mohr's Titration Method	47
3.13	Data Analysis	47

RESULTS, ANALYSIS AND DISCUSSIONS

4.1	Introduction	49
4.2	Groundwater Quality	49
4.2.1	Chuping Limestone Formation	50
4.2.2	Tertiary Bukit Arang Formation	52
4.2.3	Setul Limestone Formation	54
4.2.4	Kubang Pasu Formation	56
4.3	Comparison of Groundwater Water Properties	58
4.3.1	Copper	58
4.3.2	Hardness	60
4.3.3	Dissolve Oxygen	61

4.3.4 Chloride	62
4.4 Groundwater Quality Trend	63
4.4.1 Chloride	63
4.4.2 Hardness	64
4.4.3 Iron	65
CONCLUSIONS AND RECOMMENDATIONS	
5.1 Introduction	67
5.2 Conclusions	67
5.2.1 Conclusion on Properties of Groundwater	67
5.2.2 Conclusion on Comparison with Water Quality Standard	68
5.2.3 Conclusion on Proposed Method of Treatment	68
5.2.4 Conclusion on Groundwater Quality Comparison Between Location	69
5.2.5 Conclusion on Groundwater Quality Trend	69
5.3 Recommendations	69

REFERENCES

ABSTRACT

Toward 21st century, water demand keeps increasingly from time to time. Groundwater may be an alternative to fulfil the water demand especially at the dry area such as Perlis. To serve the population with the groundwater, the quality of the groundwater is a major factor to be consider as it contamination may be harmful to human health concern. In this study the quality of the groundwater is to be identified where groundwater from 4 different formation in Perlis which is Chuping Limestone formation, Setul Limestone fonnation, Tertiary Bukit Arang formation and Kubang Pasu formation is measured through onsite and laboratory test. From the test, the groundwater quality is found differed with each other. Iron, hardness, copper, chloride and COD concentration is found high at certain location. While several parameter is found has exceeded the Drinking Water Quality Standard where at all location the groundwater contain total coliform and faecal coliform. Several water treatment methods has been proposed to ensure the groundwater usage is safe for the consumer regarding to human health concern.

**Key Words: GROUNDWATER QUALITY; CONSUMER CONSUMPTION;
PERLIS**