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**WATER RESOURCES ENGINEERING PROGRAMME**

**FINAL YEAR PROJECT REPORT**

**Design of an Embankment/Levee on River Malaba Bank**

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## ABSTRACT

A levee or dyke is defined as an earthen embankment extending generally parallel to the river channel and designed to protect the area behind it from overflow of flood waters.

Embankments are the oldest known forms of flood protection works and have been used extensively for this purpose. These serve to prevent inundation, when the stream spills over its natural section, and safeguard lands, villages and other properties against damages.

Amoni village experiences tropical climate with both wet and dry seasons, the village experiences a problem of water spilling over the natural section damaging lands, villages and other properties.

The main research objective was to design an embankment/Levee on the River Malaba bank in Amoni village and specific objectives were to determine the topography of the project site, determine the type and physico – mechanical characteristics of the soil at the project site, determine the key climate factors contributing to floods and determine the cost-benefit analysis of the project.

The historical background, types, components and classification of Levee, the reasons which justify the need for Levee, water resources and evolution of irrigation in Uganda, design requirements for an embankment for flood control have been discussed in the literature review. Stability analysis of the embankment, dimensions of the channel by partial filling and partial cutting, design and determination of the runoff flow rate are also discussed in the literature review.

The methods used in data collection during the research included; desk study, oral interviews, consultations and discussions, carrying out topographic surveys, laboratory soil sample tests, and infiltration tests. Climatic data for 13 years for Tororo discharge and water level data for 50 years from the current year of River Malaba were obtained and Software's like MS Excel were used in analyzing the collected data.

The embankment parts; berm width, crest width, top width and drainage blanket filters were designed using the analyzed data and appropriated materials were selected. Detailed drawings were generated using AutoCAD in two dimensions.

Challenges like delay of design data, difficulty in obtaining soil sampling equipment like a core were encountered during the research. Flood control in Amoni village is possible if the project is implemented. However, Environment Impact Assessment (EIA) must be conducted before commencement of the project, a bye law to prevent all forms of human activities that can cause the degradation of the river within the project area and the levee should be fenced off with lockable fence to restrict animal traffic.

## DEDICATION

I dedicate this report to almighty God and my parents who tirelessly supported and guided me up to this stage in my life.

## ACKNOWLEDGEMENT

First and foremost, I would like to thank Almighty God for His protection and guidance up to this stage in my life.

I feel highly indebted to the entire staffs in the department of Water Resources engineering for giving me knowledge in the fields of Water and Water resources.

Specifically, I am very grateful to Eng. Okello Geatano and Mr. Otim Daniel my final year project supervisors who gave me all the necessary guidance, advice and encouragement during preparation of this report, May the Almighty God bless you abundantly.

Last but not least, I appreciate my parents, Mr. and Ms. Okello, for the support they have continued to offer me in order to attain quality education. May the Almighty God bless the work of your hands and may He make you live long enough to enjoy the fruits of your labors.

Finally I thank all my friends and colleagues for the assistance they have given me in endeavors to see me through with my research.

**DECLARATION**

I **OPIRA ALFRED** hereby declare to the best of my knowledge that this is my true and original piece of work and has never been submitted to any university or institution of higher learning by anybody for any academic award.

Signature.....

Date .....



**APPROVAL**

This piece of work has been approved by;

Main Supervisor

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## Table of Contents

ABSTRACT.....	i
DEDICATION.....	iii
ACKNOWLEDGEMENT.....	iv
<b>DECLARATION.....</b>	<b>v</b>
<b>APPROVAL.....</b>	<b>vi</b>
ACRONYMS AND SYMBOLS.....	xi
LIST OF FIGURES.....	xii
LIST OF TABLES.....	xiii
LIST OF EQUATIONS.....	xiv
LIST OF APPENDICES.....	xvi
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background.....	1
1.2 Problem statement.....	2
1.3 Purpose of the Study.....	2
1.4 Justification.....	2
1.5 Objectives of the Study.....	3
1.5.1 Main Objective.....	3
1.5.2 Specific Objectives.....	3
1.6 Scope of the study.....	3
CHAPTER TWO: LITERATURE REVIEW.....	4
2.1 Preamble.....	4
2.1.1 Brief Historical Perspective of Flood management and river training works.....	4
2.1.2 Classification.....	4
2.1.3 Water Resources in Uganda.....	5
2.1.4 Evolution of irrigation development in Uganda.....	5
2.2 Causes of damages of Embankment.....	6
2.2.1 Countermeasures for design.....	6
2.3 Topographic Investigation surveys.....	6
2.3.1 Topographical data.....	6
2.3.4 Preliminary site survey.....	7
2.4 Soils Investigation.....	7



