APPENDIX G

Water Quality Management Plan

WATER QUALITY MANAGEMENT REPORT

UPGRADING AND EXTENSION OF TONGAAT CENTRAL WASTEWATER TREATMENT WORKS, TONGAAT

To support the application for permits and exemptions for sewage purification works in terms of the requirements of the Water Act, 1956 (Act 54 of 1956)

A. EXECUTIVE SUMMARY

The Tongaat Central Wastewater Treatment Works is situated to the east of Tongaat in a spur in a meander of the Tongati River (Plate 1). The present works was designed and constructed in 1983 with a design capacity of 3Ml/d. It was upgraded to 6 Ml/d in 1987 and serves the Tongaat Central area and developed area to the north.

The works was designed on the extended aeration principle. Incoming sewage passes through the head-of-works consisting of a de-gritter, two de-gritting channels and a simple screen and a flow measuring flume. The sewage is then lifted into two aeration tanks by screw pumps. Effluent from the aeration tanks is split to eight Dortmund-type clarifiers. Sludge is recycled to the screw pumps where it is mixed with incoming sewage, while the clarified treated effluent is chlorinated and discharged to the Tongati River. Waste sludge is dried in sludge drying beds, although, in the past waste sludge was discharged to a sludge lagoon.

As a result of a Durban Metro strategic planning study, it was recommended that Tongaat Central WTW should be upgraded to a regional sewage treatment works for Tongaat and the surrounding areas. A smaller works at Tongaat South will be closed in due course and the inflows diverted to Tongaat Central WTW. This WQMR relates to the proposed extended and upgraded works.

In accordance with the strategic plan, it has been estimated that the catchment of Tongaat will generate up to 90 Ml/day of sewage over the next 50 years. The Design Branch has formulated a layout for a conservative flow estimate of 60 Ml/d. Based on this, there shall be 4 conventional activated sludge modules of 15 Ml/d each with full primary sedimentation, anaerobic digestion and sludge dewatering and disposal off-site. Extension will be undertaken in a phased manner.

This WQMR relates to phases 1a and 1b of the upgrading project and exemption is sought for an ADWF of 30Ml/d extension.

The effluent from the extended WTW is expected to comply with the General Standard for wastewater purification except *E. coli* and chlorine (as is the case with the existing plant). It is understood that DWAF intends to revise the *E. coli* standard to 100 counts/100ml and residual chlorine standard to 0.5mg/l (refer to meeting between DMWM and DWAF on 1st July 1999).

No fatal environmental flaws or significant impacts were identified in the Scoping Report (Walmsley Environmental Consultants, July 1999) in regard to the proposed expansion and upgrade of the Tongaat Central WTW. The Scoping Report prescribes outline mitigation measure for relatively minor negative impacts that may arise. It was concluded that the extended works would result in an overall improvement of water quality in the Tongati River due to more efficient, improved wastewater treatment such as de-nitrification and long contact chlorination.

B. CONTENTS

PART 1 : Administrative Information and Brief Project Description

1.1	Name of Company :	Durban Metro Council Durban Metro Water Services Unit Department of Wastewater Management
	Applicant	Director: Wastewater Management
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	Site Name	Tongaat Central WTW
1.2	Magisterial District:	Former Tongaat Town Board
	Current:	Durban Metro Council
1.3	Nearest Town:	Tongaat
	Distance from site:	approximately 6 km by road
1.4	Surface infrastructure	power lines
		gravel road
1.5	Longitude of site	29° 34′ 30″S
	Latitude of site	31° 08′ 30″E

1.6 *Ownership of land*: existing site of works owned by DMC. Site for proposed extensions owned by Tongaat Hullet Property Limited.

1.7 *Zoning of Land* : The agricultural portion would have to be rezoned for industrial use i.e. for sewage purification works.

1.8 *Ownership of adjacent land*: Tongaat Sugar owns the land surrounding the site.

1.9 *Occupiers of adjacent land*: Tongati River and sugar cane farmers.

1.10 *Zoning of adjacent land*: Environmental Reserve (50m from river edge) on riverbanks, and agricultural land.

1.11 *Name of River Catchment:* Tongati River.

1.12 Brief description of the intention of this application

The currently operated Tongaat Central WTW is reaching its design capacity. Hence the extension is to provide additional treatment capacity in accordance with the Department of Wastewater Managements Strategic Plan (see Part 12, below, for consolidated report (part)). The current, short, medium and ultimate flow to the works is delineated below.

Current treatment capacity	= 6 Ml/d
Actual flow to works	= 5 Ml/d (1999 data)
Maximum catchment flow expected over next 50 yrs	= 60 - 90 Ml/d
Phase 1a development	= 10 Ml/d (Extended Aeration)
Phase 1b development	= 15 Ml/d (Conventional Plant)
Phase 2 development	= 15 + 15 = 30 Ml/d (Conventional Plant)

Exemption Permit is being sought for an Average dry weather flow ADWF of 30 Ml/d.

