

**RESULTS CALIBRATION MEASUREMENT IN THE NILE DELTA**  
**UPDATE 1986**

## PREFACE

The 'Reuse of Drainage Water Project' is a joint activity of the technical agencies:

Drainage Research Institute (DRI), Giza, Cairo in Egypt and  
Institute for Land and Water Management Research (ICW),  
Wageningen in the Netherlands.

The project is funded by the Ministry of Irrigation of Egypt and by the Ministry of Foreign Affairs of the Netherlands in the framework of the joint programme of Technical Cooperation between Egypt and the Netherlands.

The Advisory Panel for Land Drainage in Egypt acts as steering committee.

The results of studies, carried out in the 'Reuse of Drainage Water Project', will be presented in preliminary reports and in a final report. As such the contents of preliminary reports can vary strongly, from a simple presentation of data to a discussion of research results with tentative conclusions.

All opinions, conclusions and recommendations in the reports are those of the cooperating Institutes, and not of the Ministry of Irrigation of Egypt or the Ministry of Foreign Affairs of the Netherlands.

REUSE OF DRAINAGE WATER PROJECT

RESULTS CALIBRATION MEASUREMENTS PUMPING STATIONS  
AND OPEN DRAINS IN THE NILE DELTA

UPDATE 1986

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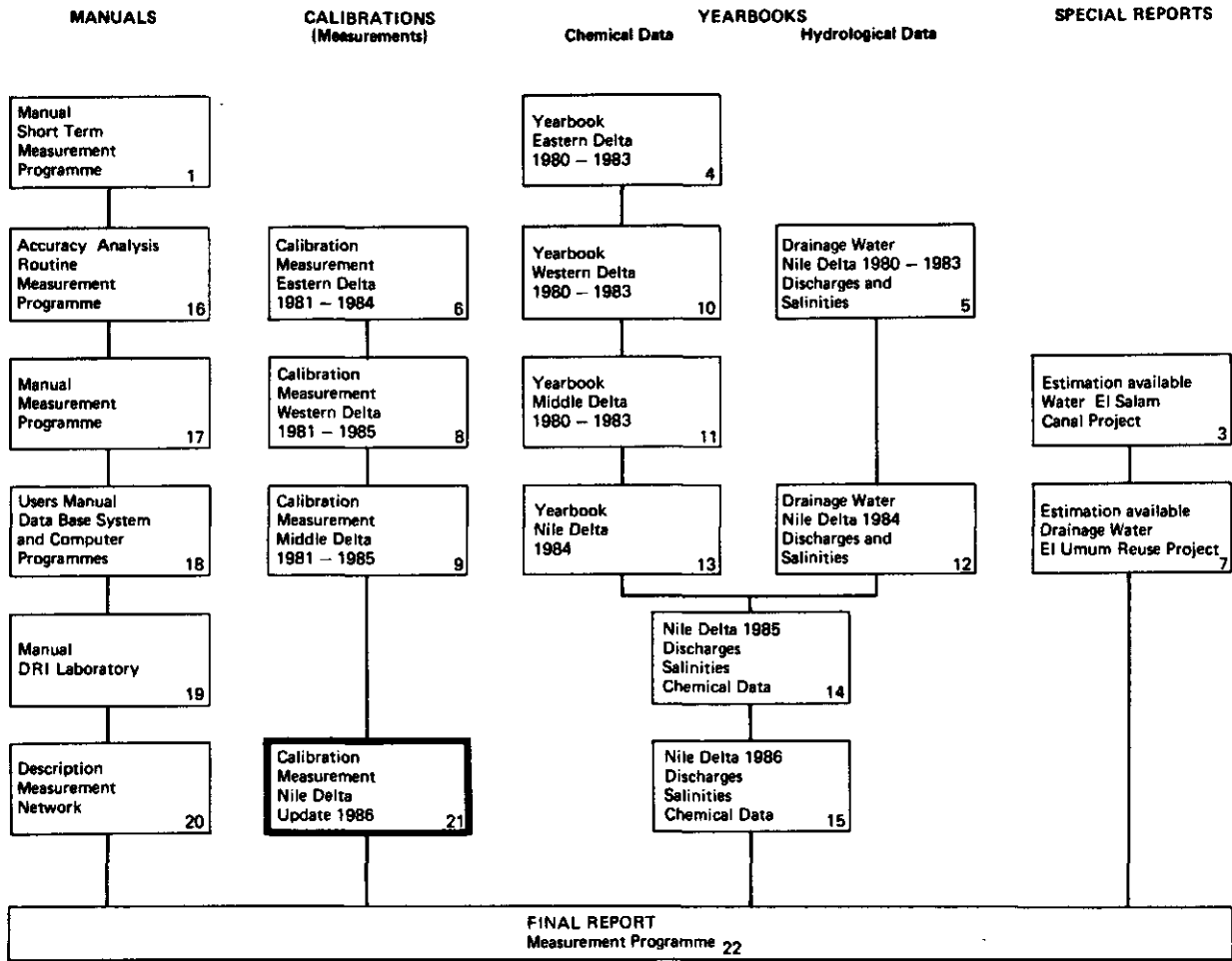
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## SUMMARY

In this report the results of the calibration measurements of pumping stations and open drains in the Nile Delta done after those mentioned in foregoing reports (nrs. 6, 8 and 9) are presented.

In 11 pumping stations 43 calibration measurements have been executed, giving a partial response to the recommendations of the above mentioned reports.

When the measurement results justified it, a new discharge-head relation (rating curve) has been established. This was the case for 5 pumping stations, 3 of them "new". Otherwise the results were just compared with the existing rating curves.

For the average lifting head (1985) the ratio between the calibrated capacity and the calculation capacity used by the Mechanical and Electrical Department of the Ministry of Irrigation has been determined.

Tables 1, 2 and 3 present the results of the calibration measurements of the pumping stations belonging to the measurement network of the Reuse of Drainage Water Project in the Eastern, Middle and Western Delta.

In 17 open locations, including the so-called outfalls, 72 calibration measurements have been performed, almost entirely meeting the recommendations following from reports 6, 8 and 9. This resulted in new rating curves for 12 locations.

Tables 4, 5 and 6 show the stage-discharge and velocity-discharge relations for respectively the Eastern, Middle and Western Delta.

The discharge relations given in the tables 1 through 6 are used for the calculation of the 1986 discharges.



CONCLUSIONS PUMPING STATION CALIBRATIONS

- Reliable rating curves have been established for the following pumping stations:

EB13 Blad El Ayed  
WE10 Edko  
WE11 Bosseilly  
WN11 Boustain

- Because of a restricted range of measured heads a possibly less accurate rating curve was found for the pumping station:

EB03N Wadi (New)

- For lack of sufficient measurement data no rating curves could be established yet for the pumping stations:

EF01 Farasqur  
MB01 Burullus  
MZ01 Zagloul  
WU10 Mariut Khalt

The calculation capacities from the Mechanical and Electrical Department are used, except for Mariut Khalt for which pumping station a reasonable estimation has been made.

For Burullus P.S. no further measurements will be undertaken as the capacity is regulated according to the power supply. The units are about to be replaced.

- The ratio between the calibration and calculation capacities is probably higher for the pumping station:

MZ01 Zagloul

- The given ratio is probably lower for pumping station:

WU10 Mariut Khalt.

CONCLUSIONS OPEN DRAIN CALIBRATIONS

- For the following open drain locations a reliable stage-discharge relation has been established:

- EB01 Bilbeis Bridge
- EH11 Bahr Hadus Bridge
- EH15 Iddowar Bridge
- WN05 Drain No. 6 Outfall

- Acceptable stage-discharge relations but with undecided reliability have been found for:

- EB05 Saada Bridge
- EH14 Gemeeza Bridge
- MG11 Gharbia Bridge No. 7
- WN10 Nubareya Drain Outfall

- Reliable velocity-discharge relations have been established for:

- EB08 Bahr Baqar Bridge
- EB11 Bahr Baqar Outfall
- EH01 Saft El Qibly Bridge
- MG15 Ezbet El Nil Bridge

- No stage-discharge relation could be found for:

- MN05 Sidi Salim Bridge

At this location no velocities can be measured in a practical way, so a velocity-discharge relation has not been sought. The location is abandoned.

#### RECOMMENDATIONS PUMPING STATION CALIBRATIONS

- It is recommended that the Mechanical and Electrical Department of the Ministry of Irrigation reports any change in pump unit capacity due to overhaul or renewal of units to the Drainage Research Institute. During field trips the DRI engineers should be alert on these changes because recalibration is required in this case.
- The following pumping stations should be calibrated without delay:
  - EF01 Farasqur
  - MZ01 Zagloul
  - WU10 Mariut Khalt
- During 1987 check measurements should be executed at all pumping stations in the Eastern Delta for heads about equal to the average operation head. If the measured discharge differs more than say 10% from the discharge following from the existing rating curve a recalibration of the pumping station is necessary.
- In the first semester of 1988 checks as described above are to be executed for all pumping stations in the Western Delta.
- In the second semester of 1988 at all pumping stations in the Middle Delta check measurements should be performed.

#### RECOMMENDATIONS OPEN DRAIN CALIBRATIONS

- Calibration measurements for a velocity-discharge relation should be undertaken as soon as possible for the following locations:
  - EH17 New Hadus Outfall
  - MNO6 Ballass Bridge (end of Nashart Drain)
  - WE13 Edko Bridge (end of Edko Drain)
- At EH01, Saft El Qibly Bridge a detailed study is suggested on the influence of the operation regime of Hanut P.S. on the discharges at the Bridge.
- At all locations discharge measurements should continue with intervals of 2 to 3 months in order to detect any changes.



## 1. INTRODUCTION

The Reuse of Drainage Water Project aims at collecting reliable data on drainage water quantities and qualities in the Nile Delta.

For this purpose an extensive measurement network comprising pumping stations as well as open locations has been implemented by the Drainage Research Institute (DRI).

For each measurement location of this network a discharge relation has been established, giving the discharge quantity as a function of the easy to measure head or waterlevel (rating curve). In some cases, namely the locations in the zone of a back water curve, the discharge relation is a function of the flow velocity in a fixed point and the cross-sectional area (velocity-discharge relation).

The process of obtaining a discharge relation from a restricted number of discharge measurements is commonly called: calibration.

A first series of these calibration measurements has been completed in the years 1984 and 1985. The results have been presented in the reports nrs. 6, 8 and 9, dealing with the Eastern, Western and Middle Delta respectively.

The same reports describe the process of establishing a discharge relation for both pumping stations and open locations. This description is omitted here.

This report presents the results of calibration measurements done after the reports 6, 8 and 9 were published. For some locations these measurements resulted in revised rating curves. The updated rating curves as well as the existing ones, in case no update was available, are used for the calculation of the 1986 discharges. They are listed in the tables 1 through 6.

The new measurements at pumping stations are treated in chapter 2. The open location calibrations are dealt with in chapter 3. Some single measurements are listed in annex 1, the measured discharge has been compared with the discharge according to the existing rating curve.

## 2. CALIBRATION MEASUREMENTS AT PUMPING STATIONS

The measured data for each separate location are presented in tables and graphs.

Table 1. Discharge relations pumping stations  
Eastern Delta

Table 2. Discharge relations pumping stations  
Middle Delta

Table 3. Discharge relations pumping stations  
Western Delta

EB03N	Wadi New P.S.
EB13	Blad El Ayed P.S.
EF01	Farasqur P.S.
MB01	Burullus P.S.
MZ01	Zagloul P.S.
WE10	Edko P.S.
WE11	Bosseilly P.S.
WN11	Boustain P.S.
WU10	Mariut Khalt P.S.

