

Table of Contents

ACKNOWLEDGEMENT	ii
ABSTRACT	iii
INTISARI.....	iv
Table of Contents	v
List of Figures	viii
List of Tables.....	x
List of Appendices	xi
CHAPTER 1	1
INTRODUCTION	1
1.1. Background	1
1.2. Problem Formulation.....	2
1.3. Research Objectives	2
1.4. Expected Outcomes	2
1.5. Scope of Research	3
1.5.1. Scope of Research area	3
1.5.2. Scope of Research works	3
1.6. Previous Researchers.....	5
1.7. Originally of Research.....	5
CHAPTER 2	6
LITERATURE REVIEW.....	6
2.1. Regional Geology and Hydrogeology	6
2.1.1. Regional Geology.....	6
2.1.2. Regional Hydrogeology	13

2.2.	Basic Theory.....	16
2.2.1.	The concept of groundwater vulnerability pollution.....	16
2.2.2.	Groundwater contamination.....	19
2.2.3.	Classifying groundwater Vulnerability	20
2.2.4.	Groundwater vulnerability mapping	21
2.2.5.	Groundwater vulnerability mapping method	21
2.3.	Hypothesis	34
CHAPTER3		35
RESEARCH METHODOLOGY		35
3.1.	Research Material.....	35
3.1.1.	Research Fund.....	35
3.1.2.	Research Equipment's and Tools.....	35
3.2.	Steps of work.....	36
3.2.1.	Research preparation stage.....	36
3.2.2.	field investigation.....	36
3.2.3.	Analyses	37
3.2.4.	Reporting.....	37
3.3.	Research methodology	38
3.4.	Field works	39
3.4.1.	Groundwater Table Measurement.....	39
3.4.2.	Soil Sampling	40
CHAPTER4		41
RESULTS AND DISCUSSTION.....		41
4.1.	Geology of Study Area.....	41
4.1.1.	Geomorphology	41

4.1.2. Geology	42
4.2. Hydrology condition of Study Area	44
4.2.1. Temperature	44
4.2.2. Rainfall	44
4.2.3. Run-off	47
4.2.4. Land use	47
4.3. Hydrogeology of study area	48
4.3.1. Groundwater Depth	48
4.3.2. Groundwater flow pattern	49
4.3.3. Aquifer System	50
4.4. Groundwater Vulnerability	51
4.4.1. DRASTIC Method	52
4.4.2. SVV Method	59
4.4.3. Nitrate in Groundwater	64
4.4.4. Map comparison Nitrate Concentration and degree of vulnerability .	65
4.4.4.1. Nitrate Concentration in DRASTIC Map	65
4.4.4.2. Nitrate Concentration in SVV Map	67
4.5. Comparing DRASTIC and SVV Map	68
CHAPTER 5	72
CONCLUSION AND RECOMMENDATION	72
5.1. Conclusion	72
5.2. Recommendation	73
REFERENCES	74
APPENDICES	76

List of Figures

Figure1.1:	Location of study area	4
Figure2.1:	Geomorphological map of Kulon Progo (Santosa, 2010)	7
Figure2.2:	Geological map of Gulon Progo (Van Bemmelen, 1949)	10
Figure2.3:	Aquifer cross section of Wates formation aquifer (MacDonald & Partners, 1984).....	15
Figure2.4:	Cross-section of Sand dune aquifer (MacDonald & Partners, 1984)	16
Figure2.5:	Natural purification of contaminated water (Vrba and Zoporozec, 1994).....	17
Figure2.6:	Parameter and evaluation of groundwater vulnerability in SVV method (Putra, 2007).	31
Figure 3.1:	Location of the dug well in study area	39
Figure 3.2:	Location of soil sampling in study area.....	40
Figure3.3:	Soil sampling and Groundwater table measurements.	40
Figure 4.1:	Geomorphological map of study area.....	41
Figure 4.2:	Geological map of study area	42
Figure 4.4:	Cross section in the study area	43
Figure 4.5:	Annual rain fall in study area	45
Figure 4.6:	Annual Precipitation map in Study area.....	45
Figure 4.7:	Annual Evapotranspiration map in study area.....	46
Figure 4.8:	Run-off map in study area	47
Figure 4.9:	land use map in study area.....	48
Figure 4.10:	Depth to groundwater table in study area.....	49
Figure 4.11:	Groundwater flow pattern in study area	50
Figure 4.12:	Aquifer Media map in study area	51
Figure 4.13:	Depth to groundwater map ranting to DRASTIC method in Wates Groundwater Basin.....	52
Figure 4.14:	Net recharge map rating to DRASTIC method in Wates Groundwater	53

