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THE EDUCATION AND TRAINING NEEDS OF WATERCARE OPERATORS AND OPERATIONS MANAGERS IN THE RSA

Report to the
WATER RESEARCH COMMISSION
by
MTI MANPOWER CONSULTING SERVICES (PTY) LTD

WRC Report No KV 35/92

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BY

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RANDBURG, SOUTH AFRICA

ISBN NO. 1 874858 27 6

WRC REPORT NO. KV 35/92

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ACKNOWLEDGEMENTS

The information documented in this report represents the consensus opinion of the following participants who the researchers believe constitute a representative sample of the organisations involved with the management of water and waste water in the Republic of South Africa :

A. DELEGATES WHO PARTICIPATED IN THE WORKSHOP THAT WAS CONDUCTED FROM 12 - 14 AUGUST 1991 AT HALFWAY HOUSE

Mr C Howarth	City Engineering Department
Mr R Mokoany	Johannesburg City Council
Mr S Deacon	Johannesburg City Council
Mr D van Deventer	Umgeni Water
Mr C Crooks	Umgeni Water
Mr M C Crawford	Department of Water Affairs and Forestry
Dr J J Barnard	Department of Water Affairs and Forestry
Mr G Saayman	Pretoria City Council
Mr P Lund	Athlone Water Care Works
Mr G Curtis	Benoni Municipality
Mr E L Choritz	Aquafund
Mr J Jouchin	Aquafund
Mr G Hesedin	Aquagold
Mr A J Goosen	ESKOM Megawatt Park
Mr K Hall	ESKOM Training College
Dr S A Mitchell	Water Research Commission

B. PERSONS WHO REVIEWED AND COMMENTED ON THE MINUTES OF THE AFORESAID WORKSHOP

Mr R Denton	Albany Coast Water Board
Mr R E Ball	Albany Coast Water Board
Mr H Symington	Bloem Area Water Board
Mr J de Klerk	Bloem Area Water Board
Mr J le Roux	Bloem Area Water Board
Mr R T Rudd	Duivenhoks Water Board
Mr L P Liebenberg	Duivenhoks Water Board

Mr W H Barnard	Kalahari East Water Board
Mr P A E Nel	Kalahari East Water Board
Mr F W Liebenberg	Karos-Geelkoppan Water Board
Mr D H Marx	Magalies Water Board
Mr N J Fenner	Magalies Water Board
Mr P de Waal	Mhlatuze Water Board
Mr D C Vorster	Mhlatuze Water Board
Mr A J Coetzee	Northern-Transvaal Water Board
Mr B J Swanevelder	Northern-Transvaal Water Board
Mr A J Dippenaar	OFS Goldfields Water Board
Mr E J Spamer	OFS Goldfields Water Board
Mr P M Vermaak	OFS Goldfields Water Board
Mr M B Forsyth	Pelladrift Water Board
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Chief Executive Officer	Noord-Transvaal R.S.C.
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Chief Executive Officer	West Cape R.S.C.
Chief Executive Officer	West Vaal R.S.C.
Mr H Nicholls	Anglo American Corporation
Mr R Chandler	Department of Water Affairs and Forestry
Mr G R Botha	Stewart, Sviridov & Oliver

The researchers would like to express their gratitude to these participants for their respective contributions and inputs.

EXECUTIVE SUMMARY

The projected population and industrial growth in Southern Africa within the next 15 to 20 years, predicts a serious shortage of water for domestic and industrial use. Water resources in South Africa can only support a population of 80 milion and this figure is expected to be reached by the year 2020.

A major problem underlying the management of existing water resources is the fact that most of the staff operating water and waste water works, are not competent to perform job tasks at performance levels which will ensure that plant effluents meet with the required quality standards. There are approximately 1 100 water and 1 500 wastewater works in South Africa that need to be properly managed and the number of operators that need to be made competent amounts to about 4 000 employees.

As early as 1974, the Institute of Water Polution Control (IWPC) recognised the need for upgrading the education and training of water care operators and submitted to the authorities a memorandum containing proposals for the classification of water and waste water treatment works, and personnel who operate these works.

As a result of this memorandum, draft regulations were published for comment in August 1984 in terms of the Health Act, 1977, and subsequently promolgated in terms of the Water Act, 1956 (Act 54 of 1956). These regulations were later revised in December 1985 and subesequently promulgated in 1988 and implemented on 1 January 1989.

The above regulations stipulate that the owner of any water care works apply for registration of the works and furnish particulars set-out in Schedule 1 or Schedule 2 of the regulations. These schedules relate to the complexity of works and the number of operators required to run them.

It is important to note that these schedules only define the minimum number of operators required and the minimum educational levels of operators employed. They do not define the competency requirements of operators that are necessary to ensure the the effective management and operation of these water care works.

The implementation of these regulations and managing water care operations within this framework, has however been jeapordised by a growing shortage of trained and experienced manpower at all levels to manage and operate water care works effectively, in both the public and private sectors of the Republic of South Africa.

This is caused by the following :

(a) Inadequate training facilities and qualified teachers to provide training at foreman and operator levels where the main deficiency exists.

(b) An apparent lack of commitment on the part of both the public and private sector management with respect to the education and training of water care personnel and reluctance on the part of managements to invest in education and training, because of increased turnover of trained personnel.

(c) Apparent lack of interest on the part of operators in improving their competence as water care operators, possibly arising from a lack of motivation and negative career expectations.

(d) Lack of cooperation and coordination of training within the public and private sectors as well as between these sectors and inadequate financial resources to meet with the present and future training demands.

In 1988 a National Committee, comprising representatives from both the public and private sectors, was established to investigate the manpower recruitment and development needs of the water and wastewater industry and to advise the minister of Water Affairs on a strategy for satisfying these needs and solving the identified manpower management problems. Two working groups were subsequently formed to investigate these general problems in more detail and to make specific recommendations regarding a strategy for solving them. Although these working groups worked independantly the following overall conclusions were made :

1. Formal education of water care operators is totally ineffective. The N courses being conducted at Technical Colleges are not attracting students and are reluctantly being supported by the management of water care works. The reluctance stems from the fact that these courses are too theoretical and consequently make a limited contribution to improving operator performance on the job.

2. Informal on-the-job training is content based and does not meet with the performance requirments of water care management. Although attempts have been made at certain water care works to define the job tasks of water care operators, it is important to note that no attempt has yet been made to identify and analyse those tasks which are common to most water care operations - an essential prerequisite for developing standardised training programmes for the industry. Different training standards are applied at water care operations where training takes place. In the few cases where on the job training is conducted, it is done informally.

3. The theoretical education provided at Technical Colleges is not integrated with the practical training provided on the job. From the above it is evident that that such an integration is totally impossible under the present circumstances, because the formal education and informal training provided are not complementary at all.

4. The water care industry has a "cinderella" image and fails to attract quality manpower and no infra-structure exists to plan and implement a national strategy for the attraction and development of manpower for the industry. The scope for growth and career advancement of operating staff is limited. This complicates the recruitment efforts and does contribute to an alarming labour turnover problem.

It was the considered opinion of both working groups that the solution to the manpower

problems associated with the management of water care, was far too complex and beyond the competence of the working groups and the committees and that the assistance of professional consultants be obtained to investigate strategy for solving the education and training problems of water care management.

With reference to the aforesaid three important needs are evident :

(a) The need for developing technical education programmes that meet the technology development and operating needs of all participants in water care management.

(b) The need for developing a competency-based training system that will enable the development of occupational competence of water care operators at management, supervisory and plant operating levels.

(c) The need for developing and implementing an image building programme at national level that will change the "cinderella" image of the water care industry and lead to the attraction of high quality manpower to the industry.

This research report contains the outcome of a national audit that was conducted to identify the key technical and vocational education needs and the on-the-job training needs of operating and management staff within the water care industry as a whole.

Based on the outcome of this initial research the next step would be to establish what is presently being done at technicons and technical colleges to satisfy the identified technical and vocational education needs. It will also be important to establish what has been done to date by each participant and stakeholder individually within the "industry" to satisfy the identified on-the-job training needs.

It is anticipated that the findings of both the initial and follow-up research projects will highlight what needs to be done nationally and what should be done at the organisational level to satisfy the specific educational and training concerns and needs identified.

LIST OF ABBREVIATIONS

AS	Activated Sludge
BNR	Biological Nutrient Removal
CLO	Chlorine Dioxide
COD	Chemical Oxygen Demand
DAF	Dissolved Air Flotation
DO	Dissolved Oxygen
DWA & F	Department of Water Affairs and Forestry
H O	Hydrogen Peroxide
I.X.	Ion Exchange
MBWA	Management By Walking Around
MLE system	Modified Ludzack Ettinger
MLSS	Mixed Liquor Suspended Solids
MOS act	Machinery and Occupational Safety Act
ND	Nitrification Denitrification
OA.	Oxygen Absorbed
OD.	Optical Density
OD.	Oxidation Ditch
Polyelec.	Polyelectrolite
P.S.T.	Primary Sedimentation Tank
RAS	Return Activated Sludge
SG.	Specific Gravity
S.O.P.	Standard Operational Procedure

LIST OF ABBREVIATIONS (Continued)

SVI.	Sludge Volume Index
THM.	Trihalomethane
TDS.	Total Dissolved Solids
TSS.	Total Suspended Solids
UCT (modified)	University of Cape Town
U.V.	Ultra Violet
WRC	Water Research Commission

BACKGROUND INFORMATION

1. INTRODUCTION

A major problem underlying the management of existing water resources in South Africa is the fact that most of the staff operating water and waste water works, are not competent to perform their job tasks at performance levels which will ensure that plant effluents meet with the required quality standards.

There are approximately 1 100 water and 1 500 wastewater works in South Africa that need to be properly managed and the number of operators that need to be made competent amounts to about 4 000 employees.

Added to the issue of managing water and waste water works, is the problem of diffuse pollution resulting from unmanned sanitation in areas where no reticulation systems exists. This highlights an urgent need to educate people living in these areas on effective water utilization, sanitation and pollution prevention.

Before 1986 there were no standard syllabi for the formal education of water care operators at Technical Colleges and Technicons. As a result, large numbers of employed plant operators could not be legally qualified for the jobs they occupy. This made it virtually impossible to implement and maintain the legally defined operating procedures and standards.

In an attempt to solve the problem of no standard syllabi being available, a committee was formed in 1985 to develop standard syllabi for technical education in water and wastewater treatment at the N1 to N3 levels. In 1986 the following syllabi were approved by the Department of Education and Culture and implemented at Technical Colleges throughout the RSA with effect from 1 January 1986.

(a) N1 in Water & Wastewater Treatment Practice

(b) N2 in Water & Wastewater Treatment Practice

(c) N3 in Water Treatment Practice

(d) N3 in Wastewater Treatment Practice

After these courses were instituted the same committee was given a further assignment to develop syllabi for courses at the N4 to N6 levels. These courses are still in the process of being developed.