2.4.1 Soil pits and trenches .....	7
2.4.2 Texture tests .....	7
2.4.3 Laboratory Tests .....	9
2.4.4 Infiltration Tests.....	9
2.5 Key Climatic factors contributing to floods.....	9
2.5.1 Hydrologic Analysis Rainfall Analysis .....	9
2.5.2 Runoff Analysis .....	9
2.5.3 Sediment transport .....	11
2.5.4 Estimation of Bed Load .....	12
2.6 Types of Embankment.....	14
2.6.1 Design of Embankment.....	14
2.6.2 Hydraulic Design of Earth-Embankment.....	15
2.6.3 Design of open channels .....	15
2.6.4 Best hydraulic section .....	15
2.6.5 Channel in Partial Cutting and Partial Filling.....	15
2.6.6 Freeboard .....	16
2.6.7 Top width of Banks.....	17
2.6.8 Berm Width.....	18
2.6.9 Balanced Depth of Cutting.....	19
2.7 Structural Design of Earth- Embankment.....	21
2.7.1 Embankment .....	21
2.7.2 Freeboard .....	21
2.7.3 Crest Width.....	22
2.7.4 Tentative section (Upstream and Downstream slopes).....	23
2.7.5 Borrow Pits.....	23
2.7.6 Slope Protection against Erosion .....	24
2.7.7 Phreatic Line in an Embankment .....	24
2.7.8 Stability Analysis of an Embankment.....	26
2.8 Safety against cracks due to unequal settlement and wetting .....	38
2.8.1 Causes of failure of embankment.....	39
2.8.2 Preventive measures.....	39
2.8.3 Closure of breach .....	39

2.8.4 Protection of embankment. ....	40
2.8.5 Merits and demerits of embankments. ....	40
2.8.7 Demerits. ....	40
2.8.9 Some of the measures to counter those Demerits are: ....	41
2.9 Economic Analysis .....	42
2.9.1 Evaluation of Flood Control Project .....	42
2.9.2 Project Benefits .....	43
2.9.3 Bank Erosion Damages.....	44
2.9.4 Economic Cost .....	45
2.9.5 Economic Life of the Project .....	45
CHAPTER THREE: METHODOLOGY.....	46
3.1 Preamble. ....	46
3.2 Tools and equipment used in the study.....	46
3.3 Data collection techniques. ....	46
3.3.1 Desk study.....	46
3.3.2 Consultations.....	46
3.3.3 Interviews.....	47
3.3.4 Topographic survey.....	47
3.3.5 Sample Testing.....	47
3.3.6 Climatic data collection. ....	47
3.3.7 Hydrological data for River Malaba .....	48
3.4 Data analysis .....	48
3.5 Actual design of the Levee.....	48
CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND DESIGN.....	50
4.1 Preamble. ....	50
4.2 Study and Analysis of the Topographical Aspect. ....	50
4.2.1 Topographic Survey .....	50
4.2.2 Slope Computation.....	50
4.2.3 Location of the Levee. ....	51
4.3 Analysis and Discussion of the Soil Test Results. ....	51
4.3.1 Infiltration Tests.....	51
4.3.2 Laboratory Tests .....	53