The peak flow that the works shall be designed to shall be 3 x ADWF.

Maps of the proposed and ultimate developments together with design data is appended to this application.

Part 2: <u>Description of the Environment (for orientation and first order screening)</u>

2.1 Climate

Meteorological data was obtained from the nearest recording station to the site at Durban International Airport (station 02408000). The data covers the last 30 years.

- *Regional climate*

The regional climate is sub-tropical, with dry winters.

- *Rainfall*

The average rainfall for the area is 926mm, 70% of which falls between October and March with January having the highest average. The highest recorded rainfall in 24hrs is 264mm.

- *Temperature*

Mean monthly temperatures range from 16^{o}C in July to 23.7^{o}C in February, while, on average, daily maximum temperatures fluctuate between 22.3^{O}C (July) and 27.4^{o}C (February) and minimum temperatures between 11^{0}C (July) and 20.0^{o}C (February). The area is frost free.

- *Wind*

The prevailing wind direction throughout the year is SW but storm winds generally flow from the south. Local topography surrounding the site will, of course, modify and influence wind conditions. The strongest winds blow in October.

- *Evaporation*

The area experiences high evaporation, with 60% occurring between October and March (i.e. the high temperature months). The humidity is greatest in February and lowest in July. The mean annual evaporation is 1830mm and in average dry years there is, therefore, a substantial moisture deficit. The average annual humidity is 78% with 95% and 57% being typical upper and lower extremes

- *Extreme weather conditions*

None, except occasional high rainfall events.

2.2 Topography

Topography of the general area is gently undulating with the site being situated on the low lying flood plane of the Tongati River.

2.3 Soil

The site is underlain by alluvium (river-derived deposits) underlain by sandy/sandy clays of the Berea Formation and a further alluvium layer consisting of silty clay containing boulders and rock fragments.

2.4 Geology

The site is on a low-lying area within the flood plain of the Tongati River consisting of alluvial deposits (river-borne particulate material that is deposited in the floodplain) of the Berea Formation. Residual siltstones and shales underlie part of the existing works. A suspected dolerite dyke forms the ridge to the NW of the works.

2.5 Land capacity

The area that would be used for construction of the new plant, is presently used for growing sugar cane.

2.6 Land use

The site is presently the site of the Tongaat Central Wastewater Treatment Works and is surrounded by agricultural land used for sugar cane farming with some informal settlement to the north west of the site.

2.7 Natural vegetation and plant life

The natural climax vegetation of the Durban area is evergreen, sub-tropical forest, consisting of widely spaced trees.

The vegetation of the site is, however, highly modified for agriculture and to accommodate the existing works. The 'natural' vegetation consists of largely invasive and alien species due to disturbance by man and has little conservation value. Marginal river vegetation (riparian zone) although largely disturbed and modified, nevertheless forms an important ecological buffer.

An artificial wetland has been formed by the existing sludge pond but has very limited conservation value as there is no open water and it is formed on waste sludge.

2.8 Surface water

- *nearest watercourse*

Tongati River and its minor tributary the Hlawe River.

- *Water quality*

DETERMINAND	ABOVE WWTW (R – TONG – 03)	BELOW WWTW (R – TONG – 02)
pH	7.15 (6.6 – 8.3)	7.26 (6.8 – 7.7)
Conductivity mS/m	23.2 (15 – 34)	32.9 (21 – 58)
Turbidity NTU	18.9 (5.3 – 140)	20.3 (5.7 – 180)
Dissolved Oxygen mg/l	5.5 (4.4 – 7.1)	4.7 (2.5 – 6.3)
PV4 mg/l O_2	2.3 (0.2 – 7.8)	2.3 (0.4 – 8.0)
COD mg/l O_2	38.6 (15 – 92)	30.3 (10 – 76)
Tot. Kjedahl Nitrogen mg/l	1.18 (0.45 – 1.9)	1.46 (0.2 – 3.5)
Ammonia Nitrogen mg/l	<0.83 (<0.5 – 1.1)	<0.61 (<0.5 – 2.1)
Nitrite plus Nitrate mg/l	<0.76 (<0.5 – 1.2)	1.79 (0.62 – 6.2)*
Sulphate mg/l	7.55 (1.0 – 12.0)	15.8 (1.0 – 25.0)*
Chloride mg/l	<31.2 (<5.0 – 48.0)	<53.45 (<5 – 74)*
Total Phosphorus mg/l	<0.17 (<0.1 – 0.81)	<1.39 (<0.1 – 5.6)*
Orthophosphate mg/l	<0.19 (<0.1 – 1.0)	<1.03 (<0.1 – 7.1)*
Total Coliforms per 100ml	18514 (2500 – 108000)	22009 (0 – 105000)
E. Coli per 100ml	4037 (500 – 32000)	5903 (0 – 70000)*
Salmonella per 100ml	734.8 (0 – 5000)	1352 (0 – 9999)*
Enterbacteria PFU	25071 (1800 – 137000)	25138 (700 – 100000)

TABLE 1: Water quality in Tongati River (above and below works) covering the period October 1996 to October 1998 (means and ranges shown) – sampling at approximately monthly intervals. (*significant elevation downstream of works; < indicates that some of the values used to calculate mean and range were expressed as 'less than' given values.