It is important to note that these syllabi were primarily designed to improve the educational levels of water care operators for plant registration purposes. *The assumption was made that operators' job competence would automatically also improve.*

2. LEGISLATION FOR IMPROVED MANAGEMENT OF WATER CARE WORKS IN THE REPUBLIC OF SOUTH AFRICA

As early as 1974, the Institute of Water Pollution Control (IWPC) recognized the need for upgrading the education and training of water care operators and submitted to the authorities a memorandum containing proposals for the classification of water and waste water treatment works, and personnel who operate these works.

As a result of this memorandum, draft regulations were published and subsequently promulgated in terms of the Water Act, 1956 (Act 54 of 1956). These regulations stipulate that the owner of any water care works must apply for registration of the works in terms of certain particulars prescribed in Schedule 1 or Schedule 2 of the regulations that define the complexity of works and the number of operators required to run them.

It is important to note that these schedules only define the minimum number of operators required and the minimum educational levels of operators employed. *They do not define the competency requirements of operators that are necessary to ensure the the effective management and operation of these water care works.*

3. PROBLEMS EXPERIENCED WITH THE IMPLEMENTATION OF PROMULGATED LEGISLATION

In 1987 the Water Institute of South Africa (WISA) drew to the attention of the Department of Water Affairs the fact that the implementation of the regulations was not proceeding smoothly due to a growing shortage of competent manpower at all levels - in both the public and private sectors of the Republic of South Africa - to manage and operate water care works effectively, .

WISA claimed that the shortage of trained and experienced manpower was caused by :

(a) Inadequate training facilities and qualified teachers to provide training at foreman and operator levels where the main deficiency exists.

(b) An apparent lack of commitment on the part of both the public and private sector management with respect to the education and training of water care personnel. There seemed to be a lack of appreciation of the need for education and training of water care operators and the ways in which identified education and training needs can be met. Management also appeared to be reluctant to invest in education and training, because of increased turnover of trained personnel.

(e) Apparent lack of interest on the part of operators themselves in improving their competence as water care operators possibly arising from a lack of motivation and negative career expectations.

(f) Lack of cooperation and national coordination of training within the public and private sectors as well as between these sectors and inadequate financial resources to meet with

the present and future training demands.

4. INITIAL INVESTIGATIONS TO ESTABLISH AND RESOLVE IDENTIFIED MANPOWER PROBLEMS

In 1988 a National Committee, comprising representatives from both the public and private sectors, was established to investigate the manpower recruitment and development needs of the water and wastewater industry and to advise the Minister of Water Affairs on a strategy for satisfying these needs and solving the identified manpower management problems.

The terms of reference of this National Committee was :

(a) To liaise with educational and local authorities with a view to encourage participation in education and training programmes.

(b) To investigate existing in-service training facilities and to make recommendations for their improvement and supplementation on a coordinated basis.

(c) To indicate amendments to and updating of training syllabi as may be required from time to time.

(d) To coordinate the financing aspects of training facilities and programmes through government-sourced subsidies.

(e) To make recommendations for the adjustment of the regulations concerned with registration and certification of works and operators.

In October 1988 the National Committee formulated the following problems that needed thorough investigation :

(a) The N1 - N3 courses presented at Technical Colleges were not being supported and private students enrolled for theoretical training, posed a problem to these institutions because they didn't have any practical experience in the trade they were studying.

(b) Theoretical training of operators at Technical Colleges was not enabling these operators to operate a plant. It was evident that additional in-service training would be necessary but private sector industries didn't have the necessary expertise in water treatment and water care management to provide the required training effectively.

(c) Municipalities and other water management organisations in industry were inclined to ignore the water care management desires and expectations of the Department of Water Affairs mainly because they lacked funds and sufficient staff to make theoretical and practical training possible.

(d) The water care management industry had no standing due to its "Cinderella" image.

The low remuneration offered throughout the industry was not attracting the type of person the industry needed to improve and maintain effective water management.

Two working groups were subsequently formed to investigate these problems in more detail and to make specific recommendations regarding a strategy for solving them.

The first working group was given an assignment to establish :

(a) the status quo of theoretical training on water care management being presented in the RSA.

(b) what legislative frameworks were available through the Local Authorities Training Act, the Manpower Training Act or any other existing legislation for the funding and controlling of water care operator training.

(c) the feasibility of forming an independently funded body to train water care operators for the industry.

The second working group, was requested to investigate the need for practical training in the water care industry. This working group had to :

(a) determine what practical training was necessary.

(b) determine what practical training was available and where.

(c) define what additional training, training material and training facilities were necessary.

(d) formulate a training package which would be acceptable to both legislators and the owners of water care works.

5. FINDINGS AND CONCLUSIONS OF THESE INVESTIGATIONS

Although the working groups worked independently the following overall conclusions were made :

(a) The N-Courses being conducted at Technical Colleges were not attracting students. These courses are reluctantly being supported by the management of water care works which stems from the fact that the courses are too theoretical and consequently make a limited contribution to improving operator performance on the job.With the exception of TECHNISA, all the other Technical Colleges where the courses are presented require that trainees attend these courses on a full time basis. This cannot be afforded by most water care organisations because of the unproductive costs involved and the fact that interim replacements are impossible to find. Most of the water care works are geographically remote from the Technical Colleges that present the N-Courses. This necessitates accommodation expenses which adds to the cost of course participation.

The N-Courses also do not appeal to the students. Students lack the basic prerequisite entry-level knowledge and skills to cope with the syllabi and consequently perceive the courses as being too difficult. They also feel that these courses are a waste of time since

in their opinion, most of the course content is academic and not applicable to the tasks they are performing on the job.

Communication and liaison between Technical Colleges and the water care industry is totally uncoordinated. No single forum exists for coordinated planning and assessment of the courses offered. As a result, course durations and standards vary. Furthermore, it is evident that most of the courses have become somewhat outdated in terms of present and future water care operating requirements.

It is often very difficult to obtain the minimum number of course participants from a particular race group to present a course. Because multiracial attendance of courses is not permitted at those Technical Colleges where they are presented, it is presently not possible to fill these courses with participants from other race groups; consequently courses have to be canceled to the detriment of the industry.

(b) Manpower planning is presently based on legal requirements i.e., the number of operators required to operate a particular plant, and not on the actual job requirements i.e., the nature and complexity of job tasks which are necessary for effective plant operation. Consequently, on-the-job training is mostly content-based and not based on the actual tasks that need to be performed. Although attempts have been made at certain water care works to define the job tasks of water care operators, it is important to note that no attempt has yet been made to identify and analyze those tasks which are common to most watercare operations - an essential prerequisite for developing standardized training programmes for the industry.

(c) Presently, there are no clear goals and standard objectives for practical training in water treatment and water care management in the RSA. Different training standards are applied at water care operations where training takes place. In most cases, however, a total lack of training is evident. In the few cases where on the job training is conducted, it is done informally. Few or no trained instructors exist at the plant level and no planned curriculum is used.

(d) The theoretical education provided at Technical Colleges is not integrated with the practical training provided on the job. Since the formal education and informal training provided are not complementary at all, such an integration has become totally impos sible.

(e) The physical working conditions at waste water treatment plants has created a "cinderella" image of water management occupations, making it very difficult to recruit high caliber manpower to the operating environment of the water care industry.

Due to the nature of organisation structures employed for the management of water works, the scope for career advancement of operating staff is perceived to be limited. This seems to be a major cause of recruitment problems which unfortunately contributes to an unacceptable labour turnover with consequent higher training costs.

The acute shortage of legally qualified manpower at plant level has reached alarming proportions and is seriously affecting the effective and efficient management of water in the country as a whole.

(f) Controlling mechanisms for ensuring standardized education and training of water care operating staff in the water care industry - a multi sector, informally defined industry comprising both public and private sector organisations - cannot be created through existing legal structures such as the existing Local Authorities Training Act or the Manpower Training Amendment Act.

Although funds are available for manpower development in the different sectors of the water care industry, there is currently no mechanism available to solicit funds for the purpose of developing standardized education and training programmes that will meet with the manpower development needs of the industry as a whole.

6. RECOMMENDATIONS

It was the considered opinion of both working groups that the solution to the manpower problems associated with the management of water care, is far too complex and beyond the competence of working groups and committees. The assistance of professional consultants was recommended to perform the following assignments :

1. Advise the National Committee on a strategy for solving the education and training problems of water care management.

2. Advise the National Committee on a strategy for attracting high quality manpower to the water care management industry.

3. Investigate and recommend a mechanism for "industry level" funding and management of manpower development.

RESEARCH METHODOLOGY

1. INTRODUCTION

The effective and efficient management of water and waste water works in South Africa in accordance with legally stated production standards is seriously being jeopardized by an acute shortage of legally qualified manpower, particularly at plant level.

The physical working conditions at effluent treatment plants has created an unattractive image of water management occupations making it difficult to recruit high caliber manpower to the operating environment of the industry.

Although operations seem to have a lot in common, work standards at different water works differ significantly resulting in different training standards being applied. A total lack of systematic training is evident. Where on the job training is done, it is done informally. Few or no trained instructors exist at the plant level and no standardized training curricula is used.

Available formal vocational education of water works operators and technicians is too theoretical and has become outdated in terms of present and future operating requirements. Different courses with different durations and standards are offered at certain technical colleges and technicons and it is also evident that these curricula lack standardization and integration with practical on the job training.

Due to the nature of organisation structures employed for the management of water works, the scope for career advancement of operating staff seems to be limited. This could be a major cause of the recruitment problem and could be a reason for the identified labour turnover problem.

Three important needs are evident :

(a) The need for developing technical education programmes that meet the technology development and operating needs of all participants in water care management.

(b) The need for developing a competency-based training system that will enable the development of occupational competence of water care operators at management, supervisory and plant operating levels.

(c) The need for developing and implementing an image building programme at national level that will change the "cinderella" image of the water care industry and lead to the attraction of high quality manpower to the industry.

The obvious solution to the above mentioned education and training problems would be to establish one coordinating body such as an Industry Training Board (similar to the ITB's

being established in terms of the amended Manpower Training Act of 1990) that will have the authority to establish and coordinate the implementation of a national recruitment, education and training strategy for water care management.

However, a major obstacle in the way of establishing such a coordinating body in terms of present manpower training legislation, is the fact that water care management cannot formally be defined as an industry and that most of the participants and stakeholders in water care management are members of different formally defined industries and business sectors, including local government.

To overcome this problem it is evident that the present situation will have to be thoroughly researched before any final recommendations can be made.

2. PROPOSED INITIAL RESEARCH

Prior to the establishment of a coordinating body for national coordination and control of water care management education and training, the following research had to be conducted on a national scale :

First, a national audit had to be conducted to identify the key technical and vocational education needs and the on-the-job training needs of operating and management staff within the water care industry as a whole.