4.4 Hydrological analysis of the rainfall data .....	58
4.4.1 Consistency .....	58
4.4.2 Rainfall intensity .....	59
4.4.3 Delineated catchment area of River Malaba .....	64
4.4.4 Maximum flood discharge Q. ....	64
4.4.5 Estimation of the bed load .....	65
4.6 Water Level for River Malaba at the NWSC Tororo Intake point.....	69
4.6.1 Embankment .....	70
4.6.2 Height of the Embankment .....	70
4.6.3 Total Freeboard Computation .....	70
4.6.4 Crest Width .....	71
4.6.5 Upstream and Downstream slopes .....	71
4.6.6 Seepage Control .....	72
4.6.7 Slope Protection against Erosion. ....	72
4.6.8 Upstream Slope protection x.....	72
4.6.9 Downstream slope protection.....	73
4.7 Plotting the Seepage Line/ Phreatic Line.....	73
4.7.1 Stability Analysis of the Embankment Using the Approximation Method.....	74
4.7.2 Overall stability of the Embankment .....	74
4.8 Basic rates. ....	80
CHAPTER FIVE: CHALLENGES FACED, CONCLUSION AND RECOMMENDATIONS .....	86
5.1 Preamble .....	86
5.1 Challenges faced .....	86
5.2 Conclusion .....	86
5.3 Recommendations .....	86
REFERENCES .....	88
APPENDICES .....	89

## ACRONYMS AND SYMBOLS

NSL	:	Natural Surface Level
HFL	:	High Flood Level
SPF	:	Standard Project Flood
PMF	:	Probable Maximum Flood
Cumecs	:	Cubic meter per second
C/S Slope	:	Country side slope
B.C. Ratio	:	Benefit-Cost Ratio
BIS	:	Bureau of Indian Standard
USBR	:	United States Bureau of Reclamation.
IDF	:	Intensity Duration Frequency Curve
AFD	:	Annual Flood Damages
RA	:	Residential Area
CIA	:	Commercial/Industrial Area.
AA	:	Agricultural Area
AVRA	:	Assessed Value of damageable property within Residential Area
AVCIA	:	Assessed Value of damageable property within Commercial Industrial Area.
AVAA	:	Assessed Value of damageable property within Agricultural Area
ABED	:	Annual Bank Erosion Damages.
TAVP	:	Total Assessed Value of Property within the threatened area.
PL	:	Project Life.

## LIST OF FIGURES

FIGURE 1: USDA SOIL CLASSIFICATION TEXTURE DIAGRAM.....	8
FIGURE 2: CHANNEL IN PARTIAL CUTTING AND PARTIAL FILLING.....	16
FIGURE 3: CHANNEL IN PARTIAL CUTTING AND PARTIAL FILLING WITH THE BERM WIDTH.....	19
FIGURE 4: SHOWING BALANCED DEPTH OF CUTTING.....	20
FIGURE 5: PLOTTED SEEPAGE LINE ON THE LEVEE CROSS-SECTION .....	26
FIGURE 6: OVERALL STABILITY OF THE EMBANKMENT .....	27
FIGURE 7: STABILITY OF THE DOWN STREAM SLOPE .....	29
FIGURE 8: STABILITY OF THE UPSTREAM SLOPE.....	32
FIGURE 9: STABILITY OF FOUNDATION AGAINST HORIZONTAL SHEAR.....	35
FIGURE 10: INFILTRATION DEPTH AGAINST TIME .....	52
FIGURE 11: INFILTRATION RATE AGAINST TIME .....	53
FIGURE 12: GRAPH SHOWING GRADING RESULTS.....	55
FIGURE 13: GRAPH SHOWING ATTERBERG TEST RESULT.....	57
FIGURE 14: CONSISTENCY TEST FOR TORORO RAINFALL DATA .....	58
FIGURE 15: GRAPH OF MAXIMUM DAILY RAINFALL (MM) AGAINST RETURN PERIOD, T.....	60
FIGURE 16: INTENSITY-DURATION-FREQUENCY (IDF) CURVE FOR TORORO.....	63
FIGURE 17: MAP SHOWING DELINEATED CATCHMENT AREA OF RIVER MALABA.....	64
FIGURE 18: CHANNEL BY PARTIAL FILLING AND CUTTING .....	69
FIGURE 19: LEVEE CROSS-SECTION SHOWING PLOTTED PHREATIC/SEEPAGE LINE.....	74