Table 1. Discharge - head relations pump stations Eastern Delta

Update per January 1986

Average head and calculation capacity from MED 1985

CODE	PUMPSTATION	units	calculation capacity N * m <sup>3</sup> /s	Q-H relation H in m ; Q in m <sup>3</sup> /s	aver. head m.	calib. cap. m <sup>3</sup> /s	ratio
EB030	WADI P.S.	OLD	5 * 6.00	Q = 7.63 - 1.14*H	2.93	4.28	0.71
EB03N	WADI P.S.	NEW	2 * ?	Q = 8.02 - 0.50*H			
EB06	SAADA P.S.		8 * 0.90	Q = 0.74		0.74	0.82
EB09	B. BAQAR IRR. P.S.		8 * 0.83	Q = 0.36		0.36	0.43
EB10	B. BAQAR P.S.		4 * 6.11	Q = 6.11	1.67	6.11	1.00
EB13	BLAD EL AYED P.S.		4 * 3.50	Q = 4.37 - 0.37*H	3.44	3.09	0.88
EF01	FARASQUR P.S.		4 * 5.03	Q = 5.03 (MED)	2.95		
EH02	HANUT P.S.		3 * 5.69	Q = 4.82	2.56	4.82	0.84
EH03	SADAQA P.S.		4 * 5.00	Q = 5.78 - 0.61*H	1.20	5.04	1.00
EH05	NIZAM P.S.		4 * 3.50	Q = 4.27 - 0.62*H	1.17	3.54	1.01
EH06	BANI EBEID P.S.		5 * 5.00	Q = 7.52 - 1.24*H	1.92	5.13	1.02
EH07	ADD. QASSABI P.S.		4 * 7.50	Q = 6.01	2.05	6.01	0.80
EH08A	MAIN QASSABI P.S.	1,2	2 * 5.00	Q = 5.34 - 0.24*H	1.99	4.86	0.97
EH08B	MAIN QASSABI P.S.	3	1 * 5.00	Q = 8.19 - 0.58*H	1.99	7.03	1.40
EH09	GENEENA P.S.		4 * 5.00	Q = 6.63 - 0.84*H	1.77	5.14	1.02
EH10	ERAD P.S.		4 * 8.00	Q = 12.42 - 1.52*H	3.00	7.86	0.98
EH12	SAFT P.S.		6 * 7.50	Q = 8.56 - 0.96*H	2.04	6.60	0.88
EM01	MATARIA P.S.		3 * 8.00	Q = 9.61 - 0.43*H	2.77	8.41	1.05
ES01	UPPER SERW P.S.		3 * 8.00	Q = 17.74 - 1.94*H	3.66	10.63	1.32
ES02	LOWER SERW P.S.		4 * 8.00	Q = 11.16 - 1.19*H	2.41	8.29	1.03

Table 2. Discharge - head relations pump stations Middle Delta

Average head and calculation capacity from MED 1985

CODE	PUMP STATION	units	calculation capacity N * m <sup>3</sup> /s	Q-H relation H in m ; Q in m <sup>3</sup> /s	aver. head m.	calib cap. m <sup>3</sup> /s	ratio
M101	UPPER P.S. NO 1		3 * 5.00	Q = 6.49 - 0.33*H	2.32	5.72	1.14
M103A	P.S LOWER No 1	1,8	2 * 2.93	Q = 1.90	1.69	1.90	0.64
M103B	P.S LOWER No 1	2,6,7	3 * 5.86	Q = 4.34	1.69	4.34	0.74
M103C	P.S LOWER No 1	3,4,5	3 * 11.73	Q = 8.64	1.69	8.64	0.73
M103N	P.S LOWER No 1	NEW	3 * 12.50	Q = 13.01 - 1.33*H	1.69	10.76	0.86
M104	P.S. NO 2		4 * 7.50	Q = 9.86 - 0.97*H	2.40	7.53	1.00
M111	P.S. NO 11		6 * 7.50	Q = 7.05	2.74	7.05	0.94
M701	P.S. NO 7		5 * 5.00	Q = 8.96 - 1.12*H	3.00	5.60	1.12
M801	LOWER P.S. NO 8		6 * 7.50	Q = 9.20 - 1.65*H	2.10	5.73	0.76
MB01	BURULLUS P.S.		3 * 3.00	Q = 3.00 (MED)	2.50		
MG01A	EAST MENUFEYA PS	3,4	2 * 7.50	Q = 8.01 - 0.23*H	2.46	7.44	0.99
MG01B	EAST MENUFEYA	1,2,5	3 * 2.50	Q = 3.67 - 0.54*H	2.46	2.34	0.93
MG02	SEGAAYA P.S.		5 * 5.00	Q = 5.54 - 0.44*H	0.27	5.42	1.08
MG03	MAHALLET RUH P.S.		4 * 2.50	Q = 2.46	2.17	2.46	0.98
MG04	SAMATAY P.S.		4 * 5.00	Q = 6.59 - 1.25*H	1.42	4.81	0.96
MG05	P.S. NO 5		4 * 6.00	Q = 6.50 - 0.52*H	0.98	5.99	0.99
MG07	P.S. NO 6		3 * 5.00	Q = 7.23 - 0.86*H	2.10	5.42	1.08
MG08A	HAMUL P.S.	unit 3	1 * 10.00	Q = 11.63 - 1.93*H	0.56	10.54	1.05
MG08B	HAMUL P.S.	units 1,2	2 * 10.00	Q = 8.24	0.56	8.24	0.82
MG09	P.S. NO 4		5 * 7.50	Q = 11.22 - 1.51*H	2.70	7.14	0.95
MG10	P.S. NO 3		4 * 5.00	Q = 7.42 - 0.75*H	2.67	5.41	1.08
MG12	HAFIR SH. EL DIN P.S.		5 * 5.00	Q = 10.12 - 1.18*H	3.92	5.49	1.09
MN01	UPPER P.S. NO 8		5 * 8.00	Q = 8.69 - 0.59*H	1.04	8.07	1.00
MN02	MANDURA P.S.		4 * 7.50	Q = 10.69 - 1.24*H	2.69	7.35	0.98
MN04A	ZEINI P.S.	unit 2	1 * 5.00	Q = 5.34 - 0.89*H	3.19	2.50	0.50
MN04B	ZEINI P.S.	units 1,3	2 * 5.00	Q = 8.31 - 1.20*H	3.19	4.48	0.89
MT01	TIRA P.S.		4 * 8.00	Q = 8.20	3.60	8.20	1.02
MZ01	ZAGLOUL P.S.		4 * 5.00	Q = 5.00 (MED)	2.65		



Table 3. Discharge - head relations pump stations Western Delta

Update per January 1986

Average head and calculation capacity from MED 1985

CODE	PUMP STATION	units	calculation capacity N * m <sup>3</sup> /s	Q-H relation H in m ; Q in m <sup>3</sup> /s	aver. head m.	calib cap. m <sup>3</sup> /s	ratio
WB01	BARSIQ P.S.		4 * 5.00	Q = 4.34 - 0.64*H	2.58	2.68	0.53
WE01	ETAY BARUD P.S.		3 * 2.60	Q = 2.44	3.76	2.44	0.93
WE02	SHUBRAKHIT P.S.		4 * 6.50	Q = 6.55 - 0.86*H	1.05	5.64	0.86
WE03	ZARQUN P.S.		4 * 5.00	Q = 9.21 - 2.30*H	1.81	5.04	1.00
WE04	EDKO IRR. P.S.		3 * 6.39	Q = 6.38	2.46	6.38	0.99
WE05	DILINGAT P.S.		3 * 5.79	Q = 8.17 - 1.05*H	2.60	5.44	0.93
WE06	KHANDAK EL GH. P.S.		4 * 2.65	Q = 2.35	3.43	2.35	0.88
WE07	KHAIRY P.S.		4 * 5.77	Q = 7.14 - 1.39*H	1.71	4.76	0.82
WE08	HALQ EL GAMAL P.S.		5 * 5.00	Q = 4.83 - 0.70*H	2.54	3.05	0.61
WE10	EDKO P.S.		3 * 3.50	Q = 5.91 - 0.76*H	2.97	3.65	1.04
WE11	BOSSEILLY P.S.		6 * 3.56	Q = 5.70 - 0.72*H	3.18	3.41	0.96
WT01	TABIA P.S		5 * 8.00	Q = 8.00 (MED)	4.80		
WU02	SHEREISHRA P.S.		6 * 8.00	Q = 7.90	1.68	7.90	0.98
WU03	TRUGA P.S.		5 * 7.00	Q = 10.83 - 1.37*H	2.69	7.14	1.02
WU05	DUSHUDI P.S.		3 * 5.50	Q = 10.32 - 2.01*H	2.27	5.75	1.04
WU06	HARES P.S.		4 * 8.00	Q = 11.44 - 1.73*H	3.08	6.11	0.76
WU07D	ABIES P.S.	diesel	2 * 1.00	Q = 1.00 (MED)	2.65		
WU07E	ABIES P.S.	electr.	5 * 0.33	Q = 0.31	2.65	0.31	0.93
WU08N	QALAA P.S.	NEW	2 * 3.50	Q = 3.50 (MED)	3.59		
WU08O	QALAA P.S.	OLD	3 * 2.65	Q = 2.65 (MED)	3.59		
WU09G	MAX P.S.	GERMAN	6 * 13.60	Q = 16.80 - 1.60*H	3.32	11.48	0.84
WU09J	MAX P.S.	JAPANESE	6 * 13.63	Q = 15.32 - 1.60*H	3.32	10.00	0.73
WU10	MARIUT KHALT P.S.		3 * 6.00	Q = 5.00 (est.n)	6.50		
WN11	BOUSTAIN P.S.		4 * 1.11	Q = 1.40 - 0.15*H	2.18	1.07	0.96

WADI NEW P.S.

EB03N

Pump station in operation since August 1985

Calibration measurements were executed by the Hydraulic Institute (Delta Barrages)

CALIBRATIONS

Guarantee curve (factory) :

date	lifting	disch. m3/s	
	head m.	unit 1	unit 2
Oct 85	3.33	6.25	
	3.33	6.21	
	3.33	6.18	
	3.18		6.49
	3.18		6.52
	3.18		6.54

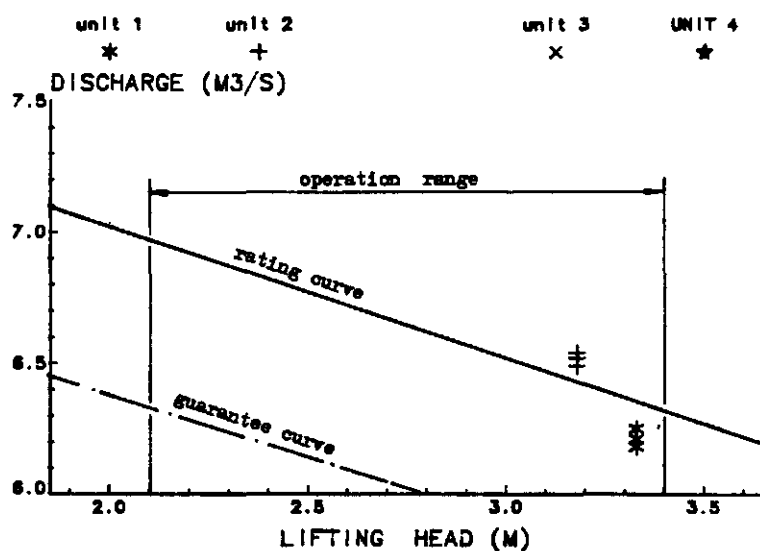
$$Q = 7.38 - 0.50 * H$$

6 Q-H pairs

Rating curve :

$$Q = 8.02 - 0.50 * H \quad \text{m3/s}$$

- Comment :
- The number of measurements is restricted and they cover only a small range of heads.
  - A rating curve is supposed with the same slope as the guarantee curve, passing through the gravity center of the calibration points.
  - More measurements are recommended.



BLAD el AYED PUMP STATION

EB13

Pump station in operation since 31 July 1985.

Calculation capacity : 4 units \* 3.50 m<sup>3</sup>/s

Lifting head (1986) : average 3.44 m. max : 3.65 m.  
min : 3.00 m.