Based on the outcome of this initial research the next step would be to establish what is presently being done at technicons and technical colleges to satisfy the identified technical and vocational education needs. It will also be important to establish what has been done to date by each participant and stakeholder individually within the "industry" to satisfy the identified on-the-job training needs.

The purpose of this follow-up research would be to establish the specific strengths and weaknesses of the existing technical education and training infrastructures relating to water care management and to establish the existing education and training resource base, including both lecturing and training staff, available facilities and available education and training programmes.

It is anticipated that the findings of both the initial and follow-up research projects will highlight what needs to be done nationally and what should be done at the organisational level to satisfy the specific educational and training concerns and needs identified.

3. NATIONAL EDUCATION AND TRAINING NEEDS AUDIT

A workshop attended by participants representing the Department of Water Affairs, Water Boards, Municipalities and the Private Sector was conducted from 12 to 14 August 1991 to establish :

(a) A generic occupational structure for the operation and management of water and waste water operations and for the maintenance of water care installations.

(b) Generic models for explaining the major processes of potable and waste water treatment methodologies in terms of present and future operating technologies.

(c) A generic Task Listing for the occupational group : Water Care Process Operator.

(d) A generic Task Listing for the occupational group : Water Care Works Manager.

(e) A specification of the critical scientific knowledge, technical knowledge and skills that will be required for competent performance of each task on the Task Listing of the occupational group : Water Care Proces Operator.

(f) A specification of the critical scientific knowledge, technical knowledge and skills that will be required for competent performance of each task on the Task Listing of the occupational group : Water Care Works Manager.

With the assistance of the workshop delegates and the other participants who were acknowledged in a previous section of this report it was possible to establish and respond to the above assignments as follows :

(a) A generic occupational structure for the operations management of water and/or waste water installations is enclosed as ANNEXURE A.

(b) A generic occupational structure for the quality control management (laboratory operations and management) of water and/or waste water installations is enclosed as ANNEXURE B.

(c) A generic occupational structure for the maintenance and development of water care installations is enclosed as ANNEXURE C.

(d) A generic model that explains the major processes of potable water treatment methodologies in terms of present and future operating technologies is enclosed as ANNEXURE D.

(e) A generic model that explains the major processes of waste water treatment methodologies in terms of present and future operating technologies is enclosed as ANNEXURE E.

(f) A generic Task Listing for the occupational group : Water Care Process Operator is enclosed as ANNEXURE F.

(g) A specification of the critical scientific knowledge, technical knowledge and skills that will be required for competent performance of each task on the Task Listing of the occupational group : Water Care Process Operator is enclosed as ANNEXURE G.

The knowledge and skills pertaining to the tasks listed for Duties D and E of the Task Listing (exhibited as Annexure F) are organisation/plant specific and will have to be

specified independantly for each particular organisation/plant.

(h) A generic Task Listing for the occupational group : Water Care Works Manager is enclosed as ANNEXURE H.

(i) A specification of the critical scientific knowledge, technical knowledge and skills that will be required for competent performance of each task on the Task Listing of the occupational group : Water Care Works Manager is enclosed as ANNEXURE I.

Although it was possible to capture a large amount of detail, as reflected in the contents of the various annexures, this information should rather be viewed as strategic guidelines for detail planning and not be interpreted as final proposals for the development of education and training programmes.

The researchers are satisfied that the information refered to represents the consensus opinion of the major stakeholders in water care management and that it provides a valid and reliable base for the assessment of education and training programmes presently being used for the development of water care and operating and management personnel.

Task Listings and education/training specifications for quality control management (laboratory operations and management) and for the maintenance of water care installations respectively, was not included in the brief for conducting this research investigation. Obviously, these occupational groups will have to be analysed at an appropriate time to enable the evaluation of the education and training programmes presently being used for the development of water care maintenance and laboratory personnel.

ANNEXURE A

A GENERIC OCCUPATIONAL STRUCTURE FOR THE OPERATIONS MANAGEMENT OF WATER AND/OR WASTE WATER INSTALLATIONS

DESIGNATION	EQUIVALENT	QUALIFICATION	PATTERSON	PEROMENES
Works-:				
-Manager	Head : Water Management.	T4/B.Sc.	M2	7
-Superintendent	Senior Professional Officer.	T3/N6	C4	8 - 10
-Supervisor	Senior Professional Officer.	T3/N6	C4	8 - 10
Process Controller	Chemist	T3/4	C4	8 - 9
Lab.Technician.	Shift Supervisor	T3	C2	
Lab.Assistant.	Chemical Analyst	Std. 10 with Maths/Science	B4	
Trainee Lab.Assistant.		Std. 10 with Maths/Science		
Process Operators:				
-Principal.	-Foreman Water Care. -Chief Technical Assistant. -Process Controller.	+N5	C1/C2	9
-Senior.	-Shift Supervisor.	+N4	C1/C2	9
-Process Operator.	-Unit Operator. -Plant Operator.	+N3	B3	10 - 13
-Trainee		Std. 8 - 10		
Plant Attendant.	-Shift Attendant	Std. 6 - 8		14 - 15
Labour Supervisor.	-Gang boss -Overseer.			15 - 16
General Worker.		Functional Literacy.	A band	17 - 18

ANNEXURE B

A GENERIC OCCUPATIONAL STRUCTURE FOR THE QUALITY CONTROL MANAGEMENT (LABORATORY MANAGEMENT) OF WATER AND/OR WASTE WATER INSTALLATIONS

DESIGNATION	EQUIVALENT	QUALIFICATION	PATTERSON	PEROMENES
Scientist.		B.Sc.(Hons.)		7
Principal Lab. Technician.	-Professional Chemist. -Section Chemist	T5 - T6	M1/P1	8
Senior Lab. Technician.	-Chemist. -Principal Technical Officer.	T4	C4	9
Lab.Technician.		T3	C2	10
Assistant Lab. Technician.	-Senior Chemical Analyst.	Std. 10 with Maths/Science.	C1	11 - 13
Laboratory Assistant.	-Chemical Analyst.	Std. 10 with Maths/Science.	B4	14 - 16
General Worker.			A band	

ANNEXURE C

A GENERIC OCCUPATIONAL STRUCTURE FOR THE MAINTENANCE AND DEVELOPMENT OF WATER CARE INSTALLATIONS

DESIGNATION	EQUIVALENT	QUALIFICATION	PATTERSON	PEROMENES
Maintenance Supervisor.	-Senior Professional Officer.			8
Maintenance Foreman : -Electrical -Mechanical -Civil. -Instruments				9
Artisan.	-Chief Technical Assistant. -Engineering Staff Artisan		B4/C1	10 - 11
Artisan Assistant.	-Handy man. -Artisans Aid. -Apprentice -3/8;5/8 Artisan			15 - 17

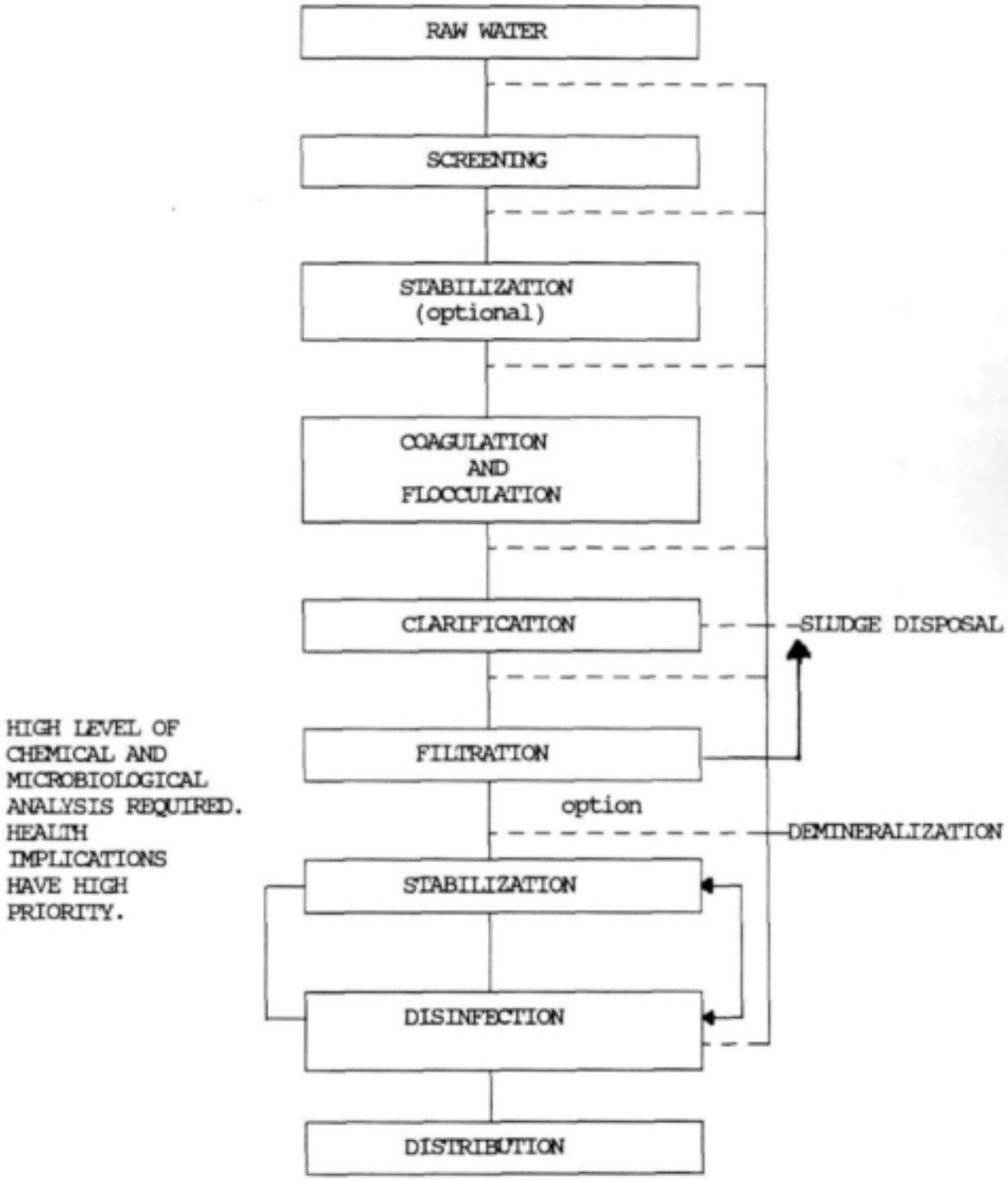
ANNEXURE D

A GENERIC MODEL THAT EXPLAINS THE MAJOR PROCESSES OF POTABLE WATER TREATMENT METHODOLOGIES IN TERMS OF PRESENT AND FUTURE TECHNOLOGIES

