REPORT No: P WMA 19/000/00/0507

Volume 6 of 7

DEPARTMENT OF WATER AFFAIRS AND FORESTRY

Directorate: National Water Resource Planning

WESTERN CAPE WATER SUPPLY SYSTEM: RECONCILIATION STRATEGY STUDY

Overview of Water Re-use potential from Wastewater Treatment Plants

FINAL

June 2007

CITY OF CAPE TOWN | ISIXEKO SASEKAPA | STAD KAAPSTAD

Submitted by:

Ninham Shand (Pty) Ltd in Association with

UWP Consulting (Pty) Ltd

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DEPARTMENT OF WATER AFFAIRS AND FORESTRY

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SUBMITTED BY

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REPORT TITLE	**:**	**Overview of Water Re-use Potential from Wastewater Treatment Plants**
CLIENT	**:**	**Department of Water Affairs and Forestry**
PROJECT NAME	**:**	**Western Cape Water Supply System Reconciliation Strategy Study**
AUTHOR	**:**	**W Ketteringham (UWP)**
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P WMA 19/000/00/0507

WESTERN CAPE RECONCILIATION STRATEGY STUDY

VOLUME NUMBER	REPORT TITLE	
1	Reconciliation Strategy	
2	Determination of Future Water Requirements	
3	Scenario Planning for Reconciliation of Water Supply and Requirement	
4	Overview of Water Conservation and Demand Management in the City of Cape Town	
5	Treatment of Effluent to Potable Standards for Supply from the Faure Water Treatment Plant	
6	**Overview of Water Re-use Potential from Wastewater Treatment Plants**	✓
7	Summary Report	

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Mr J. Frame	ex City of Cape Town
Mr J. Daniels	City of Cape Town
Mr H. Mostert	ex City of Cape Town
Mr K. Fawcett	City of Cape Town
Mr P. King	City of Cape Town

THE WESTERN CAPE WATER SUPPLY SYSTEM RECONCILIATION STRATEGY

EXECUTIVE SUMMARY

Background

The Department of Water Affairs and Forestry (DWAF) commissioned the Western Cape Reconciliation Strategy Study, to facilitate the reconciliation of predicted future water demand scenarios with supply from the Western Cape Water Supply System (WCWSS) for a 25 year planning horizon. The Study seeks to provide a decision support framework to facilitate timeous decision making of appropriate water resource interventions necessary to ensure that future water demands can be met on a sustainable basis.

It is anticipated that Water Re-Use (WRU) is likely to form part of any future suite of reconciliation interventions for the WCWSS. Therefore this report investigated the current state of WRU and possible future interventions.

The objective of this report is to investigate the extent to which Water Services Authorities (WSAs) in the study area are currently re-using water, undertaking investigations to assess the potential for re-using water and planning and/or implementing water re-use projects. This report also addresses the impact of the recent droughts in terms of WRU in general and the demand for treated effluent in particular.

The issues related to Water Conservation and Water Demand Management (WC/WDM) interventions are discussed in a separate supporting report.

Previous Studies

Three main studies on the use of treated effluent have been conducted previously by the City of Cape Town (CCT) and the former Cape Metropolitan Council (CMC). They are:

- A Strategic Evaluation of Bulk Waste Water: Water Reclamation: A Strategic Guideline; compiled in 1999 by the then CMC;
- The Integrated Water Resources Planning Studying; completed in 2001 by the then CMC; and
- The Investigation into the Distribution of Treated Effluent; completed by the CCT during 2003.

All the studies concluded that there is a potential to increase the re-use of water in a cost effective and sustainable manner, particularly for irrigation and industrial use.

Current Extent of Re-use

It appears that treated effluent is mainly used within the CCT and by a few industries in the West Coast District Municipality for process purposes. However, the re-use of water has only been pursued to a limited extent and not on an integrated and sustained basis by any of the WSAs in the Western Cape. Furthermore, the re-use of water has by and large occurred on an *ad-hoc* basis, often driven through private sector initiatives.

Approximately 9.4% of the Average Dry Weather Flow (ADWF) in the CCT is currently being re-used, primarily for local irrigation of public open space and sports fields and for industrial use. This equates to some 11.6 Mm^3/a.

Policies and Practices

On account of limited National policy and guidelines regarding the use of treated effluent, the generally ad-hoc nature of water re-use in the Western Cape and because many of the municipalities in this region have to date not regarded the distribution of treated effluent as a municipal function, most municipalities do not have the necessary policies in place to address the use of treated effluent. As a result, the following were noted regarding the schemes implemented to date:

- Many schemes were implemented and are currently being operated and maintained by the private sector/end user;
- There are no formal agreements in place;
- Schemes do not comply with the relevant norms and standards, e.g. no provision for chlorination, no servitude agreements, etc. and are often not fit for use; and
- Many have no formal tariff agreements in place (i.e. no payments are being made in many instances).

The recent drought saw an increased demand for treated effluent in response to the imposed water restrictions and as a result some of the municipalities are starting to put the necessary policies and regulations in place.

Potential for Re-use

The investigations undertaken to date for the CCT identified the following potential for re-use:

- "non-potable" use options: 50.2 Mm^3/a (29% of the current ADWF)
- "potable" use options: <u>74.6 Mm^3/a</u> (43% of the current ADWF)
- **Total** **124.9 Mm^3/a** **(72% of the current ADWF)**

Further consideration of effluent quality and its possible impact on the suitability of the various re-use options is required.

Based on studies undertaken to date, it is evident that many of the re-use options investigated are economically feasible, especially those for local irrigation and industrial use. A comparison of the unit reference values (URVs) of some of the reviewed options with those of other interventions investigated by the Reconciliation Strategy study is provided below:

Intervention	URV	Source/Comment
Treated effluent to potable standards using reverse osmosis	1,29 - 1,94	*"Reclamation of Treated Effluent for Potable Supplies"* Report (includes costs of water and treatment)
Treated effluent for commercial irrigation	2,77	URV updated from IWRP Study
Treated effluent for local irrigation and industry	0,55	URV updated from IWRP Study
Dual Reticulation	1,25	URV updated from IWRP Study
WC/WDM	0,3 to 0,7	URV updated from IWRP Study
TMG - Wemmershoek	0,56	URV updated from IWRP Study. It is estimated that dependent on wellfield siting and yield, the URV could range from 0,3 to 0,8
Cape Flats Aquifer	0,58	URV updated from IWRP Study
Raising Steenbras Lower Dam	0,98	Old URV obtained from Western Cape System Analysis and escalated. URV is however considered to be low.
Eerste River	1,28	URV updated from IWRP Study
Desalination	9.8	URV updated from IWRP Study. The actual URV would be location specific (includes water treatment and distribution infrastructure).

NOTE : URV Costs exclude water treatment and distribution infrastructure unless specifically mentioned.

Conclusions

Treated effluent is a valuable water resource, which should be considered in all future water-resource planning studies. As was borne out during the recent droughts, given certain conditions, e.g. restricted water supplies and/or appropriately priced treated effluent of suitable quality and assurance, there is a demand for treated effluent, especially for local irrigation, agricultural and industrial use. Furthermore, the re-use options investigated to date, particularly some of the non-potable use options, are cost competitive.

Most municipalities in the Western Cape have to date not sought to maximize the use of this resource in an integrated and sustained manner and limited or no investigations of water re-use have been conducted outside of the CCT. This could in part be attributed to ongoing concerns regarding the use of treated effluent such as salt build-up in soils, long-term health impacts and the ability of the respective water services institutions to effectively operate and maintain treated effluent schemes. Furthermore, there appears to be limited National policy and guidelines in place at present to specifically regulate/direct the use of treated effluent.

Treated effluent for non-potable use is viable and should be aggressively pursued as a means to reconcile supply and demand in the Western Cape. The use of treated effluent for potable use, although appearing viable, requires further investigation before it can be considered for implementation.

Recommendations

A strategic review of treated effluent as a water source to meet future supplies, needs to be undertaken at both National and municipal level. Municipalities should develop targets, policies and implementation strategies for water re-use. This will require that re-use schemes from the various waste water treatment works be conceptualised and optimised, taking into consideration the effluent quality from these works and the quality requirements for the proposed re-use schemes from these works.

In particular, it is recommended that the following be undertaken:

- Based on effluent quality and land use in the respective catchment areas, identify those works which produce higher quality effluent and are therefore better suited to service potable use schemes. Then conceptualise possible re-use schemes and if viable, ring fence these works for future potable-use schemes;
- Based on the location of industrial centres/clusters, investigate possible industrial re-use schemes to service these areas (incentives can be provided where required);
- Investigate opportunities for using treated effluent to meet riverine reserve requirements; and
- Investigate extending "local irrigation" with treated effluent schemes and to provide supplies for domestic gardening and/or toilet flushing supplies.

The above investigations will ensure that the potential demand for higher quality re-used water is clearly understood and defined, before schemes for lower quality re-used water are implemented.

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ABBREVIATIONS AND ACRONYMS

ADWF	Average Dry Weather Flow
CCT	City of Cape Town
CMA	Cape Metropolitan Area
CMC	Cape Metropolitan Council
COD	Chemical Oxygen Demand
DDM	Drakenstein District Municipality
DOM	Domestic
DWAF	Department of Water Affairs and Forestry
IND	Industrial
IWRP	Integrated Water Resources Planning Study
O&M	Operation and Maintenance
POS	Public open space
SDM	Stellenbosch Municipality
TSS	Total Suspended Solids
URV	Unit Reference Value
WC	Water Conservation
WCDM	West Coast District Municipality
WCWSS	Western Cape Water Supply System
WDM	Water Demand Management
WRU	Water Re-use
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Services Provider
WTW	Water Treatment Works
WWTW	Wastewater Treatment Works

1. INTRODUCTION

The Department of Water Affairs and Forestry (DWAF) commissioned the Western Cape Reconciliation Strategy Study to facilitate the reconciliation of predicted future water demands with supply from the Western Cape Water Supply System (WCWSS) for a 25 year planning horizon. The WCWSS serves the City of Cape Town (CCT), other urban users and irrigators and consists of infrastructure components owned and operated by both CCT and DWAF. The Study seeks to provide a decision support framework to facilitate timeous decisions regarding appropriate water resource interventions to ensure that the anticipated future water requirements can be met on a sustainable basis.

Previous studies undertaken to investigate augmentation options to reconcile future demand and supplies of the Western Cape, are the Western Cape System Analysis initiated by DWAF in 1989, the Integrated Water Resources Planning Study (IWRP Study) initiated by the then Cape Metropolitan Council (CMC) in October 1999 and the Cape Metropolitan Area Bulk Water Supply Study.

Apart from investigating three conventional supply augmentation options, the IWRP Study investigated eight Water Conservation and Demand Management (WC/WDM) options and three Water Re-Use (WRU) options. The Study, which included extensive public participation and evaluation of options processes, concluded that:

- two packages of WC/WDM options should be implemented (one to be implemented directly by the former CMC and one to be promoted by the CMC);
- all ongoing WC/WDM initiatives should be supported and advanced;
- the WC/WDM options should be implemented as soon as possible; and
- the water re-use options were not widely supported.

Following the initial screening of options workshop held during August 2005 as part of the Reconciliation Study, at which the WRU options received support, it was decided that WC/WDM and WRU investigations be undertaken prior to the completion of the Strategy, because WC/WDM and WRU would form part of any future reconciliation strategy interventions in the Western Cape.

This particular report, which forms part of a series of reports on WC/WDM and WRU supporting the Reconciliation Study, provides an indication regarding the extent to which the WSAs in the supply area of the WCWSS have implemented or have considered the implementation of WRU schemes in order to meet their existing and projected water requirements.

2. OBJECTIVE OF THE INVESTIGATIONS

The objective of these investigations are to assess the extent to which WSAs in the study area are currently re-using water, undertaking investigations to assess the potential for re-using water and planning and/or implementing water re-use projects. Furthermore, the impact of the recent droughts on WRU in general and the demand for treated effluent in particular, are also investigated.

3. INVESTIGATIONS

The following were undertaken as part of these investigations

- Interviews with Mr J. Frame, Mr H. Mostert, Mr J. Daniels, Mr K. Fawcett and Mr P. King of the City of Cape Town;
- Correspondence with Municipal officials from the West Coast, Drakenstein and Stellenbosch Municipalities;
- Review of the Water Services Development Plans (WSDP) prepared by the various WSAs in the study area. In this regard it can be noted that when approached for information, many of the WSAs merely provided their WSDPs which were generally found to be outdated and lacking in the type of information required for this investigation; and
- Review of recent WRU studies undertaken by certain of the WSAs.

4. CITY OF CAPE TOWN

4.1 Previous studies

The City of Cape Town (CCT) or the former Cape Metropolitan Council (CMC) has undertaken three main studies regarding water re-use, namely:

- A Strategic Evaluation of Bulk Waste Water: Water Reclamation: A Strategic Guideline; completed in 1999 by the then CMC;
- The Integrated Water Resources Planning Study; completed in 2001 by the then CMC; and
- The Investigation into the Distribution of Treated Effluent; completed by the CCT during 2003.

4.1.1 Strategic Evaluation of Bulk Waste Water

This study investigated a number of options for the use of treated effluent including:

- local irrigation (e.g. sports fields, public open space);
- exchange of treated effluent for raw water allocations with commercial farmers;
- industrial use;
- gardening and toilet flushing (i.e. dual reticulation for new housing developments);
- potable use; and
- aquifer recharge.

The study concluded that there is potential to increase the re-use of water, particularly for irrigation and industrial use, and recommended that medium and long-term goals be set for water reclamation. The long-term and medium-term goals recommended were "zero effluent discharge" and "zero discharge of effluent of domestic origin during mid-summer", respectively. Furthermore, in order to achieve these objectives, certain additional studies were recommended.

It is understood that the former CMC set a target of zero effluent discharge during mid summer in the medium term, but that this target has not been actively pursued on account of subsequent institutional changes.

4.1.2 Integrated Water Resources Planning Study

As stated previously, this study investigated three conventional supply augmentation options, eight water conservation and demand management options and three water re-use options. The study also included extensive public participation and comparison of option processes.

The following options pertaining to the use of treated effluent were investigated as part of this study:

- Local irrigation and industrial use;
- Exchange of treated effluent for raw water allocations of commercial farmers; and
- Potable water supplies.

The above-mentioned treated-effluent options were rated amongst the least favourable of all the options considered.

4.1.3 Investigation into the Distribution of Treated Effluent

Subsequent to the above studies, there appear to have been no concerted initiatives to further the use of reclaimed effluent. However, with the imposition of water restrictions during the recent drought, the demand for treated effluent in the Western Cape grew and the CCT responded by initiating an assessment of existing treated effluent schemes within its area of jurisdiction and an investigation into the extent to which these schemes could be extended to distribute treated effluent to potential users. Prior to the completion of these investigations, and in response to private sector demands, CCT implemented various projects to provide treated effluent from the Potsdam (for industry and agriculture), Bellville (for industry), Parow (for irrigation) and Kraaifontein (for agriculture and irrigation) wastewater treatment works.

The investigations, which were initiated by the Reticulation Section of the CCT, investigated the existing and future possible use of treated effluent from specific works, with little consideration of effluent quality issues.

The results of the investigations, which focused primarily on identifying opportunities for local irrigation and agricultural use, were the following:

- The identification of possible users of treated effluent;
- Possible treated-effluent distribution networks from selected wastewater treatment works to service potential users; and
- The capital and O&M costs of these schemes.

It can be concluded that these investigations were primarily of a practical nature in response to an increased demand for treated effluent, as opposed to a strategic initiative to maximise the use of treated effluent as a long-term alternative source to reconcile supply and demand into the future.

See **Appendix A** of this report for the organogram of CCT's Water Services Department and **Appendix E** for the layouts of the current and proposed treated effluent distribution networks.

4.2 Current studies

Apart from the studies being undertaken as part of the Reconciliation Strategy Study, there appear to be no ongoing studies investigating the possible use of treated effluent in a strategic and integrated manner.

A re-use scheme to supply treated effluent for irrigation purposes from the Macassar WWTW to the proposed "AECI" housing development near Somerset West, has been initiated.

4.3 Current extent of re-use

The current extent of water re-use from the respective waste water treatment works in the region, as obtained from previous studies is tabulated in **Table 4.1**. A detailed breakdown of the users is provided in **Appendix B** of this report.

Table 4.1 Review of effluent from CCT's Wastewater Treatment Works

No	WWTW	Current Capacity / Return Flows				Current Usage of Treated Effluent			
		Rated Hydraulic Capacity (Ml/day)	Ave. Summer Flow (Ml/day)	Ave Winter Flow (Ml/day)	Ave Annual Flow (Ml/day)	Summer Only (Ml/day)	All Year (Ml/day)	Total Summer (Ml/day)	% of ADWF
1	Bellville	54.6	49.2	59.1	53.7	2.82	4.29	7.11	14.5%
2	Kraaifontein	17.5	7.7	86	7.3	1.43	5.50	6.93	90.0%
3	Scottsdene	12.0	8.1	8.3	7.8	0.28	5.00	5.28	65.2%
4	Athlone	105.0	77.9	93.2	83.3	2.00	3.00	5.00	6.4%
5	*Cape Flats*	*200.0*	*123.5*	*153.3*	*149.5*	*4.50*	*0.00*	*4.50*	*3.6%*
6	Borcherds Quarry	35.0	29.4	29.9	27.9			0.00	0.0%
7	Parow	1.2	1.6	2.0	1.7	1.20	0.00	1.20	75.0%
8	Gordons Bay	3.1	2.4	3.0	2.5	0.50	0.00	0.50	20.8%
9	*Macassar*	*57.0*	*36.5*	*41.8*	*37.4*	*3.50*	*0.00*	*3.50*	*9.6%*
10	*Zandvliet*	*59.0*	*49.0*	*44.9*	*48.0*	*0.00*	*0.00*	*0.00*	*0.0%*
11	*Mitchell's Plain*	*48.0*	*31.4*	*31.0*	*30.9*	*0.00*	*0.00*	*0.00*	*0.0%*
12	Melkbos	5.4	2.2	2.2	2.0	1.98	0.00	1.98	90.0%
13	Potsdam	32.0	32.8	34.4	32.1	6.73	1.30	8.03	24.5%
14	Wesfleur (Domestic)	8.0	5.8	5.9	5.9	0.30	0.00	0.30	5.2%
	Wesfleur (Industrial)	6.0	4.6	5.6	4.8				0.0%
15	Simons Town	5.0	1.7	1.9	1.8				0.0%
16	Wildevoël Vlei	14.0	8.8	9.7	8.5	0.00	0.00	0.00	0.0%
	Sub Total	**662.8**	**472.6**	**534.8**	**505.1**	**25.2**	**19.1**	**44.3**	**9.4%**
17	Camps Bay Outfall	3.7	2.1	2.1	2.1				
18	Green Point Outfall	30.0	25.1	26.5	26.0				
19	Houtbay Outfall	9.8	3.6	4.0	3.9				
20	Llandudno Outfall	0.3	0.2	0.2	0.2				
	Sub Total	**43.8**	**31.0**	**32.8**	**32.2**				
	Total	**706.5**	**503.6**	**567.6**	**537.3**				

4.4 Current and projected return flows

The current and projected return flows from the respective works within CCT's area of jurisdiction are tabulated below in **Table 4.2**.

Table 4.2 Current (2004/2005) daily and projected future effluent return flows

Works	Current Dry Weather Return Flows (Ml/day)	Projected Return Flows (Ml/day)		
		2010	2020	2030
Land based	472.6	493.1	528.5	566.3
Sea Outfalls	31.0	41.9	63.2	88.1
Total	503.6	535.0	591.7	654.4

Graphs indicating the historical and projected return flows and organic loading of the various works are contained in **Appendix C** of this report.

4.5 Effluent quality considerations

Graphs indicating the quality of the effluents from the works within CCT's area of jurisdiction are provided in **Appendix D** of this report.

It must be noted that the graphs merely provide an indication of the quality of the effluent in terms of key parameters; namely Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), Ammonia (NH3) and e-coli (although others are tracked). It is often other physical and chemical parameters such as certain inorganics (e.g. disinfection by-products, cyanide, mercury and arsenic), organic compounds such as pesticides and herbicides, radionuclides and hormones and microbiological properties which determine whether the effluent is suitable for subsequent use (with or without further treatment). The presence of these compounds in the effluent from a wastewater treatment works is dependent on the source/nature of the influent to that specific works.

The presence of certain of the above-mentioned toxins and heavy metals are often prevalent in wastewaters from industrial processes, and therefore it is necessary to identify which works receive a high percentage of industrial wastewaters in their influent. The following works are reported to have high levels of industrial waste water in their influent:

- Bellvile
- Athlone
- Borcherds Quarry
- Potsdam

4.6 Current policies and practices

Prior to the recent drought, CCT appears not to have had any formal policies and tariff structures in place regarding the use of treated effluent. As a result, many of the schemes implemented to date have been implemented on an ad-hoc basis, driven by private sector initiatives with permission having been granted on the basis that the developer/end user implements and then operates and maintains the schemes (i.e. treated effluent distribution has not been seen as a municipal function). In many instances there are no formal agreements in place with the developers/end users, who are often also not paying for the treated effluent they use.

Furthermore, it appears that the CCT has not monitored these schemes to regulate the volumes of treated effluent extracted or to ensure that the effluents are fit for the purpose (i.e. in certain instances un-chlorinated effluent is being used to irrigate sportsfields where contact sports are played).

During and since the drought, which resulted in an increased demand for treated effluent, CCT has started to formalise policies and tariff structures for the use of treated effluent. It is understood that this process is ongoing

4.7 Potential for re-use

A summary of the potential for the use of treated effluent, as contained in findings of the studies undertaken to date, is tabulated in **Table 4.3**, whilst layouts of possible treated effluent schemes are contained in Appendix E of this report.

It must be noted that not all of the identified effluent re-use potential (Column C) may, after feasibility studies, ultimately translate into actual effluent re-use.

The remaining potential yield which has not yet been identified in terms of interventions is the difference between the average annual return flow and the sum of the existing re-use and the currently identified future possible effluent re-use schemes.

Table 4.3 Summary of current return flows, existing re-use and identified potential for re-use

WWTW	Rated Hydraulic Capacity (Mm^3/a)	Ave. Annual Flow [1] (Mm^3/a)	Existing Re-use (Mm^3/a)	Currently Identified Potential of Effluent Re-use Interventions [2] (*Feasibility of interventions still needs to be confirmed*)					
				Irrigation/ Industrial [3] (Mm^3/a)	Local Agriculture [4] (Mm^3/a)	Commercial Agriculture [5] (Mm^3/a)	Aquifer Recharge [6] (Mm^3/a)	Potable [7] (Mm^3/a)	Total Identifie Potential Yiel (Mm^3/a)
Bellville	19.9	19.6	2.1[8]	4.7	0.0	0.0	0.0	0.0	4.7
Kraaifontein	6.4	2.7	2.3	0.5	2.0	0.0	0.0	0.0	2.5
Scottsdene	4.4	2.8	1.9	0.5	1.8	0.0	0.0	0.0	2.3
Athlone	38.3	30.4	1.5	10.2	0.0	0.0	0.0	0.0	10.2
Cape Flats	73.0	54.6	0.8	2.5	0.0	0.0	0.0	40.0	42.5
Borcherds Quarry	12.8	10.2	0.0	3.4	0.0	0.0	0.0	0.0	3.4
Parow	0.4	0.6	0.2	0.3	0.0	0.0	0.0	0.0	0.3
Gordons Bay	1.1	0.9	0.0	0.3	0.0	0.0	0.0	0.2	0.3
Macassar	19.7	13.7	0.6[9]	2.2	0.0	1.8	0.0	8.9	13.0
Zandvliet	22.6	17.5	0.0	0.8	0.0	3.3	0.0	16.3	20.4
Mitchells's Plain	17.5	11.3	0.0	1.1	0.0	0.0	0.0	9.3	10.4
Melkbos	2.0	0.7	0.4	0.7	0.0	0.0	0.0	0.0	0.7
Potsdam	11.7	11.7	1.7[10]	6.5	4.1	0.0	0.0	0.0	10.6
Wesfleur (Domestic)	2.9	2.2	0.6	0.0	0.0	0.0	2.1	0.0	2.1
Wesfleur (Industrial)	2.2	1.8	0.0	0.4	0.0	0.0	0.0	0.0	0.4
Simons Town	1.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wildevoël Vlei	5.1	3.1	0.0	0.9	0.0	0.0	0.0	0.0	0.9
Total	**242.8**	**171.9**	**11.6**	**35.1**	**7.9**	**5.1**	**2.1**	**74.6**	**124.7**

1. This represents the true potential yield as opposed to the identified potential yield.
2. This represents yields of schemes that have already been identified and therefore does not equal the average annual flow. Some identified schemes may use treated effluent from th same source and therefore are mutually exclusive
3. The source of information for the identified potential for local irrigation (i.e. sportsfields and parks) and industrial use is the Bvi Study "Investigation into the Distribution of Treate Effluent" of 2003/04. However, where the industrial potential as determined in the IWRPS exceeds that determined in the Bvi Study, the greater value has been used.
4. The source of information for the potential for local agriculture is based on the Bvi Study (small-scale agricultural demand).
5. The source of information for the potential for commercial agriculture is based on the IWRPS study by CCT. These are large-scale stand-alone schemes.
6. The source of information for the potential for aquifer recharge is based on the Bvi Study.
7. The source of information for the potential for potable use is based on the work undertaken in the Reconciliation Strategy Study. Based on comments recently received, the range f potable use varies from 22 million m^3/a to 70 million m^3/a. This differs from the figures in the table because they are based on average summer return flows as opposed to annu average flows. The figures in the table are effluent volumes (not reclaimed/portable water volumes) and there is usually a loss in volumes due to the need to treat the effluent.
8. A project to use treated effluent from the Bellville WWTW, for industrial purposes, has just been completed. Current usage is however unknown at this stage.
9. A project to convey treated effluent from the Macassar WWTW, to a proposed housing development (old AECI property), has recently been initiated.
10. A project to use treated effluent from the Potsdam WWTW, for agricultural and industrial purposes, has just been completed. Current use is unknown at this stage.

From the above table it can be noted that:

- The identified re-use options could yield 124.7 Mm^3/a or 74.4 % of the current ADWFs of all the land-based works (i.e. WWTW that discharge into rivers or vleis);
- The identified "non-potable" re-use options could yield 50.2 Mm^3/a or 29.1 % of the current ADWFs from all the land-based works;
- All current identified "potable" re-use options could yield 74.6 Mm^3/a or 43.3 % of the current ADWFs of all the land-based works;
- It appears that insufficient investigations have been undertaken to date to identify the full potential of treated effluent for industrial use;
- The potential for gardening and/or toilet use, in conjunction with identified local irrigation and agricultural options, has not been investigated;
- The yield of all options investigated to date, for both non-potable and potable use, is less than the potential yield available; and
- The effluent quality and its possible impact on re-use opportunities has not been considered in great depth to date.

5. WEST COAST DISTRICT MUNICIPALITY

5.1 Previous studies

Based on the literature reviewed, it appears that the potential for the use of treated effluent in this municipal area has not been investigated to date.

5.2 Current studies

Apart from the studies being undertaken as part of the Reconciliation Strategy Study, there appear to be no ongoing studies investigating the possible use of treated effluent in a strategic and integrated manner.

5.3 Current extent of re-use

Limited information has been sourced with regard to use of treated effluent within the West Coast District Municipality. The WSDP provided for review contained no information on the use of reclaimed water. However, it is understood that some 600 m3/day of treated effluent is currently being used by Saldanha Steel for industrial process water.

5.4 Current and projected return flows

The current and projected return flows from the works within WCDM's area of jurisdiction are shown in Table 5.1.

Table 5.1 West Coast District Municipality : wastewater return flows

Works	Capacity of Works (Ml/day)	2002 Dry Weather Return Flows (Ml/day)	Projected Return Flows		
			2007	2020	2030
Vredenburg	4	2.2	2.6	Unknown	Unknown
Saldanha	3	1.7	2.0	Unknown	Unknown
Langebaan	1.6	0.9	1.0	Unknown	Unknown
St Helena Bay	1.6	0.3	0.4	Unknown	Unknown
Hopefield/Paternoster	1.6	0.8	0.9	Unknown	Unknown
Total	**21.1**	**5.9**	**7.0**	**Unknown**	**Unknown**

5.5 Effluent quality considerations

No effluent quality data has been ascertained. Although no information in this regard has been obtained, it is anticipated that only the Saldanha Works is likely to contain high levels of industrial waste water in its influent.

5.6 Current policies and practices

There appear to be no policies and practices regarding the use of treated effluent in place at the West Coast District Municipality at present.

5.7 Potential for re-use

Although there appear to have been no investigations regarding the potential for the use of treated effluent within the WCDM to date, potential for its use, especially for local irrigation, industrial use and possibly aquifer recharge, must exist.

6. DRAKENSTEIN DISTRICT MUNICIPALITY

6.1 Previous studies

Based on the literature reviewed, it appears that the potential for the use of treated effluent in this municipal area has not been investigated to date.

6.2 Current studies

Apart from the studies being undertaken as part of the Reconciliation Strategy Study, there appear to be no ongoing studies investigating the possible use of treated effluent in a strategic and integrated manner.

6.3 Current extent of re-use

Limited information has been sourced with regard to use of treated effluent within the Drakenstein District Municipality. The WSDP provided for review, contained no information in this regard.

6.4 Current and projected return flows

The current and projected return flows from the works within DDM's area of jurisdiction, are shown in Table 6.1.

Table 6.1 Drakenstein Municipality : wastewater return flows

Works	Capacity of Works (Ml/day)	2002 Dry Weather Return Flows (Ml/day)	Projected Return Flows		
			2007	2020	2030
Wellington	Unknown	8.6	9.3	Unknown	Unknown
Paarl	Unknown	21.8	22.5	Unknown	Unknown
Saron	Unknown	0.9	1.0	Unknown	Unknown
Total	Unknown	**31.3**	**32.9**	**Unknown**	**Unknown**

6.5 Effluent quality considerations

No effluent quality data has been obtained. However, it is understood that on occasions effluent from the Wellington and the Paarl Works does not comply with permit requirements, necessitating the release of fresh water on at least one occasion, to improve water quality in the Berg River.

6.6 Current policies and practices

There appear to be no policies and practices regarding the use of treated effluent in place at the Drakenstein District Municipality at present.

6.7 Potential for re-use

The wastewater treatment works at Wellington and Paarl discharge treated effluent into the Berg River. During the summer months this is abstracted from the river by irrigators.

7. STELLENBOSCH MUNICIPALITY

7.1 Previous studies

Based on the literature reviewed, it appears that the potential for the use of treated effluent in this Municipal area has to date not been investigated.

7.2 Current studies

Apart from the studies being undertaken as part of the Reconciliation Strategy Study, there appear to be no ongoing studies investigating the possible use of treated effluent in a strategic and integrated manner.

7.3 Current extent of re-use

Limited information has been sourced with regard to use of treated effluent within the Stellenbosch Municipality. The WSDP provided for review contained no information in this regard.

7.4 Current and projected return flows

The current and projected return flows from the respective works within SM's area of jurisdiction, is as tabulated in Table 7.1.

Table 7.1 Stellenbosch Municipality : wastewater return flows

Works	Capacity of Works (Ml/day)	2002 Dry Weather Return Flows (Ml/day)	Projected Return Flows		
			2007	2020	2030
Stellenbosch	18.0	Unknown	Unknown	Unknown	Unknown
Pniel	1.35	Unknown	Unknown	Unknown	Unknown
Klapmuts	1.30	Unknown	Unknown	Unknown	Unknown
Franschhoek	0.8	Unknown	Unknown	Unknown	Unknown
Raithby	0.18	Unknown	Unknown	Unknown	Unknown
Total	**21.6**	Unknown	Unknown	**Unknown**	**Unknown**

7.5 Effluent quality considerations

No effluent quality data has been ascertained. However, it is understood from recent media coverage that the effluent from the Stellenbosch WWTW is of very poor quality, primarily as a result of the works being overloaded.

Furthermore, it can be noted that the bacteriological quality of the water in the Eerste River and its tributaries, primarily as a result of informal settlements with inadequate sanitation provision, is said to be of major source of concern.

7.6 Current policies and practices

There appear to be no policies and practices regarding the use of treated effluent in place at the Stellenbosch Municipality at present.

7.7 Potential for re-use

Although there appear to have been no investigations regarding the potential for the use of treated effluent within the SM to date, effluent discharged into the Eerste River is abstracted downstream by irrigators.

8. QUALITY STANDARDS/CRITERIA

There appears to be no guidelines in place in South Africa at present that holistically address the use of treated effluent. There are however dated guidelines (1978) which govern "the utilisation and disposal of treated sewage effluent". These guidelines are only applicable to sewage effluent primarily of domestic origin (i.e. contains little or no industrial effluent) and address agricultural, irrigation and industrial use and also for toilet flushing. It is furthermore understood that there are no guidelines, which govern water quality for gardening, but that a code of practice for the use of grey water is currently being developed.

The licensing of the use of treated effluent from a specific works is required from a water-use perspective, but the regulatory framework pertaining to effluent quality issues, appears to be less clear.

Internationally, certain countries have already developed guidelines for wastewater re-use, including Australia (Australian Environmental Protection Agency) and the United States (United States Environmental Protection Agency; California State Water Resources Control Board; Washington State Department of Health). See **Appendix F** at the end of this report for certain extracts from these guidelines.

9. INSTITUTIONAL CONSTRAINTS

The institutional implications in terms of the re-use of domestic waste water impact at various levels including:

- National : Policy and Guidelines; Regulations
- WSA: Planning, Implementation and Regulations; and
- WSP: Operation and maintenance.

At National level there appears to be no policy or guidelines in place that holistically address the re-use of wastewater treated at WWTWs. Furthermore, the regulatory framework pertaining to water re-use seems not to be clear.

At a WSA level, although it is clear that the planning and regulation of the use of treated effluent is a WSA responsibility, WSAs have never really seen effluent re-use as a big municipal priority. Furthermore, the recent devolution of powers and functions and the associated changes in the form of the respective institutions and the various changes in political leadership, have resulted in fragmented planning and a lack of policy and strategic direction in terms of water re-use. It is however understood that this is being addressed in the CCT with the formation of an Inter-departmental Strategy Planning Committee.

At an operational level, the use of treated effluent places additional responsibility on the Water Services Provider (WSP) on account of the health implications of a failure of a water re-use system. This is of considerable concern as the quality of effluent from many of the existing WWTWs does not comply with requirements.

These institutional capacity constraints may negatively impact on the ability of the WSA and WSP to successfully plan, implement, operate and maintain a water re-use system.

10. REVIEW OF RE-USE OPTIONS

As stated previously, various re-use options have been investigated to date, the main options being for:

Local irrigation and industrial use;

- Exchange for raw water allocations with commercial farmers; and
- Potable use.

A further option to use treated effluent to maintain the in-stream flow requirements in selected rivers has also recently been mooted. Each of these options requires that the effluent is treated to a particular level before it can be used for its intended purpose, with the extent of the treatment required influencing the cost of the scheme.

Based on the investigations undertaken to date, and as indicated in Table 3 of this report, all identified "non potable" options can only deliver a yield of 50.2 Mm^3/a, or 29.1% of the current ADWFs from all the land-based works. As this yield represents a relatively small proportion of the available return flows, potable usage and/or usage for toilet flushing, riverine flow requirements and gardening should be considered in order to maximize the use of this resource. The use of treated effluent for potable use or to maintain in-stream flow requirements would require high levels of treatment, which increases both the capital and ongoing operation and maintenance costs of these options.