CALIBRATIONS

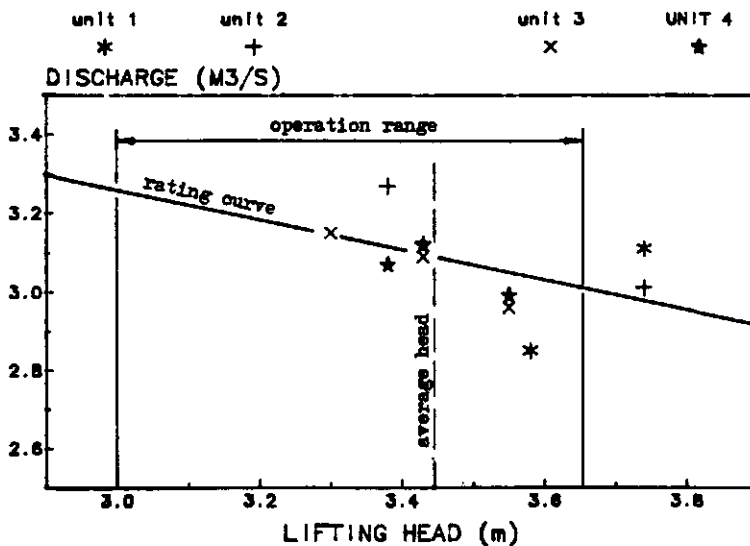
date	lifting head m.	discharges m <sup>3</sup> /s			
		unit 1	unit 2	unit 3	unit 4
17.09.86	3.58	2.85			
	3.38		3.27		
	3.30			3.15	*
	3.38			*	3.07
	3.43			3.09	*
	3.43			*	3.12
18.09.86	3.74	3.11	*		*
	3.74	*	3.01		*
	3.55			2.96	*
	3.55			*	2.99

10 Q-H pairs \* unit in operation

Rating curve :  $Q = 4.37 - 0.37 * H$  m<sup>3</sup>/s

Ratio  $\frac{\text{capacity at av. head}}{\text{calculation capacity}} = \frac{3.09}{3.50} = 0.88$

- Comment :
- The measured head range does not entirely cover the operation head range.
  - The measured discharges are all less than the calculation capacity.
  - Additional measurements for higher and lower heads are recommended.



FARASQUR PUMP STATION

EF01

-----  
 Calculation capacity : 4 units \* 5.03 m3/s (1985)

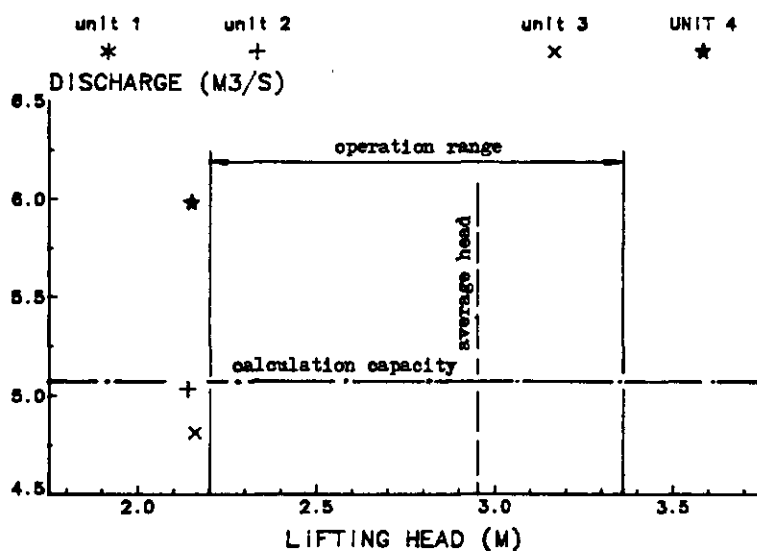
Lifting head (1985) : average 2.95 m. max : 3.35 m.  
 min : 2.20 m.

CALIBRATIONS

date	lifting head m.	discharges m3/s			
		unit 1	unit 2	unit 3	unit 4
16.09.86	2.14	5.03	*		
	2.16		4.81	*	
	2.15		*	5.98	

3 Q-H pairs \* unit in operation

Comment : - Measurements for heads over 3.00 m. are still to be executed.



BURULLUS P.S.

MB01

-----  
 Calculation capacity : 3 units \* 3.00 m3/s

Lifting head (1985) : average 2.50 m. max : 2.54 m.  
 min : 2.50 m.

CALIBRATIONS

date	lifting head m.	discharges m3/s		
		unit 1	unit 2	unit 3
02.02.87	2.45	2.15		
	2.46		2.55	
	2.41			2.15

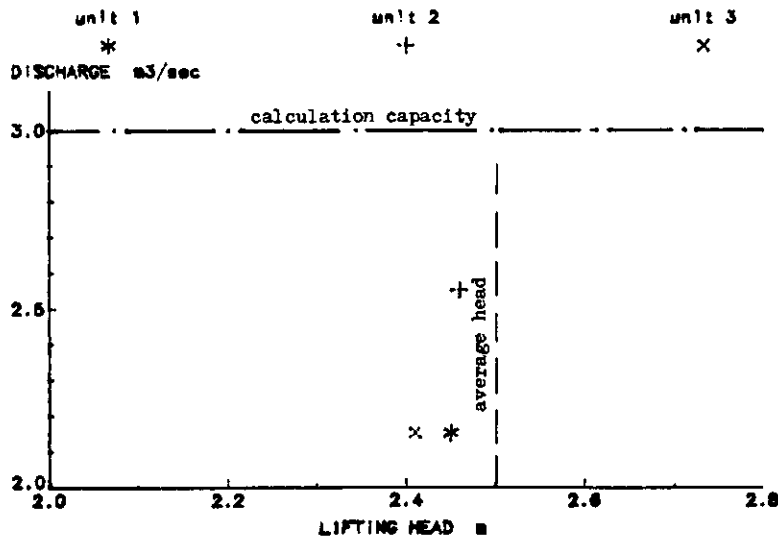
3 Q-H pairs

Average measured discharge : Q = 2.28 m3/s for head = 2.44 m.

Rating curve : NO RATING CURVE

$$\text{Ratio} = \frac{\text{capacity at av. head}}{\text{calculation capacity}} = \frac{2.28}{3.00} = 0.76$$

- Comment :
- The number of measurements is not sufficient to establish a rating curve. The measured discharges are about 3/4 of the calculation capacity.
  - The capacity of the pumps can be adjusted during operation according to the power supply.
  - New units will be installed in the near future (1987 ?).



ZAGLOUL P.S.

MZ01

-----  
 Calculation capacity : 4 units \* 5.00 m3/s

Lifting head (1985) : average 2.65 m. max : 2.75 m.  
 min : 2.52 m.

CALIBRATIONS

date	lifting head m.	discharges m3/s			
		unit 1	unit 2	unit 3	unit 4
01.02.87	3.42			4.48	
	3.41				4.36
	3.44	4.38			

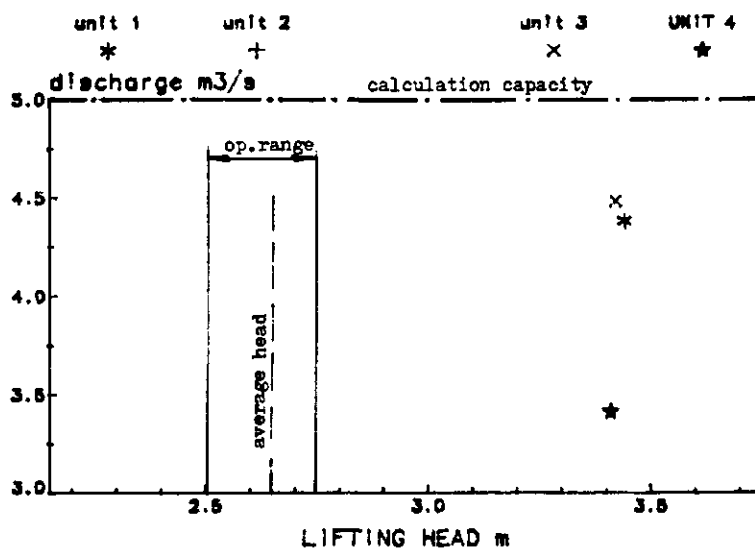
3 Q-H pairs

Average measured discharge : Q = 4.41 m3/s for head = 3.42 m.

Rating curve : | NO RATING CURVE |

Ratio  $\frac{\text{capacity at av. head}}{\text{calculation capacity}} = \frac{> 4.41}{5.00} > 0.88$

Comment : - The number of measurements is insufficient to establish a rating curve.  
 - The discharges are measured for heads higher than the average, so the ratio of 0.88 is underestimated.



EDKO P.S.

WE10

-----  
 Calculation capacity : 3 units \* 3.50 m3/s

Lifting head (1985) : average 2.97 m. max : 3.42 m.  
 min : 2.28 m.

CALIBRATIONS

date	lifting head m.	discharges unit 1	discharges unit 2	discharges unit 3	
07.12.83	3.76		3.36	3.07	<< old measurements
08.12.83	3.72	3.05	*		
	3.68	2.87			
31.01.84	3.35		3.29		
14.11.84	3.40	2.88	3.27		
	3.50			3.27	
17.12.84	3.74		3.09	3.15	
	3.76	2.87			
21.01.85	3.50	*	3.34		
-----					
04.02.87	3.07		3.59		<< new measurements
	3.08			3.76	

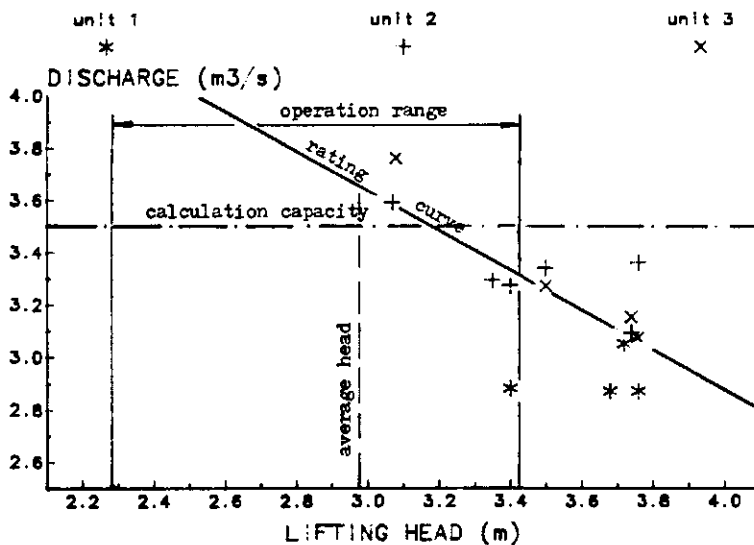
14 Q-H pairs \* unit in operation

Old rating curve : Q = 3.92 - 0.22 \* H m3/s  
 (1985)

Rating curve : | Q = 5.91 - 0.76 \* H | m3/s

Ratio  $\frac{\text{capacity at av. head}}{\text{calculation capacity}} = \frac{3.65}{3.50} = 1.04$

Comment : - The new measurements add more information about the low head capacity.  
 - Some more measurements for low heads are recommended.



Calculation capacity : 6 units \* 3.56 m3/s

Lifting head (1985) : average 3.18 m. max : 3.78 m.  
min : 2.75 m.

CALIBRATIONS

date	lifting head m.	discharges m3/s						
		unit 1	unit 2	unit 3	unit 4	unit 5	unit 6	
14.11.84	3.47	2.84	*	*	*		*	old meas.ts
	3.50	*	2.79	*	*		*	
	3.52	*	*	3.14	*		*	
	3.57	*	*	*	2.97		*	
	3.61	*	*	*	*		2.86	
17.12.84	3.66	*		3.42				
	3.69	3.15		*				
	3.77			*			2.98	
	3.83			*	3.19		*	
09.01.85	3.25		*		*		3.09	
	3.33		*		3.39		*	
	3.19	3.47						
	3.23	*		3.61				
02.04.85	3.38		3.24		*		*	
	3.28					3.43		
	3.55					3.29		
26.12.86	3.02	3.49			3.42			new meas.ts
	3.01		3.50					
	3.03			3.70				
	3.08					3.71		

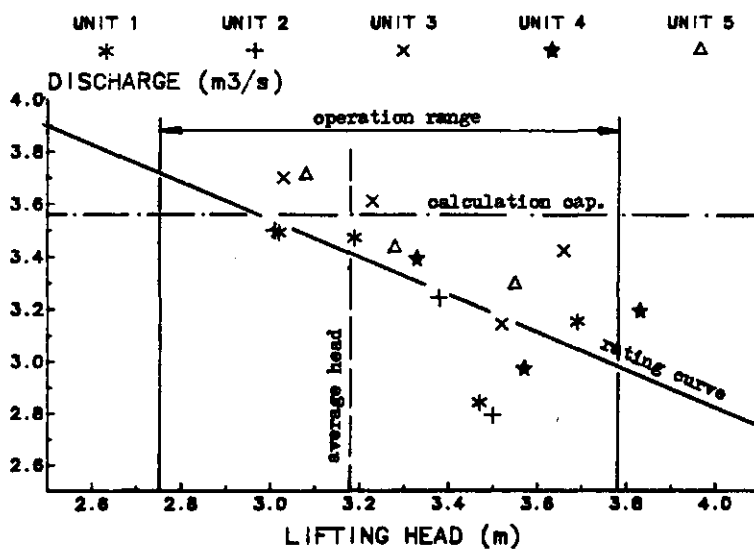
21 Q-H pairs \* unit in operation

Old rating curve :  $Q = 5.17 - 0.57 * H$  m3/s

Rating curve :  $Q = 5.70 - 0.72 * H$  m3/s

Ratio  $\frac{\text{capacity at av. head}}{\text{calculation capacity}} = \frac{3.41}{3.56} = 0.96$

Comment : - The new measurements add more information about the capacity for low heads.