Engineering disciplines involved :

- Mechanical
- Electrical
- Civil
- Chemical
- Biological
- Hydraulics
- Process Control

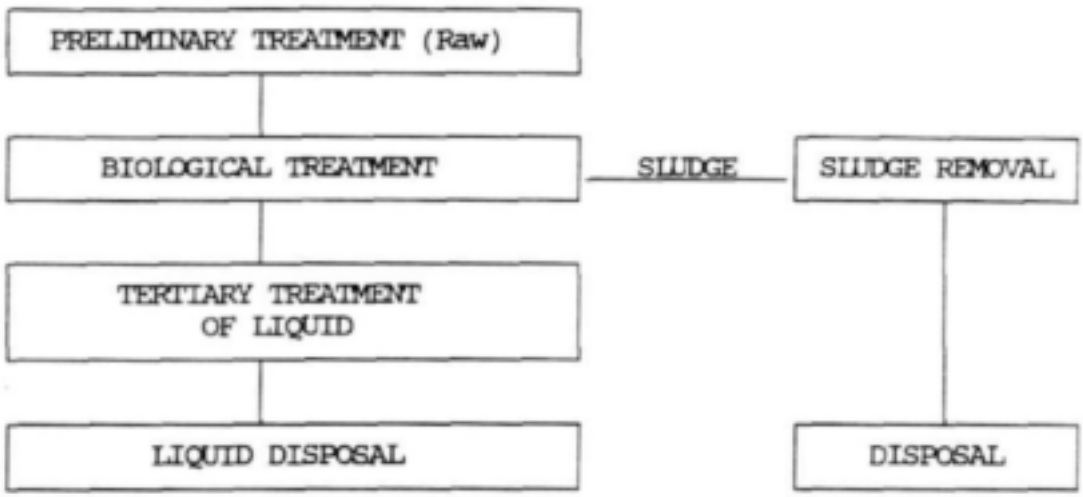
FLOW DIAGRAM - POTABLE WATER TREATMENT



ANNEXURE E

A GENERIC MODEL THAT EXPLAINS THE MAJOR PROCESSES OF WASTE WATER TREATMENT METHODOLOGIES IN TERMS OF PRESENT AND FUTURE TECHNOLOGIES

A. SEPTIC TANKS/PONDS (Low technology operation)

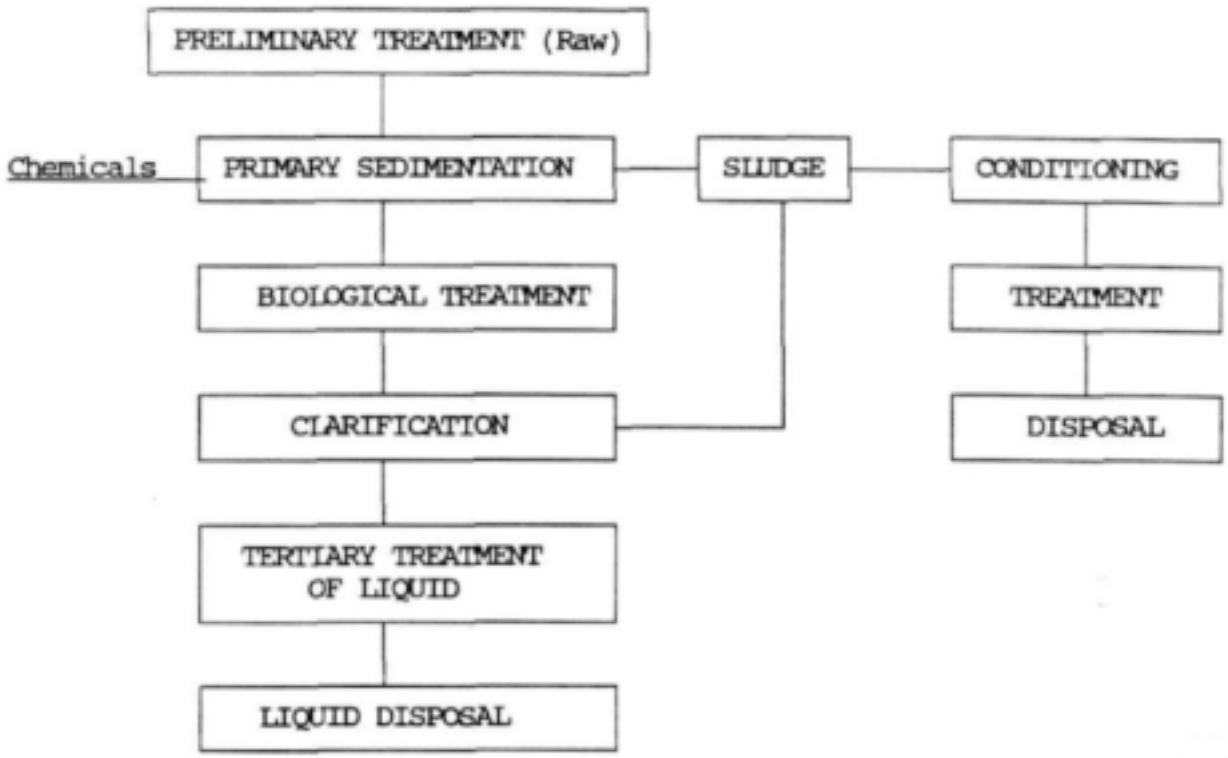


1. OPERATION :
   * Low Process Technology
   * Low interpretation of analysis
   * High health/safety
   * High microbiological understanding

2. LABORATORY :
   * Low level of analysis

3. MAINTENANCE :
   * Low mechanical/electrical

B. BIOFILTERS (Medium level operation)

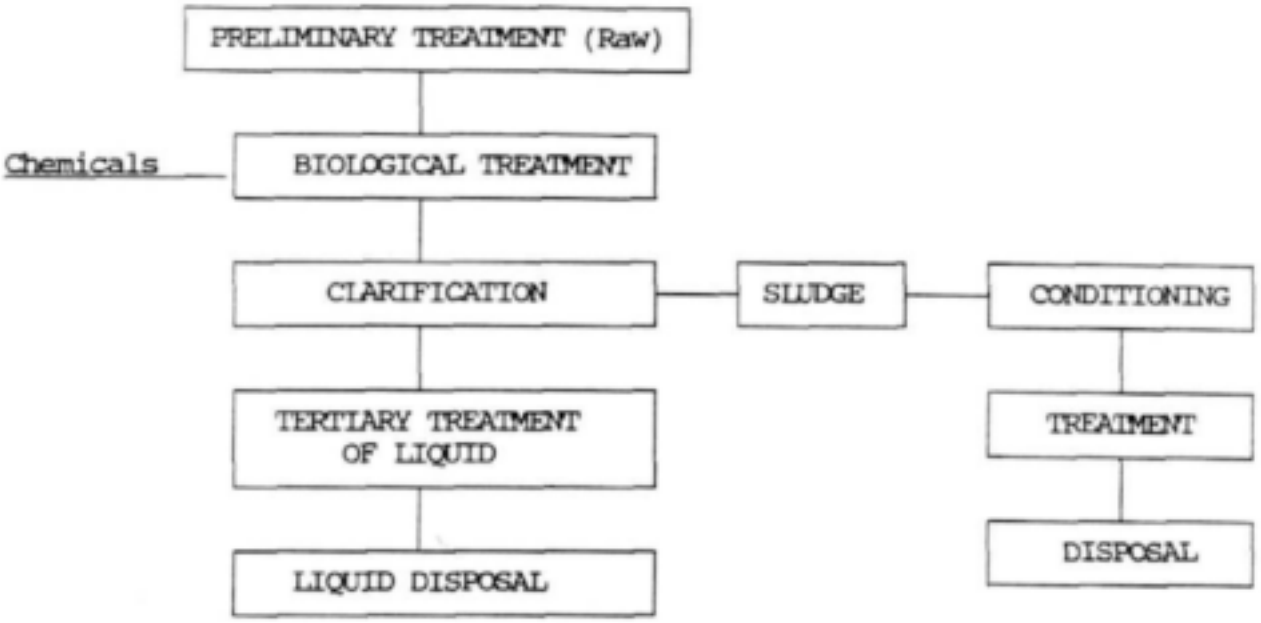


1. OPERATION :
   * Medium process technology
   * Medium interpretation of analysis
   * High health/safety
   * High microbiological understanding
   * High understanding of chemical use

2. LABORATORY :
   * High level of analysis

3. MAINTENANCE :
   * High mechanical/electrical

C. EXTENDED AERATION : (High technology operation)

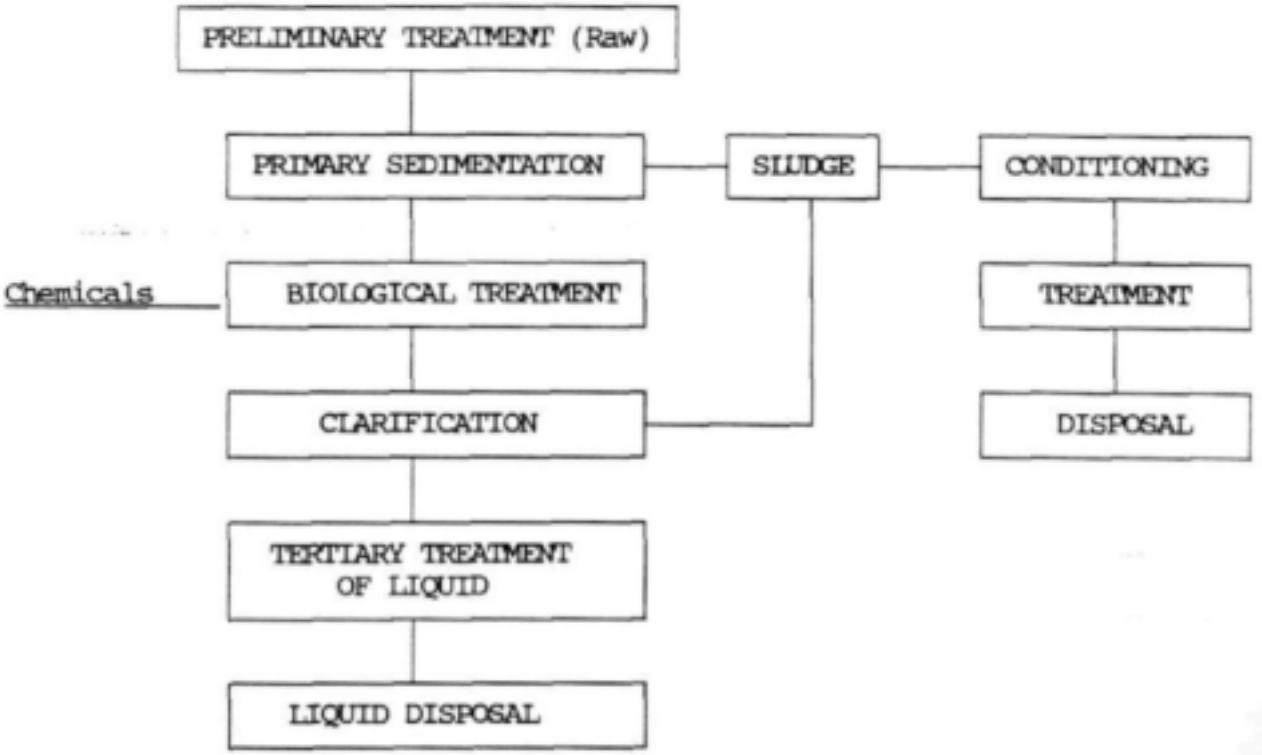


1. OPERATION :
   * Medium process technology
   * Medium interpretation of analysis
   * High health/safety
   * High microbiological understanding
   * High understanding of chemical use