## LIST OF TABLES

TABLE 1: CLASSIFICATION OF EMBANKMENT .....	4
TABLE 2: SHOWING RATIONAL RUNOFF COEFFICIENT .....	11
TABLE 3: RECOMMENDED SIDE SLOPES IN VARIOUS TYPES OF MATERIALS .....	16
TABLE 4: MINIMUM FREE BOARD .....	17
TABLE 5: THE VALUES OF THE MINIMUM TOP WIDTH OF BANKS AS GIVEN IN THE TABLE .....	18
TABLE 6: SHOWING THE EMBANKMENT TOP WIDTH FOR THE CORRESPONDING TOTAL HEIGHT OF EMBANKMENT .....	22
TABLE 7: RECOMMENDED EMBANKMENT SLOPES-TERZAGHI .....	23
TABLE 8: COORDINATES AND ELEVATION OF THE PROJECT SITE FROM GPS .....	51
TABLE 9: SHOWING INFILTRATION TEST RESULTS .....	52
TABLE 10: GRADING RESULTS .....	54
TABLE 11: SHOWING THE SOIL CLASSIFICATION USING COEFFICIENT OF UNIFORMITY CU AND DEGRADATION CK .....	55
TABLE 12: PROCTOR (COMPACTION) TEST .....	56
TABLE 13: ATTERBERG TEST .....	57
TABLE 14: MAXIMUM DAILY RAINFALL IN A YEAR AND THEIR RELATIVE RANKS .....	59
TABLE 15: MAXIMUM DAILY RAINFALL DATA AND CORRESPONDING RETURN PERIODS (T) .....	60
TABLE 16: RETURN PERIOD, MAXIMUM 24-HOUR RAINFALL, MAXIMUM 24-HOUR INTENSITY AND COEFFICIENT $a^T$ .....	61
TABLE 17: TIME OF CONCENTRATION AND INTENSITY AT VARIOUS RETURN PERIODS .....	62
TABLE 18: SHOWING COMPUTATION OF DESIGN DISCHARGE USING GUMBEL'S METHOD .....	66
TABLE 19: REDUCED MEAN AND REDUCED STANDARD DEVIATION .....	67
TABLE 20: DIMENSION OF CHANNEL IN PARTIAL CUTTING AND FILLING .....	68
TABLE 21: SHOWING THE SUMMARY OF THE EMBANKMENT CROSS-SECTION DIMENSIONS .....	71
TABLE 22: SHOWING THE VALUES OF Y FOR DIFFERENT VALUES OF X .....	73
TABLE 23: BASIC RATES ADOPTED FOR PREPARING INDICATIVE COST-ESTIMATE .....	80
TABLE 24: ESTIMATE OF THE EMBANKMENT COSTS .....	82
TABLE 25: DAMAGEABLE PROPERTY AT THE FLOOD PRONE AREA .....	83
TABLE 26: BILL OF QUANTITY CAN BE GENERATED AS FOLLOWS .....	84