BOUSTAIN P.S.

WN11

Pump station operating since Sep 1985. Not yet incorporated in measurement network.

Calculation capacity : 4 units \* 1.11 m3/s

Lifting head (1986) : average 2.18 m. max : 2.44 m.  
min : 1.61 m.

CALIBRATIONS

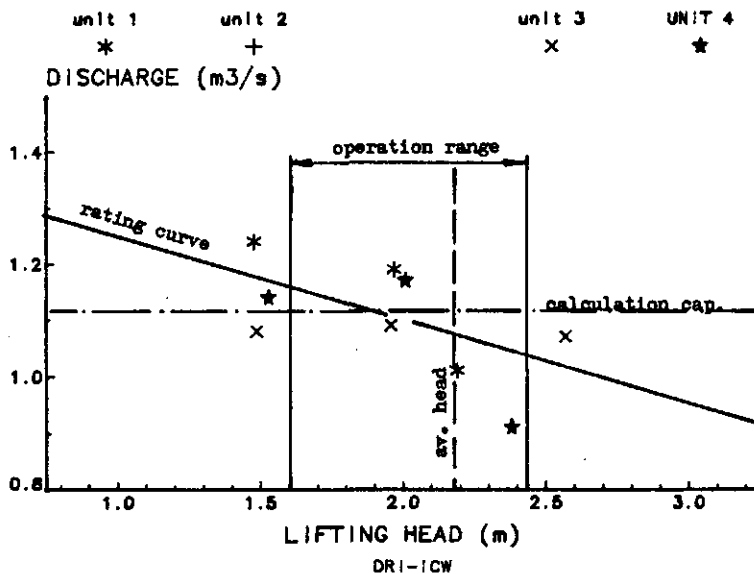
date	lifting head m.	discharges m3/s			
		unit 1	unit 2	unit 3	unit 4
22.04.86	1.97	1.19			
	1.96			1.09	
	2.01				1.17
23.04.86	1.48	1.24			
	1.49			1.08	
	1.53				1.14
	2.19	1.01			
	2.57			1.07	*
	2.38				0.91

9 Q-H pairs \* unit in operation

Rating curve :  $Q = 1.40 - 0.15 * H$  m3/s

Ratio  $\frac{\text{capacity at av. head}}{\text{calculation capacity}} = \frac{1.07}{1.11} = 0.96$

Comment : - The measured heads cover the whole range of operation heads.  
- No data available for unit 2.



MARIUT KHALT P.S.

WU10

-----  
 Calculation capacity : 3 units \* 6.00 m3/s

Lifting head (1985) : average 6.50 m. max : 6.76 m.  
 min : 6.15 m.

CALIBRATIONS

date	lifting head m.	discharges m3/s		
		unit 1	unit 2	unit 3
05.11.85	5.66		5.73	
	5.66	6.11		
04.12.85	5.36	5.52		
	5.39		5.58	
08.10.86	5.29		5.83	
	5.34	6.00		
19.01.87	5.85	5.55		
	5.80			4.98
	5.72		5.16	

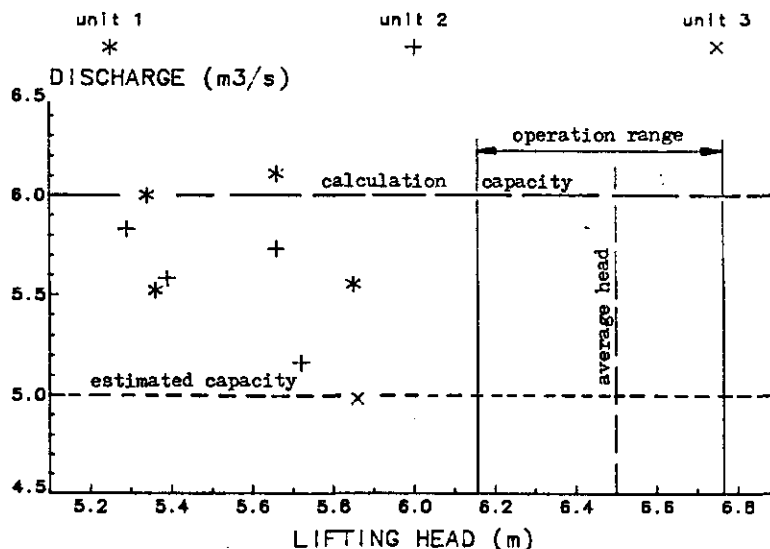
9 Q-H pairs

Average measured discharge : Q = 5.61 m3/s for head = 5.56 m.

Rating curve : | NO RATING CURVE |

Ratio  $\frac{\text{capacity at av. head}}{\text{calculation capacity}} = \frac{< 5.61}{6.00} < 0.93$

- Comment :
- The measured heads are all below the operation range of 1985 (and 1986).
  - The discharges measured are low compared to the calculation capacity and will be lower still for the average operation head. The given ratio is overestimated.
  - No rating curve can be established based on these data.
  - Measurements in the operation head range are recommended.
  - The average capacity is estimated at 5 m3/s



### 3. CALIBRATION MEASUREMENTS AT OPEN LOCATIONS

The measured data for each location are presented in tables and graphs.

Table 4. Discharge relations open locations  
Eastern Delta

Table 5. Discharge relations open locations  
Middle Delta

Table 6. Discharge realtions open locations  
Western Delta

EB01 Bilbeis Bridge  
EB05 Saada Bridge  
EB08 Bahr Baqar Bridge  
EB11 Bahr Baqar Outfall  
EH01 Saft El Qibly Bridge  
EH11 Bahr Hadus Bridge  
EH14 Gemeeza Bridge  
EH15 Iddowwar Bridge  
MG11 Bridge No. 7  
MG15 Ezbet El Nil Bridge  
MN05 Sidi Salim Bridge  
WN05 Drain No. 6 Outfall  
WN10 Nubareya Drain Outfall

Table 4. Discharge relations open locations Eastern Delta

Update per January 1986

CODE	LOCATION	DISCHARGE RELATION Level [m]; V [m/s]; Q [m3/s]	N ; r2	ref.pt m. aMSL	vel.point vert; depth #
EB01	BILBEIS BRIDGE	$Q = 14.55*(w1 - 5.39)$	7;0.91	+10.31	
EB04	WADI R.W. BRIDGE	* $Q = 20.68*(w1 - 3.44)$	7;0.76	+10.80	
EB05	SAADA BRIDGE	$Q = 18.61*(w1 - 0.63)$	11;0.85	+ 7.49	
EB07	SAUD BRIDGE 'OLD'	* $Q = 18.68*(w1 + 0.52)$	8;0.64	+ 3.21	
EB08	B. BAQAR BRIDGE	$Q = 0.75*V_{pt}*(46.5+48.4*w1)$	15;0.95	+ 3.42	35m; MSL
		** $Q = 28.02*(w1 + 0.15)$	18;0.67		
EB11	B. BAQAR OUTFALL	$Q = 0.75*V_{pt}*95$	5;0.99		29m;w1-1.25
EH01	SAFT e1 QIBLY BR.	$Q = 0.71*V_{pt}*(74.3-8.60*Hm)$	6;0.94		[B]3m;rp-6.90
		** $Q = 5.80*(7.49 - Hm)$	6;0.98		
EH04	NIZAM BRIDGE	$Q = 7.03*(w1 - 0.30)$	6;0.97	+ 5.78	
EH11	B. HADUS BRIDGE	$Q = 127.57*(w1 - 0.21)^{1.46}$	23;0.87	+ 3.18	
EH13	B. HADUS OUTFALL	Abandoned in Sept 1985			
EH14	GEMEEZA BRIDGE	* $Q = 6.01*(w1 - 0.40)$	14;0.80	+ 5.23	
EH15	IDDOWWAR BRIDGE	$Q = 23.80*(w1 - 0.05)$	13;0.90	+ 2.80	

# depth to MSL. (rp : from ref.point / w1 : from waterlevel)

\* reliability of the relation undecided

\*\* unreliable relation, used only for rough estimation of the discharge

Table 5. Discharge relations open locations Middle Delta

Update per January 1986

CODE	LOCATION	DISCHARGE RELATION Level [m]; V [m/s]; Q [m3/s]	N ; r2	ref.pt m.àMSL	vel.point vert;depth #
M102	BRIDGE DRAIN no 1	$Q = 5.37*(w1 + 1.42)$	5;0.97	+0.98	
MG06	GHARBIA BRIDGE 6	* $Q = 45.39*(w1 + 0.03)$	5;0.88	+ 3.55	
MG11	GHARBIA BRIDGE 7	* $Q = 80.75*(w1 - 0.10)$	9;0.86	+ 3.35	
MG13	GHARBIA OUTFALL	** $Q = 77.07*(w1 + 0.08)$	12;0.62	+ 1.55	
MG14	NEW GHARBIA OUTFALL	$Q = 0.78*V_{pt}*(101 + 82*w1)$	5;0.99	+ 3.99	33m; -2.25m
MG15	EZBET el NIL BRIDGE	$Q = 0.75*V_{pt}*(57.7+38.2*w1)$	6;0.98	+ 5.40	32m; -0.55m
MK01	TILLA OUTFALL	* $Q = 13.39*(w1 - 2.47)$	9;0.80	+ 8.93	
MN03	NASHART OUTFALL	$Q = 0.81*V_{pt}*(59 + 40*w1)$	7;0.98	+ 5.00	30m; -1.50m
MS01	SABAL OUTFALL	$Q = 22.46*(w1 - 6.23)^{1.80}$	5;0.97		

# depth to MSL

\* reliability of relation undecided

\*\* unreliable relation, used only for rough estimation of the discharge

Table 6. Discharge relations open locations Western Delta

Update per January 1986

CODE	LOCATION	DISCHARGE RELATION Level [m]; V [m/s]; Q [m3/s]	N ; r2	ref.pt m.aMSL	vel.point vert;depth #
WE09	HALQ el GAMAL BR.	* $Q = 77.25*(w1 - 0.48)$	14;0.76	+ 3.50	
WU01	SHERESHRA BRIDGE	Abandoned			
WU1A	SHERESHRA MARKET BR.	$Q = 0.73*V_{pt}*(110 + 26*w1)$ ** $Q = 21.12*(w1 + 2.62)$	7.0.98 7;0.65	+ 1.53	19m; -3.50m
WU04	DUSHUDI BRIDGE	$Q = 0.52*V_{pt}*(198+33.6*w1)$	15;0.84	- 0.11	31m; -4.25m
WN05	DRAIN no 6 OUTFALL	$Q = 6.38*(5.06 - H_m)$	7;0.91		
WN10	NUBARIA DR. OUTFALL	* $Q = 5.80*(8.03 - H_m)^{1.45}$	5;0.86		

# depth to MSL.

\* reliability of relation undecided

\*\* unreliable relation, used only for rough estimation of the discharge

BILBEIS BRIDGE

EB01

CALIBRATIONS

no	date	level m.aMSL	discharge m3/s
old measurements not relevant			
1	14.04.86	6.23	12.98
2	12.08.86	6.39	14.50
3	04.09.86	6.42	15.48
4	25.09.86	6.40	13.76
5	16.10.86	6.26	12.76
6	13.01.87	6.17	11.22
7	11.02.87	6.10	9.92

Ref. point : + 10.31 m.MSL

old rating curve :

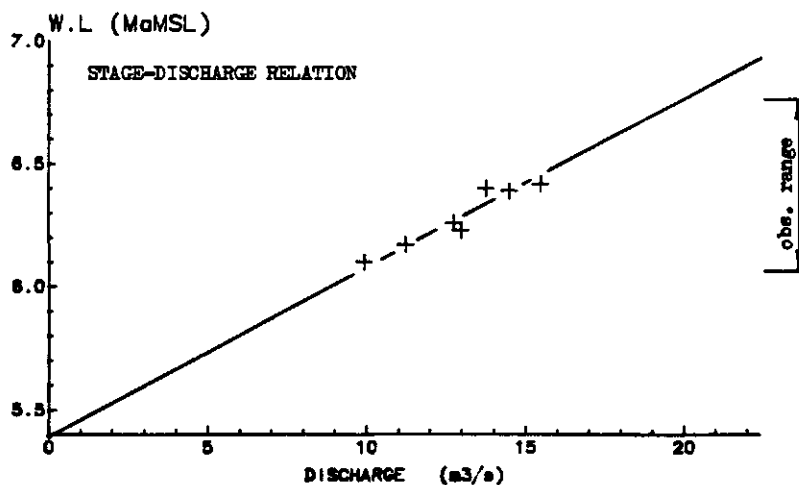
$$Q = 10.20 * (w1 - 5.08) \quad r2=0.69$$

Rating curve :

$$Q = 14.55 * (w1 - 5.39) \quad m3/s$$

corr. coeff. r2= 0.91  
w1. = waterlevel aMSL

- Comment :
- The old rating curve is not valid after January 1986 because the drain has been deepened and cleaned in this month.
  - The level range of the new measurements is restricted.
  - Reliable rating curve for levels between + 6.00 and + 6.50 m.MSL.