Although the use of treated effluent for local irrigation is well accepted, communities appear to have an aversion to its use as a potable water supply, especially via direct use. Indirect potable use is fairly extensively practised both internationally and in South Africa. The recent advances in the use of membrane technology for the treatment of waste/raw waters addresses many of the quality and cost concerns related to the use of treated effluent for potable water supplies, and could also be used to maintain in-stream flow requirements.

Treated domestic waste water is a valuable water resource, the availability of which grows with increased water usage. Apart from the high assurance of supply, the use of the waste water has certain environmental benefits in that it reduces the dependency on surface water and has the potential to return seasonal flows to the water courses where effluent is currently being discharged.

However, it must be noted that there are certain concerns regarding the use of treated effluent including the build up of salts in soil with time, possible long-term health impacts and the ability of water services institutions to effectively operate, maintain and regulate re-use schemes.

More detailed evaluations of the various treated-effluent options have been conducted either as part of previous studies or as part of the current study and are provided in Appendix G of this report. Unit reference values are summarised below:

- Treated effluent for potable supplies using reverse osmosis : R1.29 to 1.94/m^3
- Treated effluent for commercial irrigation : R2.77/m^3
- Treated effluent for local irrigation and industry : R0.55/m^3
- Treated effluent for toilet flushing and gardening (dual reticulation) : R1.25/m^3

Note: See the supplementary report compiled as part of this study entitled "Reclamation of Treated Effluent for Potable Supplies" for details on the potable use options considered.

Treated effluent for commercial irrigation has a significantly higher URV than an intervention which utilises treated effluent for local irrigation and industry for the following reasons :

- commercial irrigation is a specific scheme which has high seasonal peaks (i.e. only summer use)
- the intervention usually requires storage.

11. CONCLUSIONS

11.1 General

Based on the findings of the investigations undertaken as part of this study, it can be concluded that:

- There appear to be limited National policy and guidelines that holistically address water re-use;
- The regulatory framework governing water re-use seems not to be clear;
- The re-use of water has not been actively pursued in an integrated and sustained way by any of the WSAs in the Western Cape to date, with little or no work having been conducted by WSAs other than the CCT;
- Re-use to date has occurred mainly on an ad-hoc basis, often driven by private sector initiatives, with local irrigation and industry being the main uses for the reclaimed water;
- As a result of the generally ad-hoc nature of the re-use, many of the schemes implemented:
  - Were implemented and are currently being operated and maintained by the private sector;
  - Have no formal agreements in place;
  - Do not comply with anticipated norms and standards, e.g. no chlorination, no servitude agreements and often not fit for use; and
  - Have no formal tariff agreements in place (i.e. no payments are being made in many instances).
- As confirmed during the recent drought, provided that certain conditions are in place, there is a demand for treated effluent, e.g. water scarcity and/or appropriately priced treated effluent and treated effluent of adequate quality and reliability.
- All identified re-use options could yield 124.9 Mm^3/a, which amounts to only 72.4% of the AWDF of all the land-based WWTWs.
- All identified "non-potable use" options could yield 50.2 Mm^3/a
- All identified "potable use" options could yield 74.6 Mm^3/a.
- Some of the re-use options are economically attractive compared with other interventions, particularly those for local irrigation and industrial use as indicated below:

Intervention	URV	Source/Comment
Treated effluent to potable standards using reverse osmosis	1,29 - 1,94	*"Reclamation of Treated Effluent for Potable Supplies"* Report (includes costs of water and treatment)
Treated effluent for commercial irrigation	2,77	URV updated from IWRP Study
Treated effluent for local irrigation and industry	0,55	URV updated from IWRP Study
Dual Reticulation	1,25	URV updated from IWRP Study
WC/WDM	0,3 to 0,7	URV updated from IWRP Study
TMG - Wemmershoek	0,56	URV updated from IWRP Study. It is estimated that dependent on wellfield siting and yield, the URV could range from 0,3 to 0,8
Cape Flats Aquifer	0,58	URV updated from IWRP Study
Raising Steenbras Lower Dam	0,98	Old URV obtained from Western Cape System Analysis and escalated. URV is however considered to be low.
Eerste River	1,28	URV updated from IWRP Study
Desalination	9.8	URV updated from IWRP Study. The actual URV would be location specific (includes water treatment and distribution infrastructure).

NOTE : URV Costs exclude water treatment and distribution infrastructure unless specifically mentioned.

- Although there appears to be social acceptance for the use of treated effluent for non-potable uses, it is anticipated that its use for potable supplies, especially via direct means, may be socially unacceptable;
- There are still some health concerns related to the long-term use of treated effluent for potable use; and
- The potential for industrial use and the possibility of combining schemes for local irrigation, gardening and toilet flushing, have not been fully investigated.

From the above it can be seen that the URVs for non-potable use options are relatively attractive and should be aggressively pursued as a means to reconcile supply and demand in the Western Cape, whilst the use of treated effluent for potable use, although potentially viable, requires further investigation before it could be considered for implementation.

11.2 Institutional and organisational changes

The ability to successfully plan and implement water resource interventions in general and to sustain interventions such as WC/WDM and WRU in particular, is dependent on stable and capacitated water services institutions. The water services institutions within the Study Area of the Reconciliation Study have been subjected to numerous changes over the past few years for various reasons including demarcation, changes in political leadership and the devolution of powers and functions. This has had a significant impact on the ability of the respective institutions to plan and implement WC/WDM and WRU interventions in an integrated and sustained manner. Furthermore, the organisation structures of certain of the municipalities and the lack of leadership in the area of water re-use, has resulted in fragmented planning to date.

There has been some concern expressed regarding declining institutional capacity within certain of the WSAs/WSPs in the study area and their corresponding ability to ensure that the effluent from the respective waste water treatment works complies with the relevant standards. This declining institutional capacity could have a significant impact on the ability of the respective institutions to successfully plan, implement, operate and maintain treated effluent schemes.

11.3 The recent droughts

The recent drought experienced in the study area has had a significant impact on the focus of the respective water institutions in terms of WC/WDM and WRU over the past few years, in that they tended to focus on the short-term needs/demands as opposed to developing and implementing long-term sustainable WC/WDM and WRU interventions. However, the drought had the effect of increasing the awareness of and demand for treated effluent by potential consumers.

12. RECOMMENDATIONS

Treated effluent is a valuable water resource that should be considered in meeting the future water demands for the WCWSS and as there is a demand for treated effluent, especially for local irrigation, industrial and agricultural use, it is recommended that:

- The planning and implementation of water re-use opportunities be undertaken in an integrated and systematic manner and that the DWAF develop certain guidelines to assist municipalities in this regard;
- The earlier investigation entitled "Strategic Evaluation of Bulk Waste Water" be reviewed and a Policy and Implementation Strategy, similar to the Water Conservation and Demand Management Strategy recently completed by the CCT, be developed;
- The Policy and Implementation Strategy be developed for the area as a whole and in particular, the range of potable and non-potable uses for specific waste water treatment be evaluated and optimised, taking into consideration the effluent quality from these works;
- The sensitivity of the demand for treated effluent to tariff be investigated (i.e. the demand for treated effluent may be greatly influenced by the cost of treated effluent);
- The potential for the use of treated effluent for industrial purposes be further investigated in order to maximise its use for this purpose;
- The possibility of providing treated effluent for local irrigation, gardening and possibly toilet flushing from a single scheme, be investigated;
- Further investigations to assess the viability of treated effluent as source for potable supplies be undertaken and that the social acceptance of this option be tested.
- Adequate investigations be undertaken to ensure that the potential for and implications of higher quality reclaimed water is well understood, before schemes delivering lower quality reclaimed water are implemented at scale.

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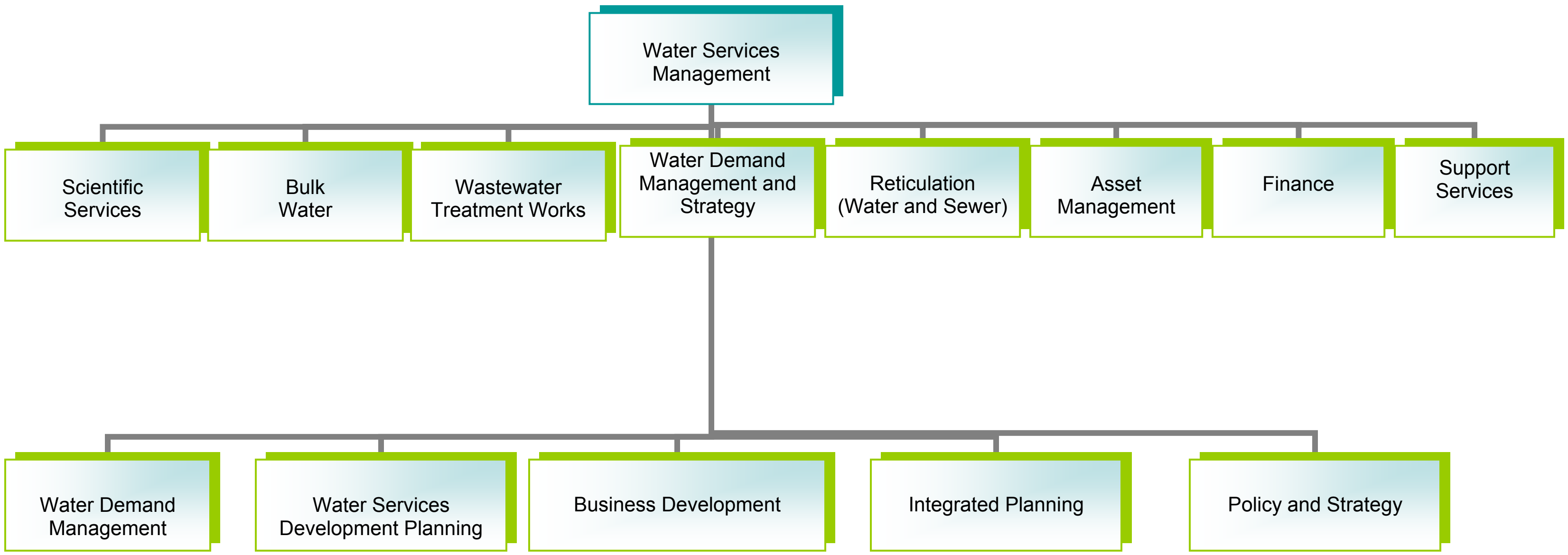
APPENDIX A
Organogram of CCT's Water Services Branch


Water Services Management
Scientific Services
Bulk Water
Wastewater Treatment Works
Water Demand Management and Strategy
Reticulation (Water and Sewer)
Asset Management
Finance
Support Services
Water Demand Management
Water Services Development Planning
Business Development
Integrated Planning
Policy and Strategy

APPENDIX B

Summary of Current Users of Treated Effluent

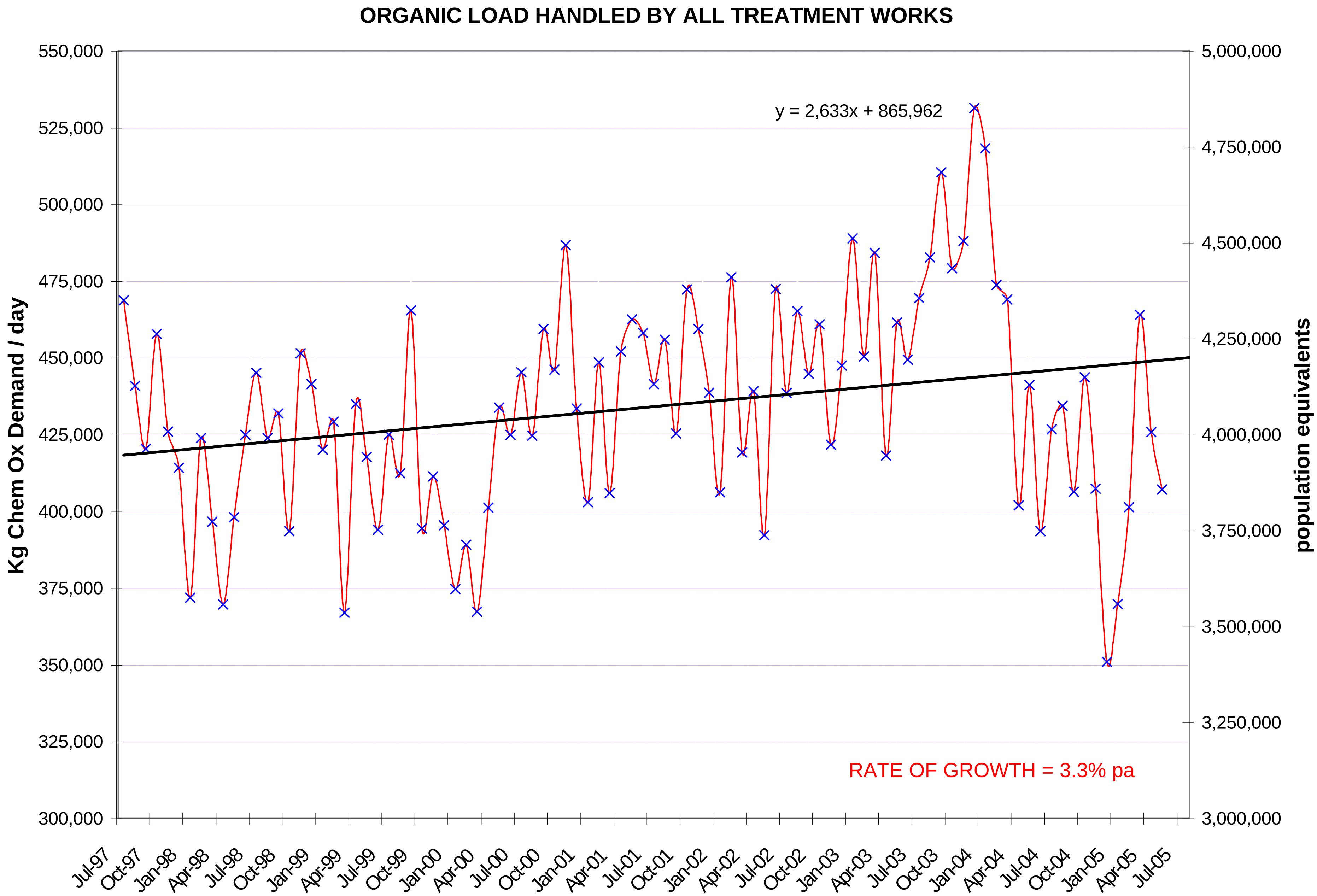
WWTW (% Usage)	USERS	USAGE (kl/day)	COMMENTS	RECEIVING RIVER
Bellville (15%)	• UWC • Landfill • Pentech • Green tissue (industrial) • Bellville South Stadium • SANS • Kasselvlei High School • Maree Park (POS) • Eendrag Street (POS) • Kasselsvlei Central (POS) • William – Hartel (POS) • William – Tayler (POS) • Winsley Primary School • Good Hope Primary School • Nampak (industrial) • Irrigation • Belt Presses	• 800 • 36 • 1100 • 400 • 288 • 120 • 80 • 26 • 42 • 78 • 26 • 26 • 46 • 37 • 2200 • 120 • 1512	• Summer only • Summer only • Summer only • All year • Summer only • Summer only • Summer only • Summer only • Summer only • Summer only • Summer only • Summer only • Summer only • Summer only • All year • Summer only • All year	• Kuils River
Kraaifontein (90%)	• Kraaifontein Sports fields • New Golf Academy • Durbanville Sports fields • Durbanville Golf Course • 2 x farmers – (crop irrigation) • Municipal Nursery	• 300 • ?? • 300 • 800 • 5500 • 30	• Summer only • Summer only • Summer only • Summer only • All year • All year	• Maasdrift River
Scottsdene (65%)	• Scottsdene Sportsfields • 1 x Farmer – (crop irrigation) • Kuils River Golf Course	• 280 • 5000 • ??	• Summer only • All year • From river just downstream of the works	• Kuils River
Athlone (7%)	• Power station (industrial) • Mowbray Golf Course • Rondebosch Golf Course	• 3000 • 1000 • 1000	• All year • Summer – from river down stream of works • Summer – from river downstream of works	• Vygekraal/ Black
Cape Flats (4%)	• West Lake Golf Course • Steenberg Golf Course • Capricorn	• 2500 • 2500 • ???	• Summer only • Summer only • ??	• False Bay
Borcherds Quarry	• King David Country Club	•	• Summer only	• Black River
Parow (75%)	• Parow Golf Course	• 1200	• Summer only	
Gordons Bay (21%)	• Fairway Golf Course	• 500	• Summer only	• Canal/ False Bay
Macassar (10%)	• Somerset Golf Course • Strand Golf Course • Greenways Golf Course • Macassar Beach	• 900 • 1500 • 1000 • 100	• Summer only • Summer only • Summer only • Summer only	• Eerste River
Mitchells Plain (0%)	• Nil	• -	• -	• False Bay
Melkbos (90%)	• Melkbos Golf estate	• 1980	• Summer only	• Soute River

WWTW (% Usage)	USERS	USAGE (kl/day)	COMMENTS	RECEIVING RIVER
Potsdam (25%)	• Century City • Irrigation • Milnerton Golf Course • Theo Marias Sports Fields • Milnerton Traffic Centre • Milnerton Medi Clinic • SAPPI (industrial) • Milnerton High School • Milnerton Primary School • Unitas Park • Woodbridge Primary • Woodbridge Island Body Corporate • Table View Irrigation • Caltex • Environmental releases	• 2400 • 300 • 1100 • 1680 • 550 • 135 • 50 • 1000 • 80 • 10 • 20 • 60 • 40 • 800 • 800 • ?? • 9Ml/day	• Summer • Winter • Summer only • Summer only • Summer only • Summer only • Summer only • All year • Summer only • Summer only • Summer only • Summer only • Summer only • Summer only • Summer only • Base peak flows (4 days per month to assist with the flushing of the mouth)	• Diep River • Rietvlei
Wesfleur (Atlantis) Domestic (5%)	• Aquifer recharge • ADE	• ?? • 300	• Indirect potable use • All year	• Aquifer
Simon's Town (0%)	• Nil	• -	• -	•
Wildevoël Vlei (0%)	• Nil	• -	• -	• Wildevoël Vlei

Notes : % usage = % of average summer return flow

APPENDIX C

CCT WWTW
Current and Projected Return Flows


ORGANIC LOAD HANDLED BY ALL TREATMENT WORKS
Kg Chem Ox Demand / day
population equivalents
y = 2,633x + 865,962
RATE OF GROWTH = 3.3% pa
550,000
525,000
500,000
475,000
450,000
425,000
400,000
375,000
350,000
325,000
300,000
5,000,000
4,750,000
4,500,000
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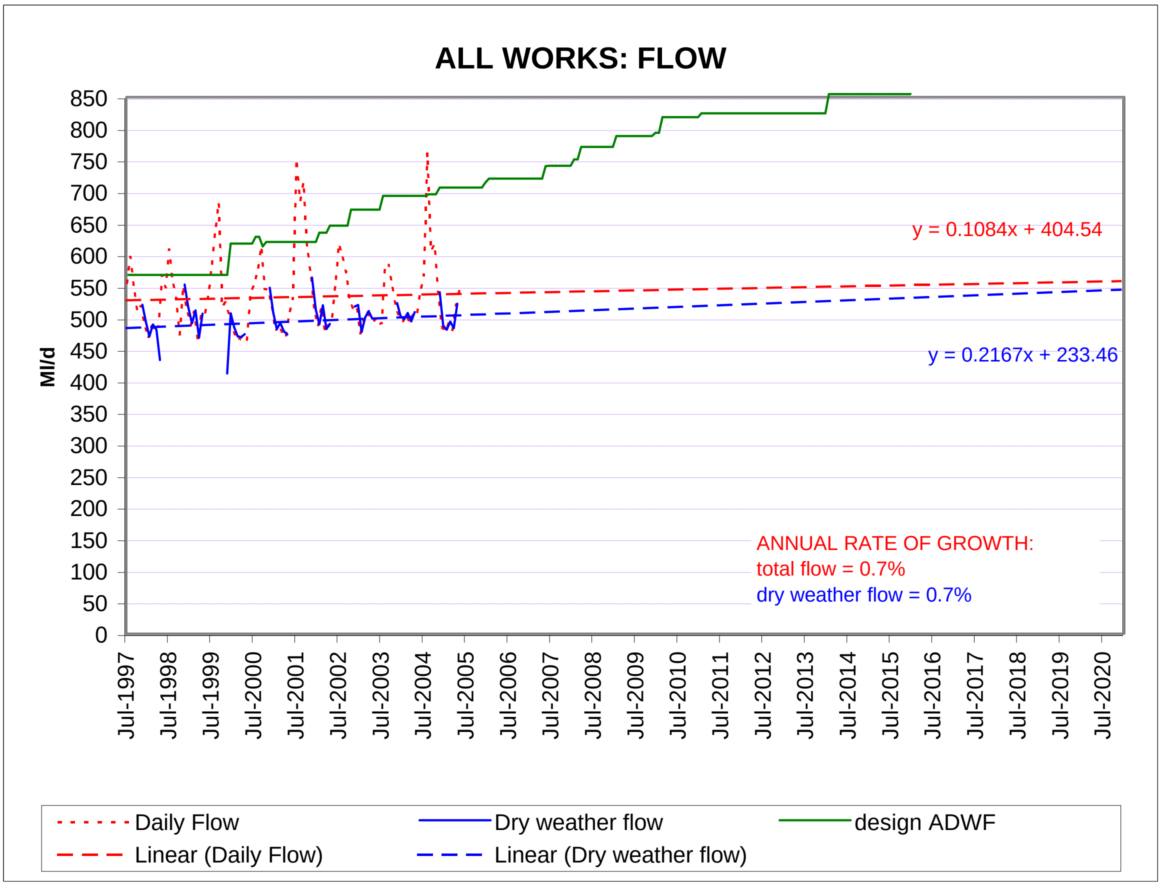
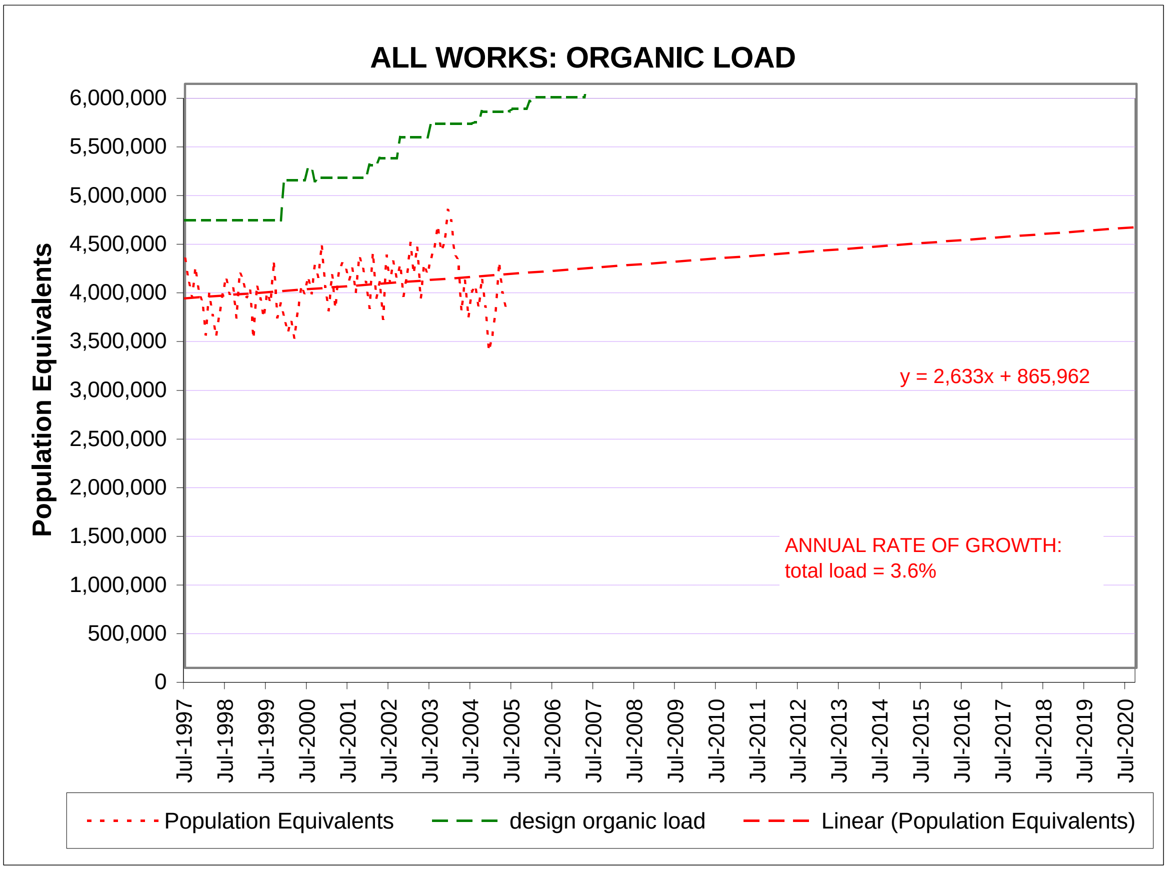
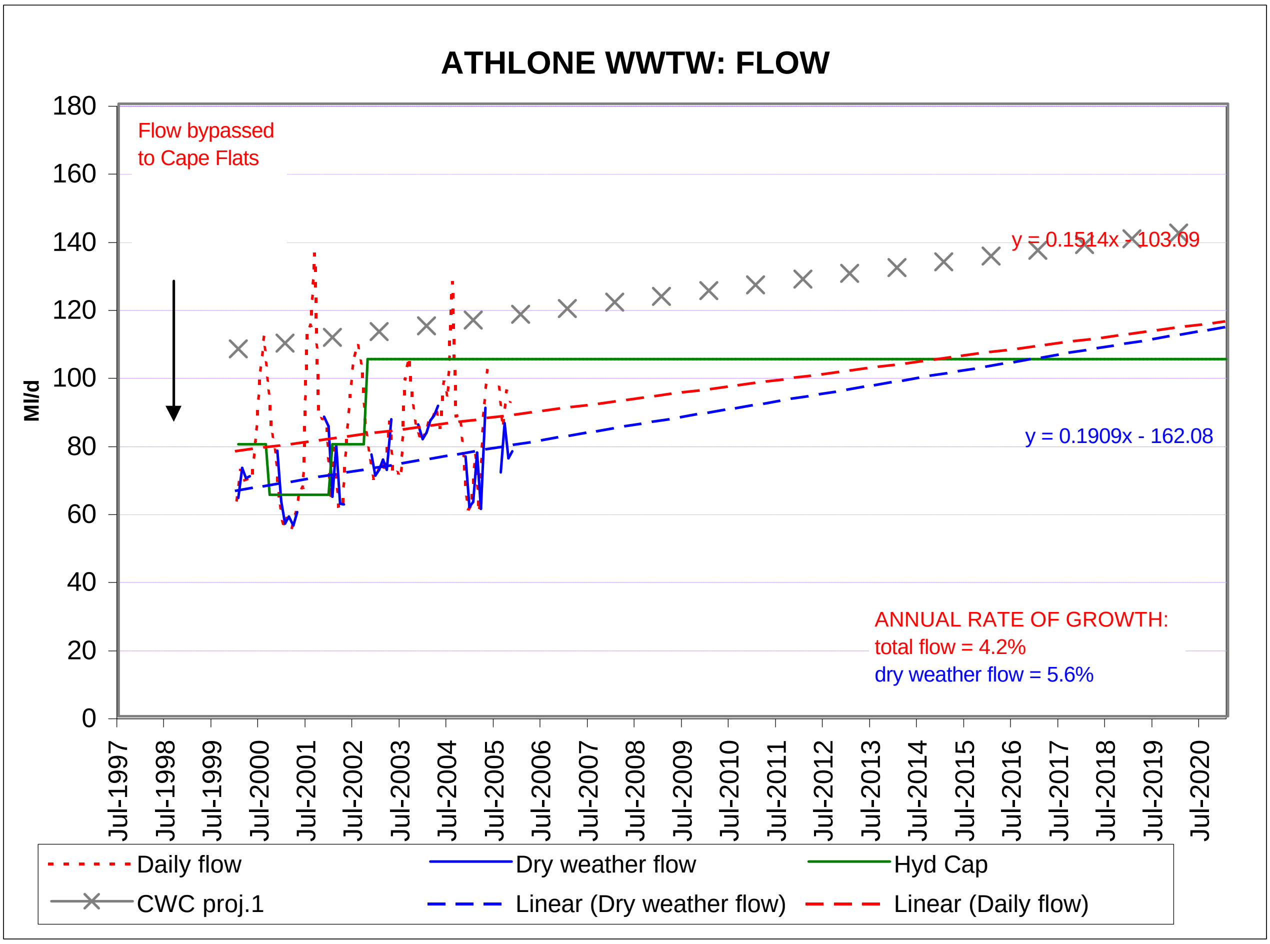
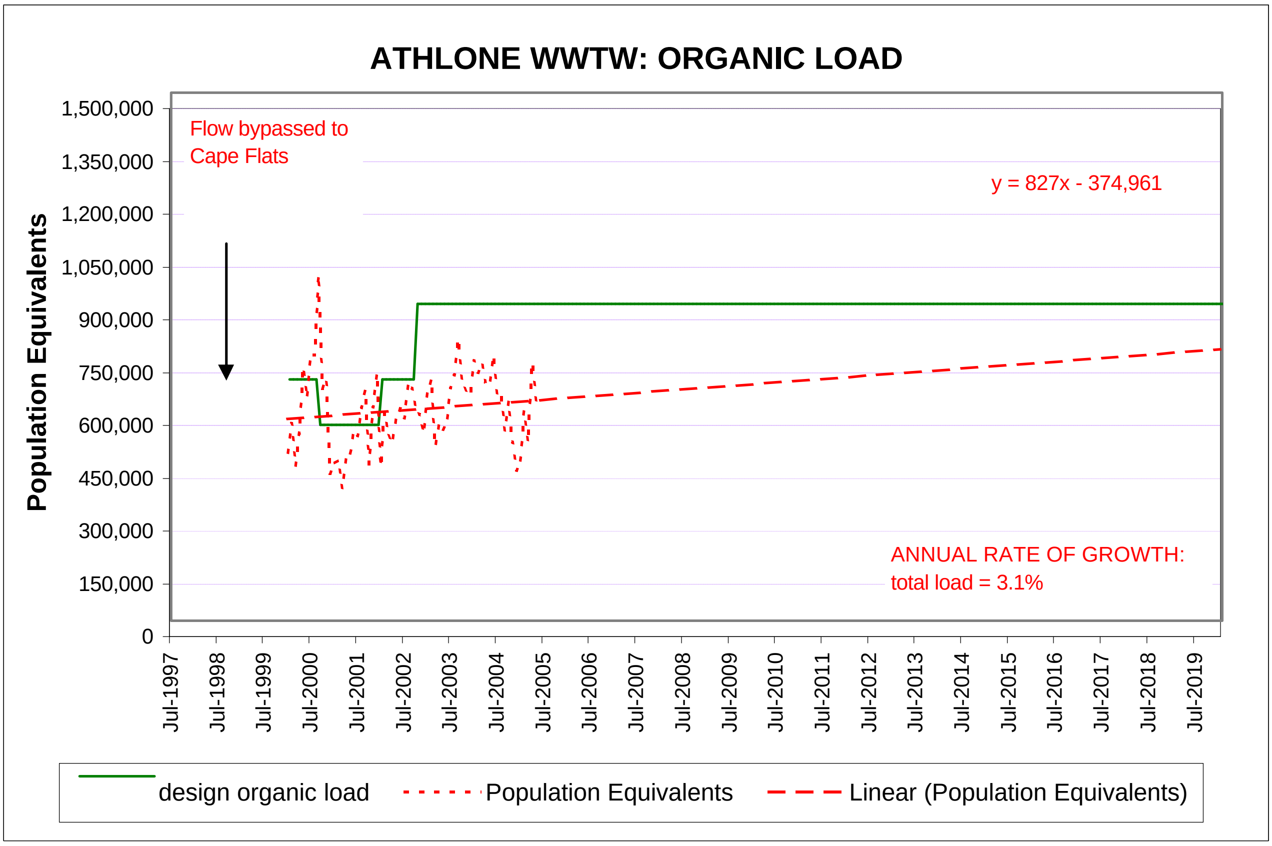
TOTAL FOR ALL WORKS