Figure 4.15: Aquifer Media map rating to DRASTIC method in Wates Groundwater Basin.....	54
Figure 4.16: Soil Media map rating to DRASTIC method in Wates Groundwater Basin.....	55
Figure 4.17: Slope map rating to DRASTIC method in Wates Groundwater Basin.....	56
Figure 4.18: Impact of vadose zone media map rating to DRASTIC method in Wates Groundwater Basin.....	57
Figure 4.19: Hydraulic Conductivity map rating to DRASTIC method in Wates Groundwater Basin.....	58
Figure 4.20: Map of Intrinsic Vulnerability in Wates Groundwater Basin using DRASTIC method.....	59
Figure 4.21: Depth to groundwater table map rating to SVV method in Wates Groundwater Basin.....	60
Figure 4.22: Net Recharge map rating to SVV method in Wates Groundwater Basin.....	61
Figure 4.23: Overlay Lithological and soil media rating to SVV method in Wates Groundwater Basin.....	62
Figure 4.24: Map of Intrinsic Vulnerability using SVV Method in Wates Groundwater Basin.....	63
Figure 4.25: Land-use with Nitrate samplings in Wates Groundwater Basin ...	65
Figure 4.26: Diagram of Nitrate Concentration in Groundwater DRASTIC Method.....	66
Figure 4.27: Nitrate Concentration in Groundwater within of Degree of Vulnerability DRASTIC Method	66
Figure 4.28: Diagram of Nitrate Concentration in Groundwater SVV Method	67
Figure 4.29: Nitrate Concentration in Groundwater within of Degree of Vulnerability SVV Method	68
Figure 4.30: DRASTIC of Degree Vulnerability in Wates Groundwater Basin.	70
Figure 4.31: SVV of Degree Vulnerability in Wates Groundwater Basin.....	71

List of Tables

Table1.1:	Previous of Researchers	5
Table 2.2:	Natural processes controlling human influence on groundwater quality (modified from Langmuir, 1972).	19
Table2.3:	Classification of Groundwater Vulnerability (Foster et al., 2002)	20
Table2.4:	Classification of DRASTIC index value(Lobo-Ferreira et al, 2003)	22
Table2.5:	Ranges and Ratings for Depth to water (Aller, et al., 1987)	23
Table2.6:	Ranges and Ratings for Net Recharge(Aller et al., 1987)	23
Table2.7:	Ranges and Ratings for Aquifer Media(Aller et al., 1987)	24
Table2.8:	Ranges and Ratings for Soil Media(Aller et al., 1987)	26
Table2.9:	Ranges and Ratings for Topography(Aller et al., 1987)	28
Table2.10:	Ranges and Rating for Impact of vadose zone media(Aller et al., 1987).....	30
Table2.11:	Range and Rating of Hydraulic Conductivity (Aller et al., 1987).	30
Table2.12:	SVV values for the thickness of unsaturated zone (Z) according	32
Table2.13:	SVV Values for percolation rate factor (w_u) according to the	33
Table2.14:	SVV Values for overlying material factor (L) according to soils .	33
Table2.15:	Final rating of the SVV method and its classification of	34
Table3.1:	Some supportive equipment's or tools required in this research area.	35
Table 4.1:	Concentration of Nitrate in Wates Groundwater Basin.....	64
Table 4.2:	Similarity and Difference between DRASTIC and SVV method .	69