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EXPERIMENTAL STUDY OF HYDRODYNAMICS OF GROUNDWATER FLOW IN KARST AQUIFERS UNDER STRESSED AND UNSTRESSED CONDITIONS

By

Amin Ahmed Emam Ahmed Hassan

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Irrigation and Hydraulics Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
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Title of Thesis:

Experimental Study of Hydrodynamics of Groundwater Flow in Karst Aquifers Under Stressed and Unstressed Conditions

Key Words:

groundwater; karst aquifer; pumping wells; matrix-conduit exchange; experimental model

Summary:

Karst aquifers are characterized by the dual porosity represented in their two main domains; matrix and conduits. This research presents a large-scale laboratory model to simulate a karst aquifer with pumping wells. Pressure and discharge measurements are obtained to provide pressure head distribution, quantification of matrix-conduit exchange, and drawdown values. Results show that the matrix-conduit exchange is dependent on conduit hydraulic gradient, conduit size, and the head difference between matrix and conduit domains. Results also show that for the same pumping rate, drawdown values of matrix wells are substantially higher than that of conduit wells. Conduits can sustain much higher pumping rates than the matrix domain. Matrix-conduit exchange under pumping conditions varies according to the domain that is being pumped and the head difference between the matrix and conduit domains.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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Table of Contents

DISCLAIMER.....	I
ACKNOWLEDGMENTS	II
TABLE OF CONTENTS	III
LIST OF TABLES	V
LIST OF FIGURES	VII
NOMENCLATURE.....	X
ABSTRACT.....	XI
CHAPTER 1 : INTRODUCTION.....	1
1.1. PREFACE	1
1.2. PROBLEM STATEMENT	3
1.2.1. Matrix-Conduit Exchange	3
1.2.2. Hydrodynamics of Pumping Wells	3
1.2.3. Laboratory Models	3
1.3. RESEARCH OBJECTIVES	4
1.4. DISSERTATION SCOPE AND METHODOLOGY.....	4
1.5. THESIS OUTLINE	5
CHAPTER 2 : LITERATURE REVIEW.....	6
2.1. INTRODUCTION	6
2.2. LABORATORY MODELS OF KARST AQUIFERS.....	6
2.3. PUMPING TESTS IN KARST AQUIFERS.....	9
2.4. SUMMARY	11
CHAPTER 3 : METHODOLOGY.....	12
3.1. OVERVIEW	12
3.2. LABORATORY MODEL SETUP	13
3.2.1. Model Components	13
3.2.2. Model Features and Measurements	17
3.2.3. Hydraulic Conductivity of Porous Media	23
3.2.4. Calibration of Weirs	25
CHAPTER 4 : RESULTS AND DISCUSSION	28
4.1. OVERVIEW	28
4.2. EXPERIMENTS PLAN	28
4.3. GROUP 1: UNDERSTANDING MATRIX-CONDUIT EXCHANGE	31
4.3.1. Description	31

4.3.2. Experiment Results	33
4.3.3. Experiment Comparison	39
4.4. GROUP 2: DEFINING KARST HYDRODYNAMICS UNDER GROUNDWATER PUMPING	42
4.4.1. Description	42
4.4.2. Experiment Results	43
4.4.3. Experiment Comparison	66
4.5. GROUP 3: SIMULATION OF KARST PUMPING TESTS.....	76
4.5.1. Description	76
4.5.2. Experiment Results	76
4.5.3. Experiment Comparison	85
CHAPTER 5 : CONCLUSION AND RECOMMENDATIONS	87
5.1. SUMMARY	87
5.2. MAIN CONCLUSIONS	88
5.3. PRIMARY FINDINGS	89
5.4. RECOMMENDATIONS	90
REFERENCES.....	91