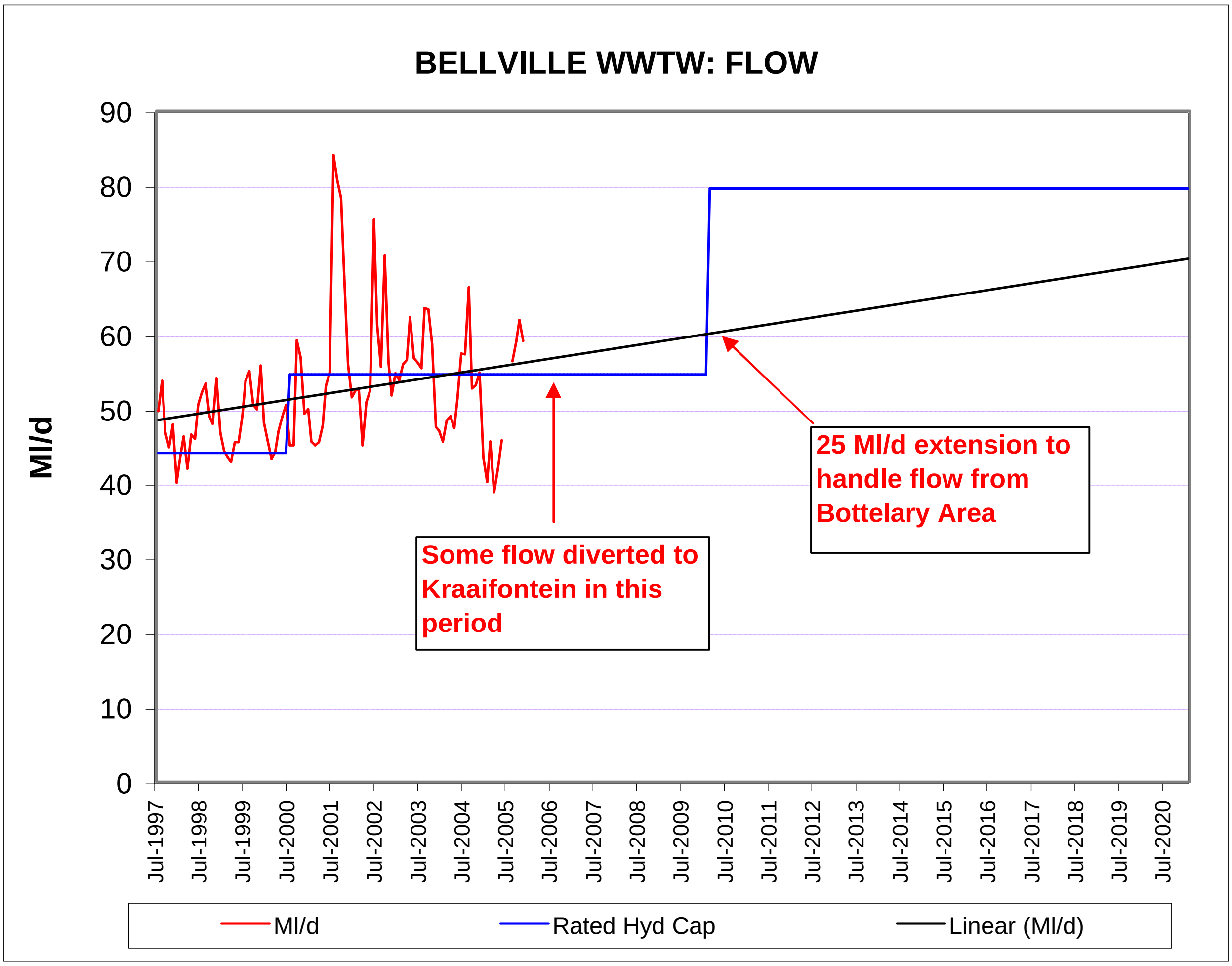


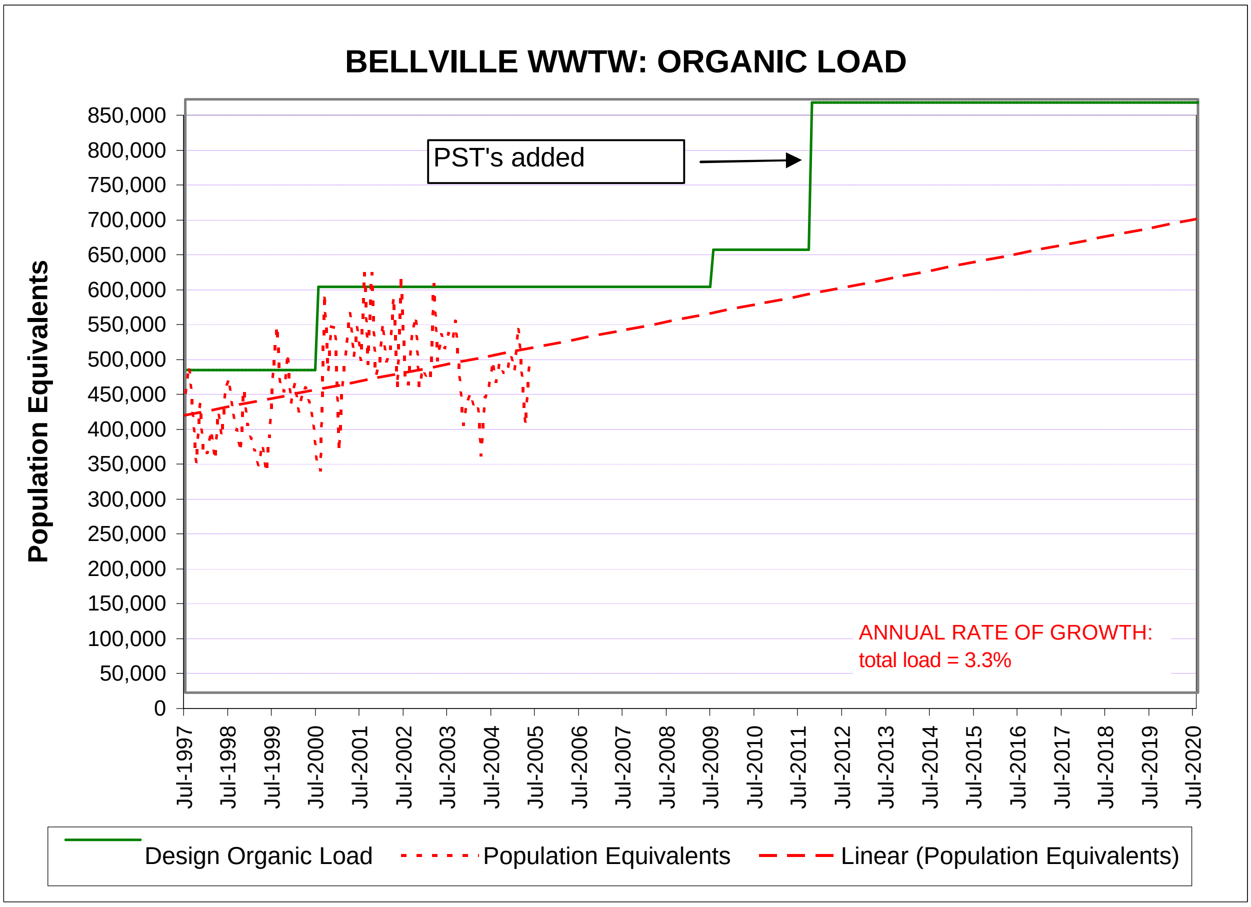
ATHLONE WASTEWATER TREATMENT WORKS



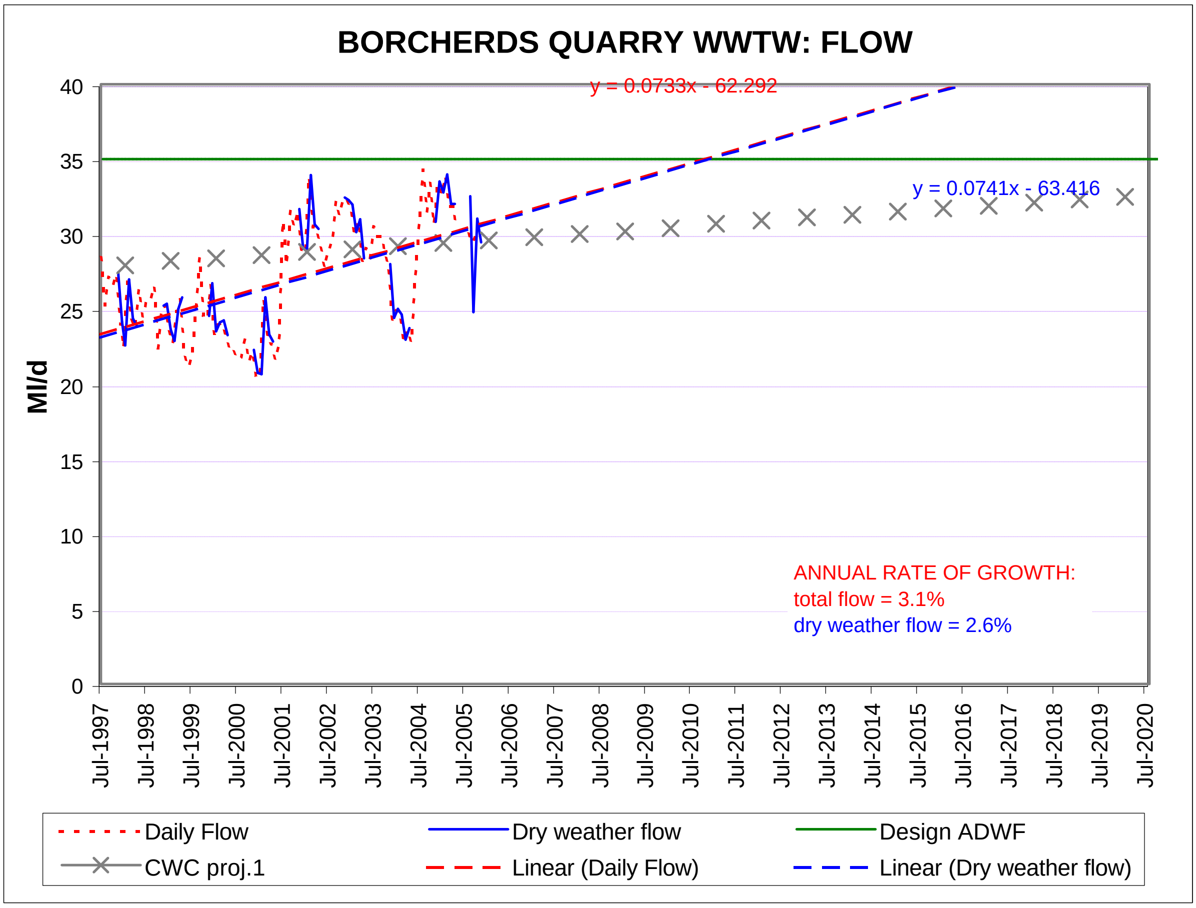


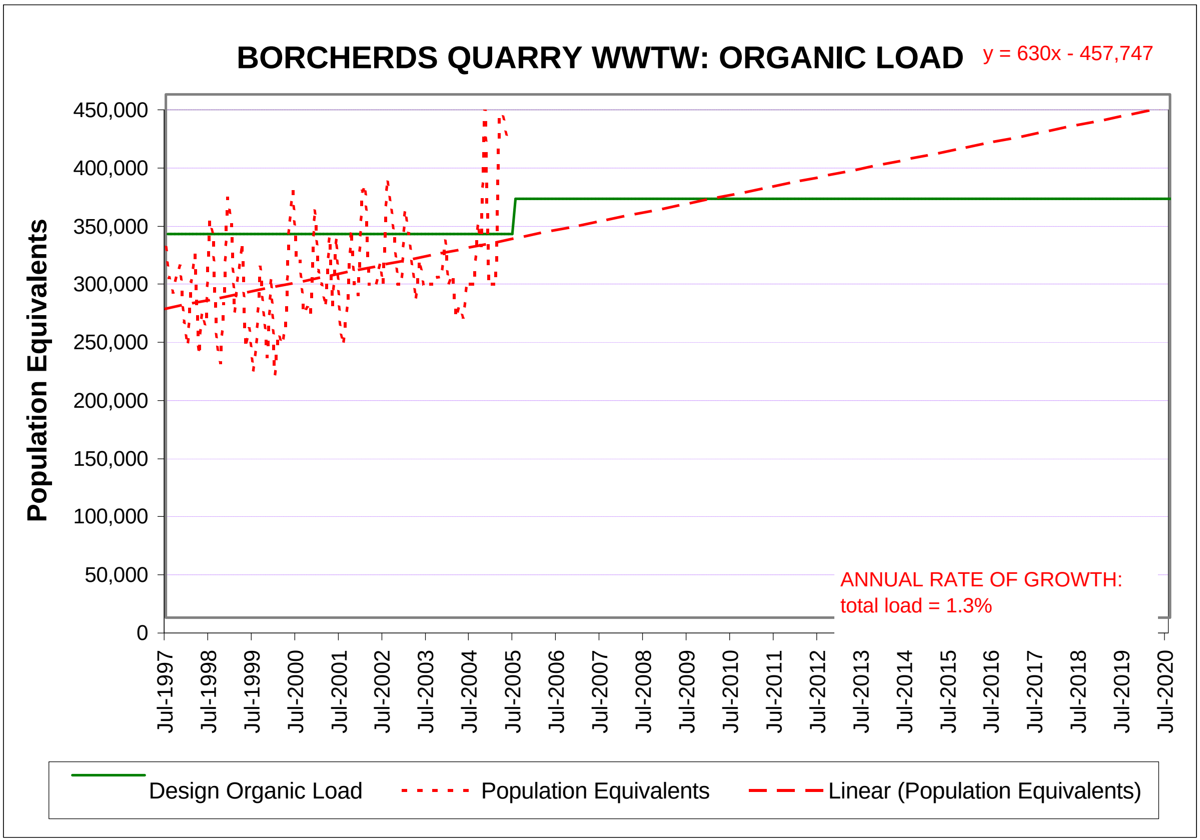
BELLVILLE WASTEWATER TREATMENT WORKS



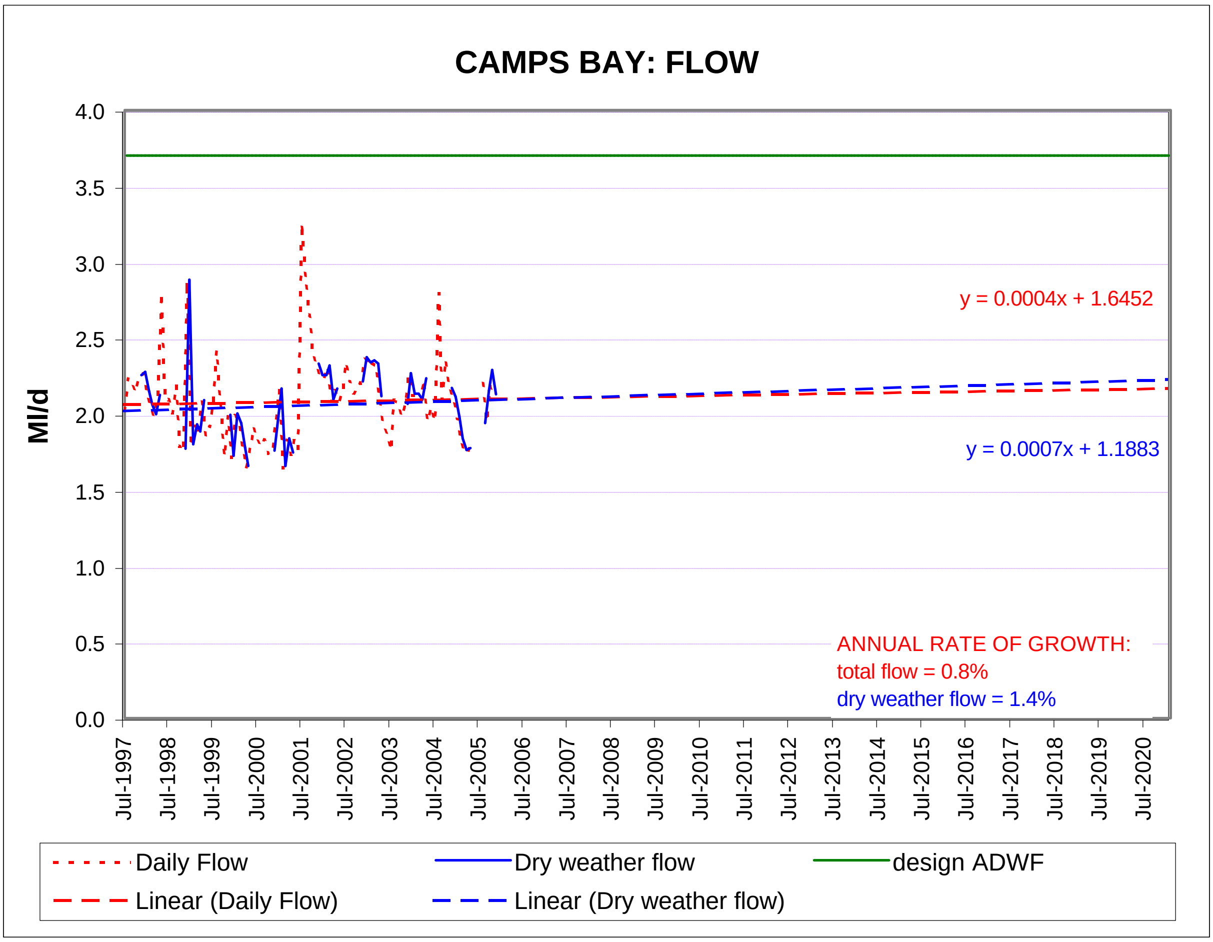


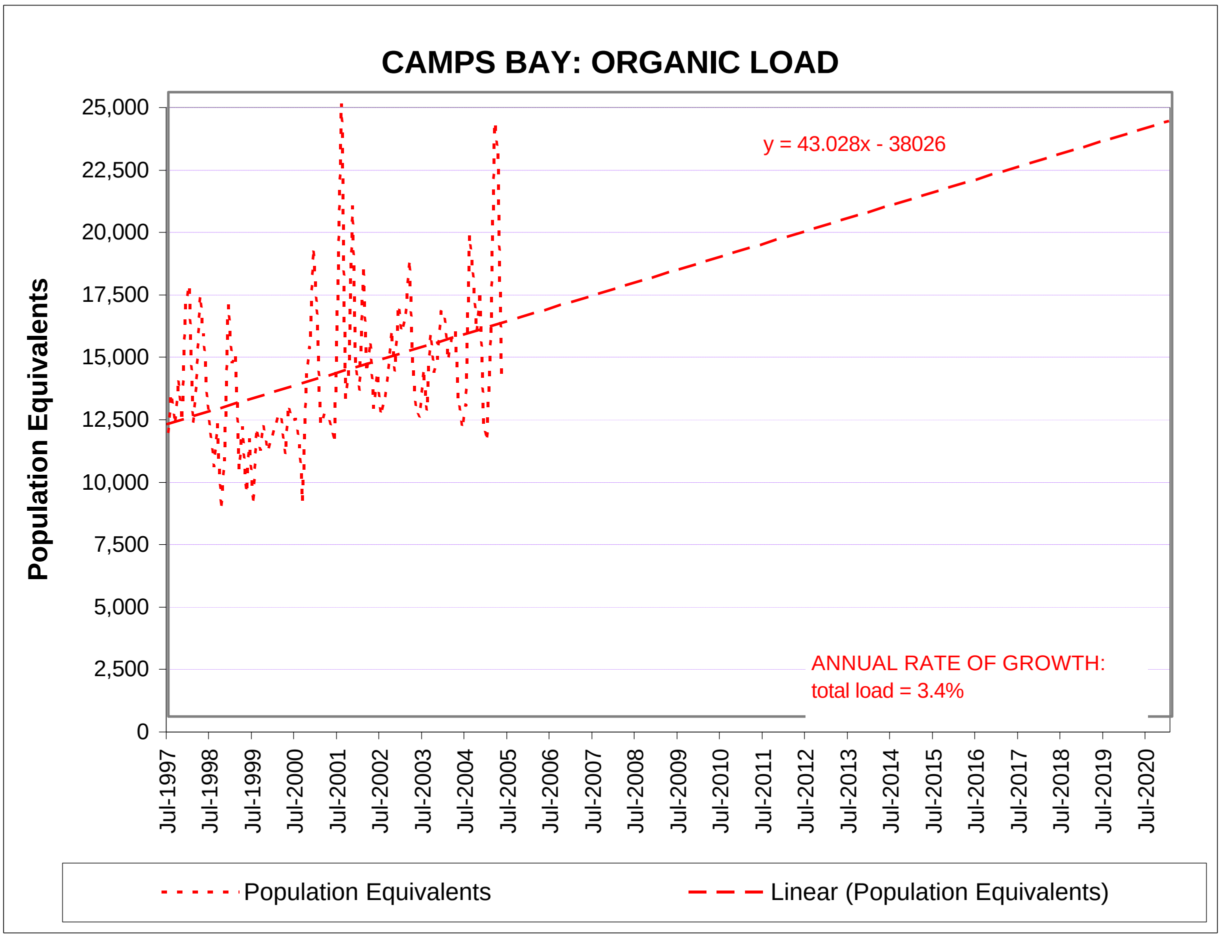
BORCHERDS QUARRY WASTEWATER TREATMENT WORKS



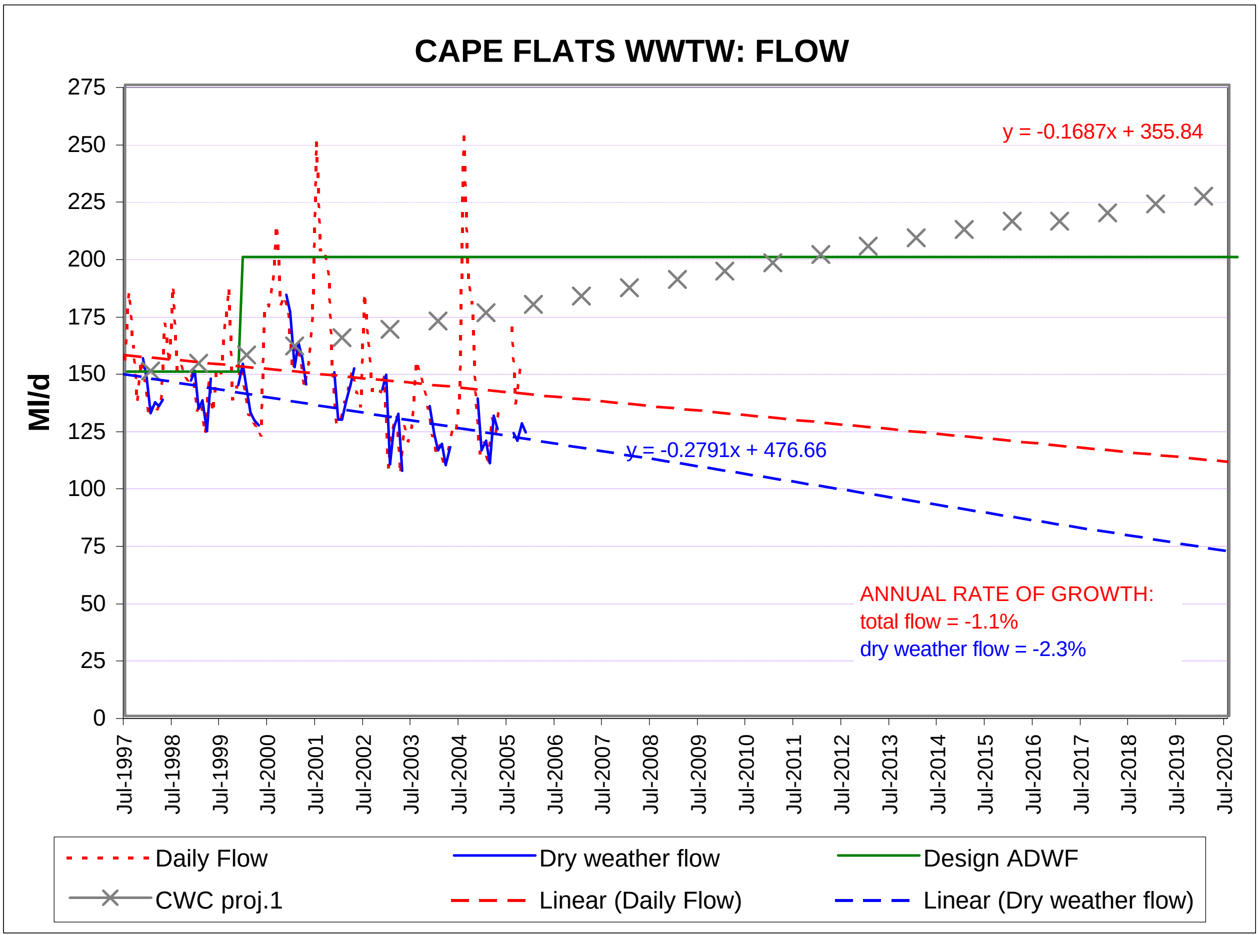


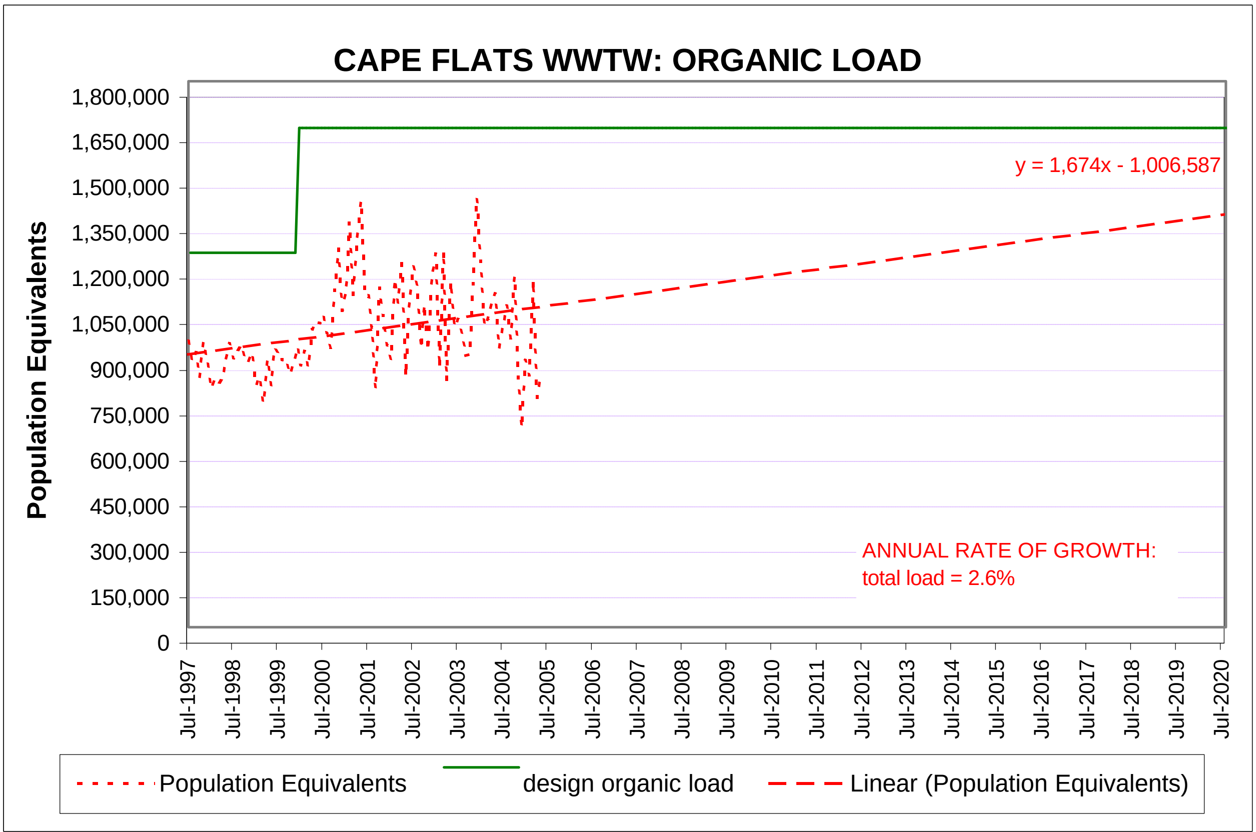
CAMPS BAY SEA OUTFALL

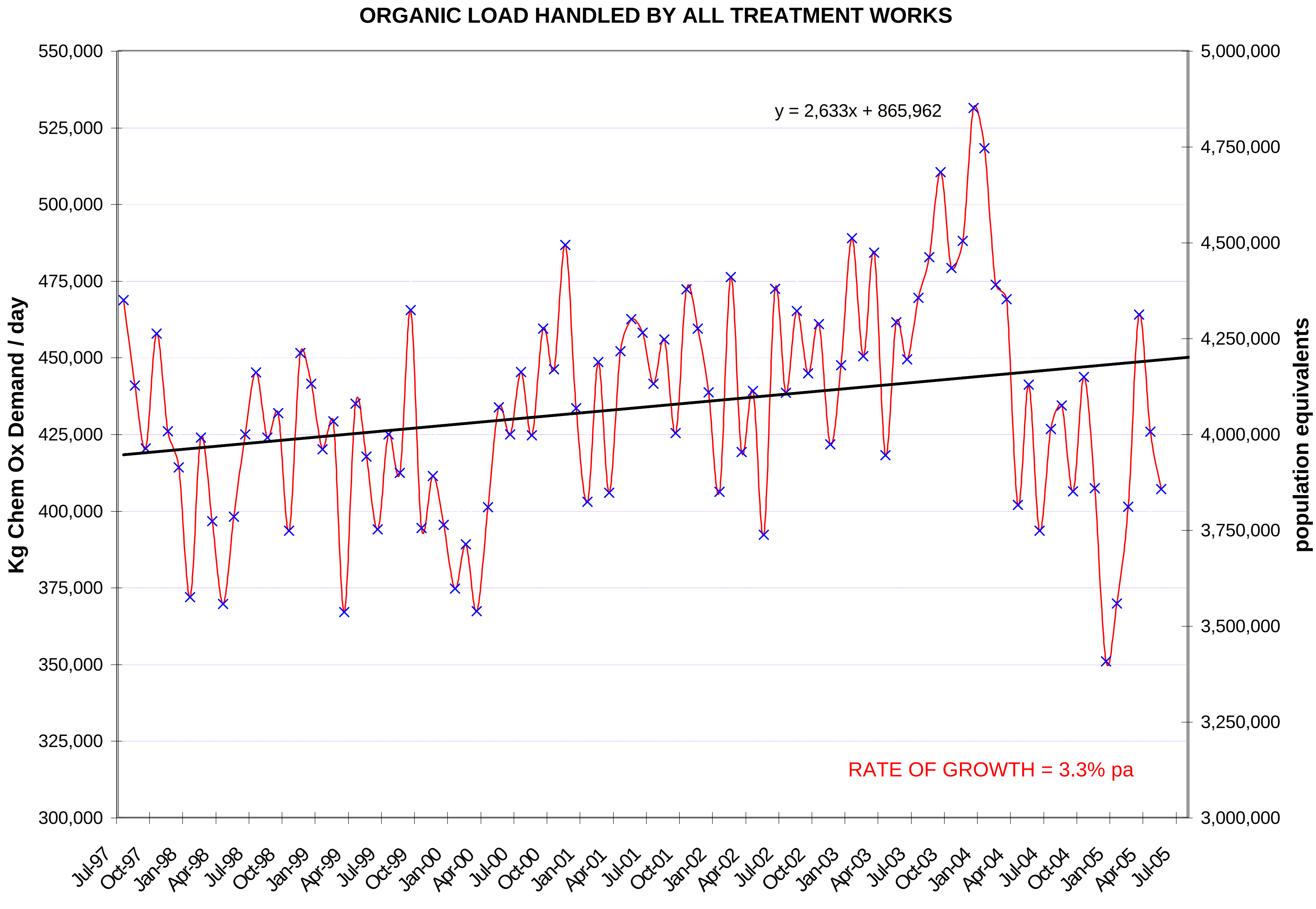




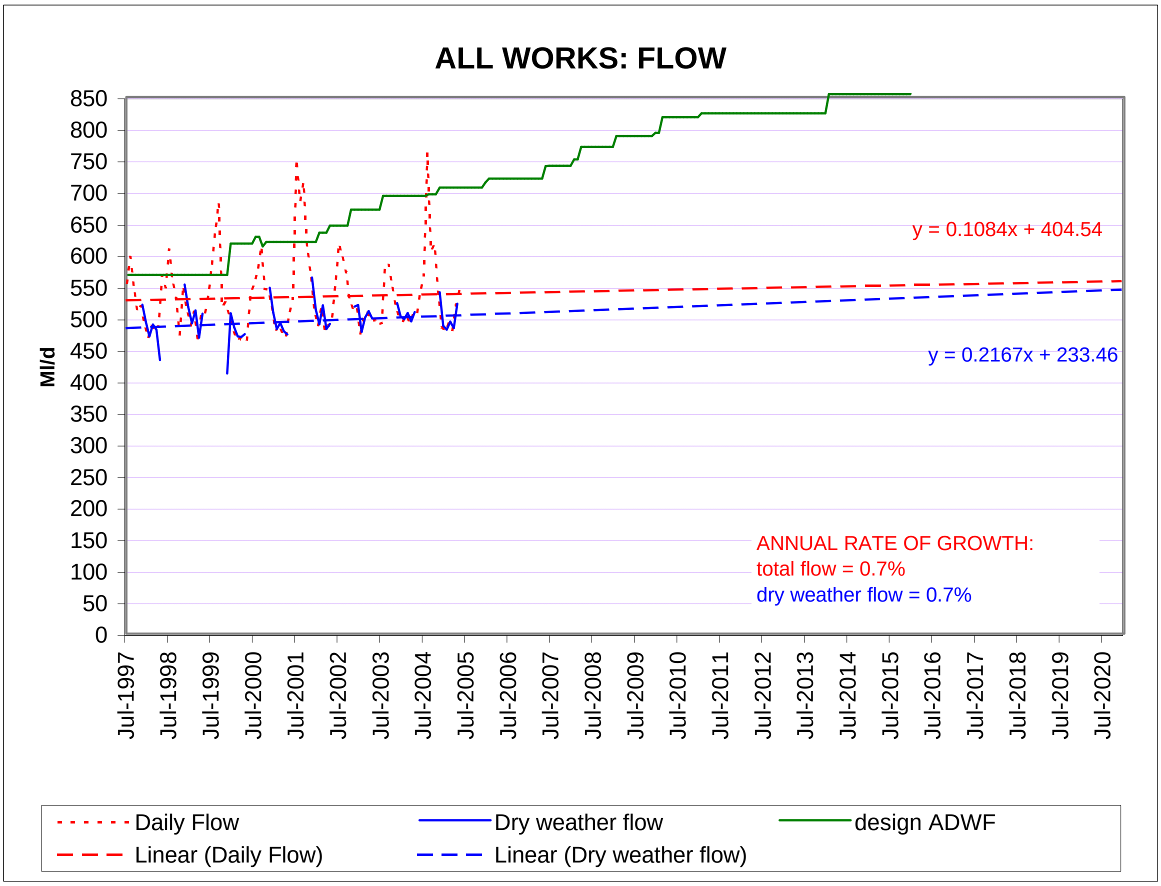
CAPE FLATS WASTEWATER TREATMENT WORKS

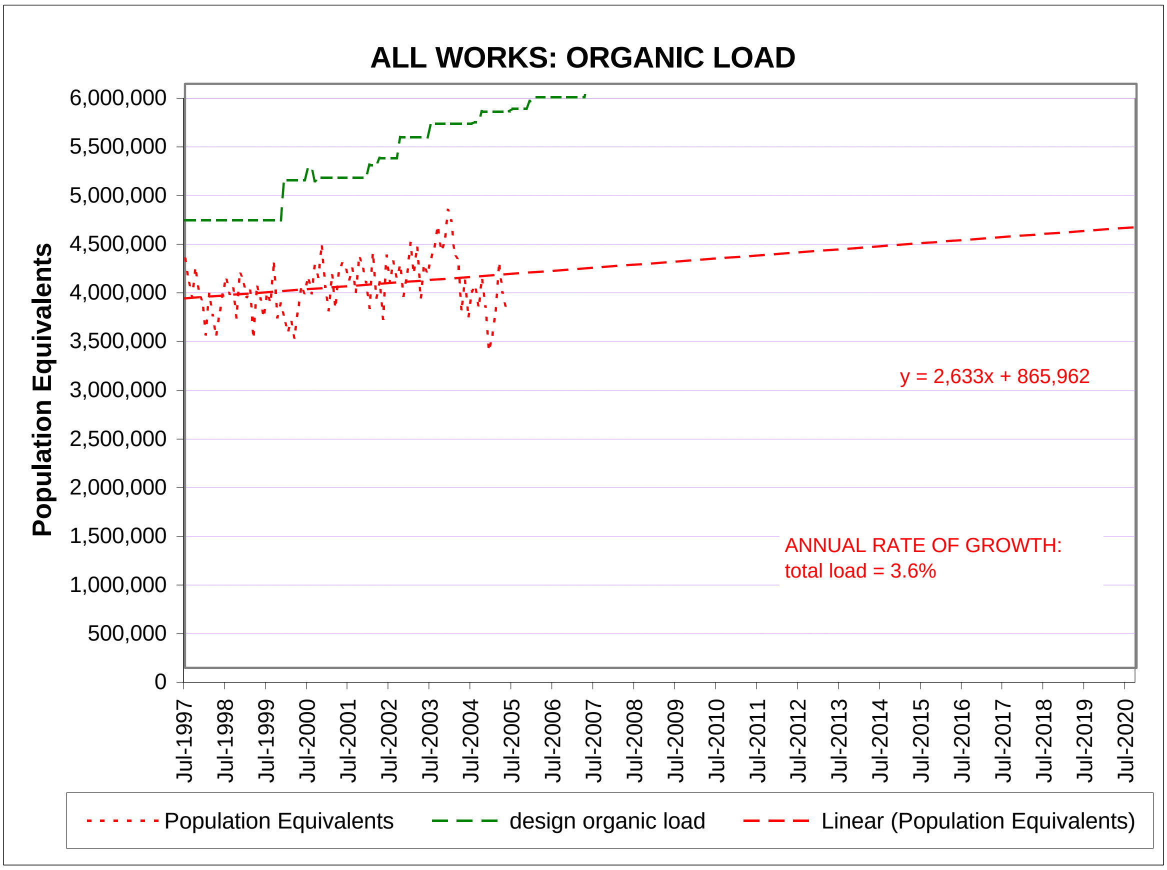




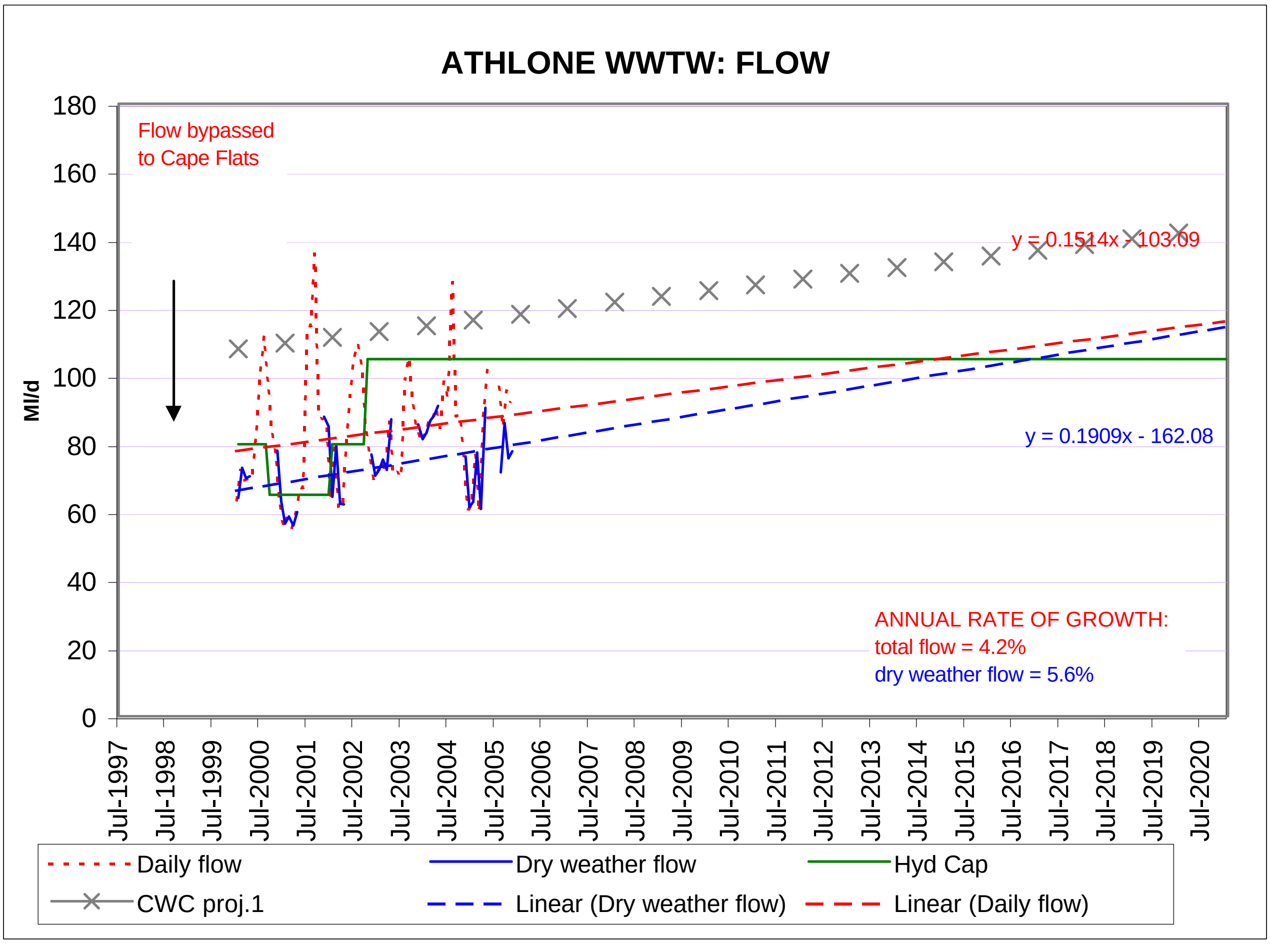

ORGANIC LOAD HANDLED BY ALL TREATMENT WORKS
Kg Chem Ox Demand / day
population equivalents
y = 2,633x + 865,962
RATE OF GROWTH = 3.3% pa
550,000
525,000
500,000
475,000
450,000
425,000
400,000
375,000
350,000
325,000
300,000
5,000,000
4,750,000
4,500,000
4,250,000
4,000,000
3,750,000
3,500,000
3,250,000
3,000,000
Jul-97
Oct-97
Jan-98
Apr-98
Jul-98
Oct-98
Jan-99
Apr-99
Jul-99
Oct-99
Jan-00
Apr-00
Jul-00
Oct-00
Jan-01
Apr-01
Jul-01
Oct-01
Jan-02
Apr-02
Jul-02
Oct-02
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05