SAADA BRIDGE

EB05

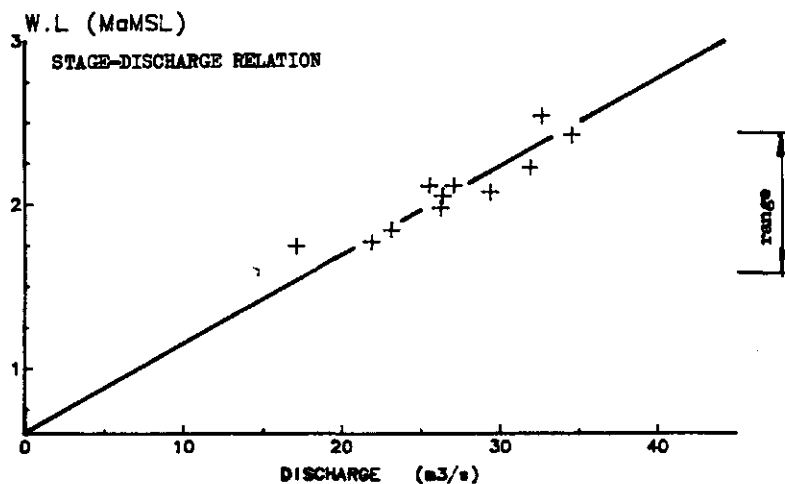
CALIBRATIONS

no	date	level m.aMSL	discharge m3/s	Ref. point : + 7.49 m.MSL	
1	03.09.81	2.42	34.53	<< old measurements	
2	19.10.81	2.22	31.89		
3	25.01.82	2.07	29.35		
4	29.01.83	2.05	26.35		old rating curve :
5	16.02.84	1.74	17.09		$Q = 19.46 * (w1 - 0.70)$
6	14.03.84	1.84	23.12		$r^2=0.85$
7	10.07.84	2.11	27.04		
8	07.08.84	2.54	32.60		
9	29.01.85	1.97	26.23	<< new measurements	
10	13.01.87	2.11	25.52		
11	10.02.87	1.77	21.88		

Rating curve :  $Q = 18.61 * (w1 - 0.63)$  m3/s

corr. coeff.  $r^2 = 0.84$   
 w1. = waterlevel aMSL

- Comment :
- The new measurements are in the low level range.
  - The datum level seems alright.
  - The reliability is undecided, but can be considered acceptable.





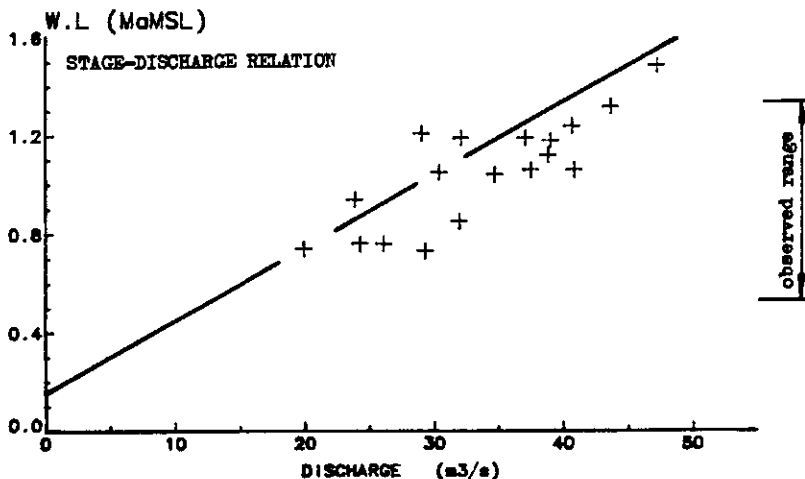
CALIBRATIONS

no	date	level m.aMSL	discharge m3/s	Ref. point : + 3.42 m.MSL	
1	27.09.81	1.32	43.63	<< old measurements	
2	01.11.81	1.21	29.02		
3	07.02.82	0.94	23.85		
4	25.01.83	1.19	32.07		
5	11.07.84	0.85	31.93		old rating curve :
6	08.08.84	1.12	38.79		Q = 25.99 * (wl + 0.26)      r2=0.46
7	03.10.84	1.06	40.83		
8	10.10.84	1.19	37.04		
9	17.10.84	1.18	38.98		
10	23.10.84	1.06	37.47		
11	06.11.84	1.04	34.70		
12	27.11.84	1.24	40.66		
13	17.12.84	1.49	47.21		
14	23.04.85	0.76	26.08	<< new measurements	
15	16.05.85	0.76	24.27		
16	22.07.85	0.73	29.32		
17	14.01.87	1.05	30.37		
18	10.02.87	0.74	19.89		

Rating curve :  $Q = 28.02 * (wl + 0.15)$       m3/s

corr. coeff. r2= 0.67  
wl. = waterlevel aMSL

- Comment :
- The new measurements give more information about low level flow.
  - The correlation of the rating curve given above is better than for the old rating curve, however still low.
  - The datum level is unlikely as it is below MSL.
  - The rating curve could only be used for a rough estimation of discharges if no other means are available.
  - UNRELIABLE RATING CURVE



BAHR BAQAR BRIDGE

EB08

Ref.point : + 3.42 m. MSL

Vpt. in vert. 35m ; at MSL

CALIBRATIONS

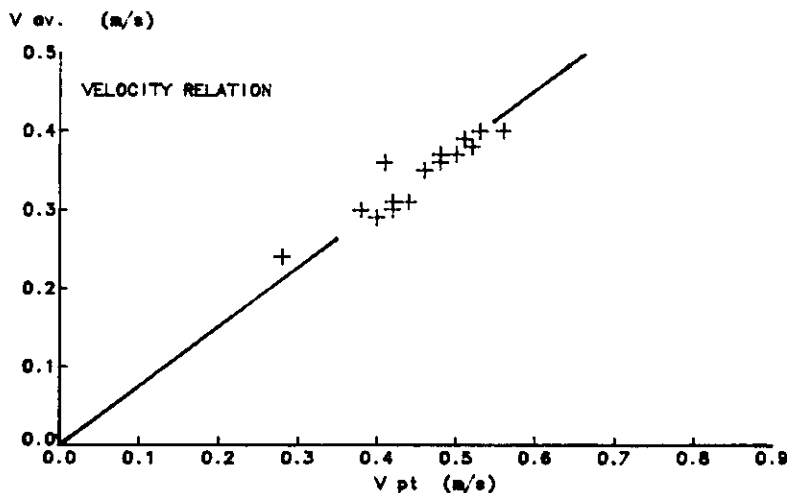
VELOCITIES

no	date	level m.aMSL	discharge m3/s	V pt. m/s	V av. m/s	Vpt. in vert. 35 m. 3.40 m below ref.pt
1	11.07.84	0.85	31.93	0.48	0.37	<< old measurements
2	03.10.84	1.06	40.88	0.53	0.40	
3	10.10.84	1.19	37.04	0.48	0.36	
4	17.10.84	1.18	38.98	0.52	0.38	
5	23.10.84	1.06	37.47	0.51	0.39	
6	06.11.84	1.04	34.70	0.46	0.35	
7	27.11.84	1.24	40.66	0.50	0.37	
8	17.12.84	1.49	47.21	0.56	0.40	
9	30.01.85	1.00	28.33	0.42	0.30	
10	27.03.85	0.88	27.23	0.38	0.30	
11	23.04.85	0.76	26.08	0.44	0.31	<< new measurements
12	16.05.85	0.76	24.26	0.40	0.29	
13	22.07.85	0.73	29.32	0.41	0.36	
14	14.01.87	1.05	30.37	0.42	0.31	
15	10.02.87	0.74	19.88	0.28	0.24	

Rating curve :  $Q = 0.75 * V_{pt} * ( 46.5 + 48.4 * w_l )$  m3/s

corr. coeff. r2= 0.95  
w<sub>l</sub> = waterlevel aMSL

- Comment :
- The new measurements add more information about low level flow.
  - The velocity curve does not change, however the correlation improves.
  - Reliable velocity curve.



BAHR BAQAR OUTFALL

EB11

Level of ref. point unknown

Vpt. in vert. 29m; at 1.25m below water surface

CALIBRATIONS

VELOCITIES

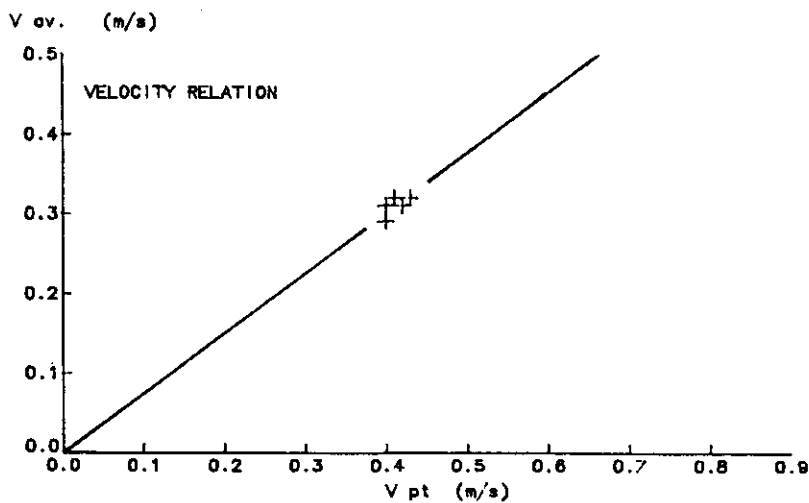
no	date	level (Hm)	discharge m3/s	V pt. m/s	V av. m/s
1	03.10.84		30.46	0.43	0.32
2	10.10.84	0.29	29.29	0.40	0.31
3	17.10.84		30.15	0.41	0.32
4	23.10.84	0.25	27.60	0.40	0.29
5	06.11.84	0.24	29.26	0.42	0.31

Rating curve :

$$Q = 0.75 * V_{pt} * 95 \quad m^3/s$$

corr. coeff. r2= 0.99  
Hm = waterlevel from reference point

Comment : - Because of the minor variations in water level the cross-sectional area of the drain is considered constant.  
- Reliable velocity curve.



SAFT e1 QIBLY BRIDGE

EH01

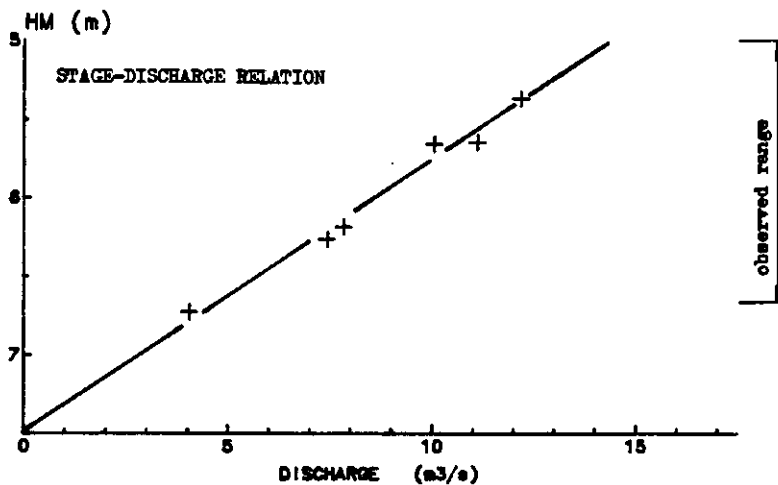
CALIBRATIONS

no	date	level (Hm)	discharge m3/s
1	05.09.86	5.65	11.12
2	23.09.86	5.37	12.19
3	16.10.86	5.66	10.06
4	06.04.87	6.73	4.05
5	06.05.87	6.27	7.44
6	27.05.87	6.19	7.84

Rating curve :  $Q = 5.80 * ( 7.49 - H_m )$  m3/s

corr. coeff. r2= 0.98  
Hm = waterlevel from reference point

- Comment :
- Earlier measurements (1981) showed that no rating curve exists.
  - This is according to the backwater theory, location lies in the backwater curve from Hanut Pump Station.
  - The high correlation in the above rating curve might be coincidental ( Hanut always operating at the same capacity at the time of measurements ?)
  - Curve could be used for an estimation of the discharge.