2. LABORATORY :
   * High level of analysis

3. MAINTENANCE :
   * High mechanical/electrical

D. BIOLOGICAL NUTRIENT REMOVAL (Specialised difficulty in operation)



1. OPERATION :
   * Very high process technology
   * Very high microbiology understanding
   * Very high interpretation of analysis
   * High automation
   * High computer use
   * High health/safety
   * High understanding of chemical use

2. LABORATORY :
   * Very high level of analysis

3. MAINTENANCE :
   * Very high mechanical/electrical
   * On line monitors

ANNEXURE F

A GENERIC TASK LISTING FOR THE OCCUPATIONAL GROUP : WATER CARE PROCESS OPERATOR

DUTY A : OPERATING POTABLE WATER TREATMENT PROCESSES

A01. Operate Abstraction System
A02.1. Operate Mn. and Fe. Removal Process
A02.2. Operate Screening Process
A03. Operate Coagulation and Flocculation Processes
A04. Operate Clarification Process
A05.1. Operate Sludge Thickening Process
A05.2. Operate Filtration Process
A06.1. Operate Sludge Dewatering Process
A06.2. Operate Disinfection Process
A06.3. Operate Demineralisation Process
A07.1. Operate Sludge Disposal Process
A07.2. Operate Stabilisation Process
A08. Operate Bulk Distribution Process

DUTY B : OPERATING WASTE WATER TREATMENT PROCESSES

B01.1. Operate Preliminary Treatment Processes
B1.1.2 Operate Degritting Processes
B01.2. Operate Balancing Processes
B02.1. Operate Pond Process
B02.2. Operate Primary Sedimentation Process
B02.3. Operate Sludge Thickening Process
B03.1. Operate Activated Sludge Process
B03.2. Operate Biological Nutrient Removal Activated Sludge Process
B03.3. Operate Bio-filter Process
B03.4. Operate Sludge Digestion Process
B04.1. Operate Chemical Phosphate Removal Process
B04.2. Operate Sludge Dewatering Process
B05.1. Operate Filtration Process
B05.2. Operate Sludge Disposal Process
B06. Operate Effluent Disinfection Process
B07.1. Operate Effluent Disposal Process
B07.2. Operate Advance Treatment Process For Specific Use

DUTY C : PERFORMING ANALYSIS

C01. Perform Sampling
C02. Perform Tests
C03. Interpret Results and Adjust Plant

DUTY D : ORGANISING AND CONTROLING PRODUCTION

D01. Maintain Production Records
D02. Control Mechanical and Electrical Functioning of Plant

DUTY E : SUPERVISING SUBORDINATES

E01. Maintain Personal and Plant Safety
E02. Manage Performance of Subordinates

ANNEXURE G

KNOWLEDGE AND SKILLS SPECIFICATION FOR THE OCCUPATIONAL GROUP : WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A01 : OPERATE ABSTRACTION SYSTEM

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1.Characteristics of Hydrology : *Precipitation *Catchment *Environmental issues *Stratification 2.Principles of Hydraulics : *Pumping *Heads *Pumps/valves *Sluice gates *Pipelines *Impoundments 3.Characteristics of Water Quality : 1) Physical : *TSS *Conductivity *Turbidity *Odour *Temperature *Colour 2) Chemical : *pH/Alkalinity *Stability *Nutrification *TDS - OD 3) Biological : *Algae *Pathogens *Aquatic life *Chlorophyl Index 4.Corrosion : *Material selected *Forms *Control	1. Operation of pumps : *Types of pumps 2. Operation of valves : *Types of valves 3. Use of Metering instruments. 4. Characteristics of water hammer. 5. Principles of Pressure/Vacuum. 6. Characteristics of Cavitation . 7. Characteristics of Syphon. 8. Process of Encrustation. 9. Process of scaling. 10.Draw-off levels. 11.Operation of Telemetry System. 12.Knowledge of Dam Safety Legislation.	1.Operating Procedures of Pumps/Valves. 2.Operating Procedures of instruments. 3.Techniques for Laboratory Tests . *Colour *Conductivity *Turbidity *pH. *OD *Stability *Biological 4.Preliminary treatment Procedures : *Chemical dosing *Stabilisation *Chlorination *Aeration 5.Operating Procedure of Telemetry System. 6.Interpretation of results.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A02.1 : OPERATE Fe AND Mn REMOVAL

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Techniques of Detection/Indicators.	1. Techniques of : *Aeration *Chlorination	1. Perform techniques.
2. Process of Oxidation.	2. Functions of Permanganate Addition.	2. Perform Analysis.
3. Importance of Reduction theory.	3. Technique for pH Control.	3. Interpret results.
4. Principles of Precipitation.	4. Removal by Green Sand.	
5. Principles of Filtration.	5. Types of filtration.	
	6. Analytical techniques.	

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A02.2 : OPERATE SCREENING PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of Corrosion (Optional) 2. Principles of Abrasion. 3. Principles of Hydraulics : *Pressure loss *Flow restriction 4. Selection of Materials.	1. Types of Screens. 2. Method of Operation.	1. Operation of screens 2. Disposal of screenings.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A03 : OPERATE COAGULATION AND FLOCCULATION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Importance of Colloidal Theory : *Double layer charge *Zeta potential *Charge neutralization *Electron theory 2. Chemistry of Coagulation. 3. Mathematical principles for coagulation and flocculation . 4. Principles of energy transfer.	1. Dosing techniques. 2. Mixing techniques. 3. Procedure of conditioning. 4. Difference between mixer types. 5. Functions of instrumentation. 6. Techniques for analytical tests : *Jar tests 7. Types of coagulants. 8. Types of flocculants. 9. Colour removal techniques.	1. Procedure for conducting jar tests 2. Performance of calculations : *Concentrations *Dosing rates 3. Performance of analysis : *Interpret results 4. Procedure for adjusting dosing. 5. Relationship between dosing and chemical/ physical changes. 6. Operation of : *Mixers *Conditioners *Instruments *Apparatus *Equipment 7. Method for measuring turbidity and colour.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A04 : OPERATE CLARIFICATION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Operation of Floc conditioning Hydraulics : *Retention time *Temperature effects *Short circuiting *Head *Fluid Flow Clarification *SG *Viscosity *Buoyancy *Surface tension *Settling rate *Zone settling *Upflow rate *Overflow rate *Floc shearing 2. Principles of : *Settling *DAF 3. Principles of Sludge Concentration. 4. Principles of Mathematics.	1. Characteristics of UNIT types, e.g. Settling tank, DAF, etc. 2. Operation of Sludge blanket. 3. Operation of Calculator 4. Analysis Techniques. 5. Sludge handling techniques. 6. Mechanical energy input devices.	1. Control floc conditioning. 2. Relate flowrate to product clarity. 3. Measure colour and turbidity. 4. Perform calculations 5. Perform analysis and test Turbidity. 6. Interpret results. 7. Sludge handling. 8. Operate mechanical devices.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A05.1 : OPERATE SLUDGE THICKENING PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Identify the origin of sludge. 2. Characteristics of sludge. 3. Sludge constituents. 4. Principles of Hydraulics. 5. Characteristics of sludge flow. 6. Specifications for waste disposal : *Principles of waste disposal *Legal principles 7. Characteristics of abrasion. 8. Characteristics of corrosion. 9. Conditions for the settling of sludge. 10. Stipulations of public health : *Environmental *Legal	1. Difference between disposal options : *Centrifuges *Tubular Filter press *D.A.F. *Drying beds *Lagooning *Slime dams *Vacuum filtration *Drum filtration 2. Operation of sludge pumps/valves. 3. Principles of chemical recovery. 4. Principles of Calcining. 5. Characteristics of refuse dumps.	1. Operation of equipment. 2. Procedure for conducting an analysis.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A05.2 : OPERATE FILTRATION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. The importance of filtration theory. 2. Basic principles of hydraulics : *Head loss *Fluid flow *Shearing *Bridging *Blanketting *Mudball formation 3. Characteristics of filter media size distribution. 4. The importance of Absorption theory.	1. Operation of types of filters : *Constant rate filters *Constant head filters *Microscreening *Rapid gravity filters *Slow sand filters *Multi media filters *Pressure sand filters *Upflow sand filters *Membrane filters *Pre-coat filters (Diatomaceous Earth). *Plate - Frame filters industrial application 2. Characteristics of Activated Carbon. 3. Techniques for backwashing. *Air scouring 4. Tecniques for cleaning: *Under drains *Flow distribution *Channeling *Ponding *Pocket formation *Air scouring	1. Operation and maintenance of filters. 2. Methods for measuring Turbidity and head loss. 3. Method for measuring colour. 4. Interpretation of results.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A06.1 : OPERATE SLUDGE DEWATERING PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Identify the origin of sludge. 2. Characteristics of sludge. 3. Sludge constituents. 4. Principles of Hydraulics. 5. Characteristics of sludge flow . 6. Specifications for waste disposal : *Principles of waste disposal *Legal principles 7. Characteristics of abrasion. 8. Characteristics of corrosion. 9. Conditions for the settling of sludge. 10. Stipulations of public health : *Environmental *Legal	1. Difference between disposal options : *Centrifuges *Tubular Filter press *D.A.F. *Drying beds *Lagooning *Slime dams *Vacuum filtration *Drum filtration 2. Operation of sludge pumps/valves. 3. Principles of chemical recovery and sludge conditioning. 4. Principles of Calcining. 5. Characteristics of refuse dumps.	1. Operation of equipment. 2. Procedure of conducting an analysis.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING COMPETENCY A06.2 : OPERATE DISINFECTION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of biology. 2. Principles of microbiology : *Bacteria *Indicator organisms *Cysts *Spore formers 3. Principles of virology : *Pathogens 4. Characteristics of water borne diseases. 5. Basic chemistry of disinfectants . 6. Principles of oxidation : *Chlorination *Ozonation H O - ClO 7. Principles of U.V. disinfection. 8. Principles of heat disinfection. 9. Method for determining disinfectant demand. 10. Principles of THM formation and prevention. 11. Principles of break point chlorination. 12. Principles of corrosion . 13. Procedure of material degradation . 14. Disinfectant contact time . 15. pH relationships .	1. Operation of disinfection equipment : *Chlorinators *Ozone generators *ClO generators *Disinfectant chemicals *Hydrogen peroxide *UV	1. Application of safety skills. 2. Operation of disinfection equipment. 3. Procedure for determining residuals. 4. Method for dosing. 5. Performance of calculations. 6. Preparation of disinfectants. 7. Performance of emergency drills. 8. Interpretation of results.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A06.3 : OPERATE DEMINERALISATION PROCESS