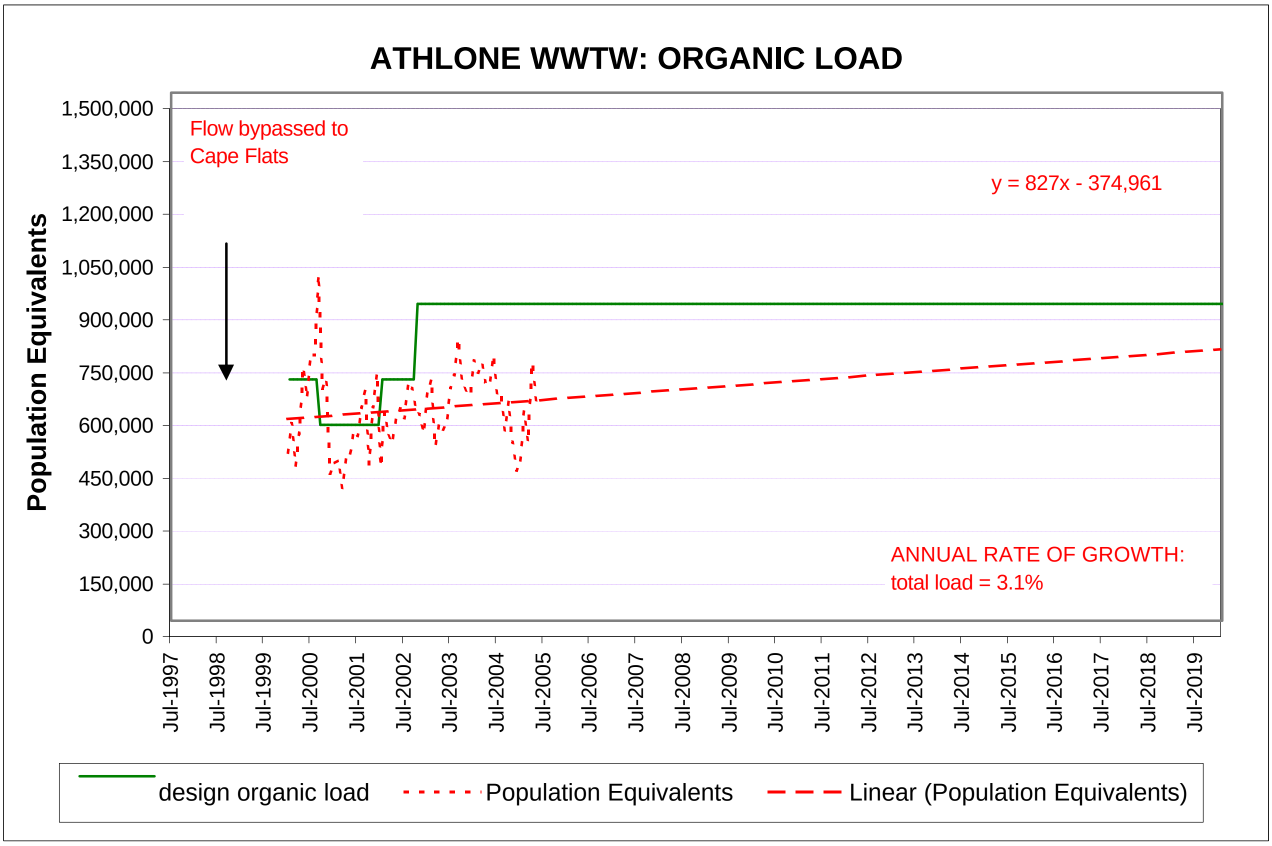
TOTAL FOR ALL WORKS



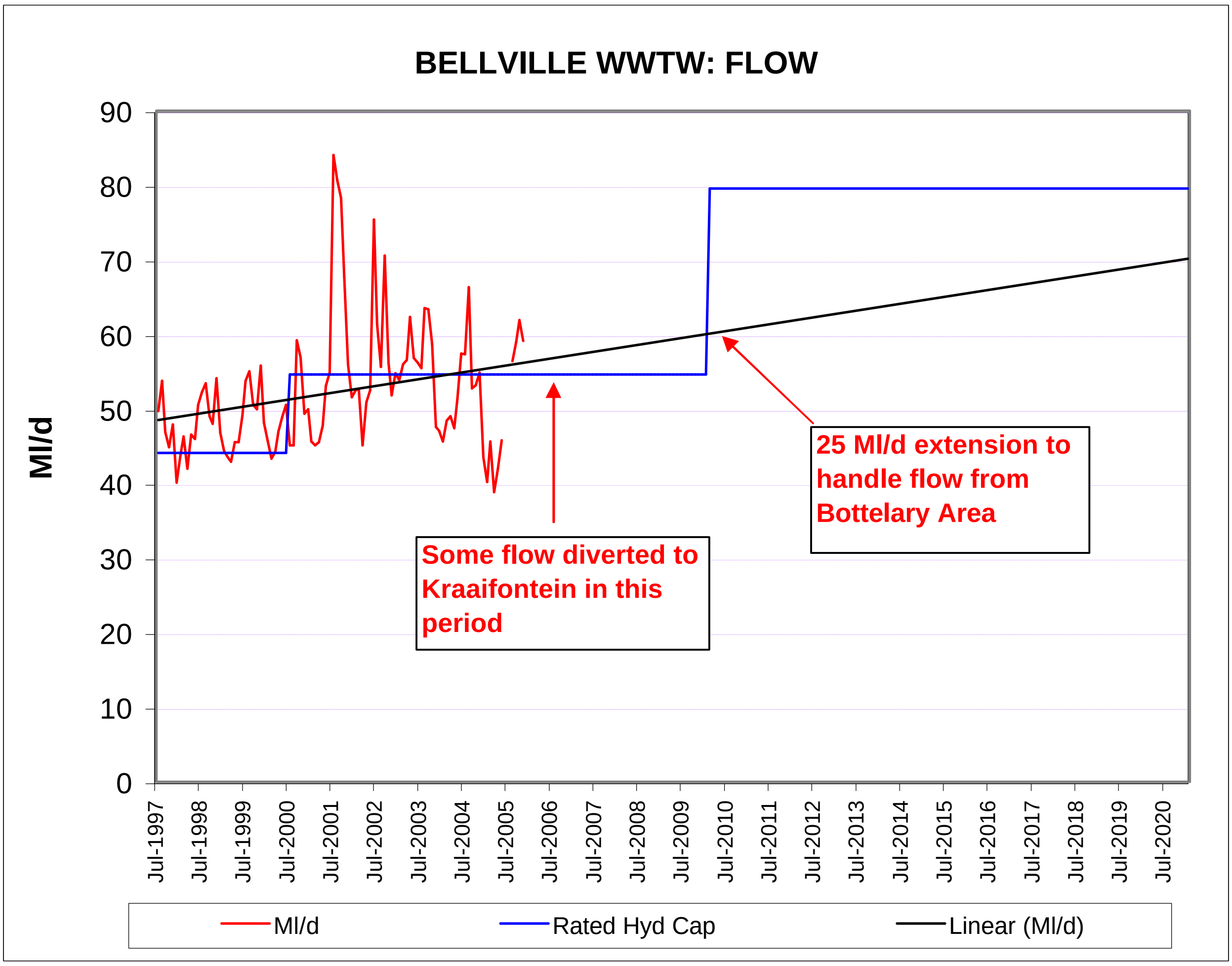


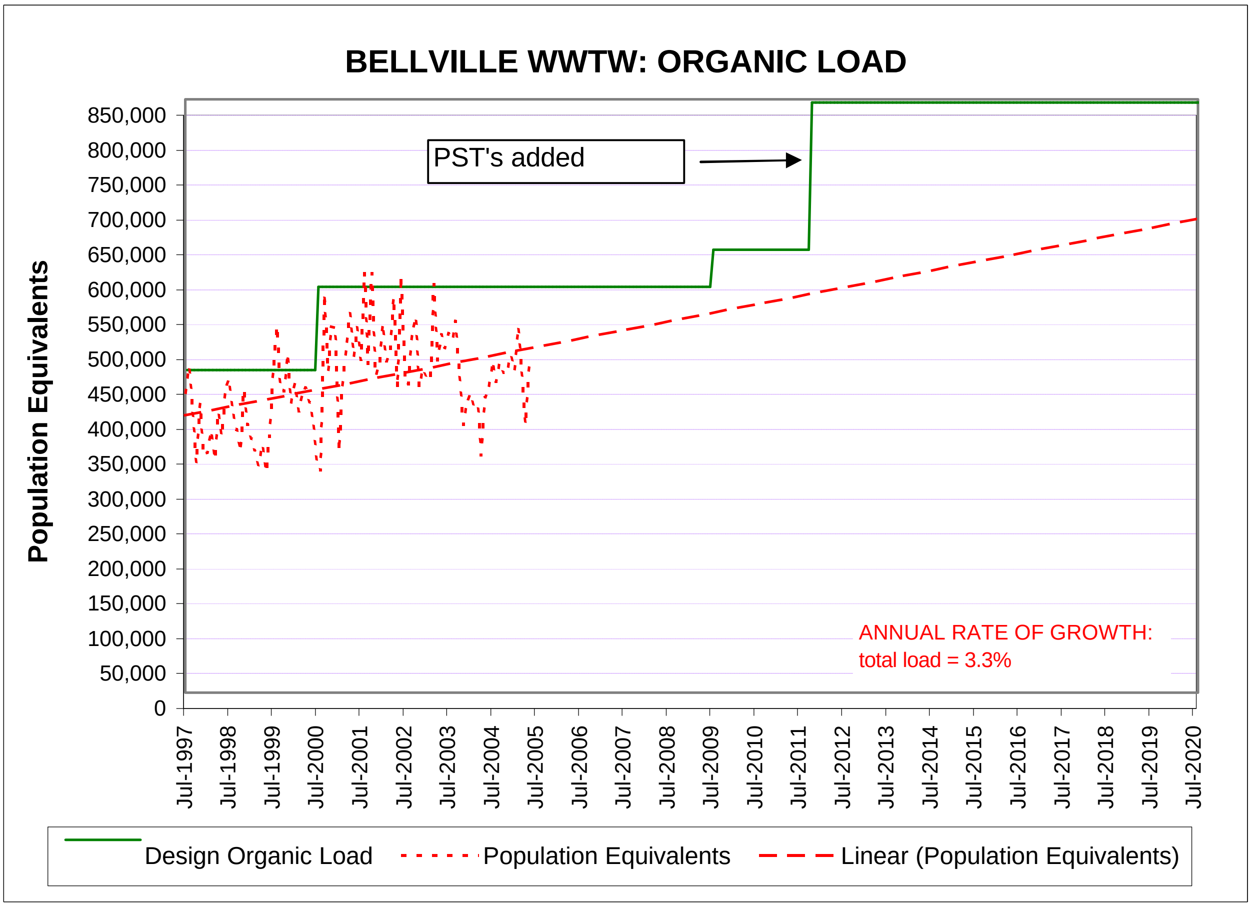
ATHLONE WASTEWATER TREATMENT WORKS



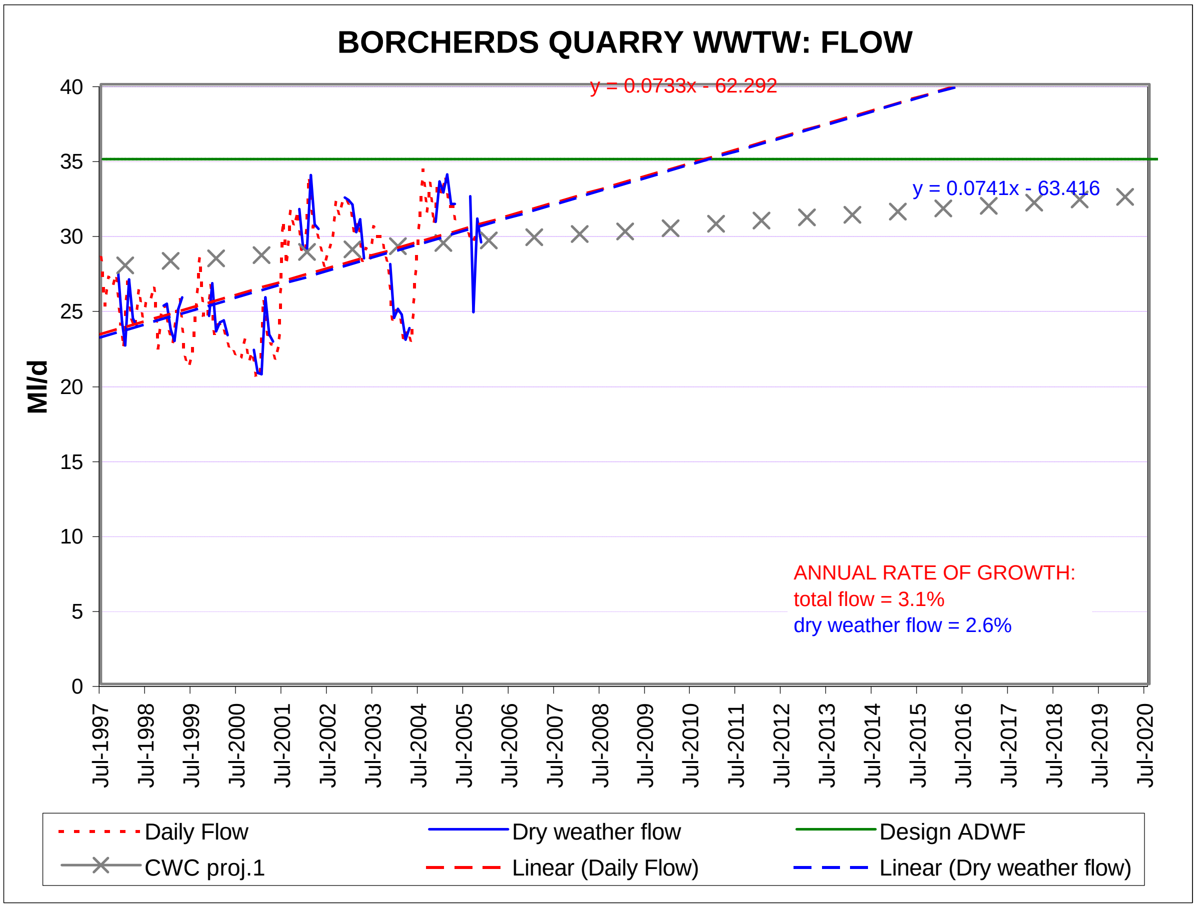


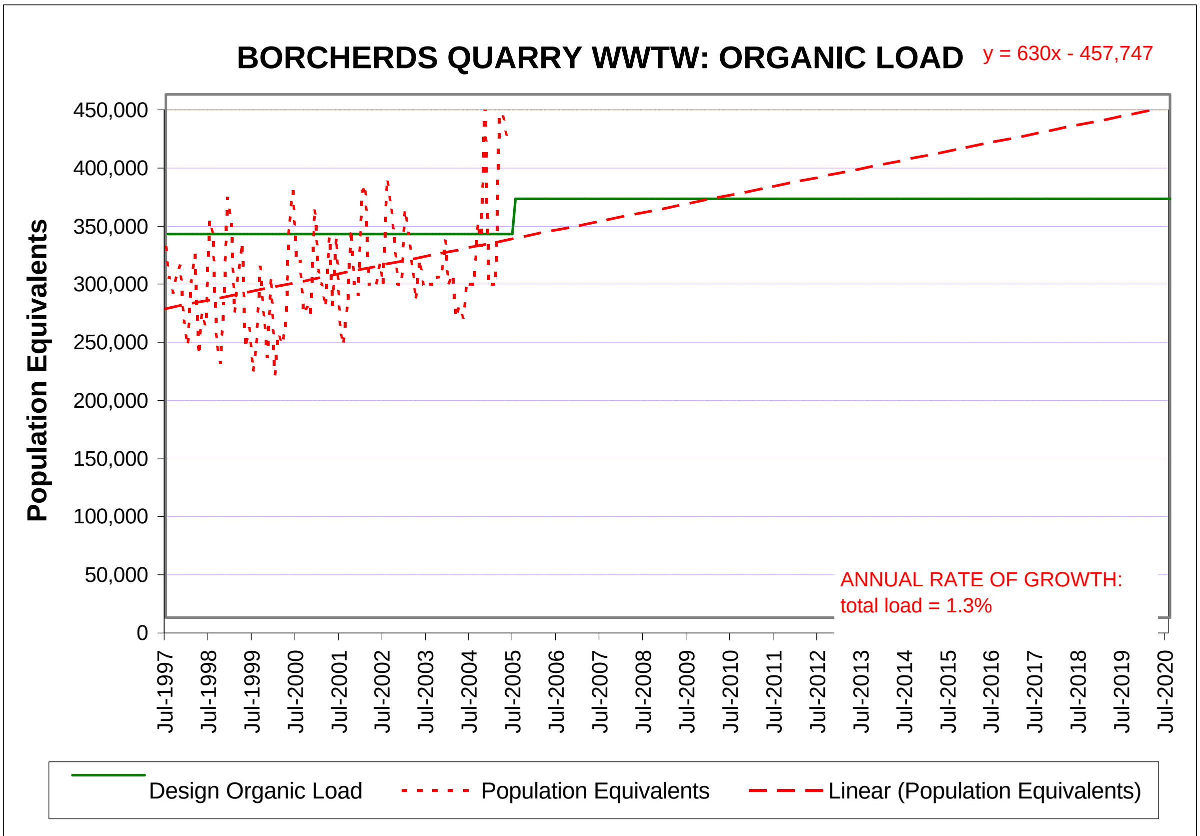
BELLVILLE WASTEWATER TREATMENT WORKS



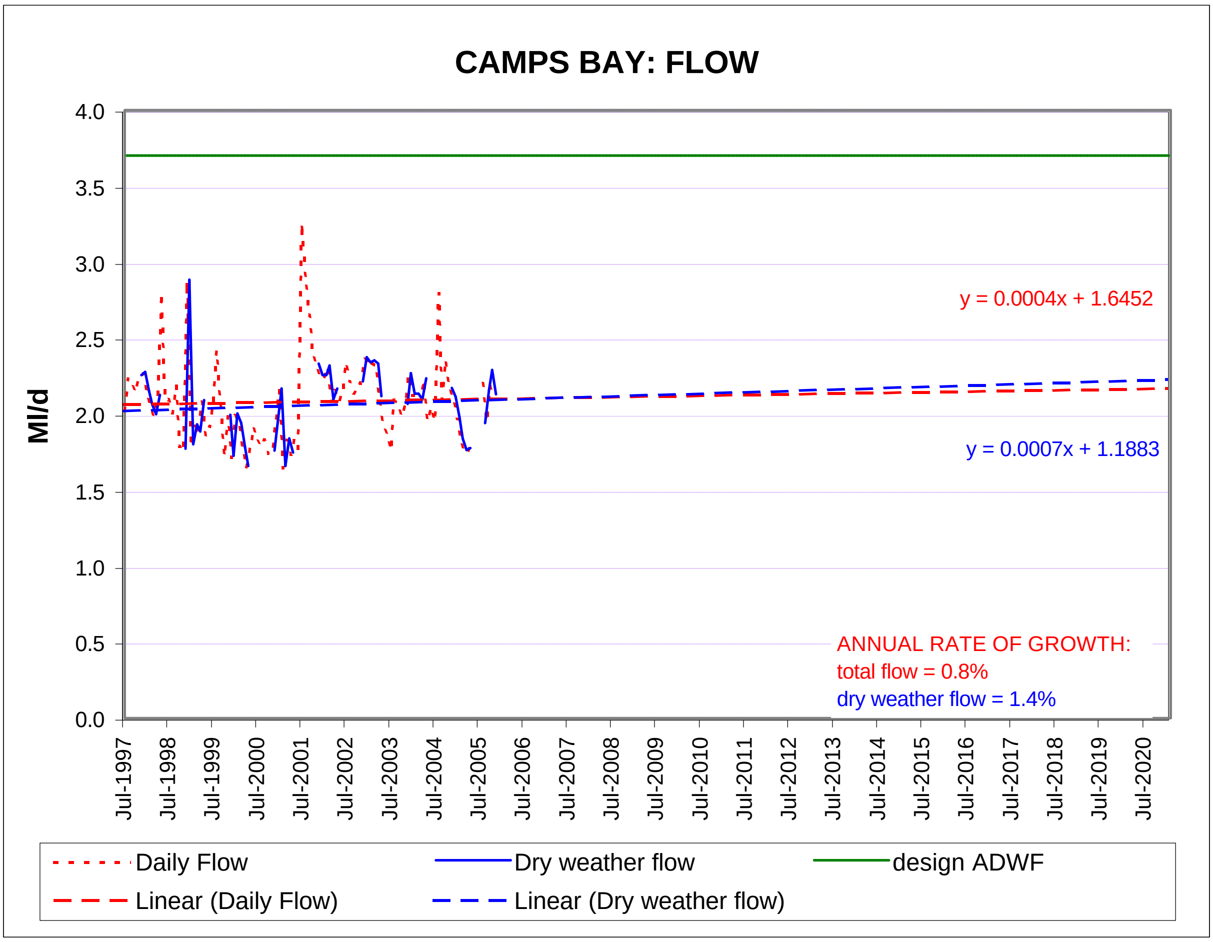


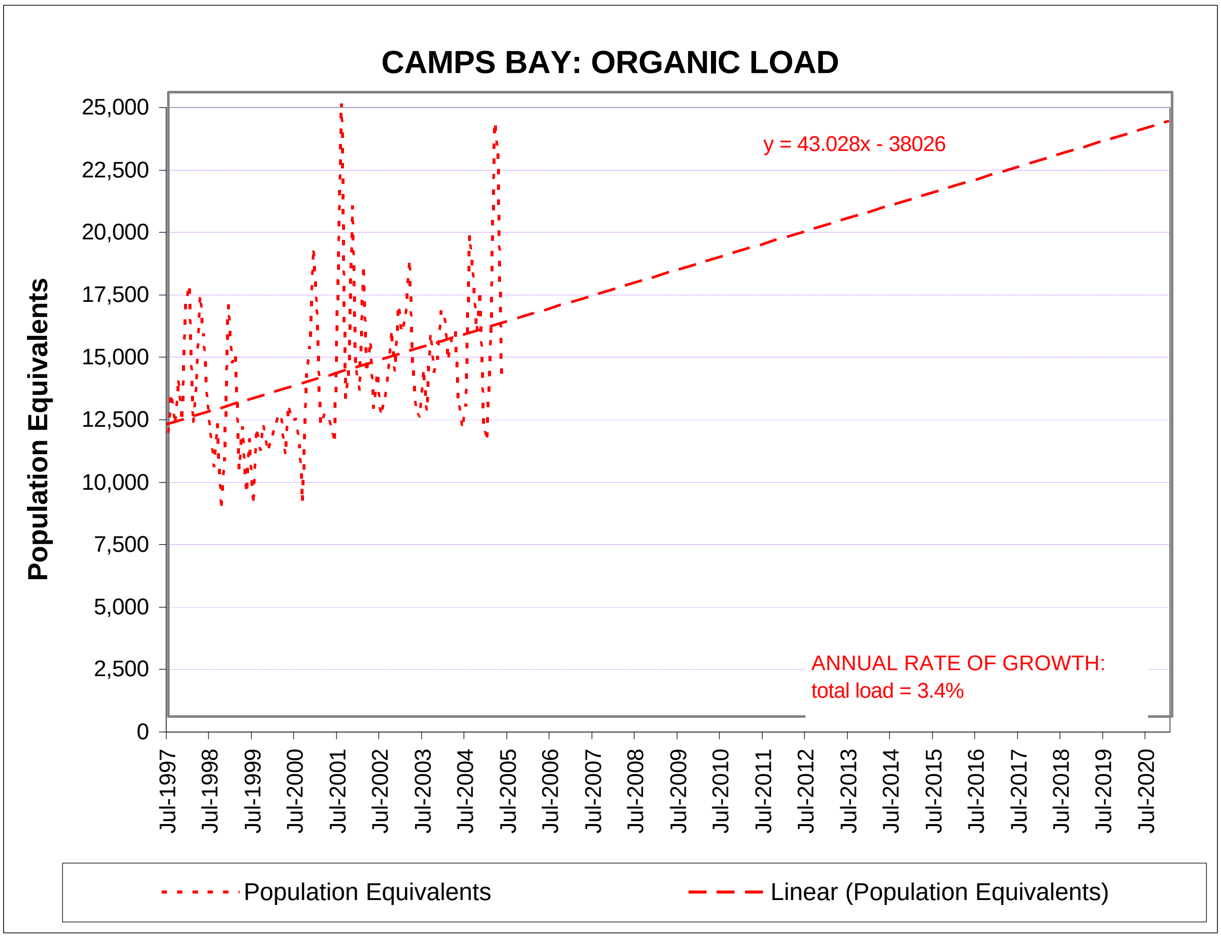
BORCHERDS QUARRY WASTEWATER TREATMENT WORKS