List of Tables

Table 3.1: Results of Darcy's experiment to determine hydraulic conductivity	25
Table 3.2: Calibration results of v-notch weirs.....	27
Table 4.1: Experiments Conditions and Details	30
Table 4.2: Details of Group 1 Experiments	31
Table 4.3: Comparison between Run 01 and Run 06: Effect of head difference between domains.....	39
Table 4.4: Comparison between Run 06 and Run 11: Effect of conduit size	40
Table 4.5: Comparison between Run 06 and Run 13: Effect of conduit gradient	41
Table 4.6: Details of Group 2 Experiments	42
Table 4.7: Comparison between Run 01 and Run 02: Effect of matrix pumping at 0.5 m height	45
Table 4.8: Comparison between Run 01 and Run 03: Effect of matrix pumping at model bed.....	47
Table 4.9: Comparison between Run 01 and Run 04: Effect of low discharge conduit pumping	49
Table 4.10: Comparison between Run 01 and Run 05: Effect of high discharge conduit pumping	51
Table 4.11: Comparison between Run 06 and Run 07: Effect of matrix pumping at 0.5 m height	53
Table 4.12: Comparison between Run 06 and Run 08: Effect of matrix pumping at model bed.....	55
Table 4.13: Comparison between Run 06 and Run 09: Effect of low discharge conduit pumping	57
Table 4.14: Comparison between Run 06 and Run 10: Effect of high discharge conduit pumping	59
Table 4.15: Comparison between Run 11 and Run 12: Effect of matrix pumping at model bed.....	61
Table 4.16: Comparison between Run 13 and Run 14: Effect of matrix pumping at model bed.....	63
Table 4.17: Comparison between Run 13 and Run 15: Effect of high discharge conduit pumping	65
Table 4.18: Comparison between Run 02 and Run 03: Effect of proximity of matrix wells to conduits	66
Table 4.19: Comparison between Run 04 and Run 05: Effect of increasing conduit pumping discharge.....	67
Table 4.20: Comparison between Run 02 and Run 04: Effect of pumping well location	68
Table 4.21: Comparison between Run 07 and Run 08: Effect of proximity of matrix wells to conduits	68
Table 4.22: Comparison between Run 09 and Run 10: Effect of increasing conduit pumping discharge	69
Table 4.23: Comparison between Run 07 and Run 09: Effect of pumping well location	70

Table 4.24: Comparison between Run 02 and Run 07: Effect of head difference between domains on matrix pumping	71
Table 4.25: Comparison between Run 05 and Run 10: Effect of head difference between domains on conduit pumping	72
Table 4.26: Comparison between Run 08 and Run 12: Effect of conduit size on matrix pumping	73
Table 4.27: Comparison between Run 08 and Run 14: Effect of conduit gradient on matrix pumping	74
Table 4.28: Comparison between Run 10 and Run 15: Effect of conduit gradient on conduit pumping	75

List of Figures

Figure 1.1: Mechanical karstification of rock [from Stevanović (2015)] [5]	2
Figure 1.2: Components of karst aquifers [from Goldscheider & Drew (2007)] [6]	2
Figure 2.1: Different solutions for time-drawdown data in a karst aquifer [from Kresic (2007)] [10]	10
Figure 2.2: Theoretical time-drawdown curve in a karst aquifer [from Kresic (2007)] [10]	11
Figure 3.1: Overview of the research methodology	12
Figure 3.2: Schematic of laboratory model components	14
Figure 3.3: Coating the interior of the model to prevent water leakage	15
Figure 3.4: Placement of lower conduit (2" perforated pipe)	15
Figure 3.5: Insertion of upper conduit (1" perforated pipe)	15
Figure 3.6: Preparation of connection between upper and lower conduits with an extended handle to control from outside the model	15
Figure 3.7: Connection between lower and upper conduit	16
Figure 3.8: Wrapping the conduits in geotextile to prevent sand infiltration	16
Figure 3.9: Filling the model with fine sand	16
Figure 3.10: Inflow and outflow reservoirs	16
Figure 3.11: Prevention of sand infiltration into the reservoir using geotextile	17
Figure 3.12: Overflow pipe with an adjustable stand to control the water level in reservoirs	17
Figure 3.13: Weirs for discharge measurements	18
Figure 3.14: Graduated cylinder for discharge measurements	18
Figure 3.15: Plastic piezometer tubes	19
Figure 3.16: Laying out the piezometer tubes	19
Figure 3.17: Piezometer board	19
Figure 3.18: Grading for piezometer readings	19
Figure 3.19: Boreholes for upper conduit (1")	20
Figure 3.20: Attachment of boreholes to upper conduit	20
Figure 3.21: Boreholes for lower conduit (2")	21
Figure 3.22: Boreholes for matrix domain screened at different depths	21
Figure 3.23: Setup of piezometers and boreholes	21
Figure 3.24: Distribution of piezometers and boreholes	22
Figure 3.25: The siphon and the pump used for pumping	23
Figure 3.26: Schematic of Darcy's experiment (Source: Maureen Feineman, Pennsylvania State University)	24
Figure 3.27: Laboratory Darcy's experiment for measuring hydraulic conductivity ...	24
Figure 3.28: V-notch weir with turbulence reduction buffers	26
Figure 3.29: Volume grading and valve of hydraulic bench	26
Figure 3.30: Calibration of weirs using hydraulic bench	26
Figure 4.1: Experiments Plan	29
Figure 4.2: Karst behavior in different seasons – Source: Li (2004) [20]	32
Figure 4.3: Run 01 hydraulic head distribution in a vertical section at $y=0.5$ m	34
Figure 4.4: Run 01 hydraulic head distribution in a horizontal section at $z=0.85$ m ...	34