## LIST OF EQUATIONS

<i>EQUATION 1: THE TIME OF CONCENTRATION, <math>T_c</math></i> .....	10
EQUATION 2: MAXIMUM FLOOD DISCHARGE GIVEN BY THE RATIONAL FORMULA .....	10
<i>EQUATION 3: MEYER- PETER'S EQUATION</i> .....	12
EQUATION 4: STRICKLER'S FORMULA .....	13
EQUATION 5: DETERMINATION OF THE BED LOAD ESTIMATION FLOW RATE.....	13
EQUATION 6: THE MANNING EQUATION FOR FLOW IN THE CHANNEL.....	15
<i>EQUATION 7: THE VELOCITY OF THE FLOW</i> .....	15
<i>EQUATION 8: THE FLOW AREA OF THE CHANNEL</i> .....	15
<i>EQUATION 9: THE BOTTOM WIDTH OF THE CHANNEL</i> .....	15
<i>EQUATION 10: THE WETTED PERIMETER P</i> .....	15
EQUATION 11: DETERMINATION OF FREE BOARD FOR OPEN CHANNEL.....	17
EQUATION 12: TOP WIDTH DETERMINATION FOR THE CHANNEL.....	18
EQUATION 13: DETERMINATION OF BERM WIDTH.....	19
EQUATION 14: DETERMINATION OF BALANCED DEPTH OF CUTTING .....	20
EQUATION 15: DETERMINATION OF WAVE HEIGHT FOR FETCH LESS THAN 32KM.....	21
EQUATION 16 : DETERMINATION OF WAVE HEIGHT FOR FETCH GREATER THAN 32KM .....	21
EQUATION 17: DETERMINATION OF CREST WIDTH OF THE LEVEE .....	23
EQUATION 18 : SEEPAGE LINE EQUATION.....	25
EQUATION 19 : FOCAL DISTANCE .....	26
EQUATION 20: DETERMINATION OF FACTOR OF SAFETY OF THE LEVEE .....	27
EQUATION 21 : RESISTING FORCE OF THE DAM DUE TO INTERNAL ANGLE OF FRICTION .....	28
EQUATION 22 : SLIDING FORCE ACTING ON THE LEVEE DUE TO WATER PRESSURE .....	28
EQUATION 23 : FACTOR OF SAFETY AGAINST THE SLIDING FORCE ACTING ON THE LEVEE .....	28
EQUATION 24: TOTAL HORIZONTAL FORCE CAUSING SLIDING OF THE DOWNSTREAM PORTION OF THE DAM .....	29
EQUATION 25 : WEIGHTED UNIT WEIGHT.....	30
EQUATION 26 : RESISTING FORCE AGAINST SLIDING OF COUNTRY SIDE PORTION OF THE LEVEE.....	30
EQUATION 27: FACTOR OF SAFETY AGAINST TOTAL SLIDING FORCE THE COUNTRY SIDE PORTION OF THE LEVEE ..	31
EQUATION 28 : MAXIMUM SHEAR STRESS IN THE COUNTRY SIDE PORTION OF THE LEVEE .....	31
EQUATION 29 : SHEAR STRENGTH DETERMINATION BY MOHR-COULOMB EQN. OF THE COUNTRY SIDE PORTION OF THE LEVEE. ....	32
EQUATION 30: FACTOR OF SAFETY AGAINST MAXIMUM SHEAR OF THE COUNTRY SIDE PORTION OF THE LEVEE ...	32
EQUATION 31: TOTAL HORIZONTAL FORCE CAUSING SLIDING OF THE RIVER SIDE PORTION OF THE LEVEE.....	33
EQUATION 32: AVERAGE SHEAR STRESS ACTING ON THE UPSTREAM PORTION OF THE LEVEE .....	33
EQUATION 33 : MAXIMUM SHEAR STRESS ACTING ON THE RIVER SIDE PORTION OF THE LEVEE .....	34
EQUATION 34 : RESISTING FORCE AGAINST THE HORIZONTAL SHEER FORCE OF THE RIVER SIDE PORTION OF THE LEVEE.....	34
EQUATION 35 : AVERAGE FACTOR OF SAFETY AGAINST SLIDING FORCE ACTING ON THE RIVER SIDE PORTION OF THE LEVEE .....	34
EQUATION 36: MAXIMUM SHEAR STRENGTH AT THE POINT OF SHEAR IN THE RIVER SIDE PORTION OF THE LEVEE .....	34
EQUATION 37: FACTOR OF SAFETY AGAINST MAXIMUM SHEAR ON THE RIVER SIDE PORTION OF THE LEVEE.....	35
EQUATION 38: HORIZONTAL SHEAR FORCE ACTING ON THE FOUNDATION AT THE RIVER SIDE PORTION OF THE LEVEE.....	35

EQUATION 39: MEAN UNIT WEIGHT OF THE SOIL MASS IN THE LEVEE AND FOUNDATION. ....	36
EQUATION 40: EQUIVALENT ANGLE OF FRICTION OF PURELY COHESIONLESS SOIL.....	36
EQUATION 41: AVERAGE SHEAR STRESS IN THE FOUNDATION AT THE RIVER SIDE PORTION OF THE LEVEE. ....	36
EQUATION 42: MAXIMUM SHEAR STRESS ACTING IN THE FOUNDATION AT THE RIVER SIDE PORTION OF THE LEVEE .....	36
EQUATION 43: SHEAR STRENGTH BELOW THE HEELS OF THE LEVEE AT THE RIVER SIDE PORTION. ....	37
EQUATION 44: SHEAR STRENGTH BELOW THE SHOULDER OF THE LEVEE AT THE RIVER SIDE PORTION. ....	37
EQUATION 45: SUB-MERGE UNIT WEIGHT OF THE SOIL MASS OF THE LEVEE AND THE FOUNDATION.....	37
EQUATION 46: FACTOR OF SAFETY AGAINST AVERAGE SHEAR IN THE FOUNDATION. ....	37
EQUATION 47: MAXIMUM SHEAR STRESS AT THE POINT OF MAXIMUM SHEAR IN THE FOUNDATION. ....	38
EQUATION 48: MEAN EFFECTIVE WEIGHT OF THE SOIL MASS ALONG THE SECTION OF MAXIMUM SHEAR .....	38
EQUATION 49: FACTOR OF SAFETY AGAINST MAXIMUM SHEAR IN THE FOUNDATION.....	38
EQUATION 50: DETERMINATION OF BENEFIT COST RATIO .....	42
EQUATION 51: DETERMINATION OF THE ANNUAL FLOOD DAMAGES.....	43
EQUATION 52: DETERMINATION OF THE TOTAL ANNUAL BENEFIT.....	44
EQUATION 53: DETERMINATION OF THE ANNUAL BANK EROSION DAMAGES .....	44