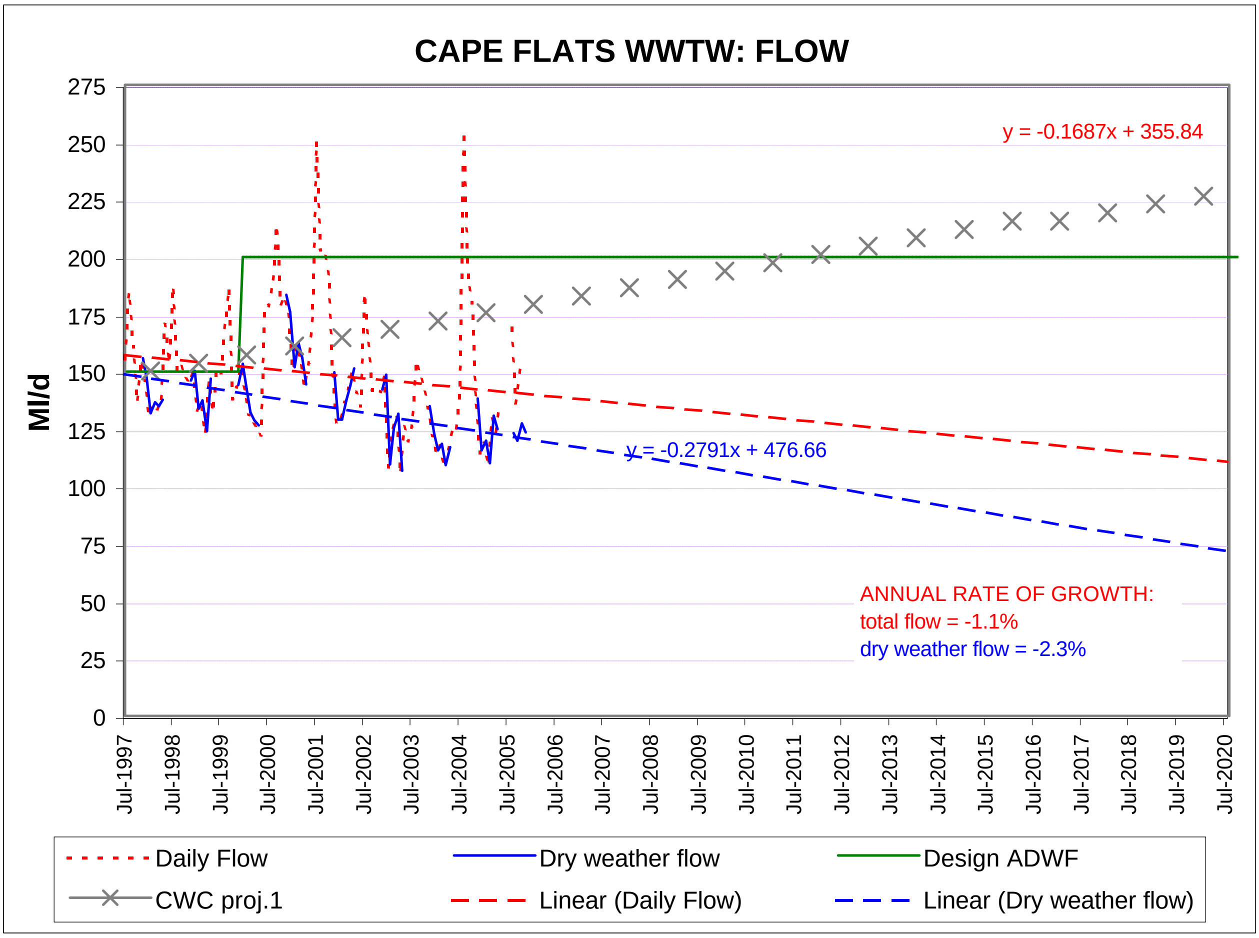


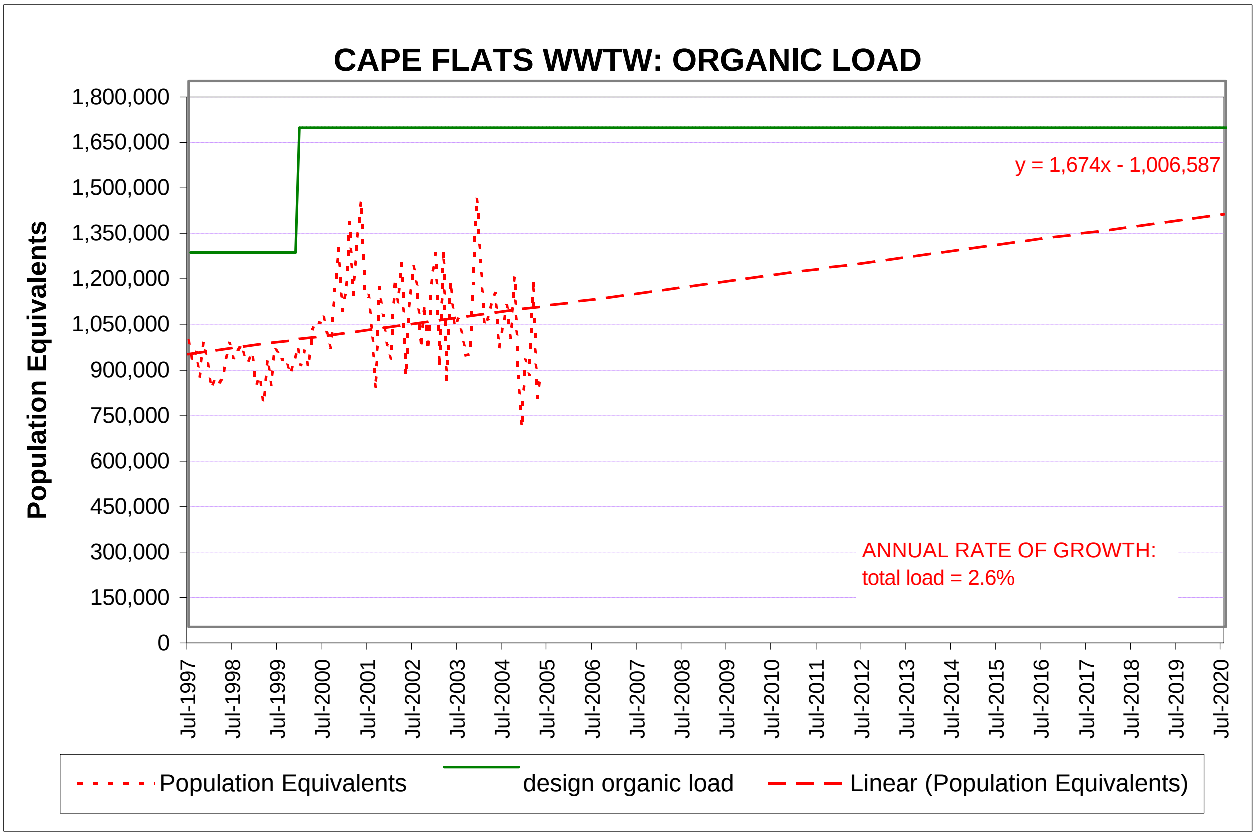
CAMPS BAY SEA OUTFALL



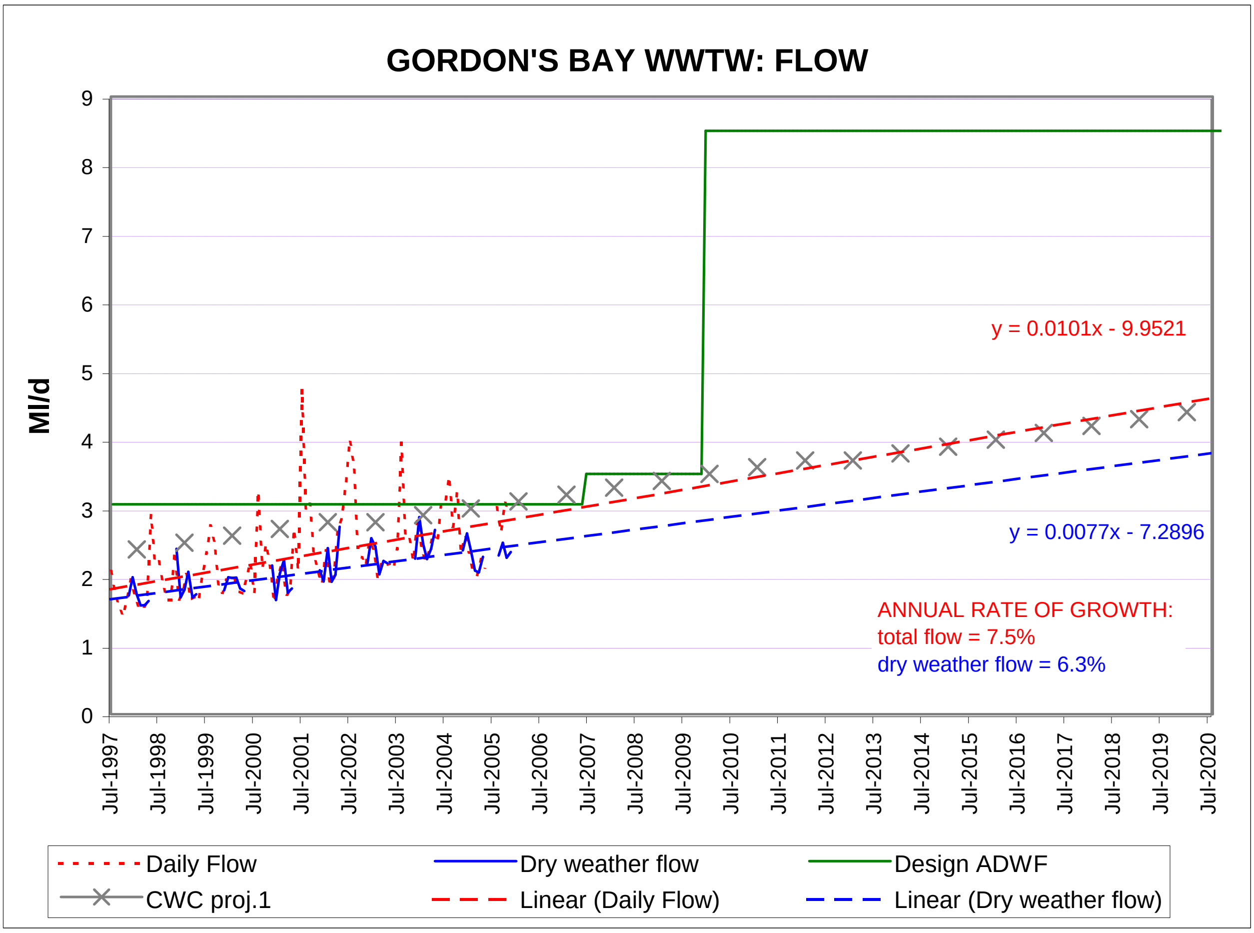


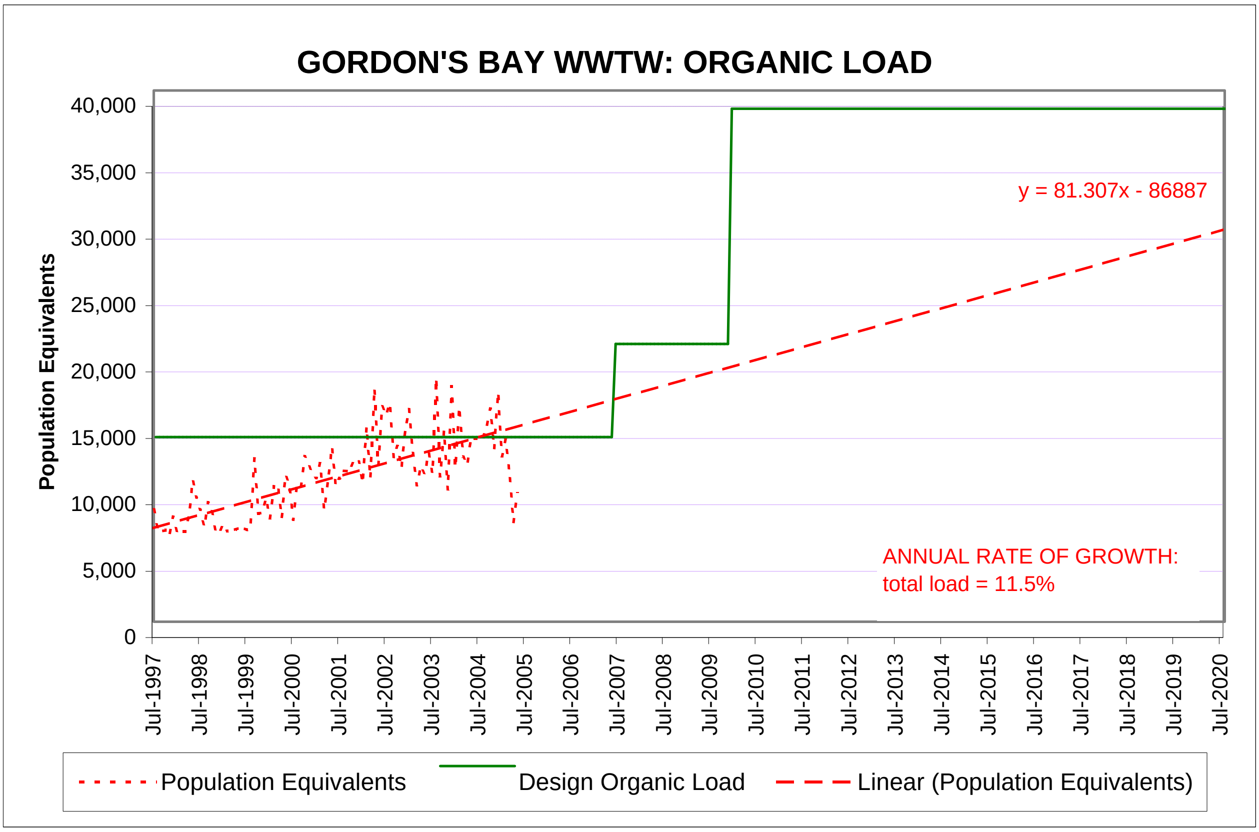
CAPE FLATS WASTEWATER TREATMENT WORKS



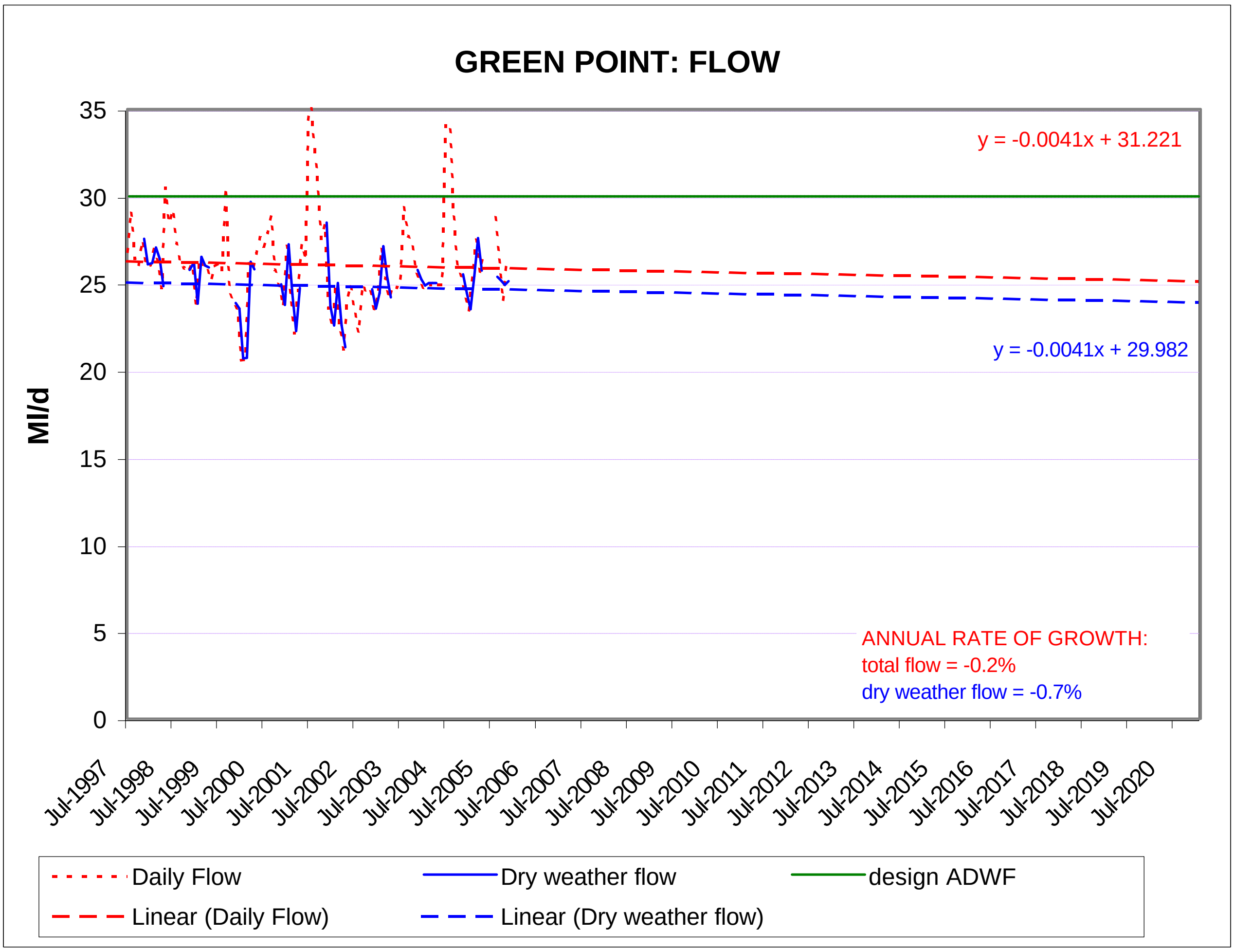


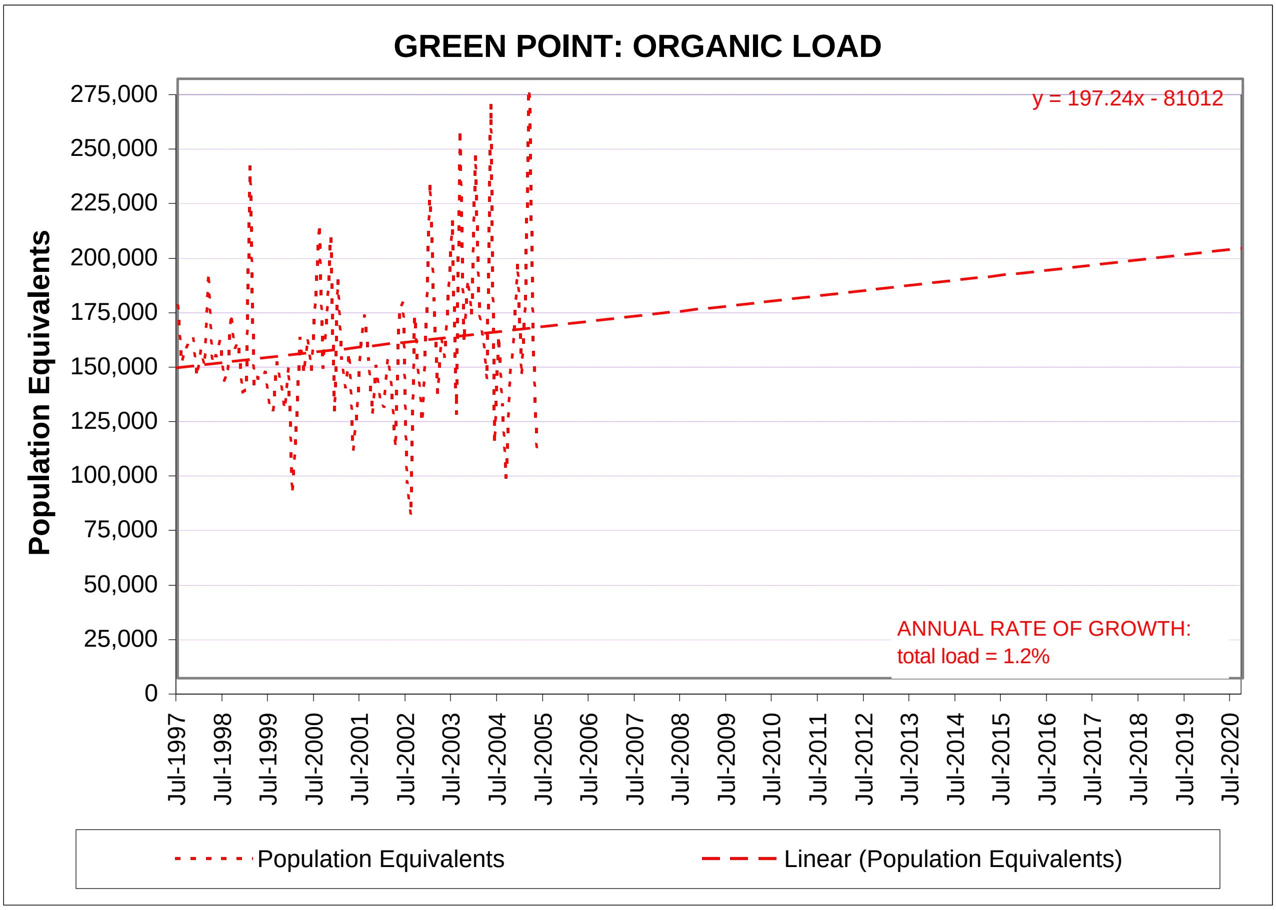
GORDONS BAY WASTEWATER TREATMENT WORKS



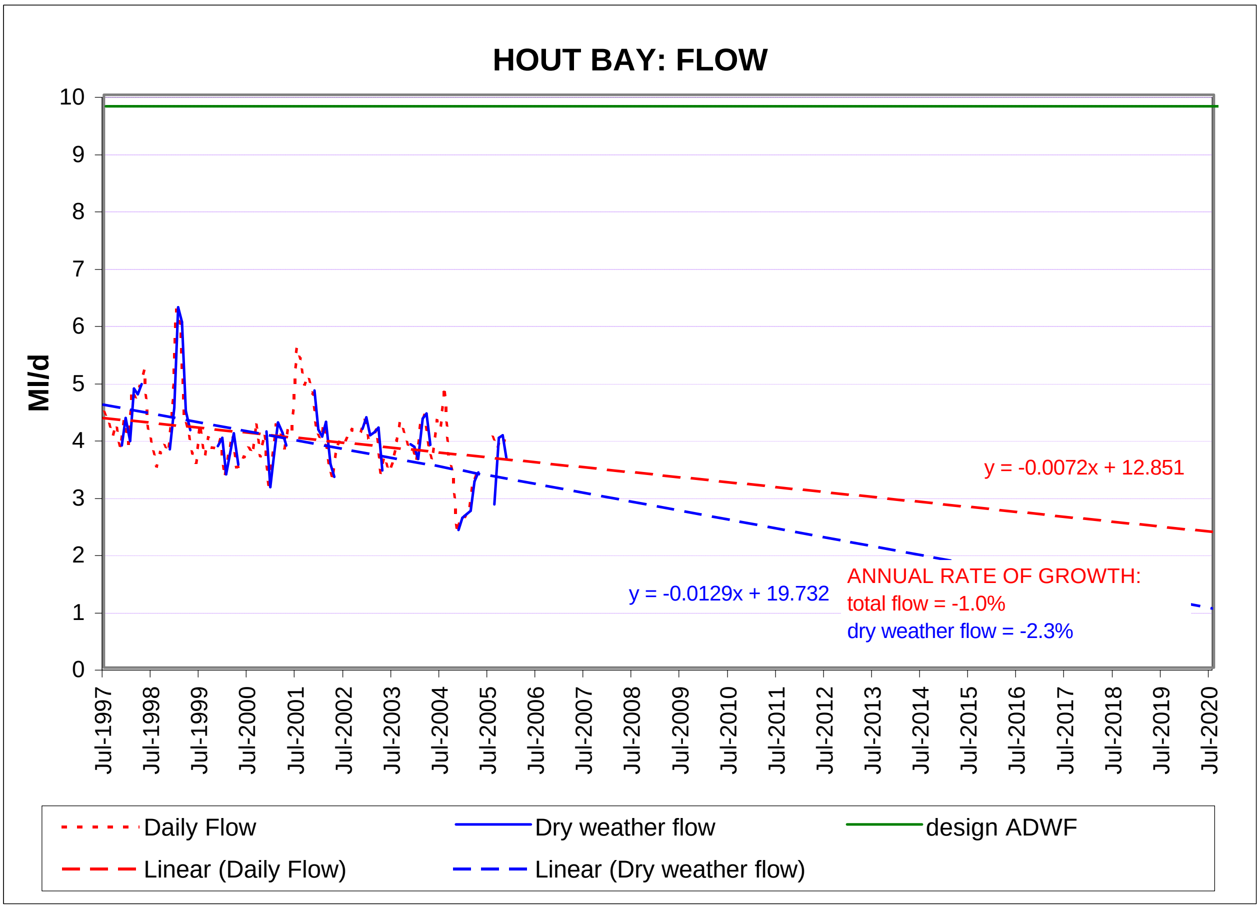


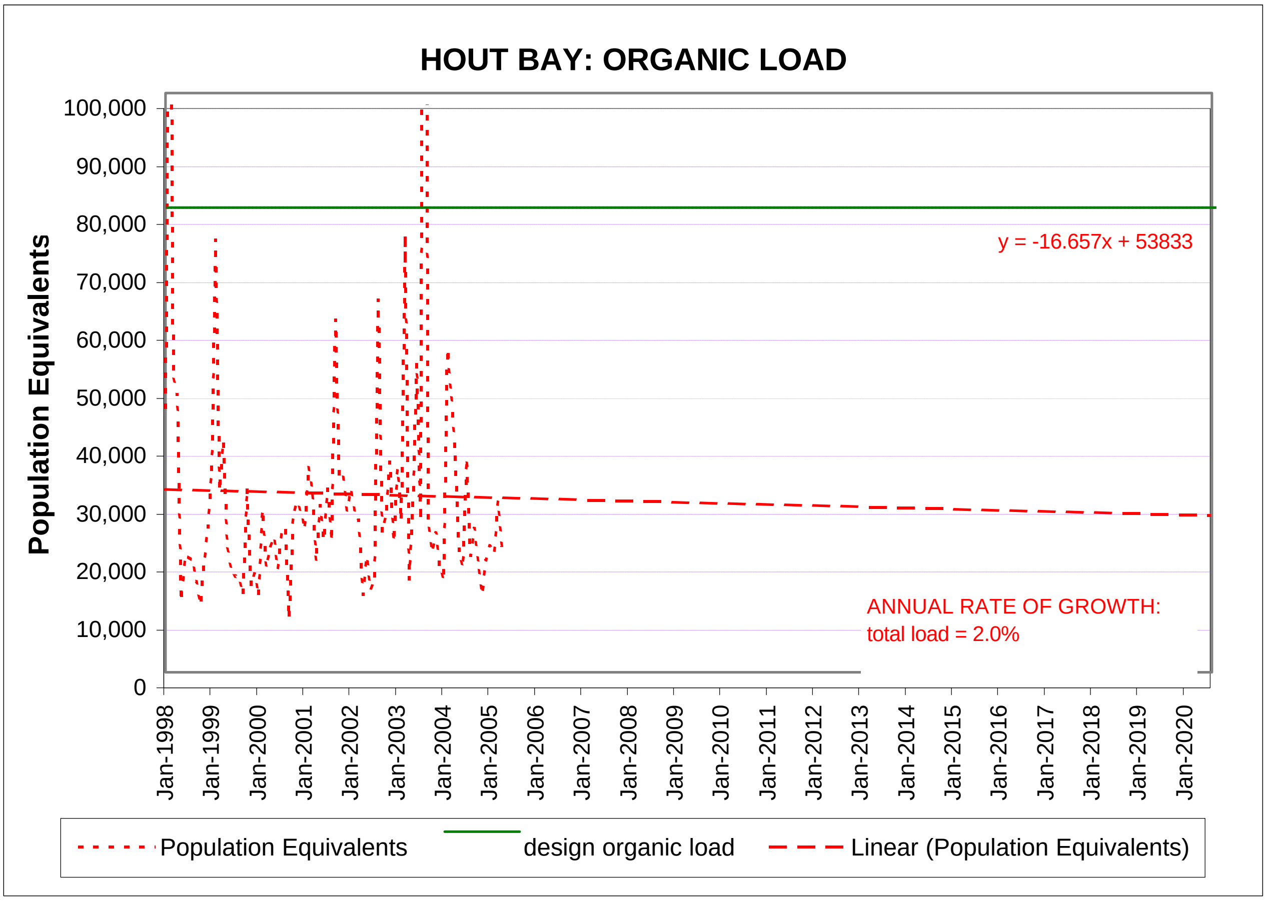
GREEN POINT SEA OUTFALL: FLOW & LOAD



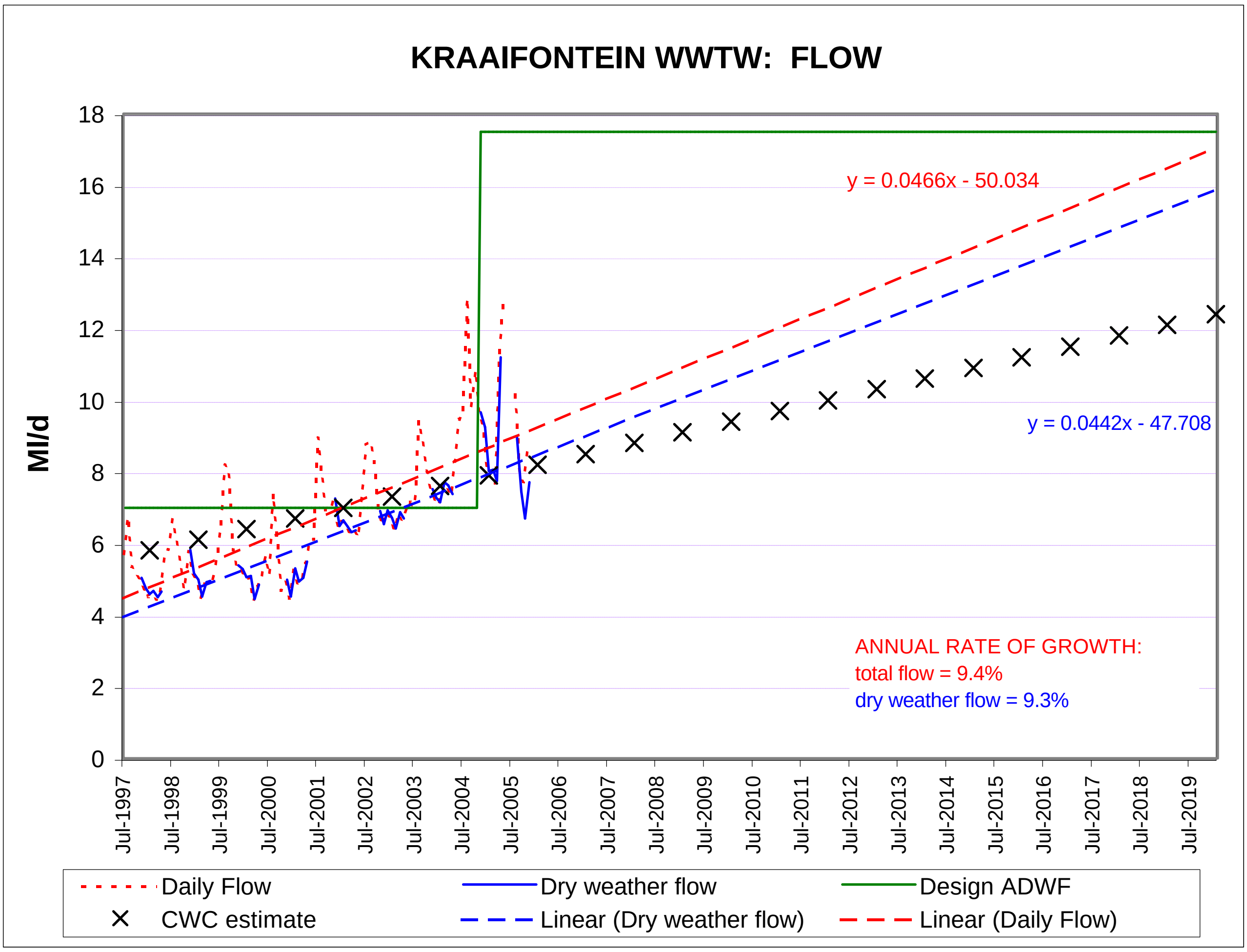


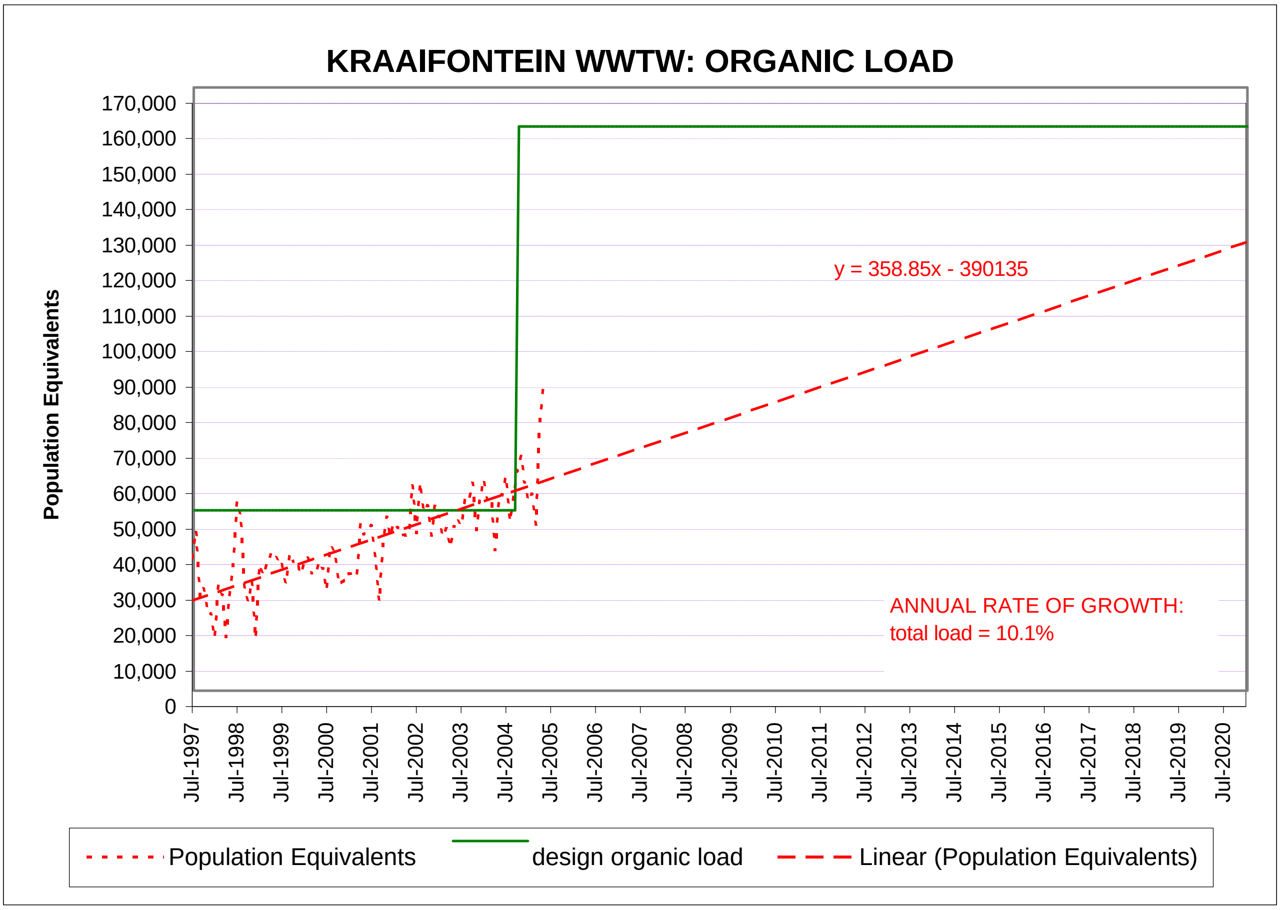
HOUT BAY SEA OUTFALL