The above data indicates that the water quality in the Tongati is generally poor – particularly in regard to high levels of plant nutrients (nitrogen and phosphorus) and sewage-derived microorganisms. This appears to be due in part to the presence of the existing WTW.

- *surface water use*

The Tongati River in the study area is used for the disposal of final treated effluent from the present Tongaat Central and Tongaat South (on the Hlawe River) WTWs. It is likely that water is used for agricultural purposes such as crop irrigation. The Tongati River is used upstream for the disposal of effluent derived from industry e.g. David Whitehead and Sons textile works in Tongaat.

As a natural ecosystem the Tongati River in the region of the site appears to be of low to moderate sensitivity and had been generally degraded through various pollution sources in the catchment.

- *water authority*

Department of Water Affairs and Forestry (KwaZulu-Natal).

- *presence of wetlands*

The only ‘wetland’ is that created artificially by the sludge lagoon (north west of site) with very little ecological/ conservation value.

2.9 Groundwater

- *presence and position of boreholes within a 1000m radius of site.*

According to the Water Resource Management Team of DWAF, there are no boreholes within a 1000m radius of Tongaat Central Works.

[the remainder of this section is not applicable].

2.10 Air quality

Air quality is generally good as the site has a rural location surrounded by agricultural (sugar cane) land. There are some odours arising from the existing treatment works but these are generally only apparent within 50-100m of the plant.

2.11 Noise

Owing to its rural setting, the site is very quiet. The existing treatment works generates low level noise due to the operation of pumps, aeration units etc.

2.12 Sites of archaeological interest

According to the Natal Museum (Pietermaritzberg) a Stone Age site was recorded on the study area a few decades ago. They believe that the area may also yield Iron Age material and

conclude that the area is of 'high ecological sensitivity' and that an ecological survey should be undertaken for the area before commencement of construction activities.

2.13 Sensitive landscapes

There an no sensitive landscapes: the environs of the site is predominantly agricultural (sugar cane farming) and there is a treatment works already in place.

2.14 Visual aspects

The site has a pleasant rural setting - although highly modified due to agricultural practice. The aesthetic value of the area has been degraded by informal settlement around the site (particularly to the north east) and by the exiting treatment works.

2.15 Regional socio-economic structure

Information on regional socio-economic structure was obtained from North Local Council and their draft document: *An Integrated Development Framework Plan for the North Local Council* (June, 1997). The information below refers to the Tongaat area.

The town of Tongaat and Hambanathi (black township) can be summarised as follows:

- Middle to lower class income, industrial/market town with Indian, African and colonial heritage.
- Industry: sugar cane farming, sugar mill and textiles (together provided 36 % of jobs in 1991); commercial (retail and trading etc.).
- Residential (upper, middle and lower income); economic, social and recreational (beach facilities).
- Gateway to peri-urban/ rural market; links to Durban.

- *population*

Tongaat has a population of 51 479 and total number or dwellings of 11 228 (approx. five persons per dwelling). A number of informal dwellings have recently become established to the north east of the site on the top of a bluff.

- *economic activities*

The *per capita* monthly income for Tongaat is R552.70 with an unemployment rate of approximately 10%. The main economic activities are sugar cane farming, medium to small-scale industry (e.g. David Whitehead and Sons) and retail. 88.2% of the population are functionally literate.

- *housing demand*

According to North Local Council this is presently static.

- *social infrastructure*

Major sealed road network and range of public facilities such as public libraries

- *water supply and sanitation*

Previously the water supply to this area was controlled by a number of independent water authorities. With the formation of Durban Metro Water, forward planning for the Durban Metro sub-region is now dealt with holistically by one dedicated department within the organisation.

The North Local Council area is essentially supplied from three sources; Durban Metro supply from Durban Heights Treatment Works in Reservoir Hills, Verulam Treatment Works which is supplied by Hazelmere Dam, and a supply from Tongaat Hulett Treatment Works which augments the supply to Tongaat village.

The supply is stretched to existing demand but does not represent a major constraint to development in the area since Durban Metro Water is a demand driven organisation.

- *power supply*

Tongaat is supplied directly by Eskom.