(COMPETENCY A06.3 IS OPTIONAL AND SITE SPECIFIC)

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Importance of Chemistry : *Carbonate *Temporary and permanent hardness *Complexation 2. Principles of Physical Chemistry. 3. Criteria for Ionic Theory. 4. Functions of Electrolysis. 5. Method for Phase Separation. 6. Importance of Osmosis. 7. Principles of Supersaturation.	1. Procedure for softening *Lime *Lime soda *IX *Nannofiltration 2. Procedure for Ion exchange (IX). 3. Procedure for Reverse Osmosis. 4. Principles of Electrodialysis. 5. Procedure of Distillation. 6. Principle of Freezing (Optional). 7. Principle of Evaporation. 8. Analytical techniques.	1. Perform analyses. 2. Manipulate plant equipment where practical. 3. Use of Instrumentation.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A07.1 : OPERATE SLUDGE DISPOSAL PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Identify the origin of sludge. 2. Characteristics of sludge. 3. Sludge constituents. 4. Principles of Hydraulics. 5. Characteristics of sludge flow. 6. Specifications for waste disposal : *Principles of waste disposal *Legal principles 7. Characteristics of abrasion. 8. Characteristics of corrosion. 9. Conditions for the settling of sludge. 10. Stipulations of public health : *Environmental *Legal	1. Difference between disposal options : *Centrifuges *Tubular Filter press *D.A.F. *Drying beds *Lagooning *Slime dams *Vacuum filtration *Drum filtration 2. Operation of sludge pumps/valves. 3. Principles of chemical recovery and sludge conditioning. 4. Principles of Calcining. 5. Characteristics of Refuse dumps.	1. Operation of equipment. 2. Procedure for conducting an analysis.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A07.2 : OPERATE STABILISATION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of Stabilisation Indices: *Hardness-Ca -Mg *Alkalinity -Bicarbonate -Hydroxide -Carbonate *pH *TDS *Conductivity *Acidity *Ryznar 2. Principles of Scale formation corrosivity: *Alkalinity *Chloride *Sulphate 3. Langelier/Ryznar Caldwell-Lawrence Deffeys 4. Occurrence of and protection from Cathode Corrosion.	1. Softening process. 2. Hardening process. 3. Procedure for Carbonating. 4. Procedure for Acidifying. 5. Chemical stabilisation: *Liming *Complexation 6. Corrosion inhibition. 7. Calcium carbonate precipitation potential. 8. Laboratory techniques.	1. Perform analyses. 2. Operate plants. 3. Calculations : *Dosing rates 4. Basic computer literacy. 5. Interpret results. 6. Conduct Cathodic Protection Tests.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A08. : OPERATE BULK DISTRIBUTION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of hydraulics : *Pressures *Water hammer *Preferential flowpath 2. Post precipitation. 3. Principles of corrosivity . *Threshold treatment 4. Use of residual disinfectant . 5. Characteristics of encrustation . 6. Principles of stagnation . 7. Control of Regrowth. 8. Control of Insect larvae. 9. Procedure for taste/ odour detection . 10. The importance of chlorination . 11. Procedure for disinfection of new and repaired reservoirs and mains.	1. Difference between types of : *Pumps *Pipelines *Reservoirs *Valves *Meters *Flow control 2. Importance of corrosion protection : *Coatings *Sacrificial anodes *Suppressed currents *Cathodic protection *Electrical continuity 3. Principles of microscopic taste/ odour detection.	1. Operation of equipment. 2. Procedure for microscopic examinations. 3. Visual inspection skills. 4. Performance of calculations.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B01.1 : OPERATE PRELIMINARY TREATMENT PROCESSES

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. The cause of blockages : *Interferes with further treatment if not removed at this stage.	1. Types of screening available : *Manual *Automatic -Rotary -Reciprocating -Chain operating -Back raked -Front raked (See W.R.C. Guide-lines) 2. Procedure for disposing of product : *Bury on/off site *Incineration *Health requirements 3. Method for record keeping.	1. Manual/Mechanical operation : *Standard operating procedures : 1) Mechanical breakdown 2) High flows (Storm flows)

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B01.1.2 : OPERATE DEGRITTING PROCESSES

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Standard operating procedure (site specific) *Correct operation *Blockage clearance *Frequency of degritting (Decisions possible) *Disposal (See competency B01.1)	1. Prevention of filling Digesters with sand : *Wear in pumps *Blockages 2. Importance of blockage clearance : *Grit contains some organic matter *Grit must be as clean as possible *Organic matter should be digested	1. Procedure of record keeping.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B01.2 : OPERATE BALANCING PROCESSES

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Characteristics of balancing tanks.	1. Operation of storm water holding tanks : *Cannot exceed hydraulic capacity of the works.	

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B02.1 : OPERATE POND PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1.Basic characteristics of sewage : *Distinction between domestic sewage and industrial effluent *Solids content (Setting solids) *Chemical strength (O.A. 4 hours, B.O.D. and C.O.D.) 2.Basic principles of hydraulics : *Retention time 3.Basic principles of microbiology : *Process *Disinfection 4.Basic principles of laboratory analysis : (Permit levels) *O.A. 4 hours, C.O.D. *Setting of solids 5.Characteristics of septic/fresh sewage. 6.Procedure of Hydrogen Sulphide production.	1.Difference between types of ponds : *e.g. oxidation (Anaerobic followed by Aerobic) *Maturation pond **Facultative pond 2.Basic principles of pond processes : *Loss of suspended solids *Sterilisation *U.V. Light 3.Principles of Loading rate : *Kilograms C.O.D and B.O.D.	1.Limited 2.S.O.P.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B02.2 : OPERATE PRIMARY SEDIMENTATION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Basic principles of hydraulics : *Retention time *Overflow rate *Weir loading rates 2. Basic principles of physics : *Density *Setting characteristics 3. Basic principles of chemistry : (Septicity) *Theory of sedimentation 4. Basic principles of microbiology : (Septicity) *Health aspects	1. Basic principles of hydraulics : *Size and shape of tanks 2. Mechanical knowledge of tank operation : *Bridge *Pumps *Valves 3. Basic principles of electricity.	1. Procedure of desludging : *S.O.P. 2. Maintenance of plant : *Site specific 3. Technique for sampling. 4. Operation of pump. 5. Use of sensory skills : *To detect problems and then initiate corrective action.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B02.3 : OPERATE SLUDGE THICKENING PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Identify the origin of sludge. 2. Characteristics of sludge. 3. Sludge constituents. 4. Principles of Hydraulics. 5. Characteristics of sludge flow. 6. Specifications for waste disposal : *Principles of waste disposal *Legal principles 7. Characteristics of abrasion. 8. Characteristics of corrosion. 9. Conditions for the settling of sludge. 10. Stipulations of public health : *Environmental *Legal 11. The importance of flotation theory.	1. Difference between disposal options : *Centrifuges *Tubular Filter press *D.A.F. *Drying beds *Lagooning *Slime dams *Vacuum filtration *Drum filtration 2. Operation of sludge pumps/valves. 3. Principles of chemical recovery. 4. Principles of Calcining. 5. Characteristics of refuse dumps.	1. Operation of equipment. 2. Procedure for conducting an analysis. 3. Mechanical operation /maintenance : *Compressors *Pumps *Scraper mechanism *Saturator *Valve adjustment 4. Ability to judge the correct sludge thickness. 5. Ability to monitor feed/recirculating ratio. 6. Reading of meters. 7. Measure float thickness. 8. Procedure for desludging of Hoppers.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B03.1 : OPERATE ACTIVATED SLUDGE PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of microbiology : *Enzymes *N-Cycle *C-Cycle *P-Cycle *S-Cycle *More advanced micro-biology where necessary. 2. Principles of biochemistry : 3. Principles of hydraulics : *Fluid flow *Pumping *Return Activated Sludge (2 phase flow) 4. Knowledge of loading rate : *COD (with or without PST) 5. Principles of oxygen transfer rates. 6. Ratio between alkalinity and N-Cycle. 7. Relation between Sludge Bulking and Foaming. 8. Relation between set-ting and Clarification *See Competency B02.2	1. Characteristics of reactor type : *Completely mixed *Plug flow *Oxidation ditches (OD) -Huisman Orbal -Pasver OD -Carousel OD 2. Process of aeration : *Extended *Step (stage) *Surface *Diffused air 3. Sludge bulking management. 4. Sludge foaming management. 5. Technique for sampling/ analysis : *SVI *MLSS *Settling 6. Importance of readings: *DO *RAS *Waste Sludge *Throughput (Volume) 7. Handling of waste sludge : *See Comp. A05.1 - A07.1 8. Knowledge of pumps, blowers, gearboxes, surface aeration diffusers.	1. Maintenance of DO levels. 2. Maintenance of RAS ratios. 3. Maintenance of sludge age. 4. Operate and maintain mechanical equipment. 5. Troubleshooting. 6. Effluent quality monitoring. 7. Manage sludge bulking/foaming. 8. Sensory perception of the process : *To detect problems and then initiate corrective action. (Continued overleaf)

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B03.1 : OPERATE ACTIVATED SLUDGE PROCESS (Continued)

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
9. Effects of toxic and poisonous substances on process. 10. Principles of chemistry : *Carbon and Nitrogen removal 11. Principles of mathematics : *N.Maths 12. Principles of hydraulics : *Retention time *Overflow rates 13. Knowledge of Design and operation of Nutrient Removal Activated Sludge Plants : *W.R.C. Manual		