SAFT el QIBLY BRIDGE

EH01

Level of ref.point unknown

Vpt. in vert. 3m (opening B);  
6.90m below ref.point

CALIBRATIONS

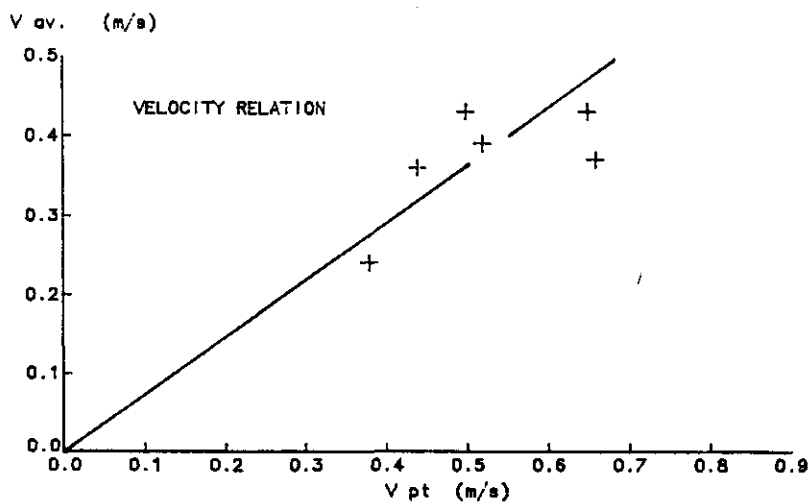
VELOCITIES

no	date	level (Hm)	discharge m3/s	V pt. m/s	V av. m/s
1	05.09.86	5.65	11.12	0.50	0.43
2	23.09.86	5.37	12.19	0.65	0.43
3	16.10.86	5.66	10.06	0.52	0.39
4	06.04.87	6.73	4.05	0.38	0.24
5	06.05.87	6.27	7.44	0.44	0.36
6	27.05.87	6.19	7.84	0.66	0.37

Rating curve :  $Q = 0.71 * V_{pt} * ( 74.3 - 8.60 * H_m )$  m3/s

corr. coeff. r2= 0.94  
Hm = waterlevel from  
reference point

Comment : - The wide range of measured levels is caused by the action of the downstream situated Hanut Pump Station (Reuse).  
- Reliable relation.

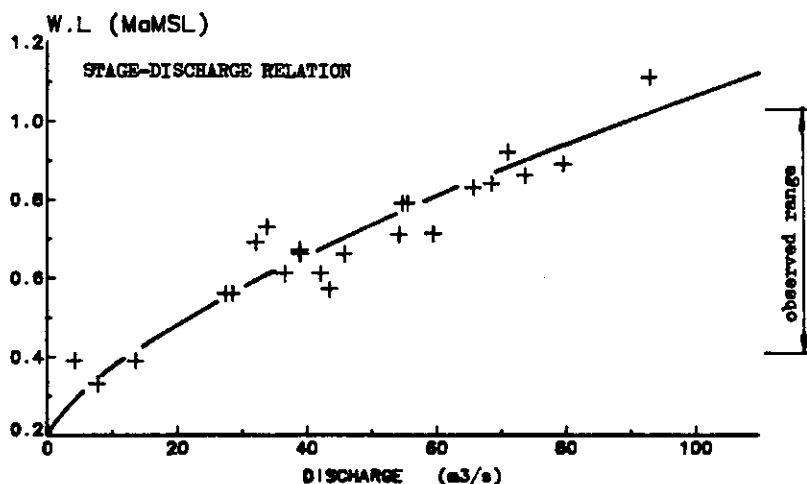


CALIBRATIONS

no	date	level m.aMSL	discharge m3/s	Ref. point : + 3.18 m.MSL	
1	22.02.81	0.67	38.58	<< old measurements	
2	08.11.81	0.66	38.94		
3	02.02.82	0.39	13.56		
4	06.02.83	0.33	7.69		
5	11.06.84	0.66	45.75		old rating curve :
6	26.07.84	0.89	79.50		$Q = 109.75 * (w1 - 0.18)^{1.38}$
7	18.08.84	0.83	65.69		$r^2=0.95$
8	27.08.84	0.79	55.47		
9	31.10.84	0.73	33.80		
10	31.10.84	0.69	32.07		
11	19.11.84	0.84	68.50		
12	11.12.84	1.11	92.88		
13	25.12.84	0.79	54.73		
14	06.03.85	0.92	70.97	<< new measurements	
15	19.03.85	0.61	42.08		
16	09.04.85	0.57	43.51		
17	01.05.85	0.61	36.52		
18	23.05.85	0.56	27.44		
19	16.07.85	0.71	54.22		
20	08.04.86	0.71	59.45		
21	30.04.86	0.56	28.50		
22	14.01.87	0.86	73.64		
23	09.02.87	0.39	4.15		

Rating curve :  $Q = 127.57 * (w1 - 0.21)^{1.46}$  m3/s  
 corr. coeff.  $r^2 = 0.87$   
 w1. = waterlevel aMSL

- Comment :
- Curve fitting for the new measurements only showed a somewhat higher correlation, for a linear curve however.
  - This linear curve is rejected in favor of the above given power curve (power about 1.5 according to general hydraulic theory)
  - Datum level seems alright and coincides with the old one.
  - Reliable rating curve.



GEMEEZA BRIDGE

EH14

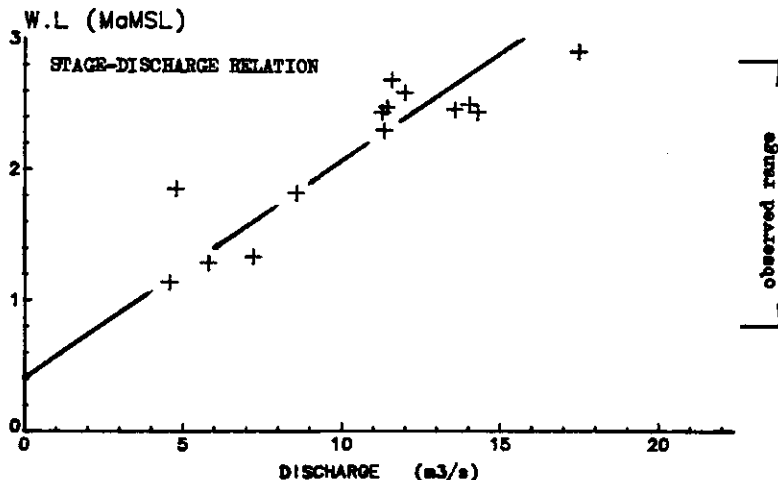
CALIBRATIONS

no	date	level m.aMSL	discharge m3/s	Ref. point : + 5.23 m.MSL	
1	30.09.84	2.90	17.49	<< old measurements	
2	15.10.84	2.49	14.04		
3	01.11.84	2.29	11.36		
4	18.11.84	2.47	11.44		
5	04.12.84	2.43	11.30		old rating curve :
6	12.12.84	2.58	12.00		$Q = 7.00 * (w1 - 0.72)$ $r2 = 0.76$
7	26.12.84	2.68	11.59		
8	24.01.85	1.85	4.79		
9	05.03.85	2.45	13.58		
10	18.03.85	1.28	5.83		
11	08.04.85	1.13	4.58	<< new measurements	
12	22.05.85	1.33	7.23		
13	17.07.85	1.82	8.60		
14	15.01.87	2.43	13.30		

Rating curve :  $Q = 6.01 * (w1 - 0.40)$       m3/s

corr. coeff.  $r2 = 0.80$   
 w1. = waterlevel aMSL

- Comment :
- The curve given above shows a better correlation than the old one while the new measurements give more information about the low level flow.
  - Apparently the old rating curve underestimated the flow for low levels.
  - The reliability of the relation is undecided.
  - More measurements are recommended.



IDDOWWAR BRIDGE

EH15

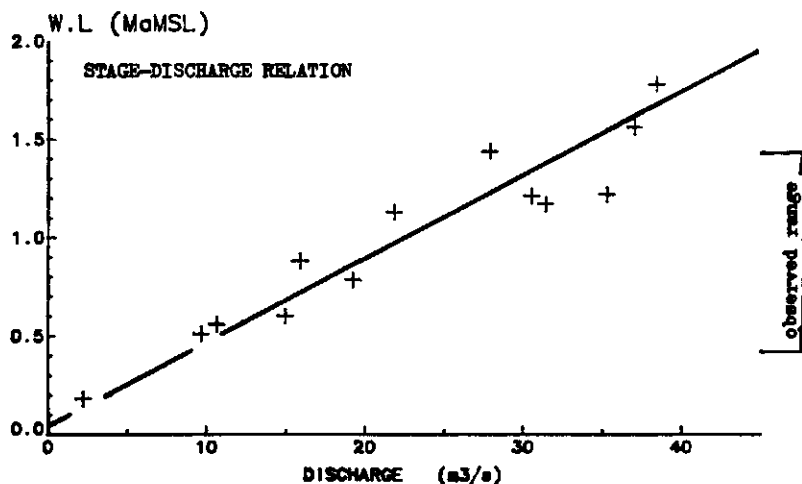
CALIBRATIONS

no	date	level m. aMSL	discharge m3/s	
				Ref. point : + 2.80 m.MSL
1	30.09.84	1.78	38.43	<< old measurements
2	15.10.84	1.44	27.89	
3	18.11.84	1.21	30.52	
4	11.12.84	1.56	37.01	
5	25.12.84	1.17	31.42	
6	24.01.85	0.78	19.24	
7	05.03.85	1.22	35.28	
8	18.03.85	0.51	9.69	
				old rating curve :
				$Q = 21.75 * (w_l + 0.11) \quad r^2 = .83$
9	30.04.85	0.60	14.98	<< new measurements
10	17.07.85	0.88	15.88	
11	15.01.87	1.13	21.84	
12	09.02.87	0.18	2.23	
13	06.04.87	0.56	10.68	

Rating curve :  $Q = 23.80 * (w_l - 0.05)$  m3/s

corr. coeff.  $r^2 = 0.90$   
 $w_l =$  waterlevel aMSL

- Comment :
- Curve fitting for the new measurements only showed a slightly higher correlation coefficient. The observed level range was limited however.
  - The curve given above shows a better correlation than the old one and covers a wide range of levels.
  - The new measurements added more information about the lower levels. The old rating curve overestimated the flow for lower levels.
  - The datum level 0.05 m ab.MSL lies somewhat low
  - Reliable relation.





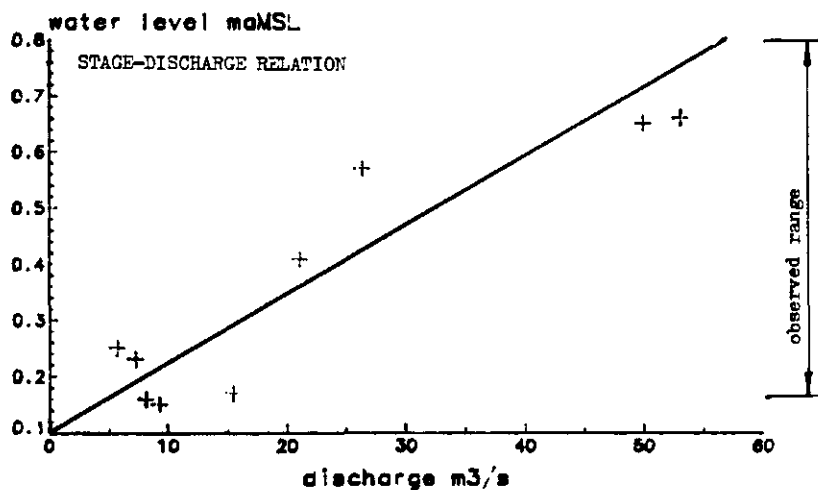
CALIBRATIONS

no	date	level m.aMSL	discharge m3/s	
				Ref. point : + 3.35 m.MSL
1	25.02.81	0.57	26.30	<< old measurements  old rating curve :  $Q = 38.31 \cdot (w_1 + 0.39)^{2.61}$  r2=0.89
2	30.01.84	0.23	7.29	
3	29.01.85	0.16	8.19	
4	11.02.85	0.15	9.30	
5	06.03.85	0.41	21.06	
6	19.05.85	0.17	15.49	
7	25.06.85	0.66	53.14	
8	17.07.85	0.65	49.88	
9	09.02.87	0.25	5.71	<< new measurement

Rating curve :  $Q = 80.75 \cdot (w_1 - 0.10)$  m3/s

corr. coeff. r2= 0.86  
w1. = waterlevel aMSL

- Comment :
- The new measurement added more information about low level flow.
  - The new rating curve gives a better estimation of the datum level, however the correlation coefficient is somewhat lower.
  - The reliability of the relation is undecided but can be considered acceptable.