2.16 Industrial activity

- *types of industries present*

Industry within the study area is generally located within the purpose-built industrial areas, which appear to have a capacity for expansion. Industry is concentrated in three locations within the study area:

- *Truro Industrial Area* – SW edge of Tongaat (clothing, plastic packaging, tiles etc)
- *Maidstone Sugar Mill* and the *David Whitehead and Sons* textile factory – on Tongati River on the eastern side of Tongaat.
- *Canelands Industrial Area* – to the north of Verulam on the banks of the Mhloti River.

- *effluent purification*

Towns and industry in this area have, to date, been serviced by a number of wastewater treatment works which have been developed as a result of zoned planning.

PART 3: Water Supply

3.1 Water Use

Potable water is not currently used for routine activities associated with the wastewater treatment process or will be required for the proposed works. Treated effluent is used for these activities, instead. Potatable water is, however, used in the office and ablution building. This is sourced from the reticulation system supplied by Durban Metropolitan Council.

No water is sourced from rivers, boreholes or groundwater for use at the works.

There are no seasonal patterns in potable water consumption at the Tongaat WTW.

3.2 Water rights

None.

PART 4 : Description of the Reticulation systems

4.1 Percentage of area served which is unsewered: 5-10% (informal dwellers)

4.1.1 This area is serviced by 5% pit latrines and 95% formal reticulation.

4.2 Percentage of area sewered: 10%

Percentage of area to be sewered: 20% over next 20 - 30 years.

4.2.1 Type of network : in place - standard/small bore
future - standard

4.2.2 Location of sewers: mid block/standard

4.3 Nature of sewage

4.3.1 Domestic component: 90%

Current flow: 5 Ml/d

Projected ultimate: 60 - 90 Ml/d over next 50 yrs

Annual growth rate: 1 Ml/d/yr.

4.3.2 Industrial component 10%

Type of industrial effluent: Mainly organic - derived from sugar processing industry.

Heavy metal concentration in order with normal domestic effluent.

4.4 Hydraulic and Organic loading

4.4.1 Hydraulic loading - refer to summary data under 4.3.1

4.4.2 COD load (kg/d) current 6 Ml/d : 5 Ml/d x 650 mg/l = 3250 kg/d

COD load (kg/d) projected for 30 Ml/d : 30 Ml/d x 650 mg/l = 19500 kg/d

4.4.3 Total Nitrogen as TKN for 6 Ml/d : 240 kg/d

" for 30 Ml/d: 1 200 kg/d

4.4.4 Phosphate as P for 6 Ml/d: 33 kg/d

" for 30 Ml/d: 165 kg/d

4.4.5 Peak dry weather flow factor x ADWF = 2 x ADWF = PDWF

4.4.6 Peak wet weather flow factor x PDWF = 3 x ADWF

Part 5. Description of Sewage Purification Works And Classification

5.1 Inlet Works

The inlet works is designed for an ADWF of 30 M**l**/d. Flows in excess of this will be diverted via a side-spill spillway to an emergency pond. Sewage diverted to the pond will be pumped back to the inlet works during low flow periods. In the initial phases there will be no excess flows spilled to the pond as the capacity of the existing trunk sewers to the works is substantially less than 30M**l**/d.

The inflow is split into two channels each with a capacity of 15M**l**/d. Each channel is provided with a coarse screen (125mm spacing) which is hand raked. The duty channel has a mechanically raked screen with a 6mm wedged bar spacing. The standby channel is provided with a removable vertical bar screen with a 10mm spacing. This screen is hand raked.

After the screens the channels converge into a single channel to a 30M**l**/d vortex type degritter.

Two large diameter screw pumps (1 duty, 1 standby) lift the inflow 7,0m into a channel flowing to the works. These pumps are connected to an emergency standby generator set.

5.1.1 Disposal of Screenings and Grit

Screenings and grit are dewatered and placed in a waste bin for transport to landfill

5.1.2 Permitted Landfill

The permitted landfill is the La Mercy (Tongaat) Landfill site operated by Durban Solid Waste, and is 15 km from the works.

5.1.3 Flow Measurement

The inflow is measured by means of a flume situated in the channel after the screw pumps. The level is calculated by means of an ultrasonic level transmitter upstream of the flume.

5.2 Primary Sedimentation Tanks

Two 30 m diameter circular mechanically scraped sedimentation tanks will be constructed for a flow capacity of 30M**l**/day. In the initial phase primary sedimentation tanks are not provided, but will be constructed when inflows reach the required levels.

5.2.1 Upflow Rates

Upflow rate at ADWF	=	1,2m/h
Upflow rate at PWWF	=	2,4m/h

5.3 Septic Tanks

N/A

5.4 Biological Filtration Systems

N/A

5.5 Activated Sludge

The existing works at the site consists of a 6 M**l**/d extended aeration treatment works, which was constructed in the early 1980's.

The new activated sludge plant consisting of one aeration basin with a design capacity of 15 M**l**/d is to be operated in conjunction with the existing works. However, as a primary sedimentation tank is not initially being installed, the new works will be operated on an extended aeration basis with a capacity of 10 M**l**/day.