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B03.2 : OPERATE BIOLOGICAL NUTRIENT REMOVAL ACTIVATED SLUDGE PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Same as Activated Sludge (See competency B03.1) PLUS :	1. Same as Activated Sludge (See competency B03.1) PLUS :	1. Same as Activated Sludge (See competency B03.1) PLUS :
2. Principles of biochemistry/ microbiology : *Relationship between nutrification - denitrification and biological excess *Phosphate removal (See W.R.C. Manual on B.N.R. design criteria)	2. Knowledge of configurations : *Conventional AS and ND (M.L.E. System) *Bardenpho (Phoredox) -3 Stage -5 Stage *UCT *Modified UCT *Johannesburg	2. Maintenance of DO levels.
3. Reason for sequencing and sizing of zones.		3. Maintenance of RAS ratios.
4. Importance of Phosphate removal : (See Special Phosphate Standards)		4. Maintenance of sludge age.
		5. Operate and maintain mechanical equipment.
		6. Troubleshooting.
		7. Efficient quality monitoring.
		8. Manage sludge bulking/foaming.
		9. Sensory perception of the process : (Sensitive process, requires high level of supervision)

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B03.3 : OPERATE BIO-FILTER PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of microbiology. 2. Procedure for Carbon and Nitrogen oxidation.	1. Method for COD loading. 2. Procedure of recirculation. 3. Operation of Humus Tank. 4. Importance of theory of operation : *Aerobic process (See Clarifiers under Competency B03.1.)	1. Basic mechanical knowledge. 2. Filter maintenance : *Cleaning 3. Adjustment of arms to change speed of rotation. 4. Operation of Humus Tank. *(As in clarifiers) 5. Recognition of a healthy filter : *Colour - lack of ponding 6. Correction of ponding. a) Two stage b) Alternating Two Stage 7. Roughing filtration

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILL FOR PERFORMING

COMPETENCY B03.4 : OPERATE SLUDGE DIGESTION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
HANDBOOK WILL BE PUBLISHED IN 1992		

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B04.1 : OPERATE CHEMICAL PHOSPHATE REMOVAL PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Importance of phosphate removal : *Special phosphate standards. 2. Chemistry of phosphate precipitation. 3. Chemistry of chemicals used : *Corrosion 4. Procedure for chemical phosphate removal : *See W.R.C. Manual on Chemical Phosphate removal.	1. Mechanism for control of addition. 2. Method for introduction of Ferric Chloride, aluminium and ferrous Sulphade. 3. Interpretation and use of Ferric Chloride, aluminium and ferrous Sulphade Analysis. 4. Awareness of Safety Procedures in handling hazardous chemicals.	1. Knowledge and ability to handle and make up chemicals which are dosed : (Hazardous chemicals). 2. The use of special sample procedures. 3. Ability to adjust Dosing rates using Watch and Measuring Cylinder.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B04.2 : OPERATE SLUDGE DEWATERING PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1.See W.R.C. guidelines under Competency B04.1.	1.Operation of : *Drying beds *Centifuge *Rotary Vacuum Filter *Belt Press *Filter Press	1.Making up of conditioning chemicals : *Such as Polyelec. 2.Control of dosing rates. 3.Selection of correct dosing rate. 4.Knowledge of S.O.P. for Specific Unit. 5.Maintenance of mechanical plant.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILL FOR PERFORMING

COMPETENCY B05.1 : OPERATE FILTRATION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. The importance of filtration theory. 2. Basic principles of hydraulics : *Head loss *Fluid flow *Shearing *Bridging *Blanketting *Mudball formation 3. Characteristics of filter media size distribution. 4. The importance of Absorption theory .	1. Operation of types of filters : *Constant rate filters *Constant head filters *Microscreening *Rapid gravity filters *Upflow sand filters *Membrane filters *Pre-coat filters 2. Characteristics of Activated Carbon. 3. Techniques for backwashing. *Air scouring 4. Techniques for cleaning : *Under drains *Flow distribution *Channeling *Ponding *Pocket formation *Air scouring	1. Operation and maintenance of filters. 2. Methods for measuring Turbidity and head loss. 3. Method for measuring colour. 4. Interpretation of results.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B05.2 : OPERATE SLUDGE DISPOSAL PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Characteristics of stable sludge.	1. Awareness of health aspects : *Microbiological pathogens *Chemicals - heavy metals pesticides. *Danger of unstable sludge *Composting of sludge *Land application of sewage sludge eg. problems with heavy metal accumulation and plant phototoxicity.	1. Recognition of stable sludge : *Appearance *Lack of smell *No fly breeding 2. Tractor driving skill. 3. Ploughing skill. 4. Management of disposal site. 5. Operation and maintenance of mechanical equipment. 6. Composting of sludge. 7. Land application of sewage sludge.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B06. : OPERATE EFFLUENT DISINFECTION PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of microbiology. 2. Chemistry of chlorination . 3. Chemistry of ozonation . 4. Chemistry of Alternative means : *e.g. Hydrogen Peroxide 5. U.V. irridiation. (See Competency A06)		

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B07.1 : OPERATE EFFLUENT DISPOSAL PROCESS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Impact of poor quality effluent on receiving water : *(Water cycle) 2. Analysis of effluent discharge.	1. D.W.A. Permit requirements. 2. Method for flow measurement : *Selection of method 3. Knowledge of multiple disposal routes.	1. Procedure for meter reading and maintenance. 2. Method of sampling for analysis . 3. Procedure of record keeping.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY C01 : PERFORM SAMPLING

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Methods for different sampling techniques : *Representative sampling *Random sampling *Grab sampling *Isokinetic sampling 2. Procedure for trending statistics. 3. Methods for sample preservation. 4. Difference between sample types.	1. The use of sampling equipment : *Manual *Automatic 2. Knowledge of different sampling areas. 3. The use of portable equipment. 4. The difference between sampling types. 5. The difference between sampling stations.	1. Performance of sampling procedures. 2. Performance of calculations. 3. Operation of equipment/stations.

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY C02 : PERFORM TESTS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1.Basic : *Analytical Chemistry *Biology *Physics *Equations	1.Analytical Techniques. 2.Analytical Equipment.	1.Perform analyses to control all processes. 2.Perform calculations

WATER CARE PROCESS OPERATOR

ESSENTIAL KNOWLEDGE AND SKILL FOR PERFORMING

COMPETENCY C03. : INTERPRET RESULTS AND ADJUST PLANT

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
COMPETENCY C03. IS SITE SPECIFIC		

WATER CARE PROCESS OPERATOR

NOTE : THE CRITICAL SCIENTIFIC KNOWLEDGE, TECHNICAL KNOWLEDGE AND SKILLS REQUIRED FOR COMPETENT PERFORMANCE OF THE FOLLOWING TASKS ARE ORGANISATION/PLANT SPECIFIC AND WILL HAVE TO BE ANALYSED INDEPENDANTLY FOR EACH ORGANISATION/PLANT :

DUTY D : ORGANISING AND CONTROLLING PRODUCTION

D01. Maintain Production Records
D02. Control Mechanical and Electrical Fuctioning of Plant

DUTY E : SUPERVISING SUBORDINATES

E01. Maintain Personal and Plant Safety
E02. Manage Performance of Subordinates

ANNEXURE H

A GENERIC TASK LISTING FOR THE OCCUPATIONAL GROUP : WATER CARE WORKS MANAGER

DUTY A : MANAGING STAFF

A01. Manage Employment, Remuneration and Termination of Employment of Staff
A02. Manage Development of Staff
A03. Manage Industrial Relations
A04. Administer Personnel Records
A05. Manage Performance of Subordinates
A06. Fascilitate Organisational Communications

DUTY B : MANAGING PRODUCTION

B01. Plan and Control Input and Output of Flow
B02. Plan and Control Quality of Treatment
B03. Manage Routine Maintenance and Repairs
B04. Control Maintenance of Production Records
B05. Plan and Control Work Scheduling
B06. Participate in Plant Optimisation Programme
B07. Manage Procurement of Materials

DUTY C : MANAGING SAFETY, HOUSEKEEPING AND SECURITY

C01. Plan and Control Machine and Plant Safety
C02. Plan and Control Personal Health and Safety
C03. Plan and Control Housekeeping
C04. Manage Prevention of Environmental Polution
C05. Plan and Control Plant Security

DUTY D : MANAGING FINANCE

D01. Participate in Planning of Operating and Capex Budgets
D02. Control Expenses Against Budgets
D03. Plan and Control Utilisation of Assets

DUTY E : HANDLING CUSTOMERS

E01. Handle Queries and Complaints
E02. Build Customer Relations
E03. Advise/alert on Variances and Disruptions

ANNEXURE I

KNOWLEDGE AND SKILLS SPECIFICATION FOR THE OCCUPATIONAL GROUP : WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A01 : MANAGE EMPLOYMENT, REMUNERATION AND TERMINATION OF EMPLOYMENT OF STAFF

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
	1. Knowledge of Labour Relations Act : *(Sections) 2. Knowledge of conditions of employment. 3. Company procedures/ policies and pay structures. 4. Selection methods/ processes. 5. Principles of a grading system.	1. Interviewing. 2. Assessment of interview information. 3. Induction procedure. 4. Conduct a termination interview.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A02 : MANAGE DEVELOPMENT OF STAFF

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of Adult Learning.	1. Methods to analyse needs. 2. Training strategies and methods. 3. Procedures and policies. 4. Method for progress evaluation. 5. Knowledge of training system. 6. Procedure for career planning. 7. Procedure for succession planning. 8. Characteristics of needs and styles of adult learners. 9. Prerequisites for training. 10. Identify learning resources.	1. Communicating. 2. Training needs analysis. 3. Mentoring and coaching. 4. Counselling.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A03 : MANAGE INDUSTRIAL RELATIONS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of Labour handling. 2. Principles of Industrial Relations. 3. Principles of motivation. 4. Principles of conflict management. 5. Characteristics of Organisational/Group behaviour. 6. Principles of effective working relationships. 7. Principles of participative management. 8. Characteristics of organisational culture and value systems. 9. Procedures for change.	1. Regulations of Labour Relations Act. 2. Knowledge of policies and procedures : *Disciplinary code *Grievance procedures 3. Knowledge of Unions/ Works Committee/ Liaison Committee. 4. Principles of Recognition Agreement. 5. Procedure for handling strikes. 6. Conditions of employment. 7. Characteristics of culture and values of organisation. 8. Principles of change management. 9. Procedure of warnings. 10. Rules for minutes/ meetings. 11. Characteristics of briefing systems.	1. Negotiation. 2. Strike handling. 3. Handling of disciplinary hearings/grievances. 4. Team building. 5. Trust building. 6. Problem solving. 7. Use of interpreter.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A04 : ADMINISTER PERSONNEL RECORDS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
	1. Method for writing labour reports. 2. Procedure of calculating costing/ cost allocation. 3. Rules for minutes/ meetings. 4. Method for issue of warnings. 5. Procedure for keeping record of leave/ sick leave/ absenteism. 6. Procedure for writing evaluation reports. 7. Knowledge of report and record system. 8. Company personnel procedures.	1. Quick response to hygiene issue. 2. Report writing. 3. Numeracy. 4. Computer literacy.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A05 : MANAGE PERFORMANCE OF SUBORDINATES