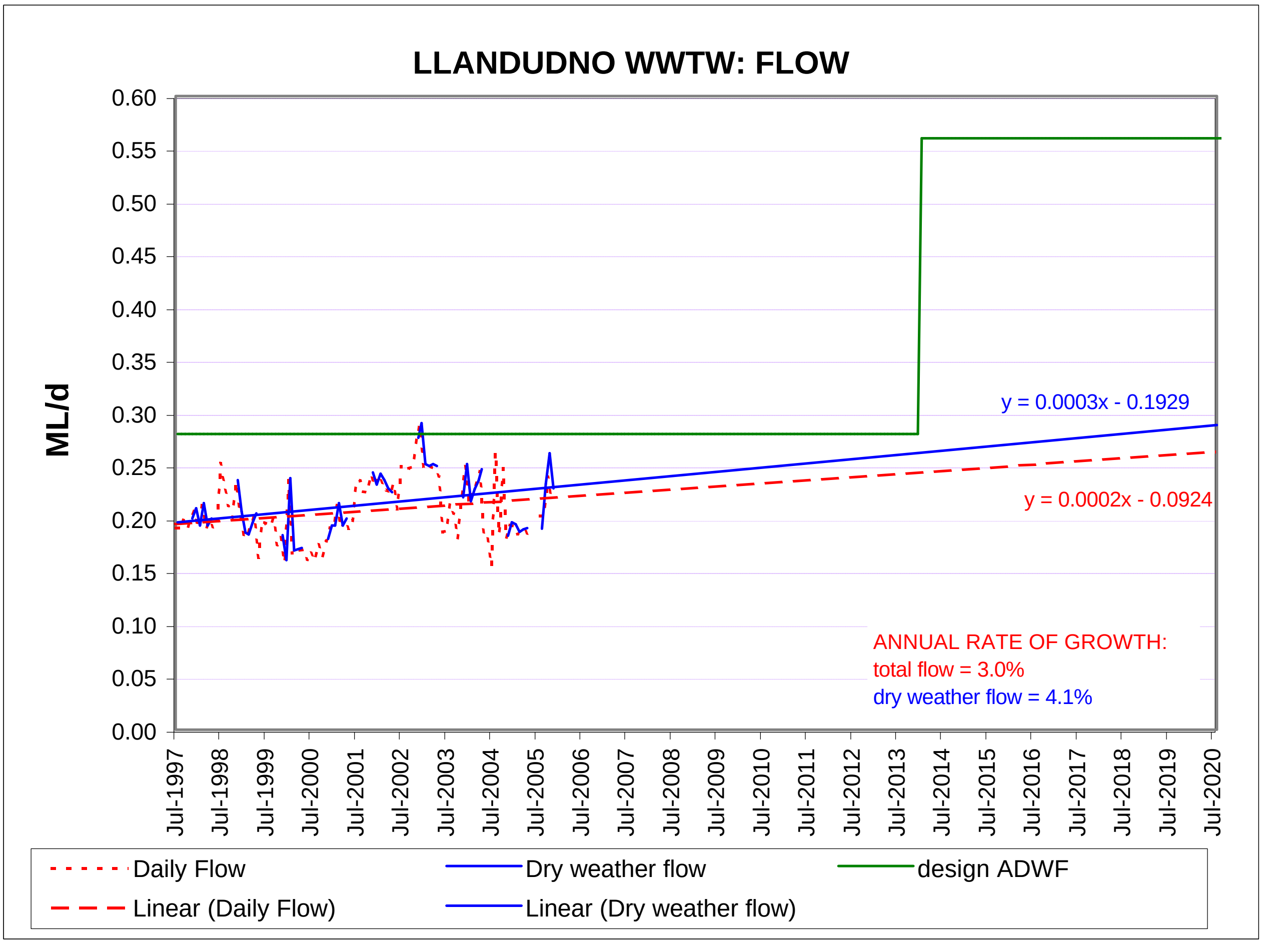


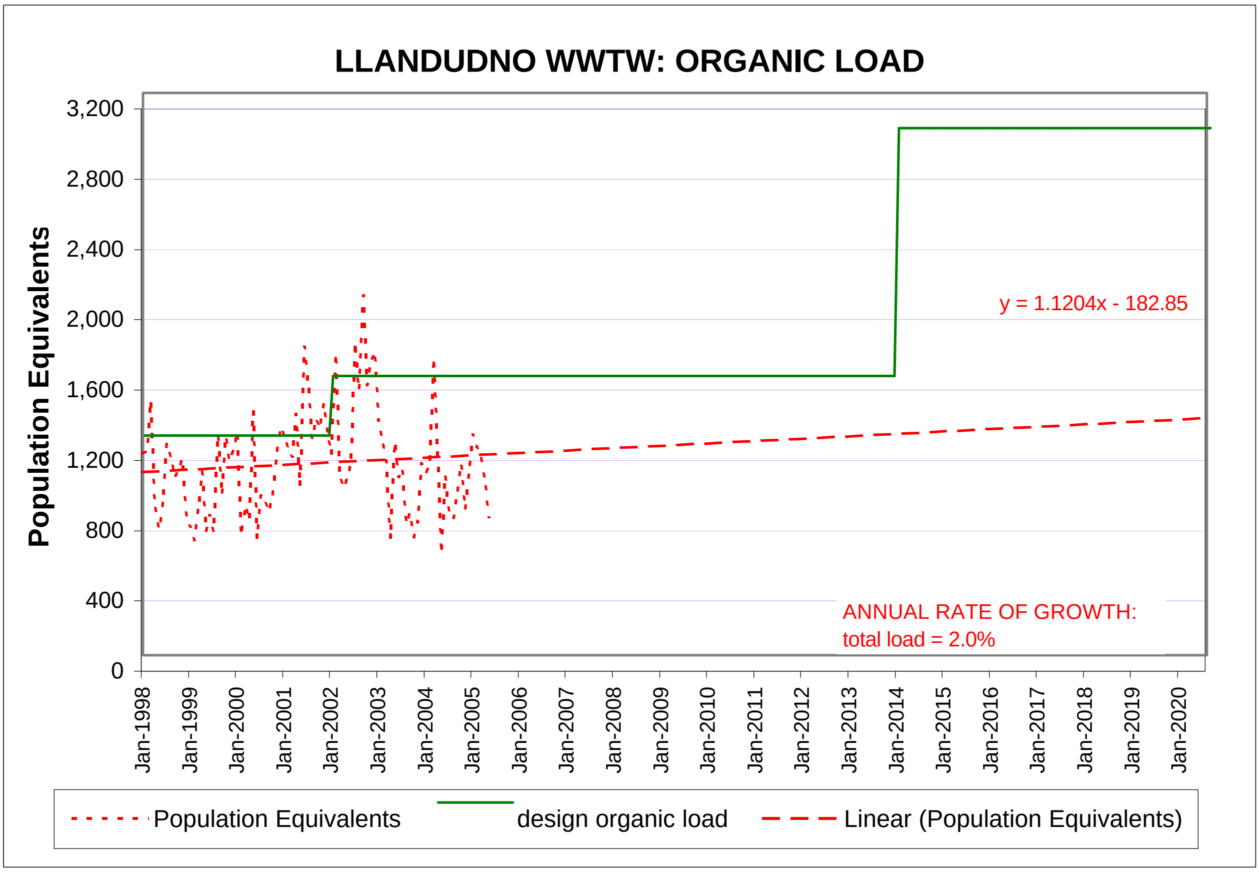
KRAAIFONTEIN WASTEWATER TREATMENT WORKS



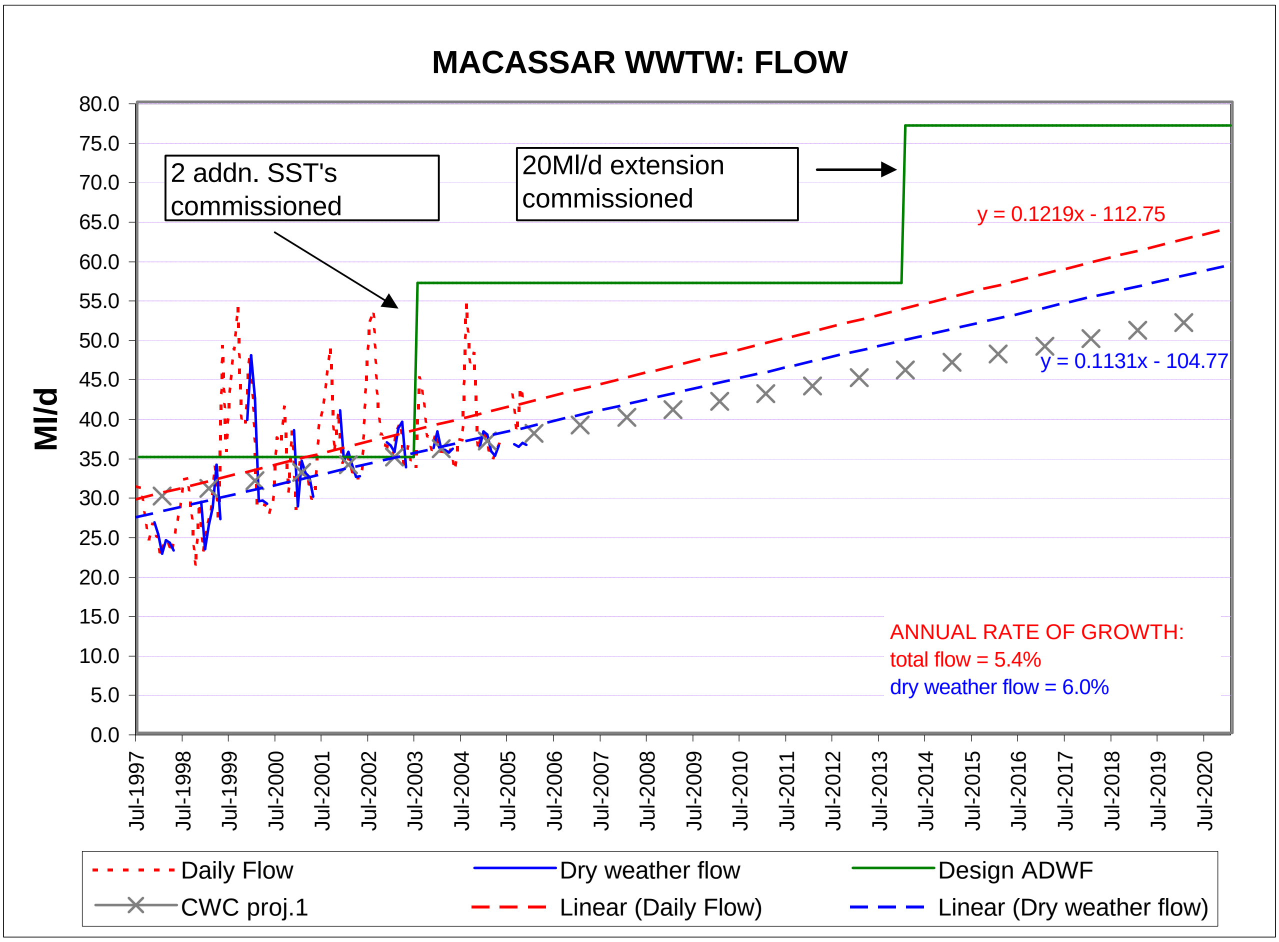


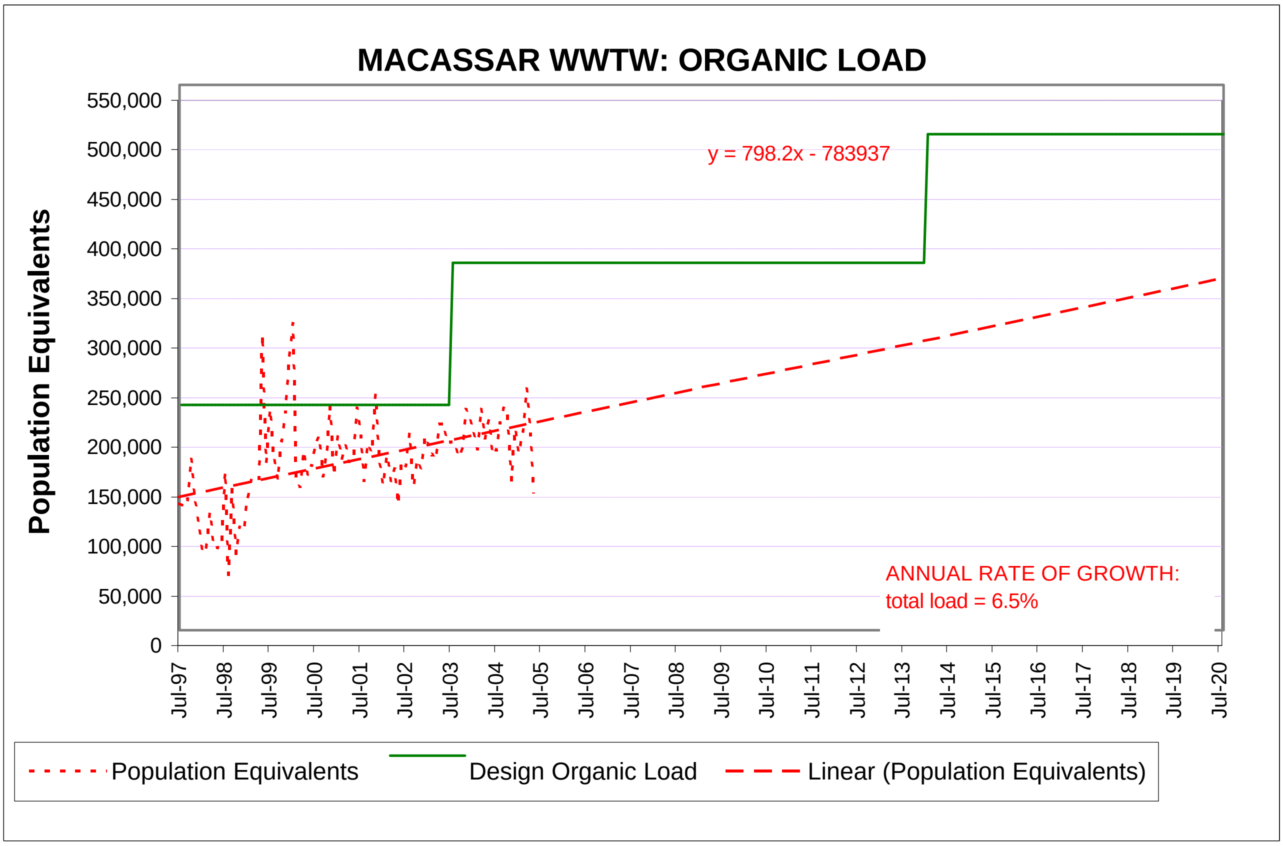
LLANDUDNO WASTEWATER TREATMENT WORKS



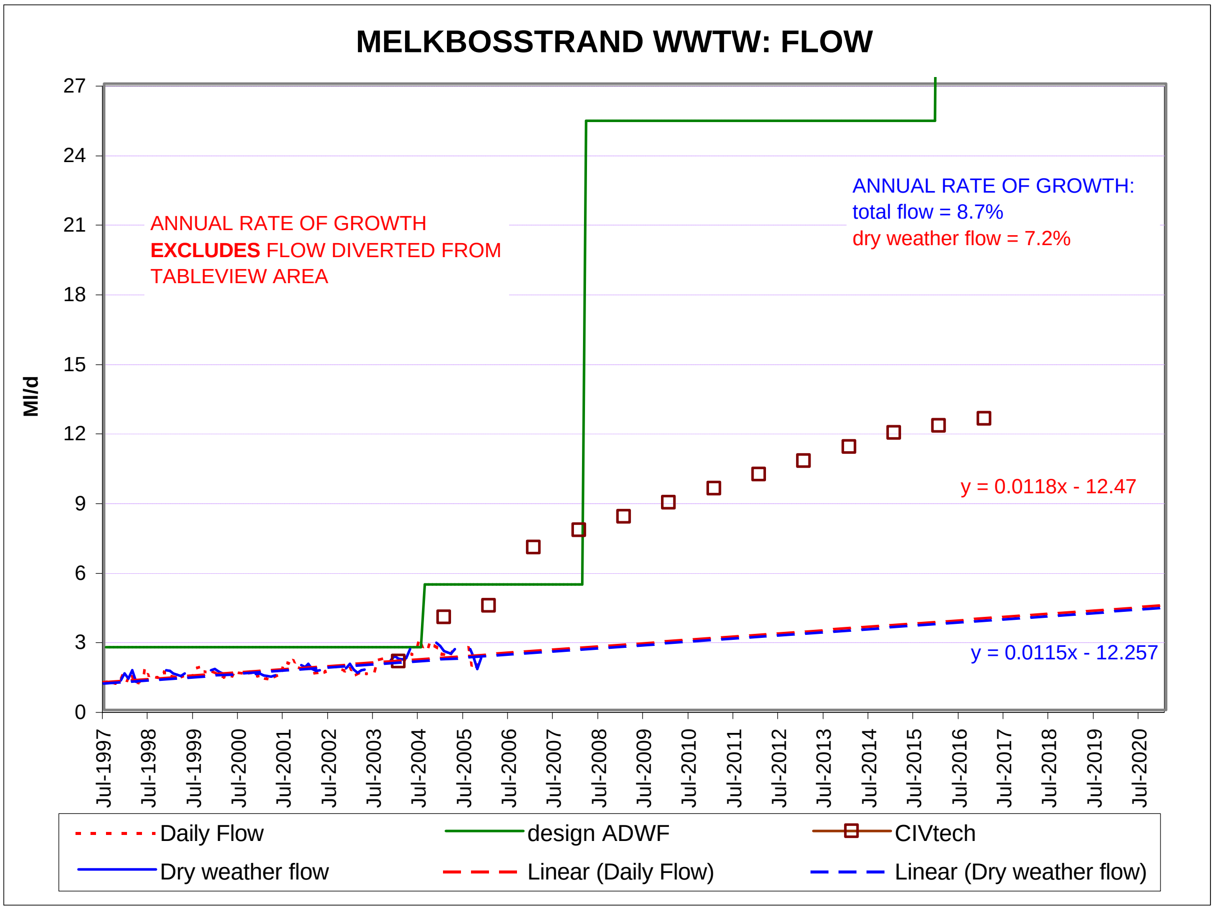


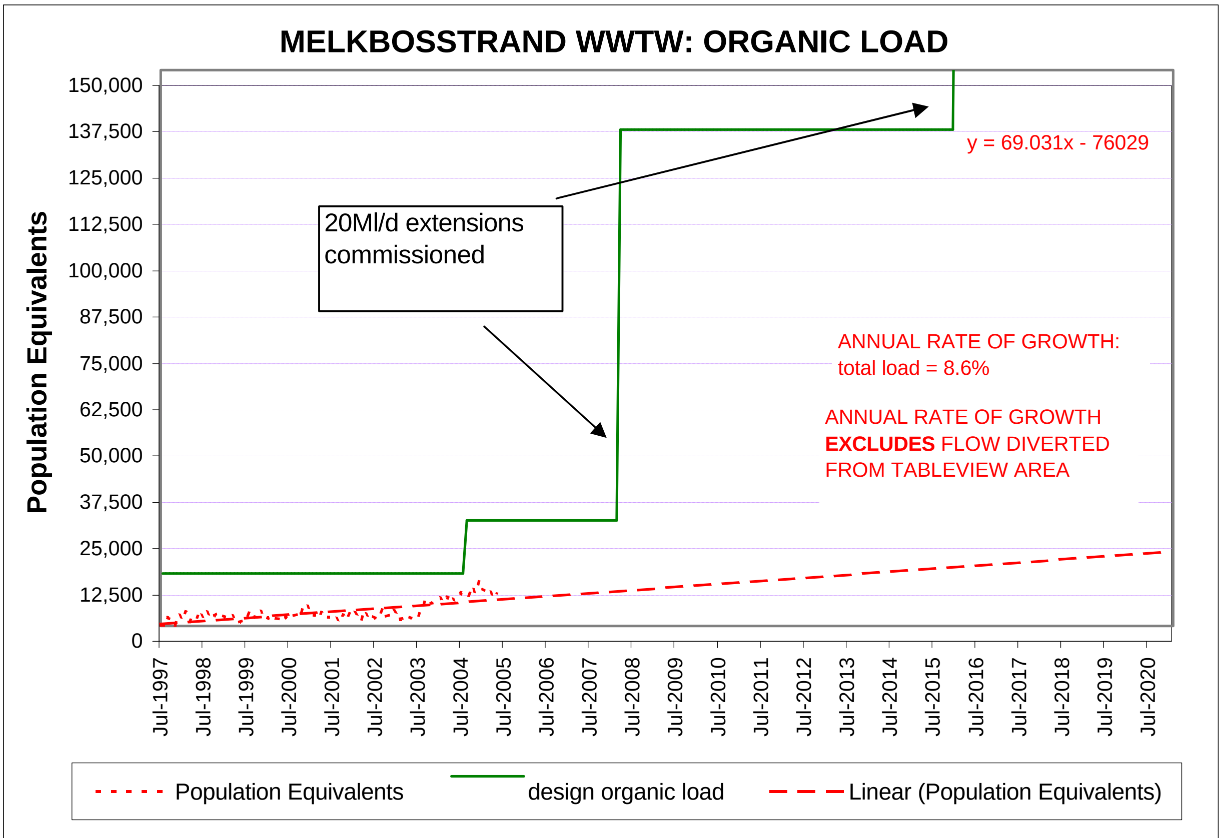
MACASSAR WASTEWATER TREATMENT WORKS



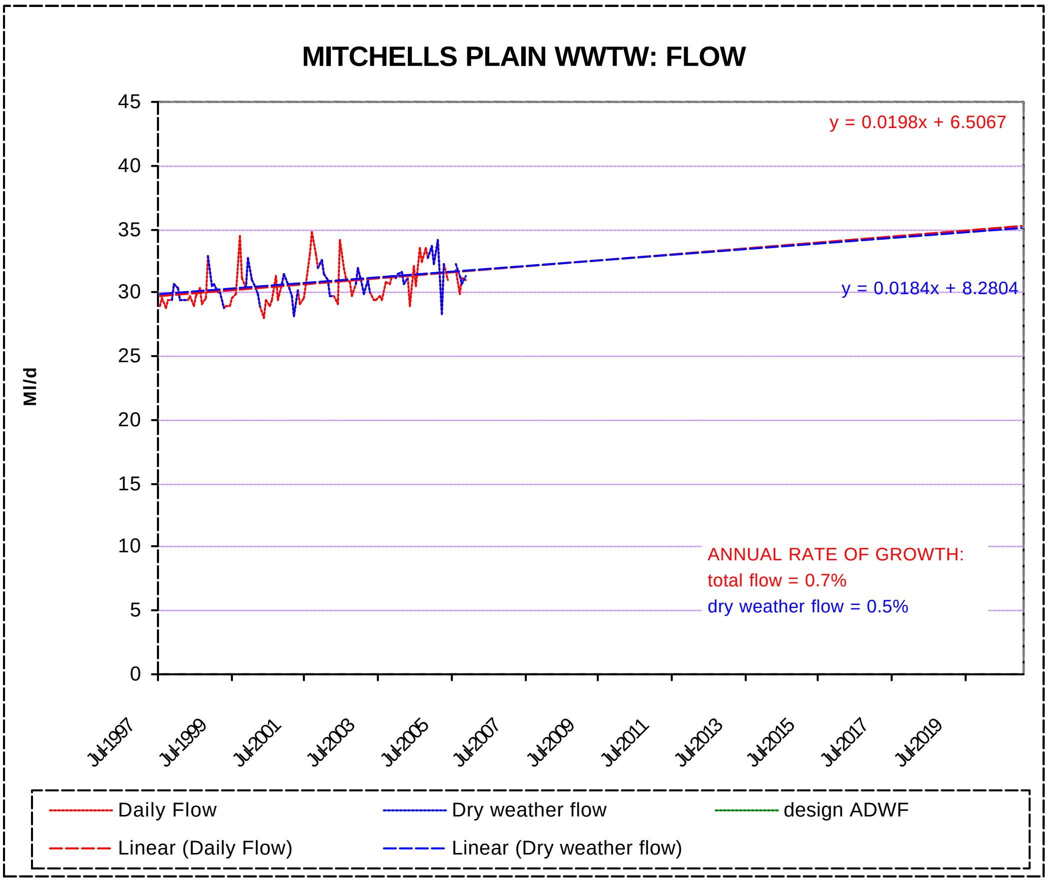


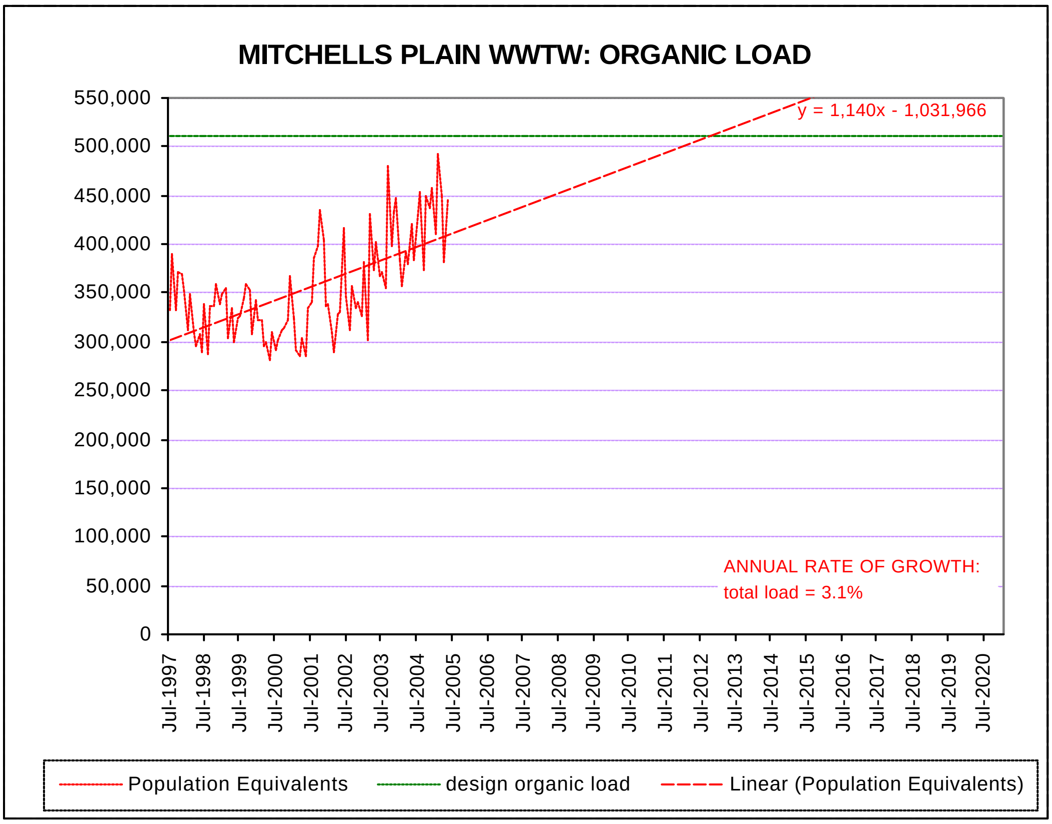
MELKBOSSTRAND WASTEWATER TREATMENT WORKS



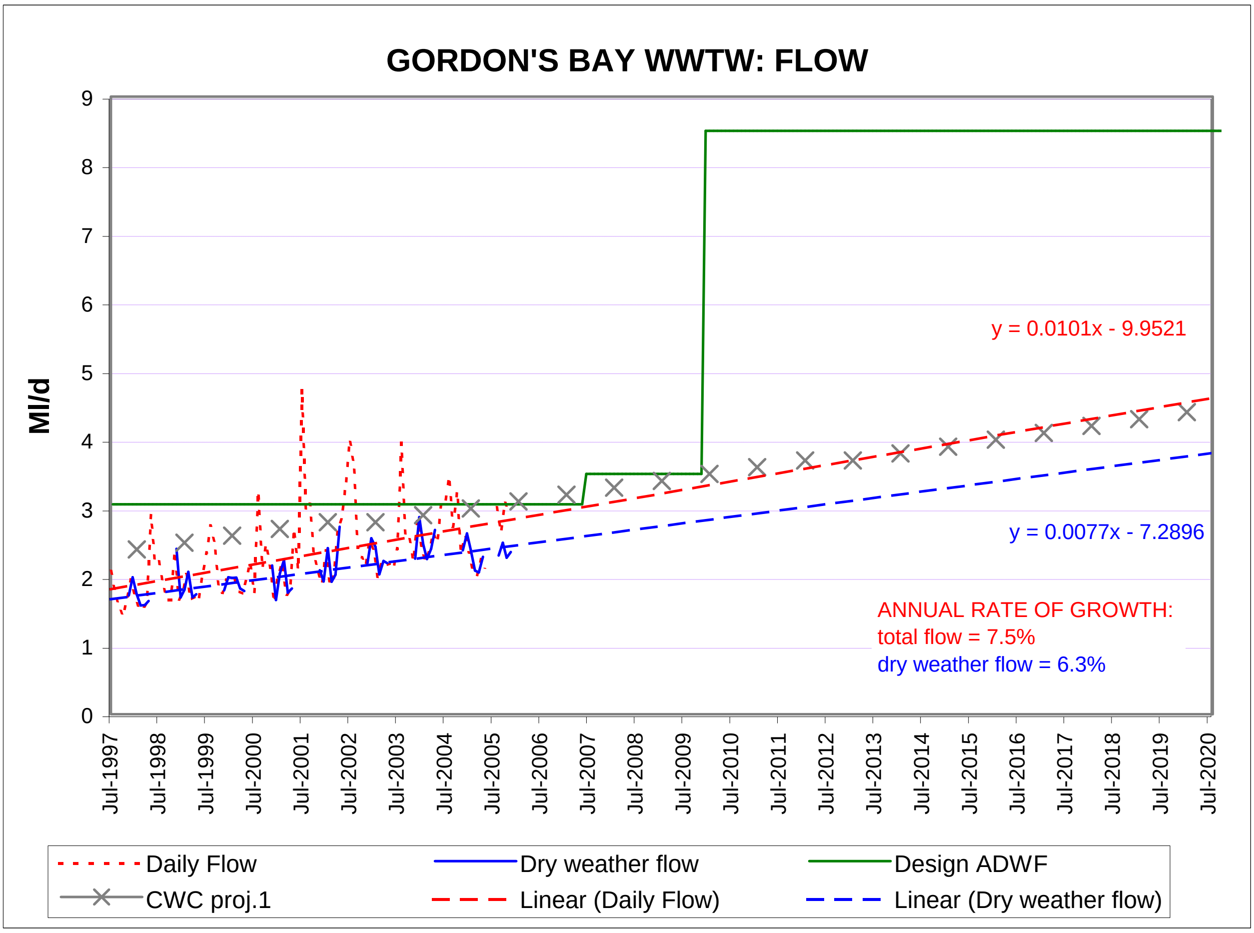


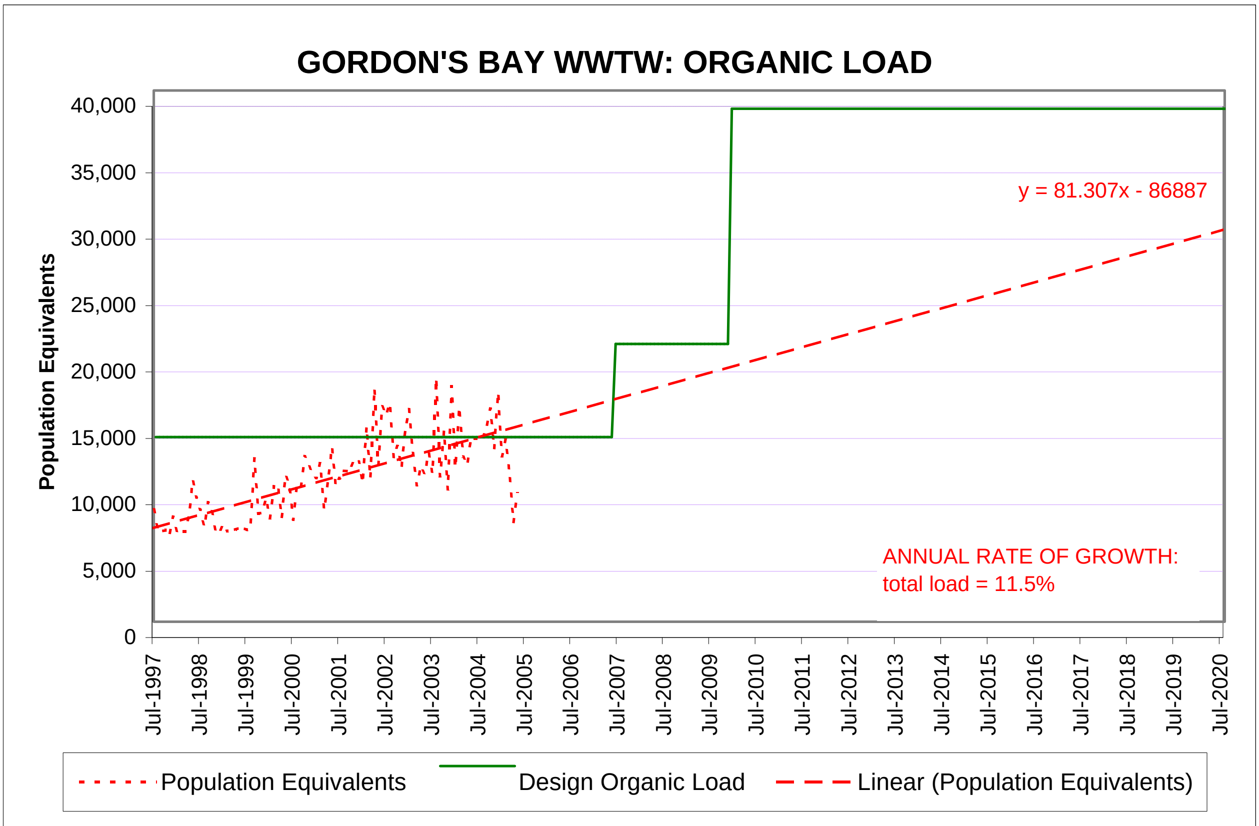
MITCHELLS PLAIN WASTEWATER TREATMENT WORKS