Figure 4.5: Run 06 hydraulic head distribution in a vertical section at $y=0.5$ m	35
Figure 4.6: Experiment from Faulkner (2008) with similar behavior [15].....	36
Figure 4.7: Comparison between hypothetical and actual hydraulic gradient lines for matrix and conduit domains of Run 06.....	36
Figure 4.8: Run 11 hydraulic head distribution in a vertical section at $y=0.5$ m.....	37
Figure 4.9: Run 13 hydraulic head distribution in a vertical section at $y=0.5$ m.....	38
Figure 4.10: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 01, b) Run 02, c) hydraulic head drop (Run 02 – Run 01) due to pumping	44
Figure 4.11: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 01, b) Run 03, c) hydraulic head drop (Run 03 – Run 01) due to pumping	46
Figure 4.12: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 01, b) Run 04, c) hydraulic head drop (Run 04 – Run 01) due to pumping	48
Figure 4.13: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 01, b) Run 05, c) hydraulic head drop (Run 05 – Run 01) due to pumping	50
Figure 4.14: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 06, b) Run 07, c) hydraulic head drop (Run 07 – Run 06) due to pumping	52
Figure 4.15: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 06, b) Run 08, c) hydraulic head drop (Run 08 – Run 06) due to pumping	54
Figure 4.16: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 06, b) Run 09, c) hydraulic head drop (Run 09 – Run 06) due to pumping	56
Figure 4.17: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 06, b) Run 10, c) hydraulic head drop (Run 10 – Run 06) due to pumping	58
Figure 4.18: Horizontal hydraulic head distribution at $z=0.5$ m a) Run 11, b) Run 12, c) hydraulic head drop (Run 12 – Run 11) due to pumping	60
Figure 4.19: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 13, b) Run 14, c) hydraulic head drop (Run 14 – Run 13) due to pumping	62
Figure 4.20: Horizontal hydraulic head distribution at $z=0.85$ m a) Run 13, b) Run 15, c) hydraulic head drop (Run 15 – Run 13) due to pumping	64
Figure 4.21: Time-drawdown curves for pumping wells (conduit head > matrix head)	76
Figure 4.22: Time-drawdown curves for matrix observation wells (conduit head > matrix head)	77
Figure 4.23 Time-drawdown curves for conduit observation wells (conduit head > matrix head)	78
Figure 4.24: Time-drawdown curves for matrix and conduit observation wells under matrix pumping (conduit head > matrix head)	79
Figure 4.25: Time-drawdown curves for matrix and conduit observation wells under conduit pumping (conduit head > matrix head).....	80
Figure 4.26: Time-drawdown curves for pumping wells (matrix head > conduit head)	81
Figure 4.27: Time-drawdown curves for matrix observation wells (matrix head > conduit head).....	82
Figure 4.28: Time-drawdown curves for conduit observation wells (matrix head > conduit head).....	83
Figure 4.29: Time-drawdown curves for matrix and conduit observation wells under matrix pumping (matrix head > conduit head)	83

Figure 4.30: Time-drawdown curves for matrix and conduit observation wells under conduit pumping (matrix head > conduit head)	84
Figure 4.31: Comparison between matrix pumping tests	85
Figure 4.32: Comparison between conduit pumping tests	86

Nomenclature

HGL	: Hydraulic Gradient Line
M	: Matrix
C	: Conduit
UC	: Upper Conduit
LC	: Lower Conduit
Q	: Discharge
PVC	: PolyVinyl Chloride
HP	: Horsepower
k	: Hydraulic Conductivity
C_d	: Coefficient of Discharge