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of motivation. 2. Methods for performance evaluation. 3. Method for potential assessment. 4. Principles of. *Job enrichment *Job enlargement *Job rotation 5. Principles of Resource management. 6. Principles of productivity. 7. Characteristics of quality/excellence.	1. Procedure for performance planning . 2. Procedure for performance review. 3. Methods for performance assessment. 4. Method for development planning. 5. Procedure of setting objectives. 6. Procedure of developing managable standards. 7. Method for promoting policies and procedures 8. Use of diagnostic techniques.	1. Coaching. 2. Negotiation. 3. Communicating about performance. 4. Mentoring. 5. KITA/MBWA 6. Monitoring performance. 7. Handling unsatisfactory performance. 8. Ability to motivate "Salt of the earth" performance.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY A06 : FACILITATE ORGANISATIONAL COMMUNICATIONS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Importance of Communication theory. 2. Importance of Cross-Cultural theory. 3. Principles of Cross Discipline Communications. 4. Knowledge of other languages.	1. Briefing procedures. 2. Principles of assertiveness. 3. Knowledge of Organisational Communication Systems. 4. Principles of "Bottom-up" communications.	1. Writing . 2. Speaking/Linguistic 3. Negotiation. 4. Conflict handling. 5. Team building. 6. Motivating. 7. Assertiveness. 8. Use of interpreter.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B01 : PLAN AND CONTROL INPUT AND OUTPUT OF FLOW

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Understanding of the hydraulic, mechanical and process parameters of a treatment works.	1. Knowledge of the total picture of the environment.	1. Communication skills with his staff.
2. Importance of being aware of the latest technology, etc. *See to the update of courses.	2. Full knowledge of the operating procedures.	2. Motivating staff.
	3. Understanding the performance capabilities and restrictions of the works.	3. Problem solving and identifying faults.
	4. Methods to regulate/ control flows.	4. Delegating responsibilities and checking on performances.
	5. Systems of recording/reporting on inputs/outputs and storage facilities.	5. Numeracy and calculation.
	6. Knowledge of disruption warning system and contingency plans	
	7. Requirements for reticulation.	
	8. Knowledge of customers.	
	9. System demand .	
	10. Importance of production planning.	
	11. Usages of plant power.	

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B02 : PLAN AND CONTROL QUALITY OF TREATMENT

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Basic knowledge of laboratory analysis requirements. 2. Basic knowledge of chemicals. 3. Importance of process operating theory. 4. Importance of water and waste water treatment theory. 5. Method for calculation of plant performance.	1. Identify characteristics of the products at each phase of treatment. 2. Knowledge of the application of chemicals. 3. Knowledge of statutory requirements for final product. 4. Knowledge of sampling techniques. 5. Interpretation of meter and gauge readings. 6. Control of quality records and system and procedures. 7. Process operating design philosophy. 8. Interim treatment steps and performance requirements.	1. Practical evaluation of sampling. 2. Water treatment skills. 3. Waste water treatment skills. 4. Problem solving skills.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B03 : MANAGE ROUTINE MAINTENANCE AND REPAIRS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Operation of equipment and instrumentation. 2. Importance of updating courses in latest technology. 3. The importance of safety courses.	1. Knowledge of maintenance manual and procedures. 2. Identify mechanical and electrical faults. 3. Knowledge of routine maintenance control systems. 4. Knowledge of maintenance and repairs report and record system. 5. Assessing replacement/ repair issues of equipment. 6. Knowledge of expected performances from plant, equipment and instrumentation. 7. Knowledge of statutory acts pertaining to his work *MOS Act *Responsible person *Safety Representatives *Fire drills,etc. *Health Act *Water Act *Safety of Dams Act *Environment Legislation.	1. Ability to assess quality of maintenance and repair work. 2. Communication with suppliers/repair crews re possible causes of faults. 3. Ability to carry out or supervise minor repair work.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B04 : MANAGE PRODUCTION RECORDS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1.Use of computer.	1.Knowledge of targets and ratios. 2.The use of historical information in the development of future production targets. 3.Control 'on site' record systems. 4.Procedure of future planning on production requirements. 5.Use of reporting systems : *Up *Down *Across 6.Procedure for disruption reporting and communication actions.	1.Evaluation of the accuracy of reporting by subordinates. 2.Report writing. 3.Language skills.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B05 : PLAN AND CONTROL WORK SCHEDULES

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of management processes : *Plan *Organise *Direct *Supervise *Control	1. Procedure of development of work rosters, including manpower planning. 2. Procedure for inspection of work rosters. 3. Method for assessment of production versus work schedules. 4. Methods for adjustments to work schedules. 5. Importance of control and planning systems. 6. Knowledge of operational plans and programmes. 7. Procedure for productional planning. 8. Knowledge of transport procedures, systems and scheduling.	1. Assessment of productivity from 'on site' inspections. 2. Planning, delegating and scheduling. 3. Problem solving. 4. Integrative planning and scheduling.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B06 : PARTICIPATION IN WORKS OPTIMISATION

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
	1. Motivation techniques. 2. Method for setting realistic targets : *People *Chemicals *Power 3. Importance of attending works committees etc. to fascilitate suggestions from subordinates. 4. Procedure of following up on 'quality of life' issues. 5. Knowledge of I.R procedures. 6. Method for coordinating the various sections. 7. Procedure for long term planning. 8. Knowledge of plant design philosophy.	1. Union/management relations. 2. Long term planning.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY B07 : MANAGE PROCUREMENT OF MATERIALS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Knowledge of materials. 2. Procedure of material handling and storage. 3. Characteristics of chemical compounds and their dangers.	1. System for company's requisition of materials. 2. System of store control. 3. System for control and report back on quality of materials and supplier services. 4. Technique for wastage control. 5. Systems for material record and audits on materials stored at the works. 6. Knowledge of costs of materials and suppliers. 7. Procedure for budget and cost control. 8. Tender specifications. 9. Tender procedures. 10. Knowledge of equipment procurement. 11. Knowledge of maintenance procurement and planning.	1. Calculation skills. 2. Planning, delegating and controlling. 3. Scheduling. 4. Observing skills.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY C01 : PLAN AND CONTROL MACHINE AND PLANT SAFETY

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of Safety Awareness.	1. Regulations of MOS Act. 2. Method for record keeping. 3. Knowledge of safety procedures. 4. Procedure of routine inspections. 5. Identify responsible person. *Duties *Delegation 6. Principles of grading systems.	1. Transfer of safety awareness to subordinates. 2. Observance.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY C02 : PLAN AND CONTROL OF PERSONAL HEALTH AND SAFETY

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Characteristics of occupational hygiene. 2. Characteristics of safety hazards : *Chemicals *Gas *Biological *Biocides *Fire *Explosions 3. Principles of safety/ first aid/fire fighting.	1. Regulations of the law: *Regarding safety 2. Safety procedures. 3. Procedure for routine inspections. 4. Method for record keeping. 5. Procedures to train and adjudicate staff. 6. Disposal practices.	1. Train and assess staff. 2. Instill staff awareness. 3. Motivation of staff 4. Communication. *Up *Down *Two-way 5. Safety/first aid. *MOS Act 6. Fire fighting. 7. Occupational hygiene. (required early on in career) *MOS Act.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY C03 : PLAN AND CONTROL HOUSEKEEPING

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
	1. Plant area knowledge. 2. Routine maintenance and housekeeping scope/ procedure/programme. 3. Equipment requirements and maintenance. 4. Characteristics of cleaning materials. 5. knowledge of cleaning routines/schedules. 6. Procedure for inspection. 7. Protective clothing requirements and inspection thereof.	1. Awareness of clean working conditions. 2. Transfer of this awareness.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY C04 : MANAGE PREVENTION OF ENVIRONMENTAL POLLUTION

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of environmental pollution awareness : *Air *Land *Water(surface/ground) *Biological/chemical 2. Basic principles of ecology.	1. Identification of problems per plant. 2. Regulations of Law. 3. Implementation of preventative measures. 4. Principles of warning system. 5. Knowledge of contingency plan. 6. Procedure for inspection. 7. Use of recording/ reporting system.	1. Motivate staff 2. Make staff aware.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY C05 : PLAN AND CONTROL PLANT SECURITY

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
	1. Principles of security systems. 2. Identify potential threats. 3. Procedure/programme to minimise risk. 4. Procedure for inspection. 5. Method of report/ record holding. 6. Scheduling procedure. 7. Identify choice of options/contingency plan. 8. Principles of warning System. 9. Knowledge of area emergency services infra-structure.	1. Staff motivation. 2. Transfer of awareness.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY D01 : PARTICIPATE IN PLANNING OF OPERATING AND CAPEX BUDGETS

COMPETENCY D02 : CONTROL EXPENSES AGAINST BUDGETS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of finance for non-financial managers. 2. Principles of costing. 3. Principles of the Systems Approach.	1. System and procedures of company. 2. Method for target setting. 3. Procedure for monthly reporting. 4. Use of Early-bird warning systems. 5. Procedure of ordering and systems. 6. Method for scenario setting. 7. Interpretation of monthly print-outs/ variances. 8. Control methodology. 9. Characteristics of Company Strategic Plan.	1. Interpretation of monthly print-outs. 2. Projection. 3. Monthly reporting. 4. Procurement. 5. Negotiations. 6. Computation. 7. Computer literacy. 8. Intervention skill.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY D03 : PLAN AND CONTROL UTILISATION OF ASSETS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
1. Principles of planning and controlling. 2. Importance of organisation.	1. Principles of loss control systems. 2. Use of assets register. 3. Method for stock control. 4. Use of log systems . 5. Use of reporting systems.	1. Computer literacy. 2. Computation skills. 3. Planning/control/ organisation. 4. Reporting.

WATER CARE WORKS MANAGER

ESSENTIAL KNOWLEDGE AND SKILLS FOR PERFORMING

COMPETENCY E01 : HANDLE CUSTOMER QUERIES AND COMPLAINTS

COMPETENCY E02 : BUILD CUSTOMER RELATIONS

COMPETENCY E03 : ADVISE/ALERT ON VARIANCES AND DISRUPTIONS

SCIENTIFIC KNOWLEDGE	TECHNICAL KNOWLEDGE	SKILLS
	1. Methods for conflict avoidance. 2. Principles of customer care. 3. Knowledge of company culture/mission. 4. Procedures for handling customers. 5. Principles of follow up system. 6. Technique for recording /reporting/evaluation. 7. Knowledge of customers, their requirements and contingency plans. 8. Principles of customer care budget.	1. Conflict handling. 2. Handle telephone queries/complaints. 3. Accurate recording. 4. Listening skills. 5. Speaking. 6. Writing. 7. Negotiation. 8. Interpersonal skills 9. Motivate subordinates. 10. Instill culture in subordinates.