For a capacity of 30M**l**/d the new works consists of two aeration basins each with 6 equal sized chambers. The inflow enters the first chamber, while return activated sludge (from the secondary sedimentation tanks) and the internal recycle (from the sixth chamber) can be directed to the first, second or both chambers. The first chamber has a mechanical stirrer while the remaining 5 chambers are fitted with slow speed surface aerators. The first chamber stirrer and the internal recycle enable the system to denitrify.

The volume of each aeration basin is approximately 8000m³ and the hydraulic retention time is approximately 13 hrs.

Phosphate removal is not considered necessary at these works. However if it is required in future it will be achieved by chemical means.

5.6 Secondary sedimentation

The existing 6 M**l**/d extended aeration treatment works is served by 8 Dortmund-type clarifiers. The new aeration tanks are to be served by three 30 m diameter mechanically scraped secondary clarifiers for a capacity of 30M**l**/d. Initially two clarifiers will be built to provide operational flexibility and adequate level of safe Upflow Rates

5.6.1 Upflow Rates

Upflow rate at ADWF	=	0,65 m/h
Upflow rate at PDWF	=	1,3 m/h

5.7 Sludge Handling

Waste sludges from the existing 6 M**l**/d works are discharged to drying beds. Once dried, the sludge is removed for disposal.

For a works capacity of 30 M**l**/d two sludge streams are produced :

- Primary sludges from the primary clarifier = 210 k**l**/d at 3,1% solids
- Waste activated sludge from the aeration basin = 748k**l**/d at 0,5% solids.

Primary sludges will be thickened in a gravity thickener and digested in two closed, heated and mixed anaerobic digestors.

Waste activated sludges will be stabilised and digested in two open anaerobic digestors (formerly the existing 6M**l**/d aeration chambers).

Both treated sludges will be further thickened by a linear screen and then dewatered by means of a belt press.

Dewatered sludge cake will be transported to the KwaMashu Wastewater Treatment Works for drying and incineration.

In the initial phase neither the primary sedimentation or the anaerobic digestors will be required until the inflow capacity increases to the required levels. However the full 30 M**l**/d sludge handling facility is being constructed to handle initial sludges.

5.7.1 Quantity of Wet Sludge

Given in 5.7.

5.7.2 Sludge Treatment

Given in 5.7.

5.7.3 Land Disposal

N/A

5.7.4 Relative Capacity

N/A

5.7.5 Digester Capacity

Anaerobic digesters capacity (primary sludges) = 25d retention time for 210 k**l**/d at 30Ml/d.

Open digestor capacity (waste activated sludges) = 20d retention time for 748 k**l**/d at 30Ml/d .

5.7.6 Supernatant

Supernatant from all the sludge handling processes are returned to the aeration basin.

5.7.7 Drying Bed Capacity

N/A

5.7.8 Drying Bed Area

N/A

5.7.9 Other Sludge Handling Measures

Given in 5.7

5.7.10 Drainage

All drainage from the thickening and de-watering is returned to the aeration basin.

5.7.11 Sludge Disposal

Dewatered sludge is to be transported to the KwaMashu Wastewater Treatment Works for drying and incineration.

5.8 Oxidation ponds

N/A

5.9 Disinfection

Chlorine dosing proportional to effluent flow rate is provided. A chlorine contact tank with a contact time of 30mins at full hydraulic design flow, consisting of a zigzag channel arrangement allows for disinfection to take place before discharge.

A residual chlorine monitor will be installed on the final chlorinated effluent line. The monitor will issue an alarm signal in the event of high residual chlorine.

5.10 Classification Summary

Design capacity (megaliters per day)	Up to 1 1+ to 5 5+ to 20 20+ to 100 Over 100	 X
Concentration of raw influent or sewage as COD	Less than 700 mg/**l** 700 mg/**l** and over	X
Process	Preliminary treatment with more than one mechanical item	X
	Primary sedimentation	X (future)
	Anaerobic digestion	X (future)
	Sludge drying beds	X (short term)
	Gas utilisation (e.g. gasholder, boiler, etc.)	X (future)
	Oxidation ponds (not for tertiary use)	
	Biofilters (Biof) or biodiscs	X
	Activated sludge (AS) in any form	
	Tertiary treatment (e.g. sand filtration)	
	Maturation ponds	X
	Chlorination	
	Mech or phys/chem sludge treatment incl.	X
	Stabilisation and/or dewatering	X
	Nutrient removal (over and above AS or Biof)	X
	Complicating factory (e.g. gas engines, air filtration, etc.)	

Sensitivity of water environment into which treated or purified effluent is discharged	LOW – e.g. ocean or evaporation pond MEDIUM – e.g. GENERAL STANDARD or ocean Discharge near a swimming beach HIGH – e.g. SPECIAL STANDARD or trout stream or downstream potable water supply	X
State any complicating or simplifying factors	N/A	

Part 6 Disposal of Purified Sewage Effluent (liquid and solid waste)

6.1 Description of treated liquid and solid waste

6.1.1 Quantity

Treated effluent is discharged continuously throughout the year.