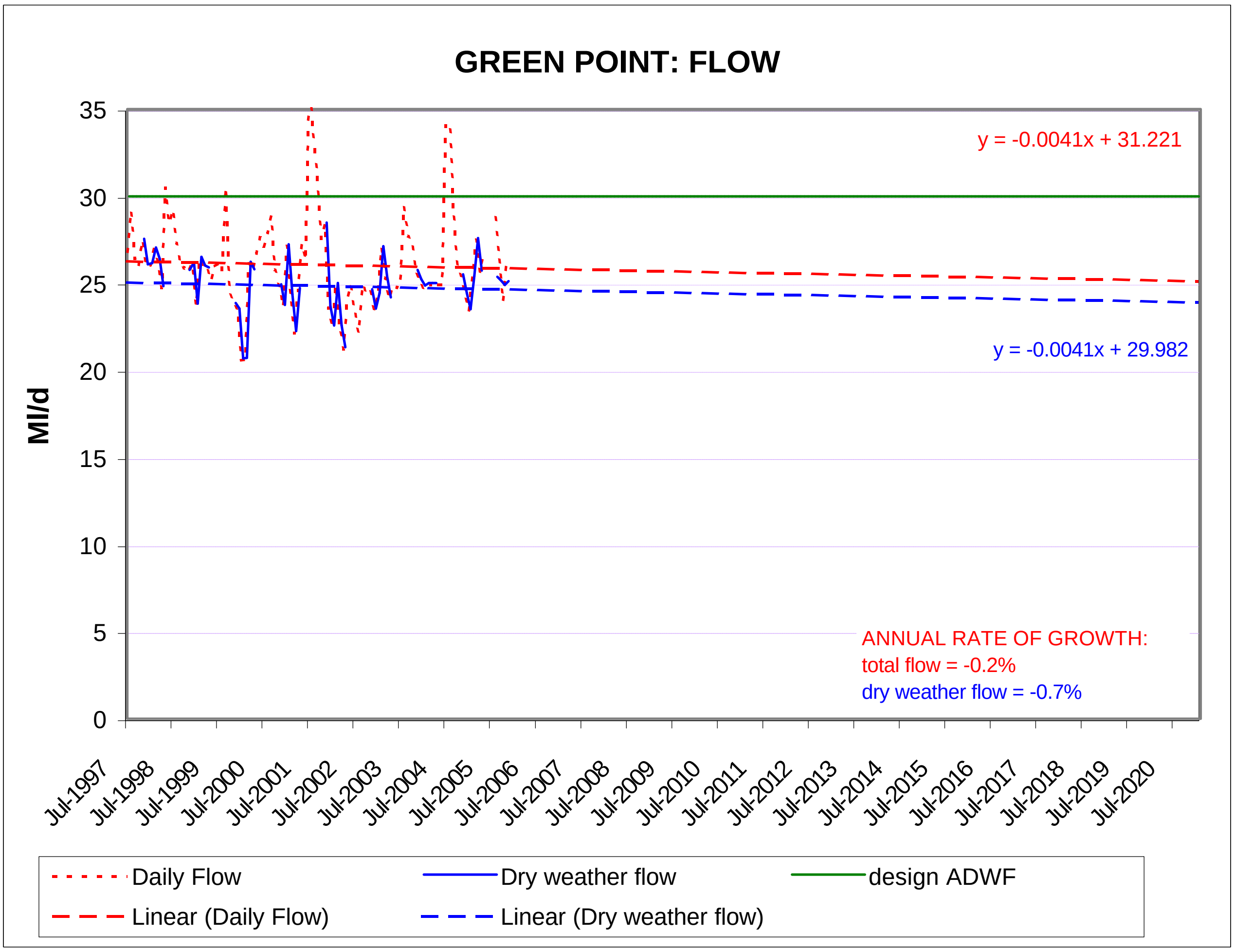


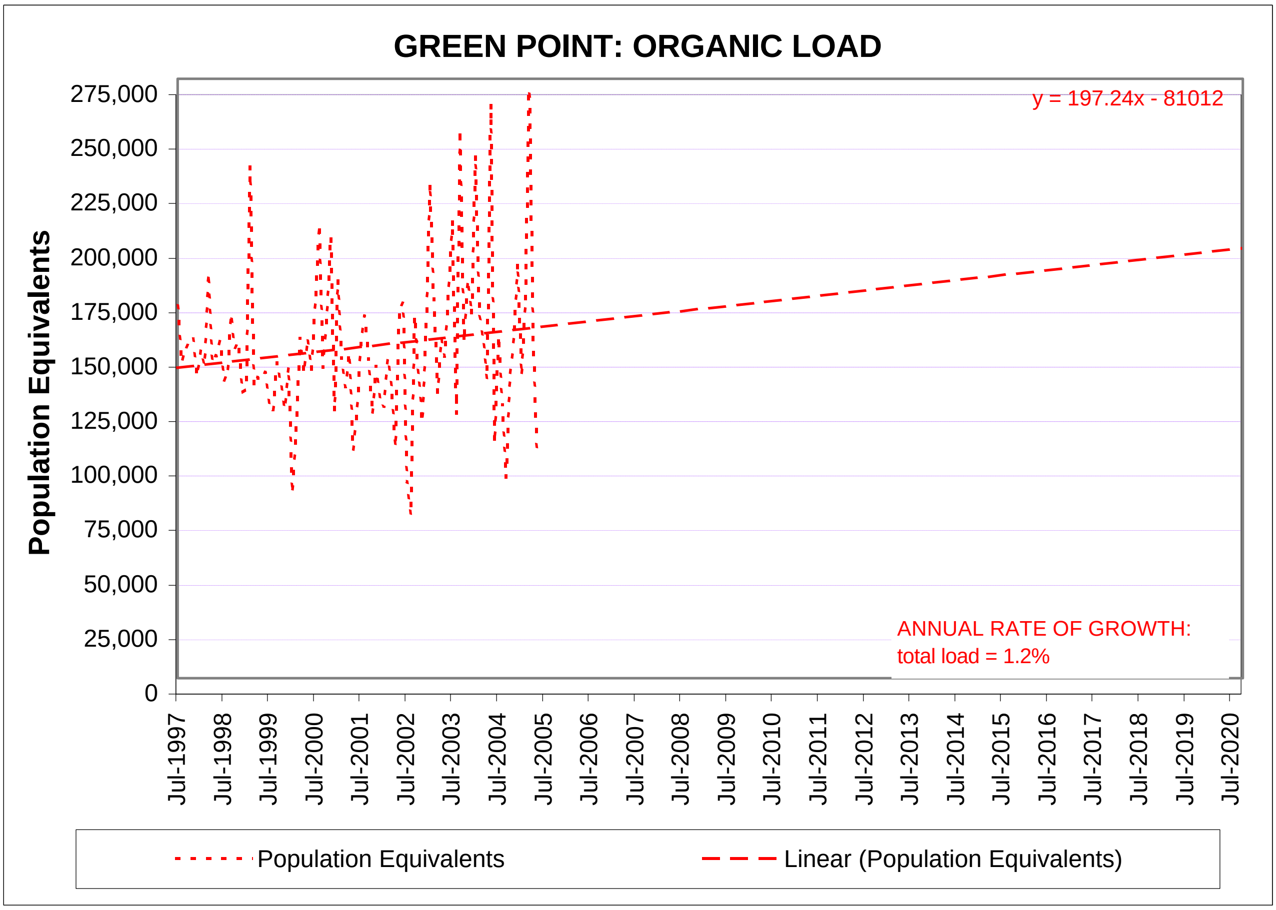
GORDONS BAY WASTEWATER TREATMENT WORKS



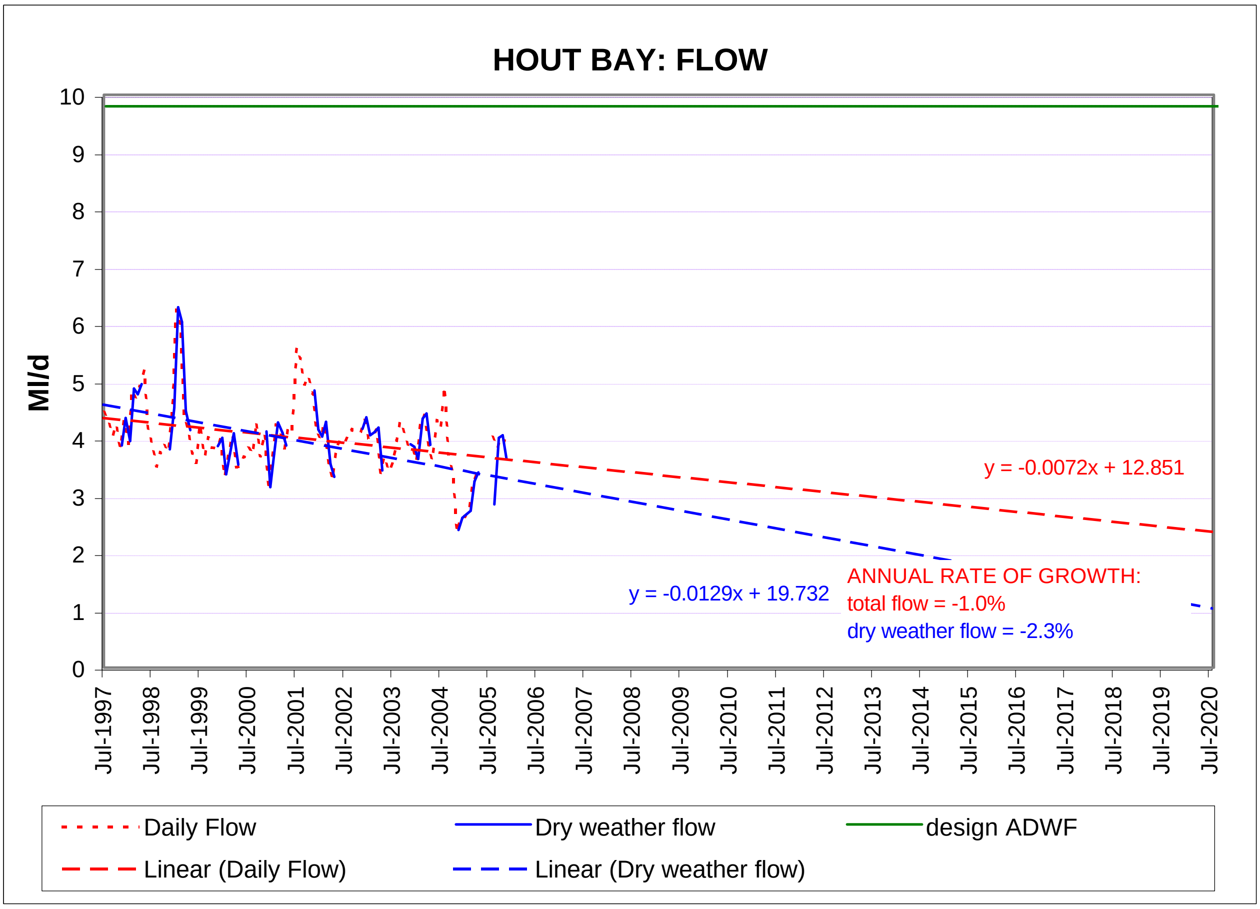


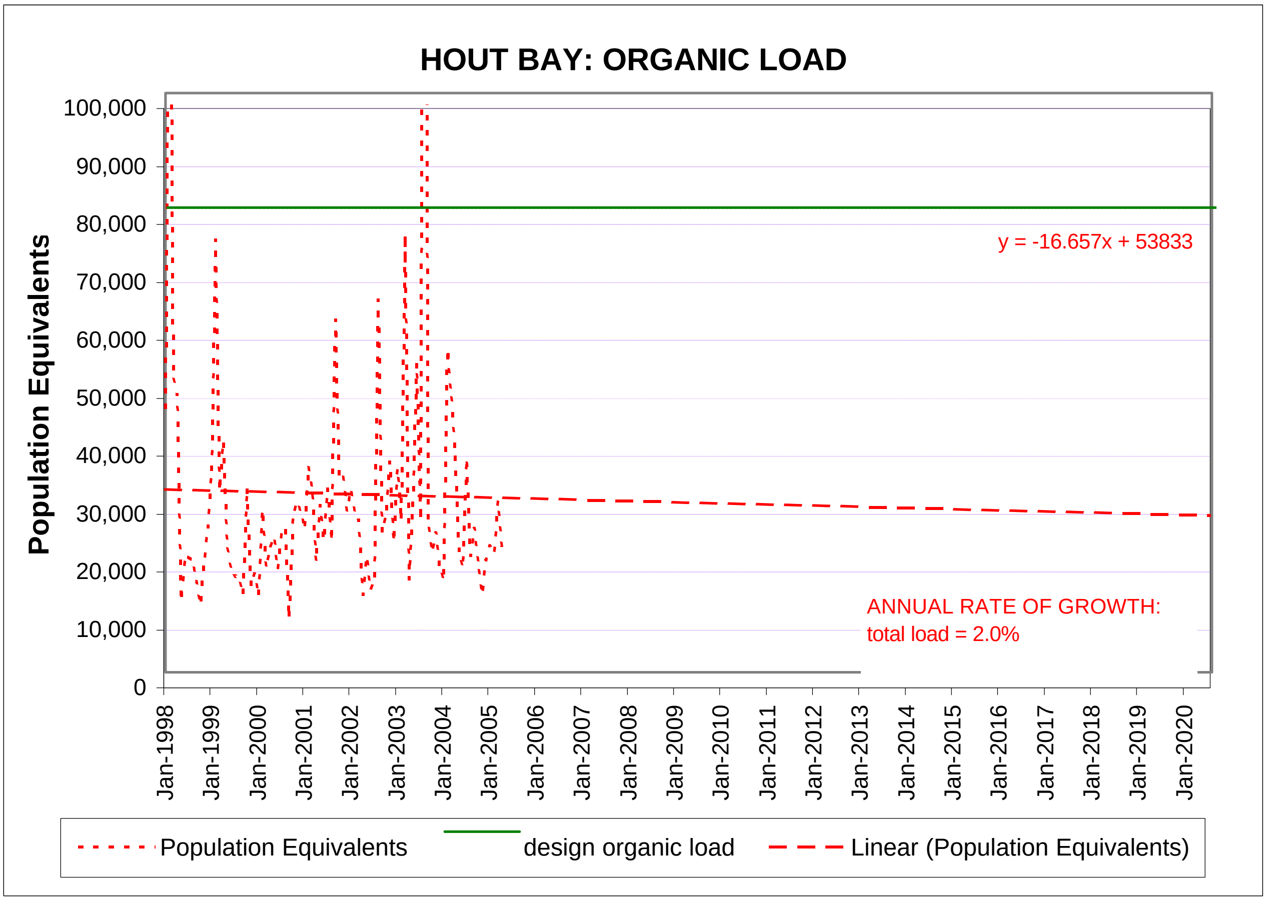
GREEN POINT SEA OUTFALL: FLOW & LOAD



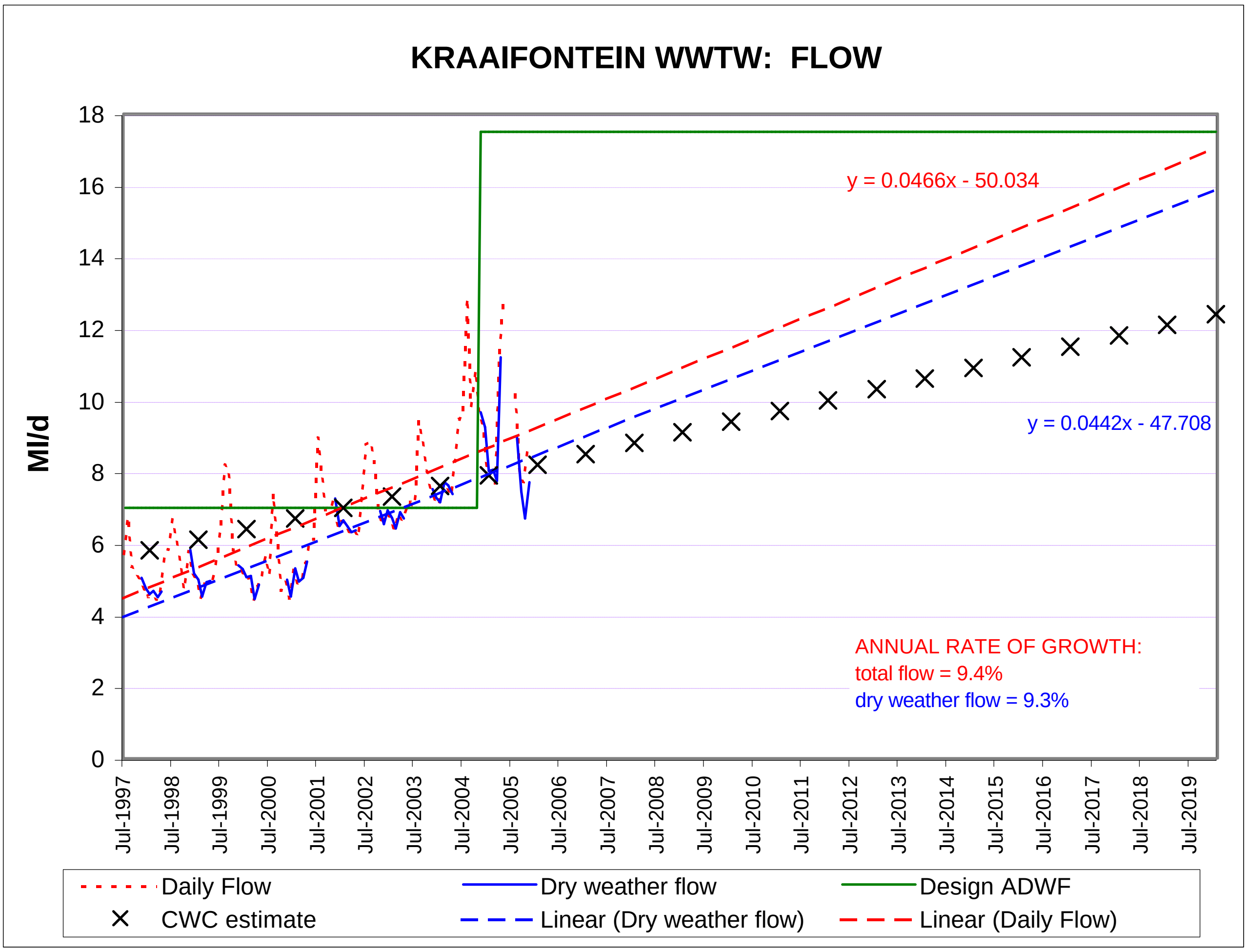


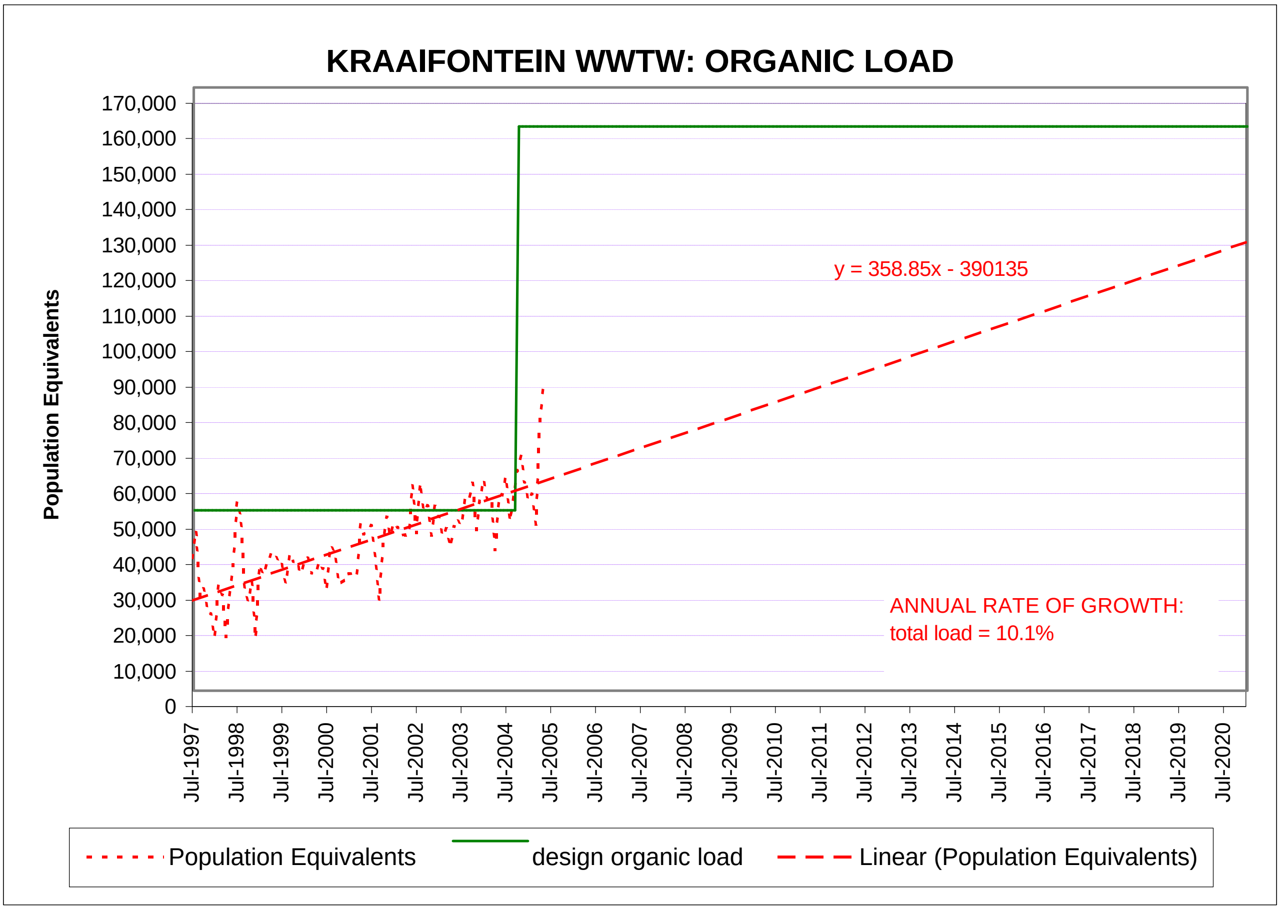
HOUT BAY SEA OUTFALL



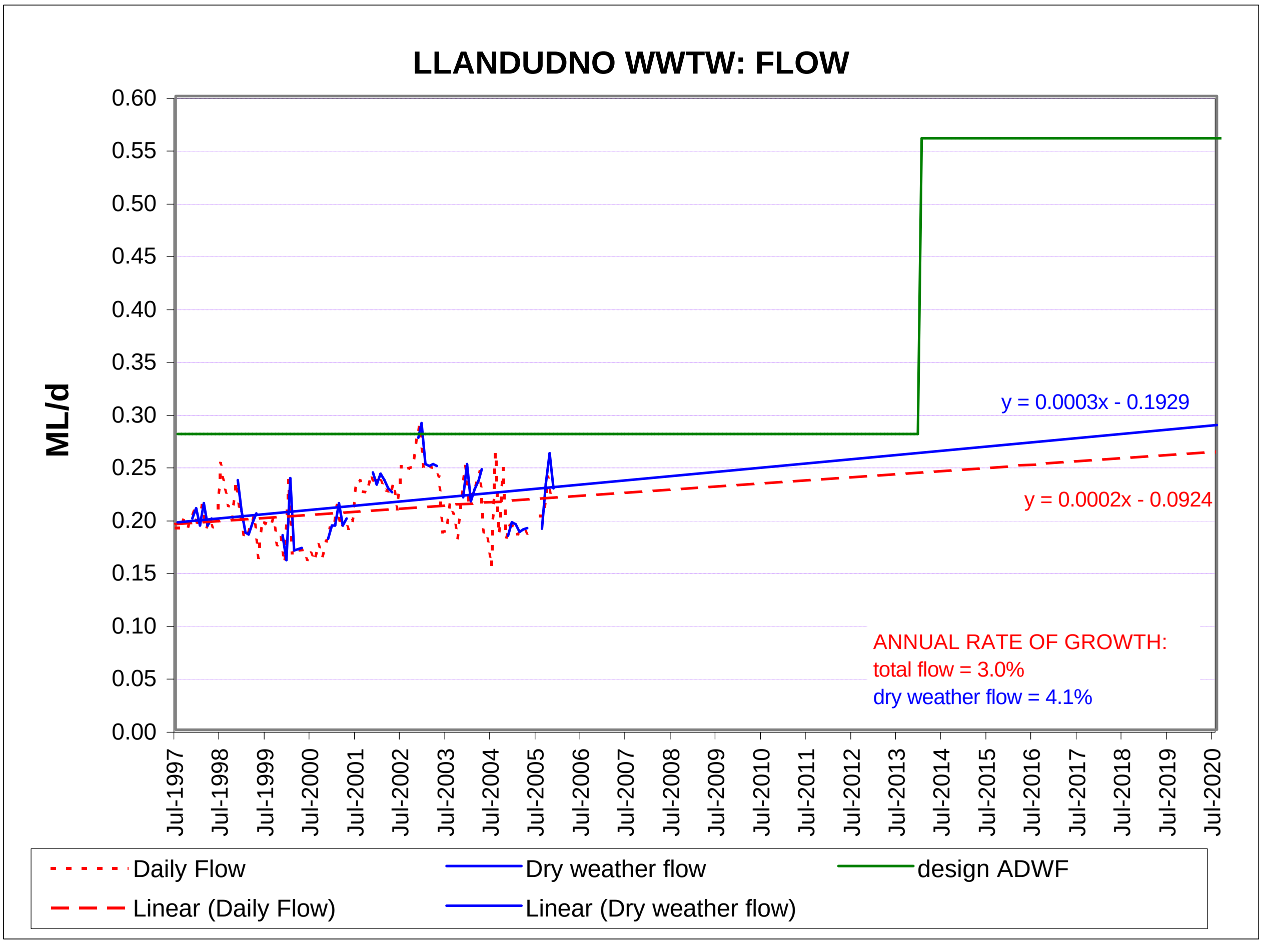


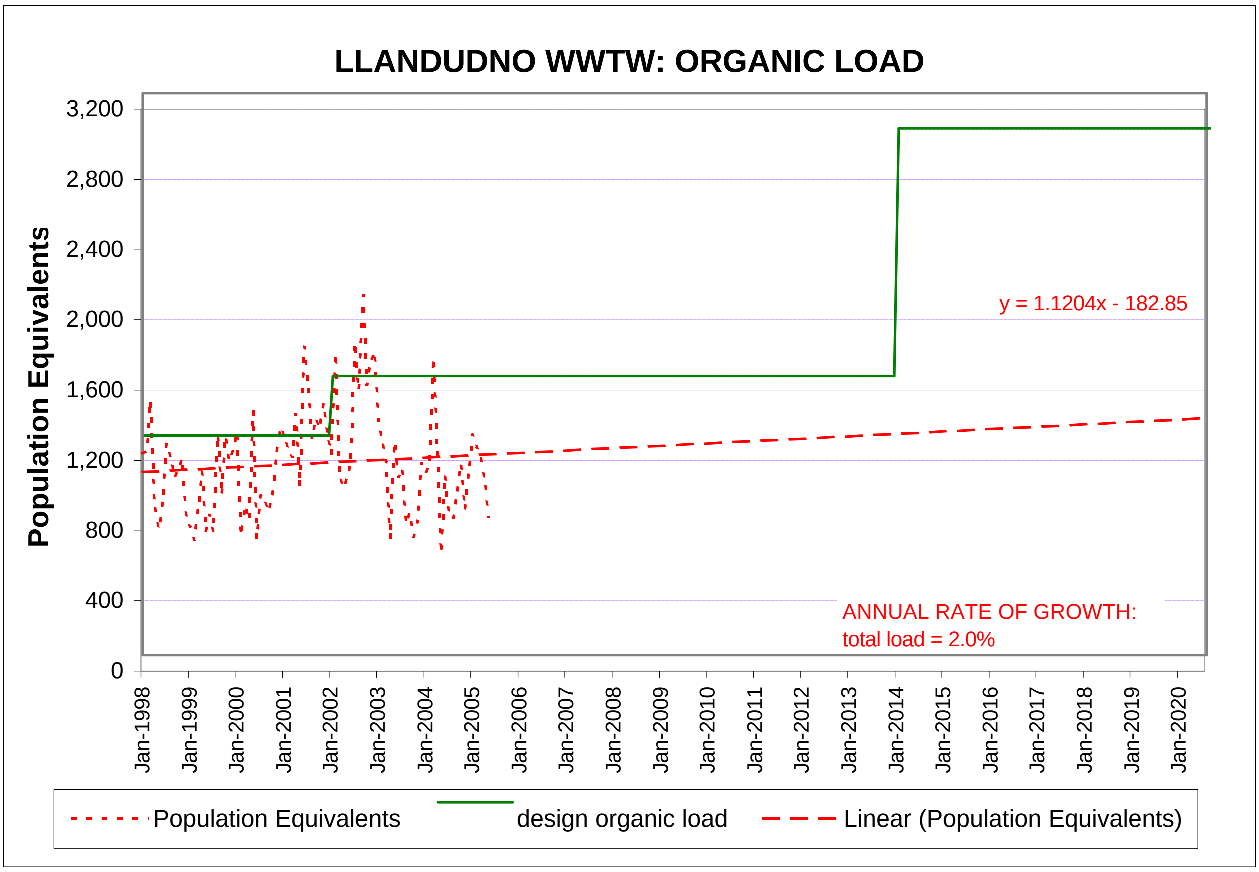
KRAAIFONTEIN WASTEWATER TREATMENT WORKS



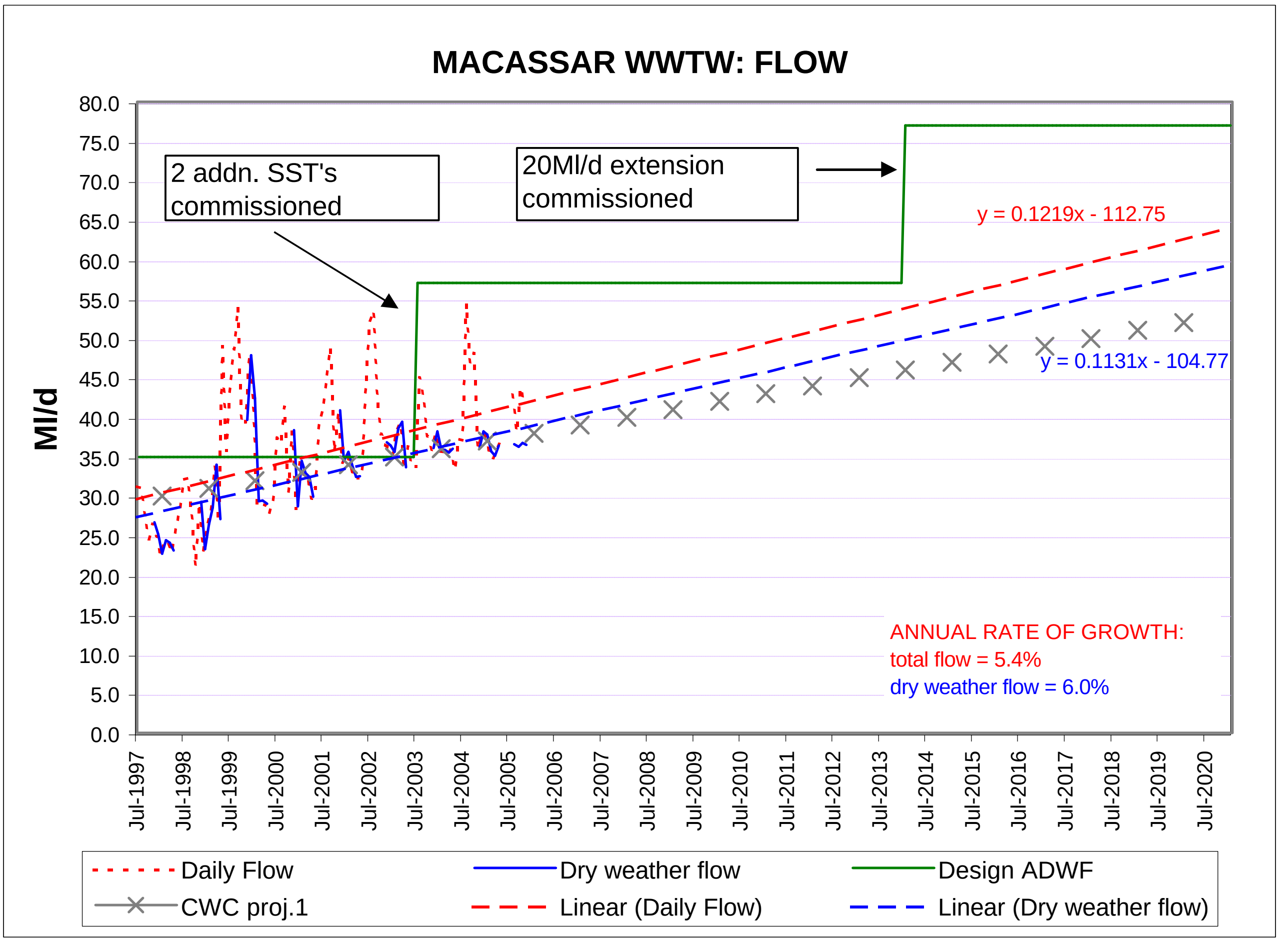


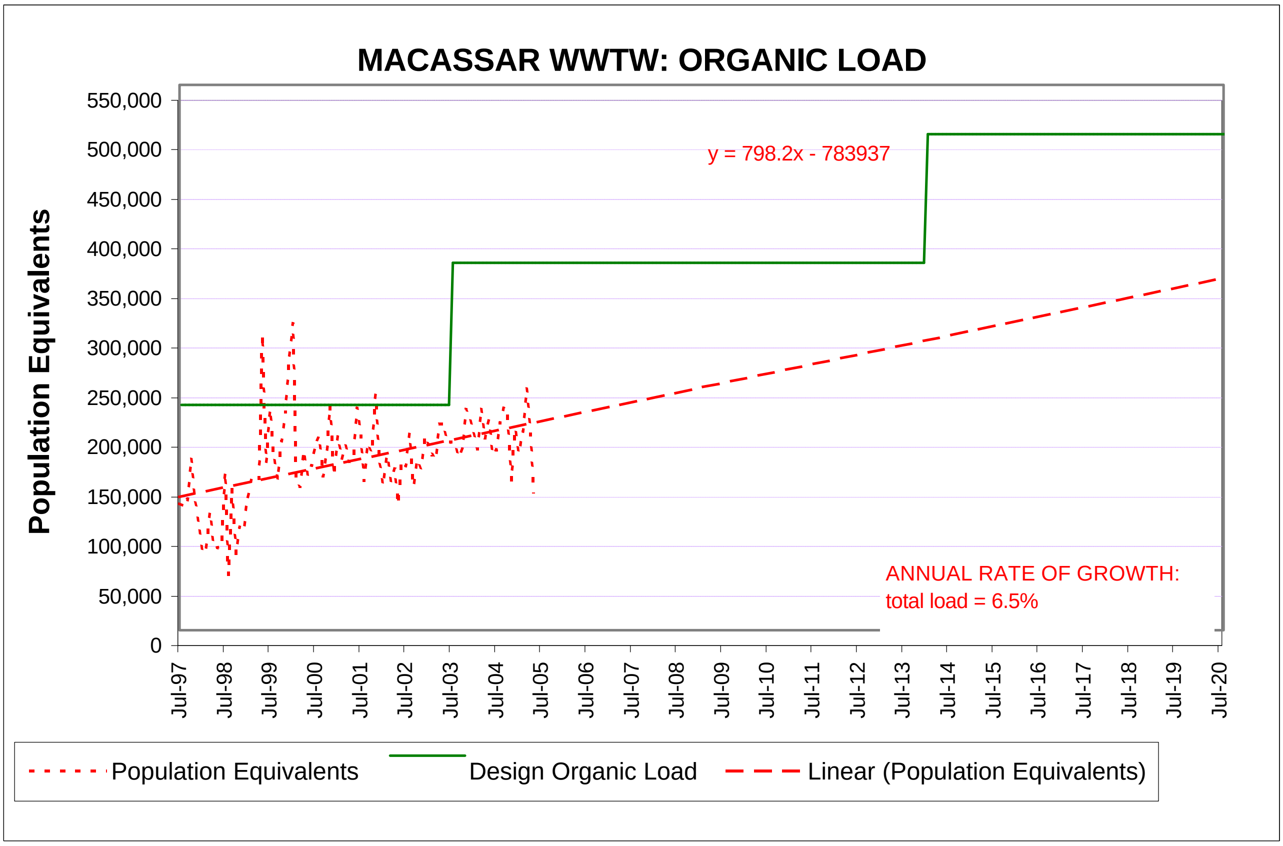
LLANDUDNO WASTEWATER TREATMENT WORKS



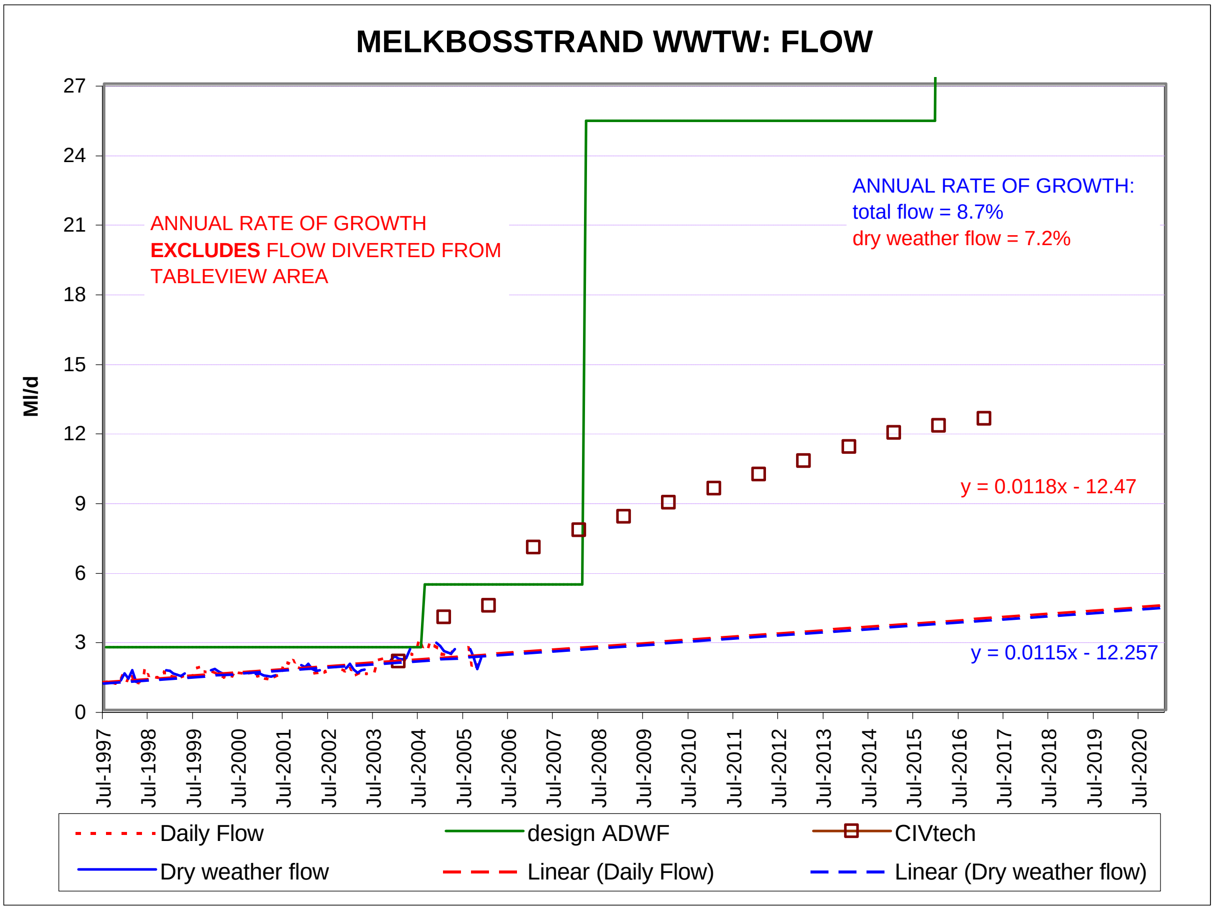


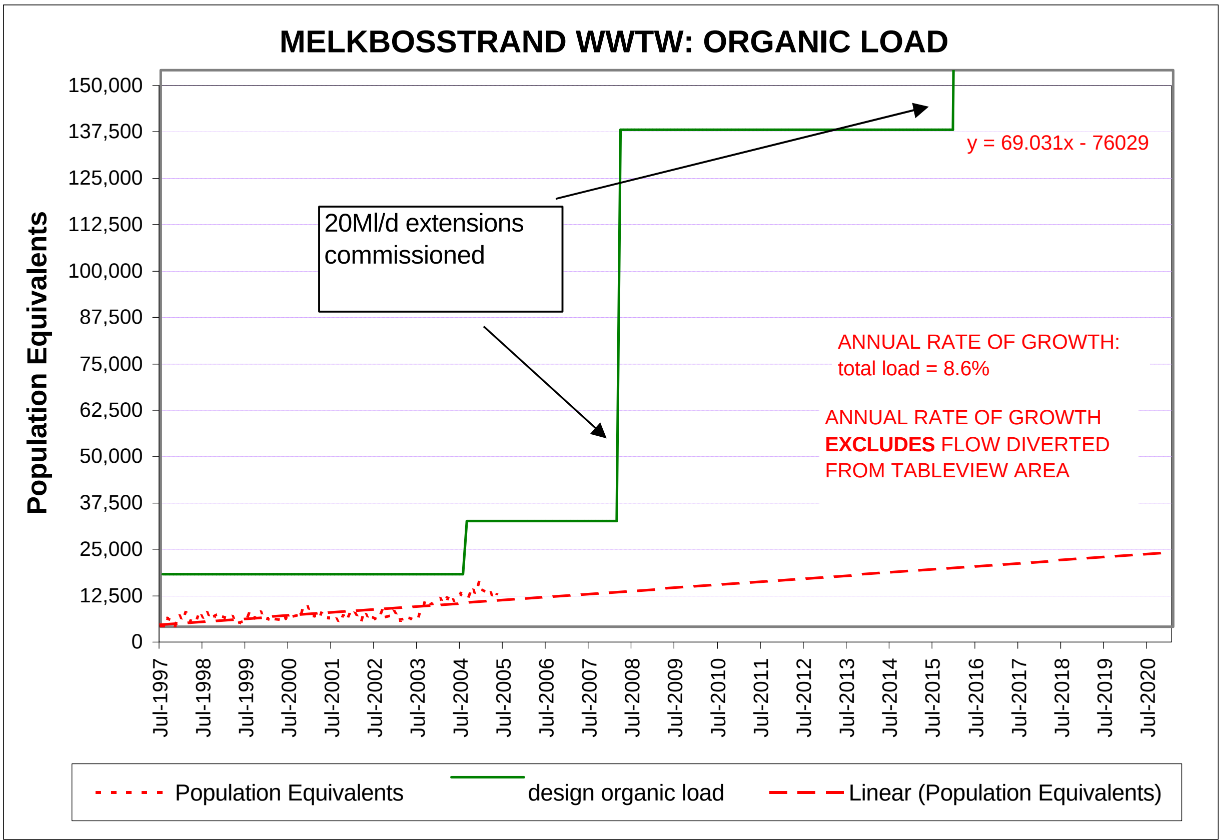
MACASSAR WASTEWATER TREATMENT WORKS



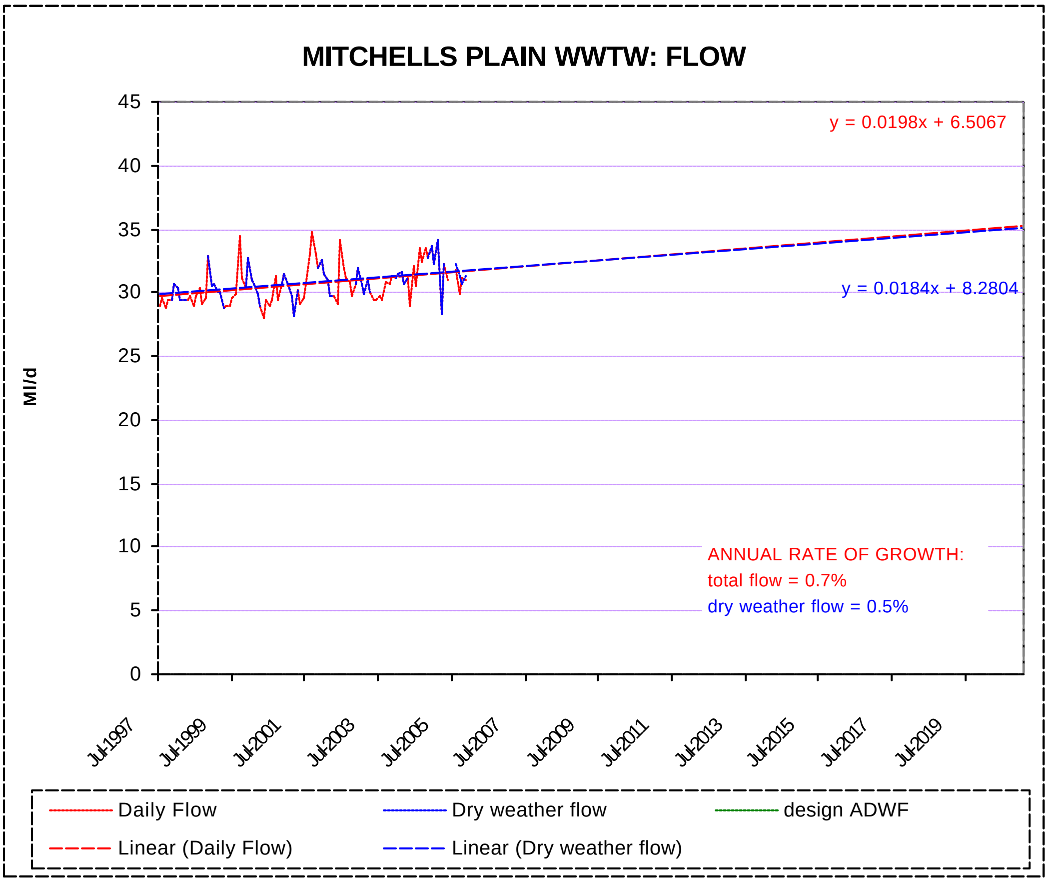


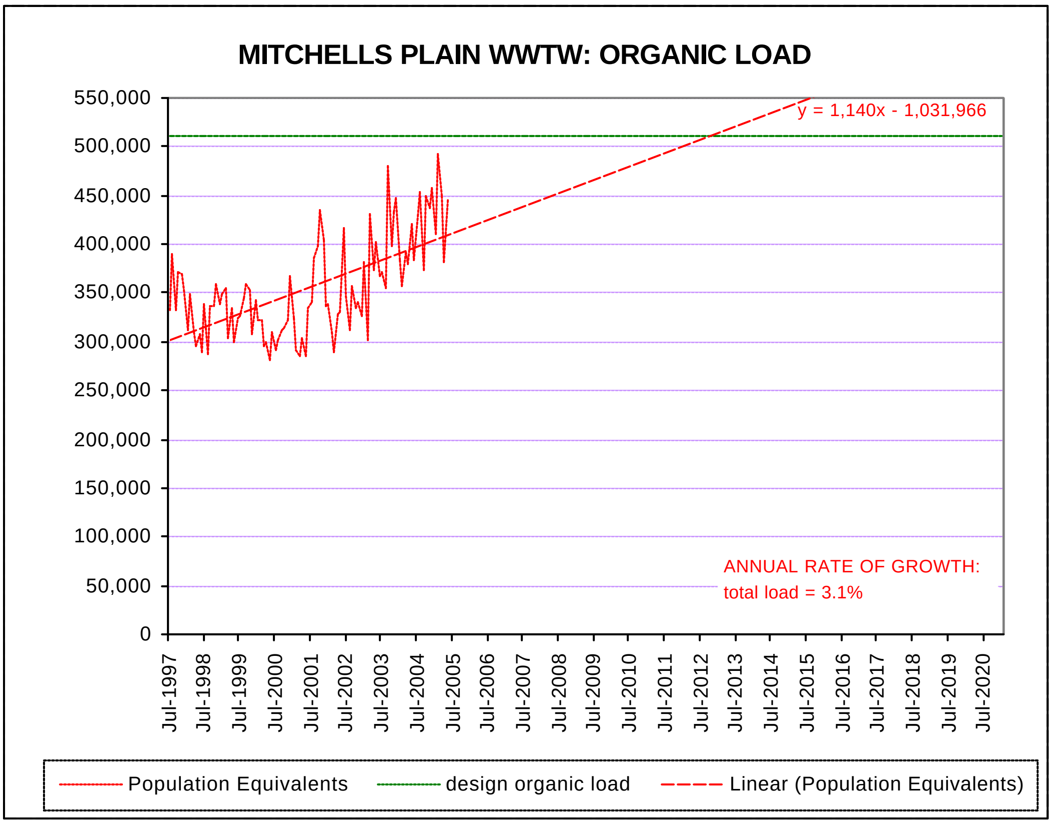
MELKBOSSTRAND WASTEWATER TREATMENT WORKS