EZBET e1 NIL BRIDGE

MG15

Ref.point : + 5.40 MSL

Vpt in vert. 32 m.; - 0.55m MSL

CALIBRATIONS

VELOCITIES

no	date	level m.aMSL	discharge m3/s	V pt. m/s	V av. m/s
1	02.10.85	0.72	27.24	0.43	0.32
2	06.11.85	0.60	15.40	0.27	0.20
3	03.12.85	0.68	24.20	0.38	0.28
4	23.12.85	1.02	36.73	0.52	0.38
5	26.02.86	0.67	26.84	0.41	0.31
6	02.04.86	0.56	33.00	0.54	0.43

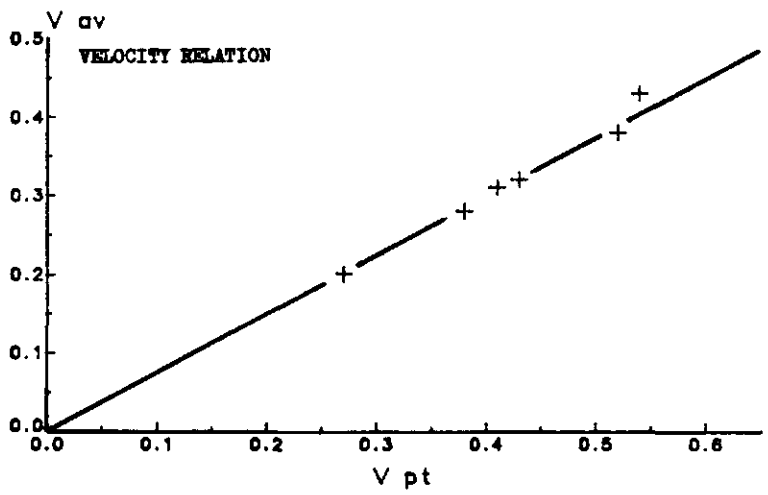
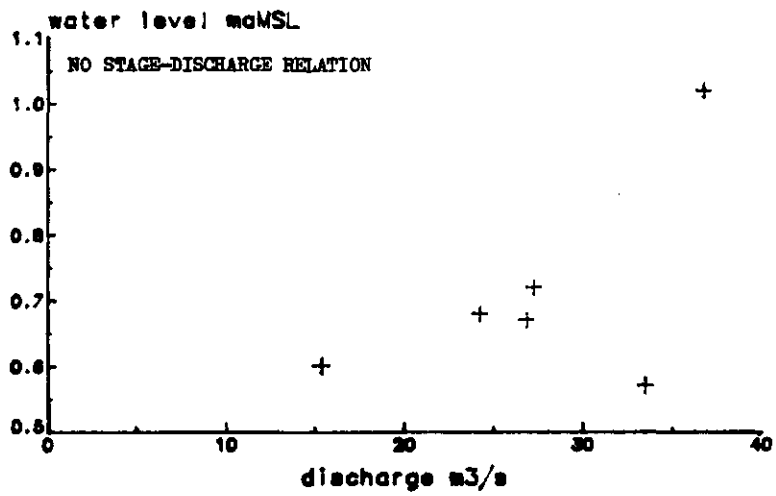
Rating curve :

$$Q = 0.75 * V_{pt} * ( 57.7 + 38.2 * w_l )$$

m3/s

corr. coeff. r2= 0.98  
wl. = waterlevel aMSL

Comment : - Reliable velocity relation

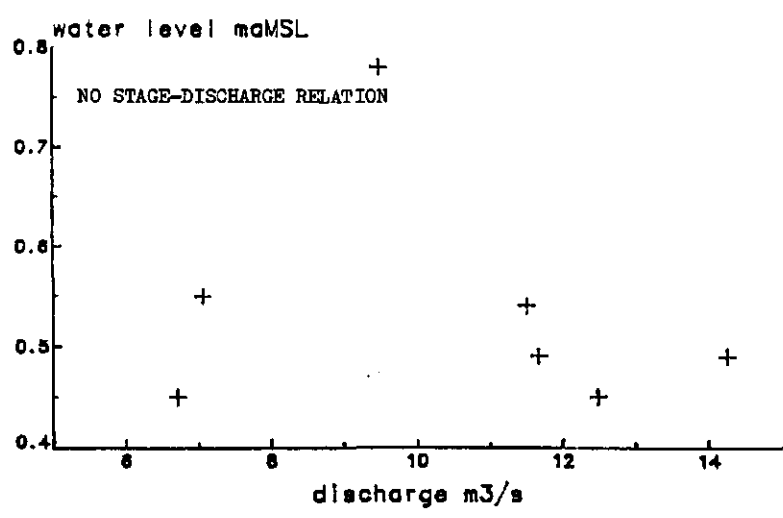


CALIBRATIONS

no	date	level m.aMSL	discharge m3/s
1	02.10.85	0.78	9.48
2	07.11.85	0.45	6.71
3	03.12.85	0.56	7.05
4	23.12.85	0.46	12.46
5	03.09.86	0.54	11.49
6	16.09.86	0.49	11.66
7	01.10.86	0.49	14.25

Rating curve : NO RELIABLE RATING CURVE

- Comment :
- No reliable rating curve found.
  - A velocity discharge relation has not been elaborated as the location is unsuitable for installation of a velocity recorder.
  - Location has been abandoned.



DRAIN 6 OUTFALL

WN05

Discharge point in Nubaria Drain. Location not yet incorporated in measurement network.

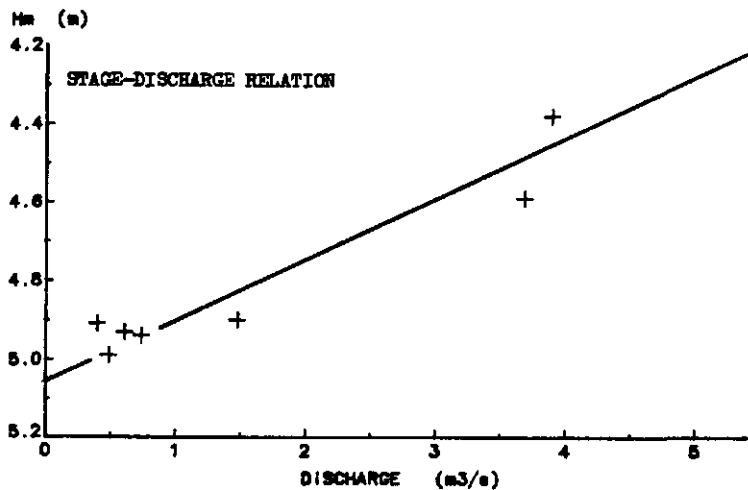
CALIBRATIONS

no	date	level Hm	discharge m3/s
1	26.08.86	4.91	0.40
2	17.09.86	4.99	0.49
3	28.10.86	4.93	0.61
4	16.12.86	4.94	0.74
5	20.01.87	4.90	1.48
6	12.02.87	4.59	3.69
7	20.04.87	4.38	3.90

Rating curve :  $Q = 6.38 * ( 5.06 - Hm )$  m3/s

corr. coeff. r2= 0.91  
Hm. = waterlevel from ref.  
point downward

Comment : - There are indications that the bottom level at the location is not constant. Regular check measurements are recommended.  
- Reliable relation.



NUBARIA DRAIN OUTFALL

WN10

Measurement point in Nubaria Drain situated near Nubaria Canal Shiplocks.  
 From here on the drain continues to the Mediterranean Sea.  
 Not incorporated in the measurement network yet.

CALIBRATIONS

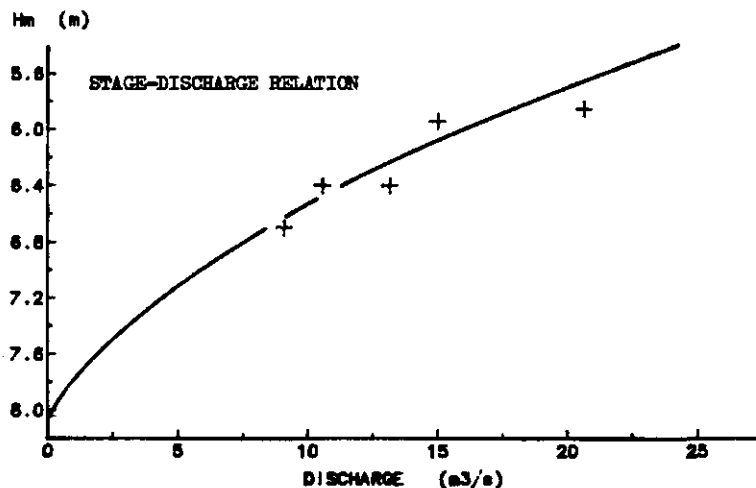
no	date	level Hm	discharge m3/s
1	17.09.86	6.40	10.56
2	11.12.86	5.85	20.62
3	20.01.87	6.40	13.14
4	12.02.87	6.70	9.09
5	20.04.87	5.94	14.99

<< corrected Hm

Rating curve :  $Q = 5.80 * ( 8.03 - H_m )^{1.45}$  m3/s

corr. coeff. r2= 0.86  
 Hm. = waterlevel from ref.  
 point downward

- Comment :
- Satisfying range in level and discharges.
  - Reliability of relation is undecided.
  - More measurements are recommended.



## ANNEX 1. ADDITIONAL DISCHARGE MEASUREMENTS

Situation per 01.06.87

CODE	LOCATION	DATE	lev/head mMSL/m	Vpt. m/s	Qmeas m3/s	Qr.c. m3/s	Qm/Qrc
-----							
EASTERN DELTA							
open locations :							
EB04	WADI R.W. BRIDGE	28.01.85	+ 4.40		21.31	19.85	1.07
EB07	SAUD BRIDGE	29.01.85	+ 1.03		31.34	28.96	1.08
EH04	NIZAM BRIDGE	29.04.86	+ 1.13		3.88	5.80	0.67
MIDDLE DELTA							
open locations :							
MG15	EZBET el NIL BRIDGE	15.09.86	+ 0.90	.50	35.23	34.53	1.02
MN03	NASHART OUTFALL	16.09.86	+ 0.40	.28	15.20	17.01	0.89
pump stations :							
MG01	EAST MENUF. unit 2	04.02.87	0.81		3.15	3.23	0.98
	unit 2		1.10		3.14	3.08	1.02
MG04	SAMATAY unit 1	02.02.87	0.54		5.80	5.92	0.98
	unit 3		0.51		5.61	5.95	0.94
	unit 4		0.58		5.49	5.87	0.93
WESTERN DELTA							
open location :							
WU1A	MARKET BRIDGE	10.12.85	- 1.80	.08	4.16	3.87	1.07

- \* مصب مصرف بحر حادوس الجديد .
- \* كويرى البلاصى عند نهاية مصرف نشرت .
- \* كويرى أدكو عند نهاية مصرف أدكو .

عند كويرى صفت القبلى مطلوب عمل دراسة مفصلة عن تأثير نظام

- تشغيل محطة ظلمبات حانوت على التصرفات عند الكويرى .