The existing works is discharging an average of 5,78 M**l**/d with peak discharges during rainstorm events of 11,26 M**l**/d.

Historical flow data from this works is considered unreliable due to malfunctioning of flow recording equipment. The existing inlet works has been modified and new flow recording equipment was installed in December 1998. Annual flows are expected to be at or near the design capacity of the works i.e. 6,0 M**l**/d.

The new works has a design capacity initially of 10 M**l**/d (extended aeration operation) giving a total ADWF capacity of 16 M**l**/d. When upgraded to activated sludge the works will have a treatment capacity of approximately 30 M**l**/d.

6.1.2 Analysis of Liquid Wastes

A summary of the treated effluent discharge between July 1997 and August 1998 is presented below.

Parameter	**Average Value**
pH	7,3
Conductivity	57 ms/m
Suspended Solids	12 mg/**l**
COD	31 mg/**l**
NH_3	< 1,0 mg/**l**
NO_3	2,8 mg/**l**
Orthophosphate	3 - 5mg/l (from 3 samples taken during 1999)
E.coli	nil (two results of 130/100m**l** in 13 months)

6.1.3 Solid Waste

The existing works produces the following solid wastes :

Screenings and rakings: approximately 0,2 m^3/d
Dried Sludge: approximately 0,6m^3/d

This translates to approximately 292m^3/year.

At 30M**l**/d the following solid wastes are estimated :

Screening and rakings: approximately 4,5m^3/d
Dried sludge: approximately 7,68 tonnes/d

Waste sludges used to be pumped to a sludge lagoon located adjacent to the works. This practice was stopped in 1992 when additional sludge drying beds were constructed.

6.1.4 Analysis of Liquid Waste

The composition is given above. A detailed analysis of the constituents has not been undertaken, but is typical for a sewage treatment works.

6.2 Destination of Wastes

6.2.1 Effluent Purification Works

N/A

6.2.2 Re-use

N/A

6.2.3 Land

N/A

6.2.4 Stormwater Drains

N/A

6.2.5 To Water Course / River

The treated effluent is discharged to the Tongaat River adjacent to the works. This river is the major catchment for the area.

6.2.6 To Estuary

N/A

6.2.7 To Sea

N/A

6.2.8 Solid Waste Disposal Site

Solid waste is currently disposed of at the permitted La Mercy (Tongaat) Landfill operated by Durban Solid Waste.

All de-watered sludges from the expanded works will be transported to the KwaMashu Wastewater Treatment Works for disposal by incineration.

Screening and rakings will continue to be disposed of at the landfill site.

6.2.9 To Groundwater

N/A

6.2.10 To Mines

N/A

PART 7 **Water Balance Diagram**

See Section 12 below.

PART 8 **Management Systems and Pollution Prevention Methods**

8.1 See Section 12 below.

8.2 Mechanical maintenance staff shall be either form internal Mechanical Branch or contracted out to a private company.

8.3 Same as for 8.2

8.4 Process control staff shall be drawn from the Works Treatment Branch of DMWM in addition to private contracted staff.

8.5 Drainage bylaws – see Section 12 below

8.6 Technology Choice (includes 8.6.1 – 8.6.5)

There is a spectrum of wastewater treatment technology options available in the market place. These are simple systems like ponds, aerated lagoons to intermediate systems like RBC's and more high tech options like extended aeration, activated sludge and primary sludge anaerobic digestion. The key factor determining technology choice is scale of works. The parameter used here is flow rate in Ml/d. For less than 1 Ml/d, the Extended Aeration (EA) process is economically viable and technically acceptable. For flows in excess of 20Ml/d, conventional Activated Sludge process with anaerobic digestion (AS) represents the optimised technology choice.

Furthermore, DMWS has the institutional and technical capacity to operate EA and AS and to comply with DWAF permit requirements.

Hence, in the case of Tongaat Central Works, the technology option would be EA up to 10 Ml/d and thereafter conversion to conventional AS with anaerobic digestion of primary sludge.

8.7 Operational Management Plan.

8.7.1 The system can fail under the following conditions

(a) toxic material input
(b) extreme flood events
(c) electricity supply failure.

8.7.2 The implication of failure due to the above would be AS biomass washsout, thereby necessitating long system recovery periods.

8.7.3 Safety Factors

(a) Toxic material input: buffered by domestic proportion, stringent trade effluent bylaws and vigilant pollution control inspectorate located within Business Branch of DMWM.
(b) Flood events: Works will cope adequately within 1:50 year flood events.
(c) Electricity supply: DMWM currently negotiating with Metro Electricity to secure power supply to works. In addition, a standby generator will be used to provide for the minimum power requirements to avoid system failure and excessive pollution to the environment.