## LIST OF APPENDICES

APPENDIX 1: TOPOGRAPHIC MAP OF THE SELECTED SITE FOR THE PROJECT.....	89
APPENDIX 2: DIMENSIONS OF THE EMBANKMENT.....	90
APPENDIX 3: PLAN VIEW OF THE LEVEE.....	90
APPENDIX 4: DIMENSIONS OF THE CHANNEL BY PARTIAL FILLING AND CUTTING.....	91
APPENDIX 5: CATCHMENT AREA OF THE SELECTED SITE FOR THE PROJECT.....	91
APPENDIX 6: GOOGLE EARTH IMAGE SHOWING LAND USED PATTERN AT THE SELECTED SITE PROJECT.....	92
APPENDIX 7: SUMMARIES OF LABORATORY SOIL TEST RESULTS.....	92
APPENDIX 8: DIRECT SHEAR TEST RESULTS.....	93
APPENDIX 9: SHOWING VARIATION IN RIVER MALABA FLOW.....	93
APPENDIX 10: TORORO MEAN MONTHLY MAXIMUM RELATIVE HUMIDITY (%).....	94
APPENDIX 11: TORORO MEAN MONTHLY MINIMUM RELATIVE HUMIDITY (%).....	94
APPENDIX 12: TORORO MEAN MAXIMUM TEMPERATURE (°C).....	95
APPENDIX 13: TORORO MEAN MINIMUM TEMPERATURE (°C).....	95
APPENDIX 14: TORORO AVERAGE WIND SPEED DATA IN M/S.....	96

## CHAPTER ONE: INTRODUCTION

### 1.1 Background

Floods are recurrent phenomena in world from time immemorial. Floods of varying magnitudes, affect parts of the world, almost every year due to different climate and rainfall patterns. With the increase in population and developmental activities in the world, there has been a tendency to occupy the floodplains, often resulting in serious flood damages to properties and loss of lives over the years. Of late, some areas, which were not traditionally prone to floods, also experienced severe inundation.

Floods cause severe bank erosion if the river banks are fragile and not protected against the heavy flood discharges. It may therefore become very essential for an embankment to be constructed along a river or stream.

Embankments are the oldest known forms of flood protection works and have been used extensively for this purpose or confine the course of a river to provide higher and faster water flow. These serve to prevent inundation, when the stream spills over its natural section, and safeguard lands, villages and other properties against damages, (Puram, 2012)

The River Malaba catchment is part of a broader division referred to as the Lake Kyoga basin, which is one of the eight major surface water basin delineations for Uganda.

The Lake Kyoga basin covers an area of 26,796 square km; the area considered in the study as the River Malaba catchment covers about 6,455 square km.

The main river reach modeled in the study has its origins on the slopes of Mount Elgon, from where it forms the border between Uganda and Kenya for several kilometers before turning into Uganda. There it flows through the districts of Mbale, Tororo, Butaleja, and Pallisa before finally discharging into Lake Kyoga (Kizito *et al.*, 2006).

Amoni village at the bank of river Malaba experiences tropical climate with both wet and dry seasons in a year, it has a total annual rainfall estimated to be 1,494 mm, bimodal rainfall with peaks from March – May and August – November, and the dry season runs from December to February although some seasonal variations have occurred in recent years in form of torrential rains. The village has a mean annual minimum and maximum temperatures of 16.2<sup>o</sup>C and 28.6<sup>o</sup>C respectively, mean annual humidity of 68% and mean annual sunshine duration of 6.9 hours per day (CLIMWAT 2.0 & CROPWAT 8.0).

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