يلزم عمل قياسات التصرف عن كل المواقع على فترات تتراوح بين شهرين

- وثلاثة أشهر لكشف أى تغيرات .
-





\* نتائج المعايير على المصارف المكشوفة :-

- تم ايجاد علاقات تصرف جيدة للمواقع الآتية على المصارف المكشوفة وهى :-

كوبرى بلبيس

كوبرى بحس حادرس

كوبرى الدوار

مصب مصرف رقم ٠٦

تم ايجاد علاقات تصرف مقبولة ولكن غير محددة بشكل نهائى للمواقع الاتية

بيانها :-

كوبرى السعده

كوبرى الجميزه

كوبرى رقم ٧ على مصرف الخريفة الرئيسى

مصب مصرف غرب النوبارية

- تم ايجاد علاقات جيدة بين التصرف والسرعة للمواقع الاتية بيانها وهى :-

كوبرى بحر البقر

مصب مصرف البقر

كوبرى بحر القبلية

كوبرى عزبة النيل

\* لم يمكن ايجاد علاقة تصرف للموقع التالى :-

كوبرى سيدي سالم

عند هذا الموقع لم يمكن قياس السرعة بطريقة عملية لذا لا يمكن ايجاد علاقة يبين

التصرف وسرعة المياة وبناءً على فقد تم استبعاد هذا الموقع من شبة القياس .

\* نتائج معايير محطات التلمبات :-

- تم ايجاد علاقات جيدة لمحطات التلمبات الاتى بيانها :-

محطة تلمبات بلاد العايد

محطة تلمبات أدكو

محطة تلمبات البوصيلى

محطة تلمبات البستان

وبسبب عدم امكانية زيادة عدد القياسات عند ضواغط مختلفة امكن

ايجاد علاقة اقل دقة للمحطة الاتية :-

• محطة تلمبات الوادى الجديد

ونظرا لنقص البيانات اللازمة للقياسات وجد انه لايمكن ايجاد منحنيات

تصرف لمحطات التلمبات التاليتة :-

محطة تلمبات فارسكو

محطة تلمبات البرنس

محطة تلمبات زغل

محطة تلمبات مريوط خلط

تم استخدام التصرفات النظرية من واقع بيانات الميكانيكا والكهرباء

فيما عدا محطة تلمبات مريوط خلط فقد تم تقدير تصرفها بشكل مناسب . . ولن

تؤخذ اى قياسات جديدة على محطة البرلس حيث انه يتم التحكم فى تصرفها

طبقا لمعدل التزويد بالطاقة كما ان الوحدات على وشك ان تستبدل .

من الممكن ان تكون النسبة بين تصرف المعايير والتصرف النظري

اكبر بالنسبة للمحطة الاتية وهى :-

محطة تلمبات زغل

ومن الممكن ان تكون النسبة المعطاة أقل بالنسبة للمحطة

الاتية وهى :-

محطة تلمبات مريوط خلط

## ملخص

يعرض هذا التقرير نتائج قياسات معايرة محطات الطلمبات والمصارف المكشوفة

في دلتا النيل التي تمت بعد تقديم التقارير السابقة ارقام ٦ ، ٨ ، ٩ .

في احدى عشرة محطة طلمبات تم تنفيذ (٤٣) قياس معايرة ، تغطي

جزئيا التوصيات التي وردت في التقارير السابق الاشارة اليها .

تم ايجاد علاقات جديدة بين التصرف ومنسوب المياه في حالات تأييد هذه العلاقات

بنتائج القياس . يمكن عمل ذلك في خمس محطات طلمبات ، ثلاثة منهم لم يسبق

عمل قياسات معايرة لها اما في الحالات الاخرى فتم مقارنة النتائج بمنحنيات المعايرة

المتاحة .

وقد تم تحديد النسبة بين التصرف حسب قياس المعايرة والتصريف النظري

المستخدم بواسطة مصلحة الميكانيكا والكهرباء بوزارة الري عند متوسط الرفع الاستاتيكي

لعام ١٩٨٥ .

وتمثل الجدول ارقام ١ ، ٢ ، ٣ نتائج قياسات المعايرة لمحطات الطلمبات

التي تشملها شبكة قياس مشروع اعادة استخدام مياه الصرف في مناطق شرق ووسط وغرب

الدلتا .

وفي سبعة عشرة موقع في المصارف المكشوفة والتي تشمل المصببات تم عمل

(٧٢) قياس معايرة ليغطي بشكل كامل تقريبا ، التوصيات التي وردت في التقارير

ارقام ( ٦ ، ٨ ، ٩ ) ومنها تم استنتاج منحنيات معايرة جديدة لاثنا عشر موقعا

تعرض الجدول ارقام ٤ ، ٥ ، ٦ علاقات التصريف / عمق المياه - التصريف

/ سرعة المياه لمناطق شرق ووسط وغرب الدلتا على التوالي .

وقد تم استخدام علاقات التصريف الموضحة في الجدول ارقام (١) الى (٦) عند

حساب التصريفات لعام ١٩٨٦ .

\* مقدمة :-

معظم اعمال هذا التقرير نفذت بواسطة المهندسون التالي اسماؤهم وهم :-

القياسات فى الموقع ، التحاليل الحسابية :-

مهندس / محمد عزت حســــن

مهندس / مجدى عبد النبــــى

مهندس / ابراهيم احمد لاشيــــن

مهندس / عادل عبد الرشيد سليــــم

مهندس / محمد سعد عبــــس

مهندس / احمد محمد مرــــس

\* تقييم وتقديم البيانات :-

مهندس / محمد سعد عبــــس

مهندس / مجدى عبد النبــــى

مهندس / ابراهيم احمد لاشيــــن

مهندس / محمد عزت حســــن

\* المحرر :-

مهندس / هندريك باينــــ

\* المعامــــل :-

رئيسه الشعبة بالمعهد : دكتورة / سامية الجنــــى  
فريق المشــــروع :

مهندسة / ليلي السيسى  
مهندسة / عطيات ابو بكر  
مهندس / جمال عبد الناصر كامــــل  
مهندسة / سميرة سيد محــــوس  
مهندسة / نصره عبد اللــــه

\* الاستشاريين :-

مهندس / د . بولــــى  
مهندس / روست  
د . ج / هارمــــن

الفريق البحثى للمشروع

مدير المشروع :

د. م / محمد حسن عامر  
د / ب . أ . رايتما

\* قسم الصرف المكشوف :-

رئيس الشعبة بالمعهد : دكتور / ضياء الدين القوصى

\* الفريق الهولندى المقيم :

مهندس / م . ماسكانت  
مهندس / ه . جى . م . بنى زورب  
مهندس / م . ف . ر . سمىث  
مهندس / ج . د . زويتب رود

\* الفريق المصرى للمشروع :

دكتور / محمد احمد عبد الخالق  
دكتورة / شادن عبد الجواد  
المهندس / عادل عبد الرشيد سليم  
المهندس / احمد محمد مرسى  
المهندس / محمد عزت حسن  
المهندس / ابراهيم احمد لاشي  
المهندس / مجدى عبد النبى  
المهندس / نبيل فتحى قنديل  
المهندس / محمد سعد عباس  
المهندسة / ميرفت الجنيدى  
المهندسة / سمىة محمد عباس

# تقارير برنامج القياسات

## التقارير الخاصة

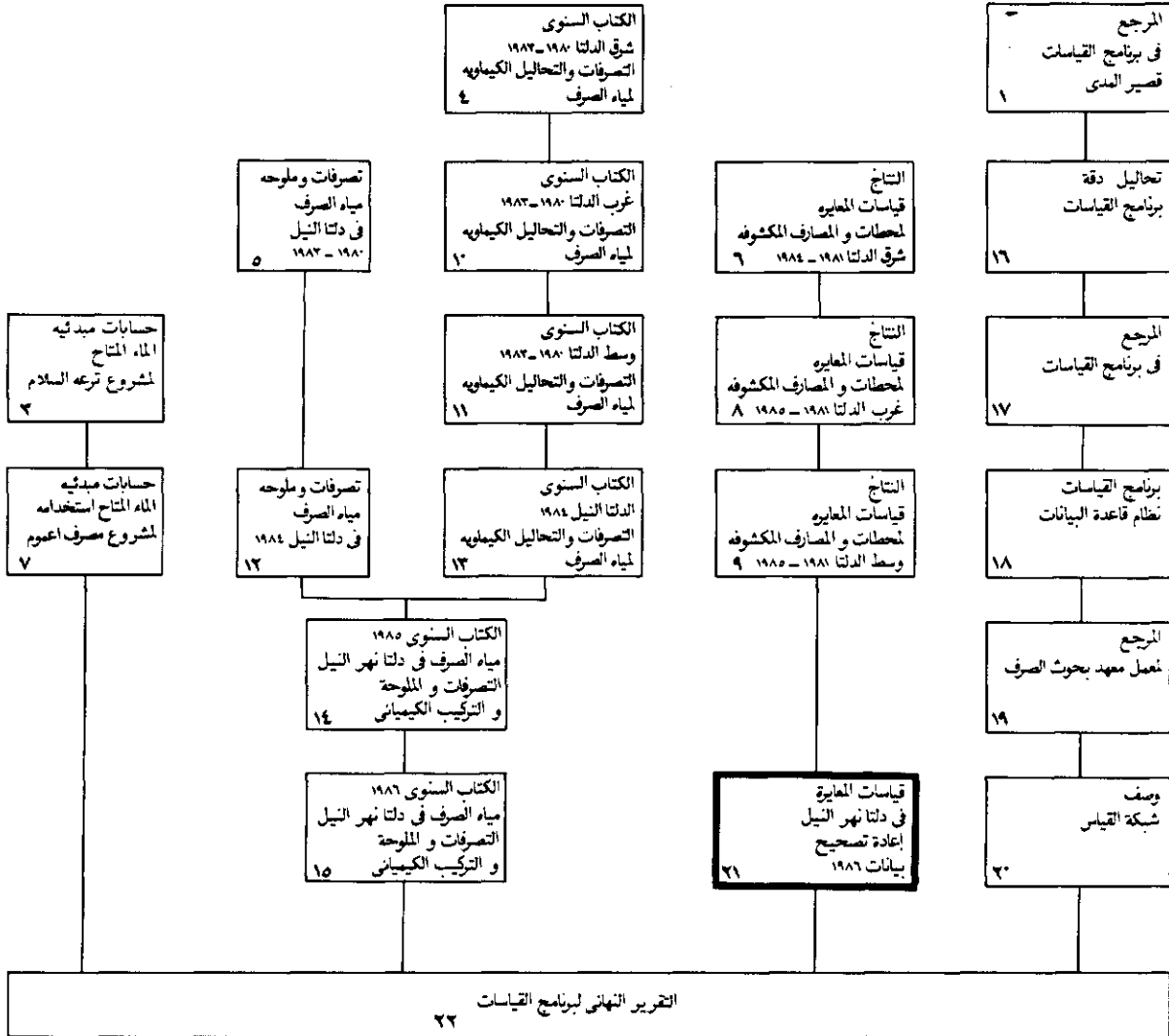
## الكتب السنوية

## المعايير

## المراجع

البيانات  
الهيدرولوجية

البيانات  
الكيميائية



مشروع إعادة استخدام مياه الصرف  
تقرير رقم ٢١

قياسات المعايرة في  
على محطات الطلمبات و المصارف المكشوفة  
دلتا نهر النيل  
إعادة تصحيح بيانات ١٩٨٦

ه.ب.م. باينز دورب  
ابراهيم احمد لاشين  
ضياء الدين القوصى

١٩٨٧

معهد بحوث الصرف مركز البحوث المائية ج.م.ع.  
معهد بحوث ادارة الاراضى والمياة  
واخنجن، هولندا



مشروع اعاده استخدام مياه الصرف نشاط مشترك بين : -  
معهد بحوث الصرف - الجيزه - جمهوريه مصر العربيه  
ومعهد بحوث اداره الاراضى والمياه - فاجنجن - هولندا

وتعتبر الجهة المموله للمشروع وزاره الري بجمهوريه مصر العربيه  
ووزاره العلاقات الخارجيه بهولندا فى إطار البرنامج المشترك للتعاون الفنى  
بين مصر وهولندا .

ويعمل المجلس الاستشارى المصرى الهولندى كهيئة مشرفة .

نتائج الدراسات التى تمت خلال هذا المشروع ستعرض اما فى تقارير مبدئيه  
او تقارير نهائيه . حيث ان محتويات التقارير المبدئيه ممكن تختلف بشدة  
من تقديم مبسط للبيانات او مناقشات لنتائج وخلصات بحثيه .

الاراء والتوصيات الموجوده فى التقارير السابقه تعتبر اراء المؤلف فقط  
وليس لها علاقه بالمعاهد والوزارات المعنية .

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ  
"وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيًّا"  
صَدَقَ اللّٰهُ الْعَظِیْمُ