8.7.4 Management and Maintenance Plan

All mechanical, electrical, process instrumentation to be managed and maintained in accordance with standard best practices and vendor specification. The routine maintenance schedule is managed by the Mechanical/ Electrical Branch of DMWM.

8.7.5 Accident and Emergency plans are instituted in accordance with the Work's Safety Programme. A safety meeting is held monthly. This attended by Management and a designated safety officer.

8.7.6 In addition to following a standard design protocol for conventional treatment works, and drawing from years of experience; the design for the proposed extension was subject to a thorough Hazard and Operability Study (HAZOP).

8.7.7 Monitoring is via control set points, alarms and a rigorous sampling program. Audit is via weekly, monthly and yearly report generation and meetings with senior management.

8.7.8 Yes, alarms systems are in place at pump stations.

8.7.9 Not applicable.

Part 9: Final Effluent Disposal Evaluation

9.1 Land disposal – ponds or dams

Not applicable

9.2 Land disposal – irrigation areas

Not applicable

9.3 Disposal to groundwater

None

9.4 Disposal to surface water

Final treatment effluent is disposed of to surface water i.e. to the Tongaati River.

9.4.1 *Quantity of effluent*

Current treatment capacity	=6 Ml/d
Actual flow to works	=5 Ml/d
Maximum catchment flow Expected over next 50 years	=60 – 90 Ml/d
Phase 1a development	=10Ml/d (Extended Aeration)
Phase 1b development	=15 Ml/d (Conventional Plant)
Phase 2 development	= 15 + 15 = 30Ml/d (Conventional Plant)

9.4.2 Annual discharge pattern

The discharge of treated effluent to the Tongati River will be affected by seasonal summer rainfall and the works will typically handle greater volumes in the summer months.

9.4.3 - 9.4.7 Minor river catchment

Not applicable - the works is situated and will discharge to a major river catchment i.e. the Tongati River Catchment.

9.4.8 Major river catchment

The Tongati River is the main river catchment. It has an area of approximately 400km^2 and mean annual run-off of approximately 90.7 x 10^6 m^3.

Quality of river upstream and downstream of discharge point:

DETERMINAND	ABOVE WWTW (R – TONG – 03)	BELOW WWTW (R – TONG – 02)
pH	7.15 (6.6 – 8.3)	7.26 (6.8 – 7.7)
Conductivity mS/m	23.2 (15 – 34)	32.9 (21 – 58)
Turbidity NTU	18.9 (5.3 – 140)	20.3 (5.7 – 180)
Dissolved Oxygen mg/l	5.5 (4.4 – 7.1)	4.7 (2.5 – 6.3)
PV4 mg/l O_2	2.3 (0.2 – 7.8)	2.3 (0.4 – 8.0)
COD mg/l O_2	38.6 (15 – 92)	30.3 (10 – 76)
Tot. Kjedahl Nitrogen mg/l	1.18 (0.45 – 1.9)	1.46 (0.2 – 3.5)
Ammonia Nitrogen mg/l	<0.83 (<0.5 – 1.1)	<0.61 (<0.5 – 2.1)
Nitrite plus Nitrate mg/l	<0.76 (<0.5 – 1.2)	1.79 (0.62 – 6.2)*
Sulphate mg/l	7.55 (1.0 – 12.0)	15.8 (1.0 – 25.0)*
Chloride mg/l	<31.2 (<5.0 – 48.0)	<53.45 (<5 – 74)*
Total Phosphorus mg/l	<0.17 (<0.1 – 0.81)	<1.39 (<0.1 – 5.6)*
Orthophosphate mg/l	<0.19 (<0.1 – 1.0)	<1.03 (<0.1 – 7.1)*
Total Coliforms per 100ml	18514 (2500 – 108000)	22009 (0 – 105000)
E. Coli per 100ml	4037 (500 – 32000)	5903 (0 – 70000)*
Salmonella per 100ml	734.8 (0 – 5000)	1352 (0 – 9999)*
Enterbacteria PFU	25071 (1800 – 137000)	25138 (700 – 100000)

TABLE 2. Water quality in Tongaat River (above and below works) covering the period October 1996 to October 1998 (means and ranges shown) – sampling at approximately monthly intervals. (*significant elevation downstream of works; < indicates that some of the values used to calculate mean and range were expressed as 'less than' values.

Effluent quality analysis for present works.

DETERMINAND	FINAL EFFLUENT QUALITY (mean and range)	GENERAL STANDARD[1]
Settleable solids ml/l	6.9 (0 – 39.0)	–
pH	7.4 (6.9 – 7.8)	5.5 – 9.5
Conductivity mS/m	57.2 (49.0 – 70.0)	250 Max
E. Coli per 100ml	86.7 (0 – 130)*	0.00
Oxygen absorbed mg/l	5.1 (3.2 – 8.4)	10 Max
COD mg/l O_2	31.1 (16.0 – 44.0)	75 Max
Kjedahl Nitrogen mg/l	-	-
Ammonia Nitrogen mg/l	0.4 (0.8 – 3.6)	10 Max
Nitrate Nitrogen mg/l	1.3 (3.6 – 5.1)	-
Nitrite Nitrogen mg/l	0.03 (0.02 – 0.15)	-
Orthophospate P mg/l	3.8 (2.6 – 5.6)[2]	-
Total Suspended Solids mg/l	12.2 (3.0 – 35.0)*	25 Max
Volatile Susp. Solids mg/l	-	-
Dissolved Oxygen mg/l	-	> 75% saturation
Free Chlorine mg/l	0.18 (0.05 – 0.20)*	0.1 Max

TABLE 3. Final Effluent Quality for July 1997 - Aug 1998 at approx monthly intervals. [*sometimes exceeds standard limit; [1] section 21 of Water Act 1956; [2] mean and range of 4 samples taken in February 1999].

Due to proposed improved treatment in the extended works, it is anticipated that the above effluent quality will be improved – particularly *E. coli* due to improved chlorine contact and nitrogen levels due to de-nitrification.

Established uses of river

It is likely that the Tongati River downstream of the proposed works has a number or uses but at a low level as it does not flow through any major industrial or residential areas before discharging to the sea after only 10km. Most of the land in the downstream catchment is used for growing sugar cane.

Receiving Water Quality Objectives

There are no specific RWQOs for the catchment. The water quality objectives should be based on the uses of the river and the appropriate water quality for each use (e.g. recreation, agriculture) as given in DWAF's *Water Quality Guidelines (1996)*

PART 10 Recommendations From Other Interested Parties

A number or persons and organisations were consulted as part of the Scoping Study for the project:

- The general public by means of a public meeting held at Tongaat Cental Library on Tuesday 23rd March 1999. This meeting was advertised in three newspapers.
- Durban Metro Environment Branch
- DWAF (including Catchment Management Forum)
- Wildlife and Environment Society of Southern Africa (Tongaat Branch)
- North Local Council (Planning and Environment Departments)
- Relevant Councillors
- Tongaat United Squatters Association
- Tongaat Hullet Properties
- Natal Museum, PMB

Key issues specifically raised by I&APs in the consultation process and our comments are as follows:

- *Given water shortages in the geographical area, can wastewater be recycled and utilised in any way e.g. for agriculture, industry or a tree nursery on or near the site?* Previous experience by DMWM with other works in this regard, is that it is extremely difficult to implement recycling for technical and administrative (i.e. licensing) reasons.

- *It is important to provide as many new jobs as possible in the construction and running of the proposed upgraded works*. Cognisance should be taken of this issue in construction and operation of the works.

- *As part of the site of the proposed works is below the 1:50 year flood-line, what will be the impact of flooding?* The possible flooding of the works has been accounted for in works design and is not considered to be a significant issue.

- *How will the sludge from the existing sludge lagoon be disposed of?* Sludge will be disposed of or used in a licensed manner in accordance with standard procedures.

- *With respect to maximising conservation opportunities on the site of the works, it was suggested that a path be created running along the Tongati riverbank to form part of a larger nature trail along the river. The creation of conservation ponds on the site as, for example, bird habitat, was also suggested.* These suggestions should be given consideration in works design and operation

.

- *It was suggested that the Tongaat South works could be used in a constructive way such as for fish farming/ aquaculture.* This idea should be given consideration when the Tongaat South Works is closed for wastewater treatment.

- *Consideration should be given to forming a buffer zone around informal settlement near the site periphery.* There is not intention to built plant close to the informal settlement.

- *General water quality concerns related to the contribution of the works to nutrient enrichment (eutrophication) of the Tongati River, particularly phosphorus, and high levels of sewage-derived bacteria.* These issues are not considered to be significant due to proposed treatment plant improvements.

PART 11 Conclusion

It is concluded that no fatal environmental flaws or significant impacts would arise from the proposed upgrading and extension of the Tongaat Central WTW. Due to more efficient and rigorous treatment it is anticipated that effluent quality in regard to, for example, bacteria and plant nutrient levels, will improve upon the present situation. Given the proposed relaxation of standards for *E. coli* and chlorine by DWAF, it is anticipated that effluent quality standards will be met.

A permit is thus requested from DWAF, in terms of Section 21 of the Water Act, to discharge treated effluent to the Tongaat River which complies with the General Standard for wastewater purification.

PART 12 **References and Supporting Documentation**

See attached.

PART 13 **Confidential Material**

Not applicable.

PART 14 **Declaration**

I hereby declare that the information submitted in this Water Quality Management Report is, to the best of my knowledge, correct.

SIGNED…….

DESIGNATION……..

APPLICANTS REF. NO……...

DATE……...