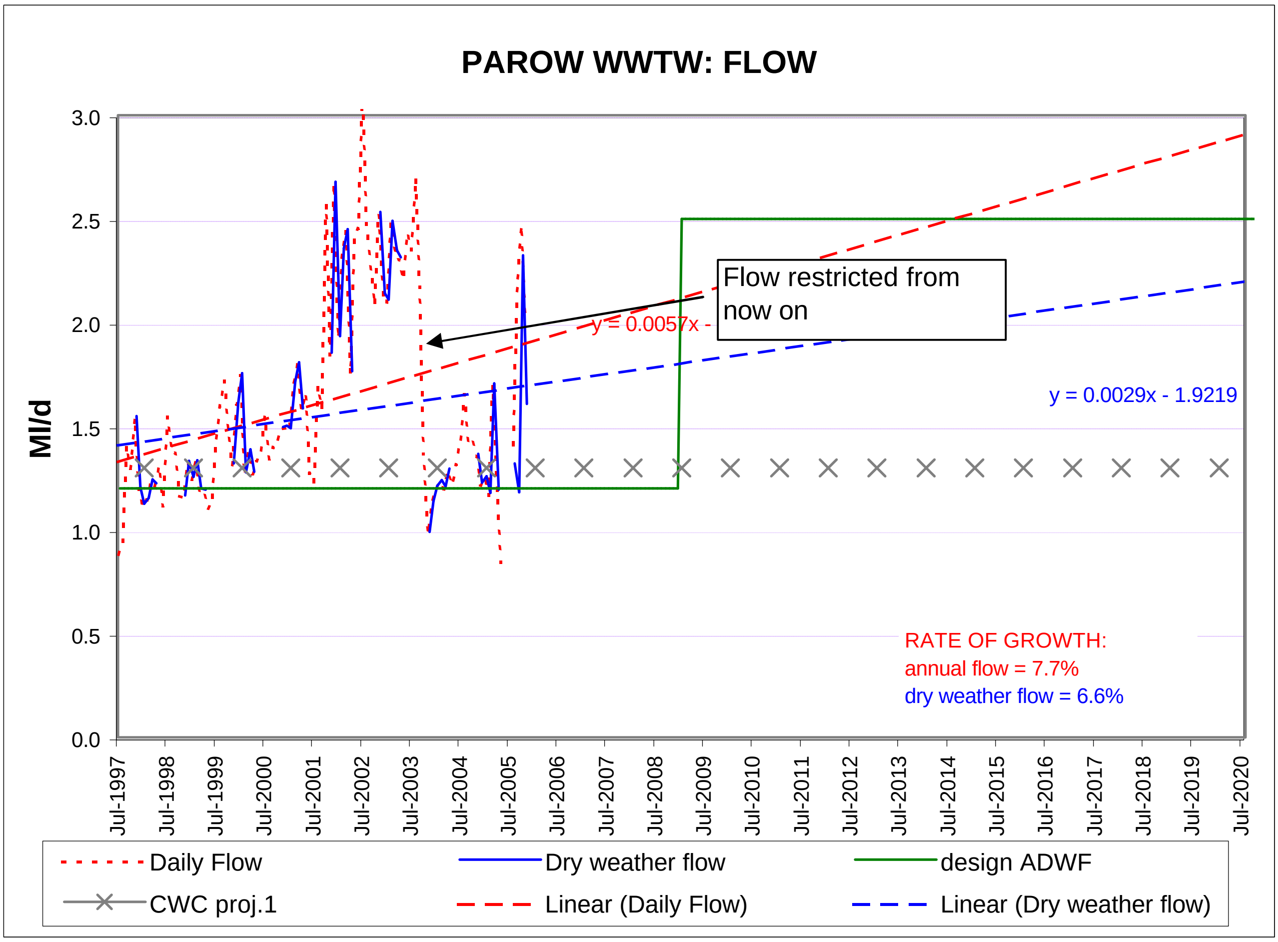


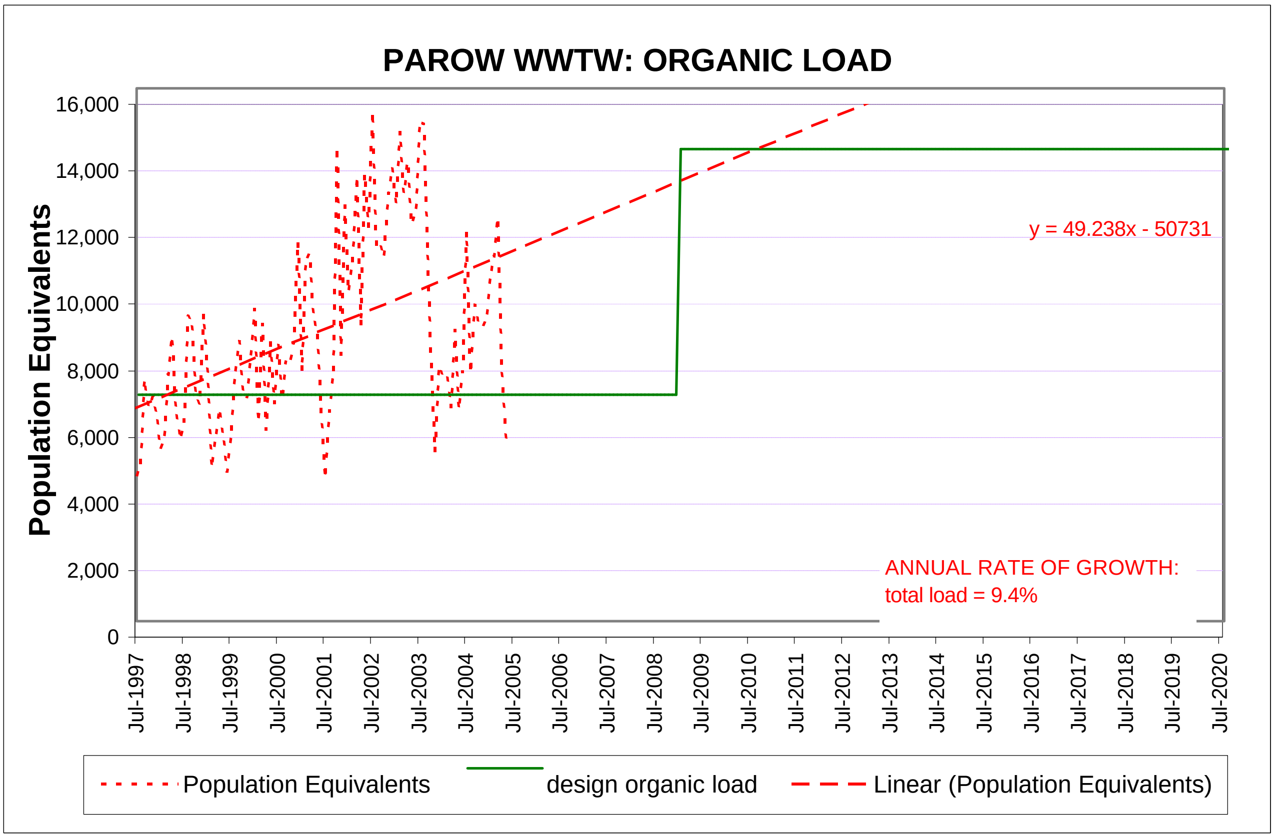
MITCHELLS PLAIN WASTEWATER TREATMENT WORKS



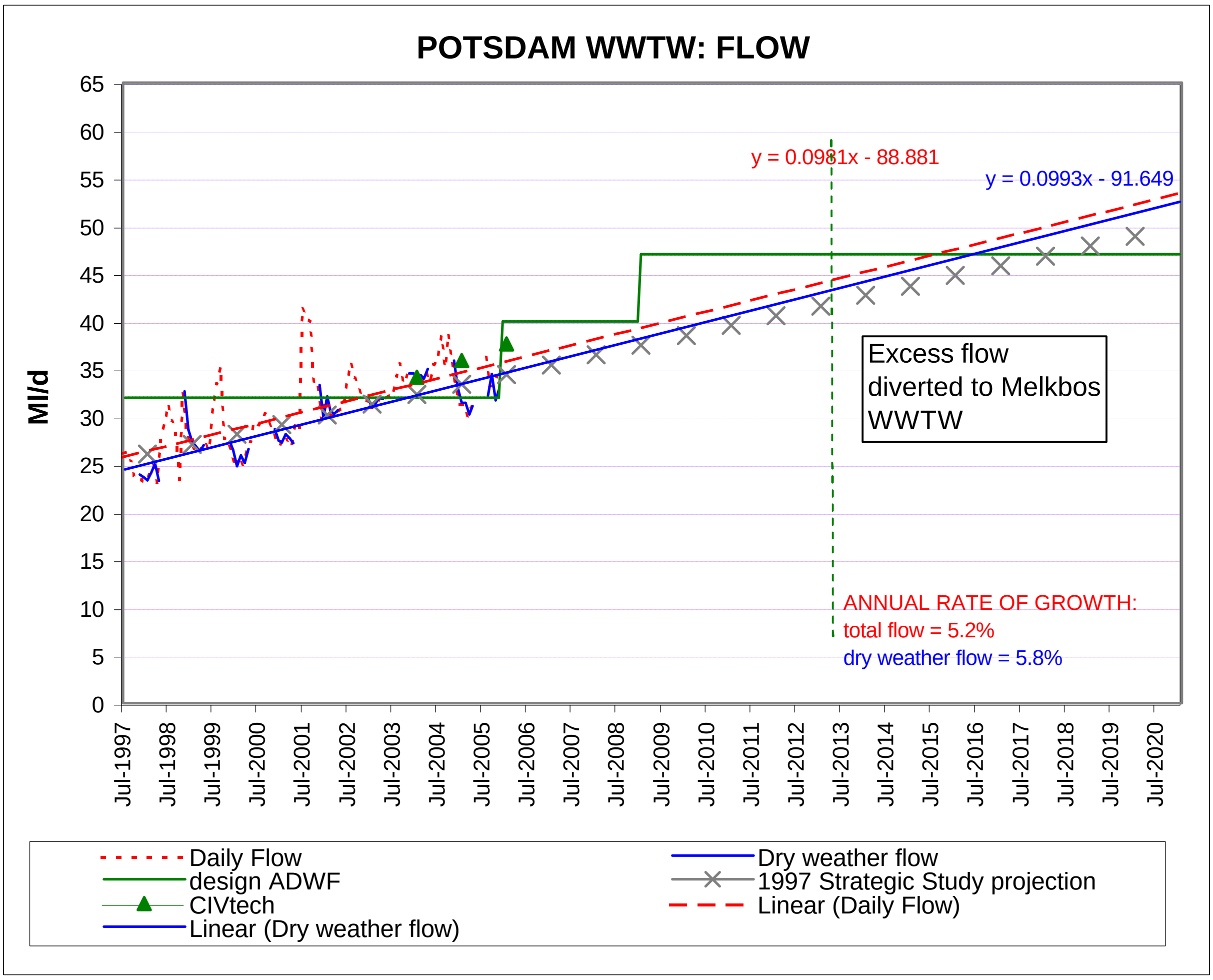


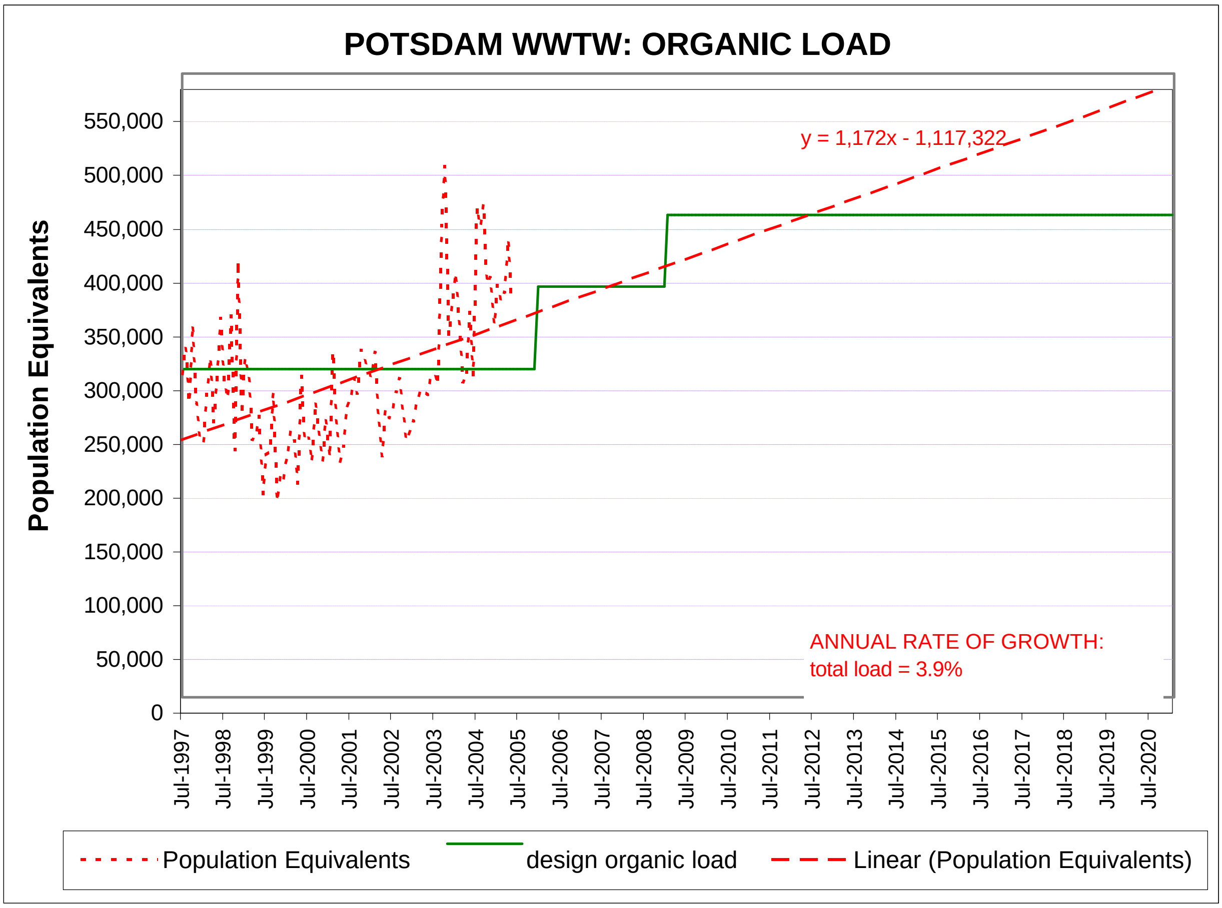
PAROW WASTEWATER TREATMENT WORKS

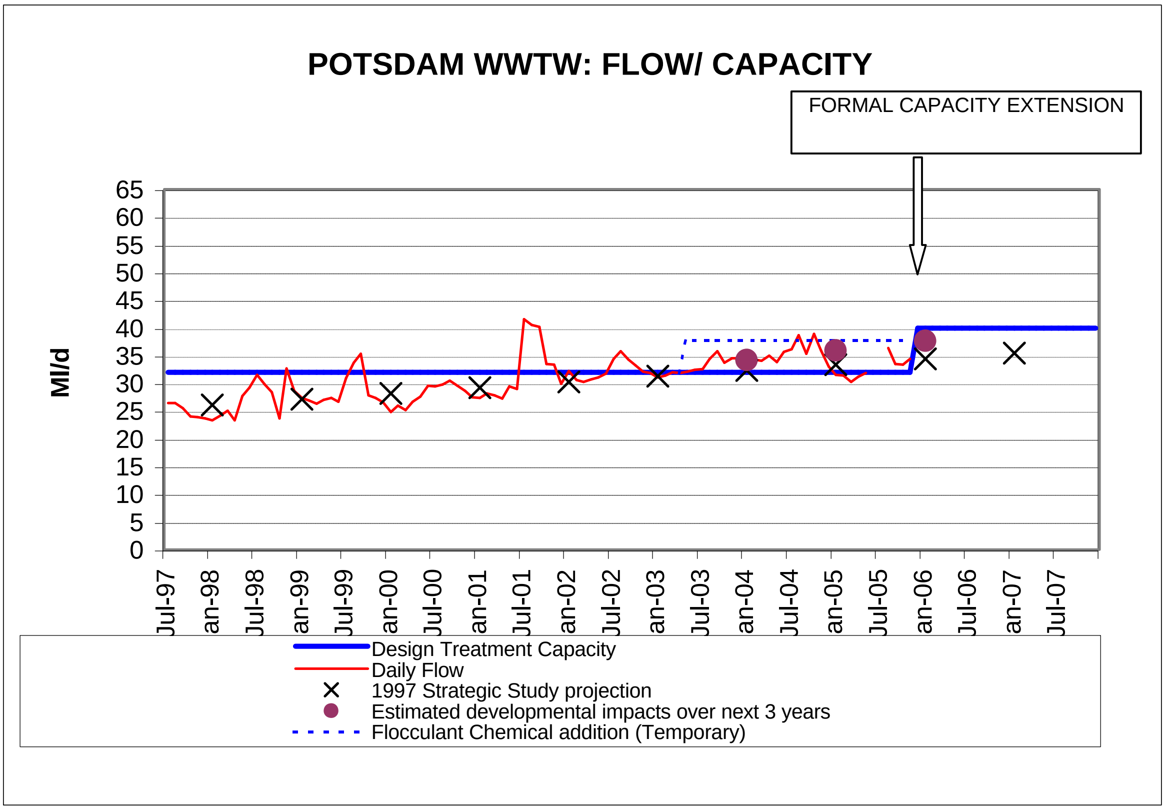




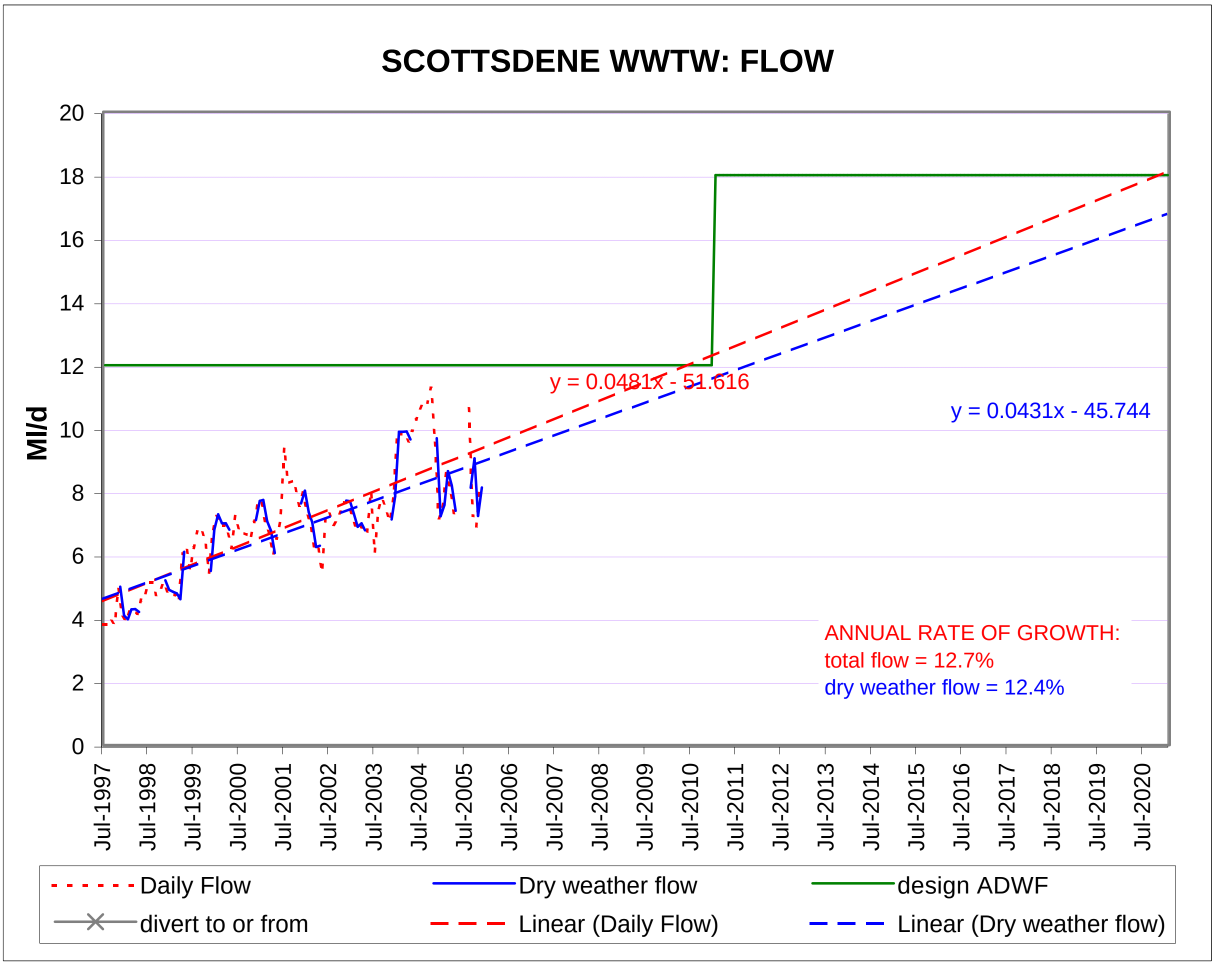
POTSDAM WASTEWATER TREATMENT WORKS

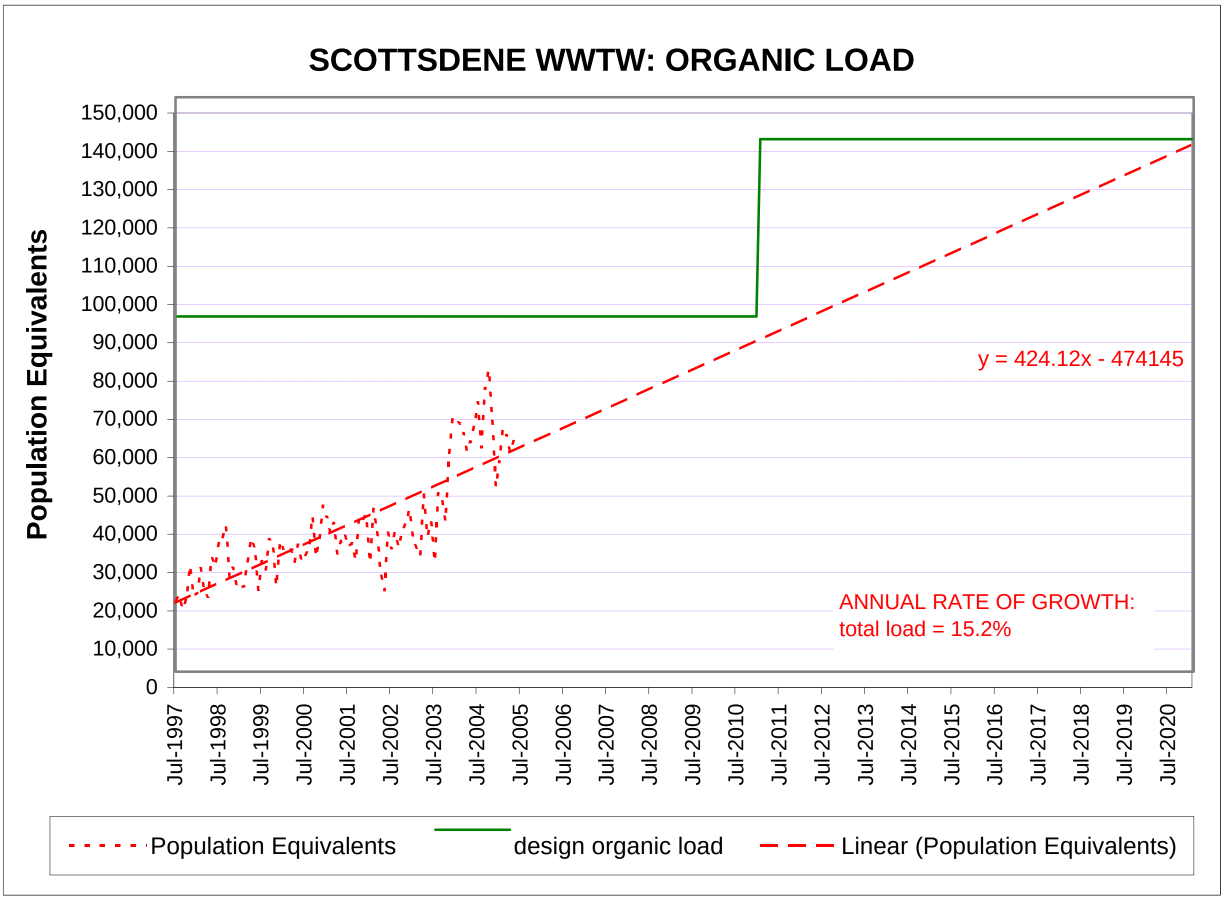




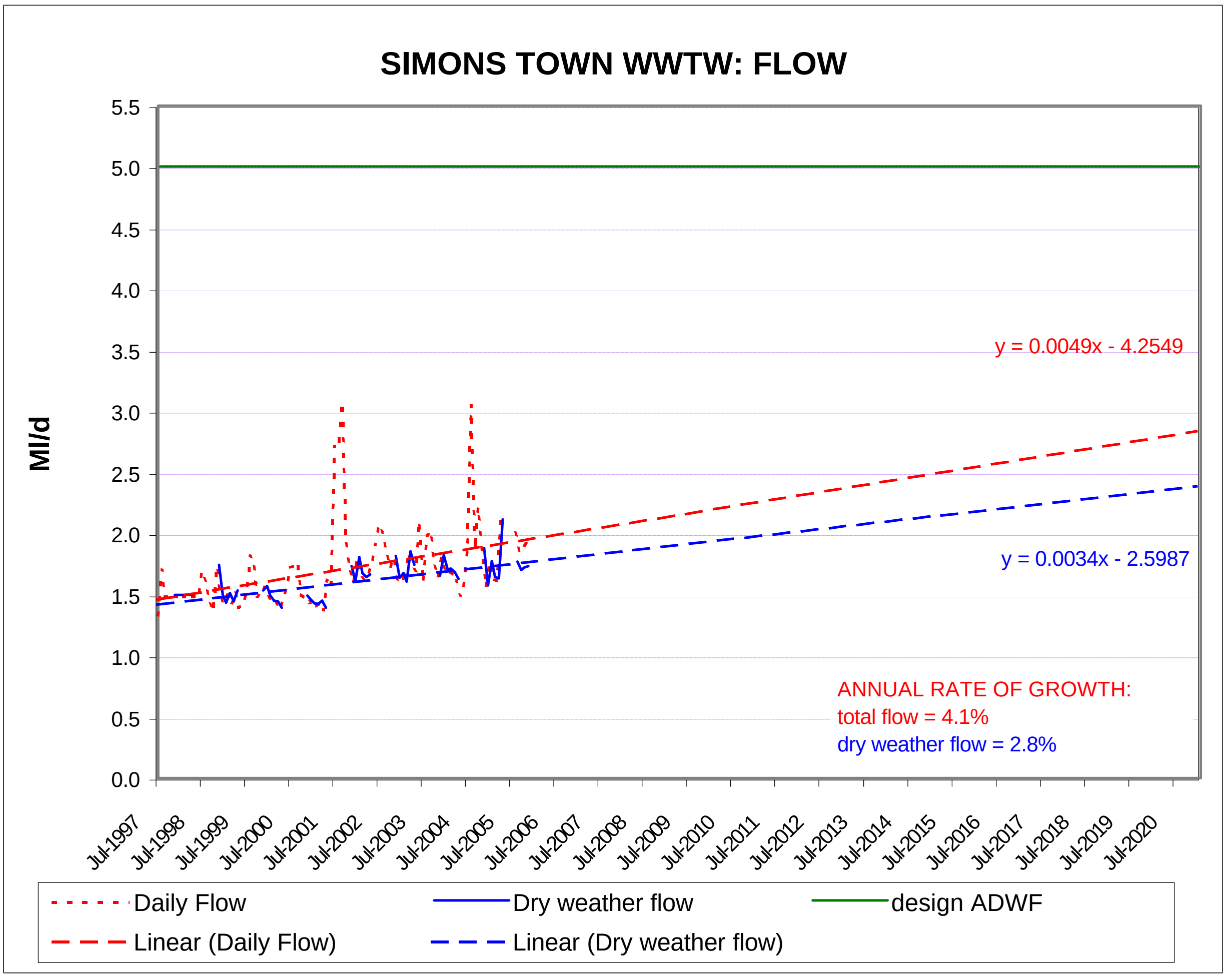

POTSDAM WWTW: FLOW/ CAPACITY
FORMAL CAPACITY EXTENSION
Ml/d
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Jul-97
an-98
Jul-98
an-99
Jul-99
an-00
Jul-00
an-01
Jul-01
an-02
Jul-02
an-03
Jul-03
an-04
Jul-04
an-05
Jul-05
an-06
Jul-06
an-07
Jul-07
Design Treatment Capacity
Daily Flow
1997 Strategic Study projection
Estimated developmental impacts over next 3 years
Flocculant Chemical addition (Temporary)

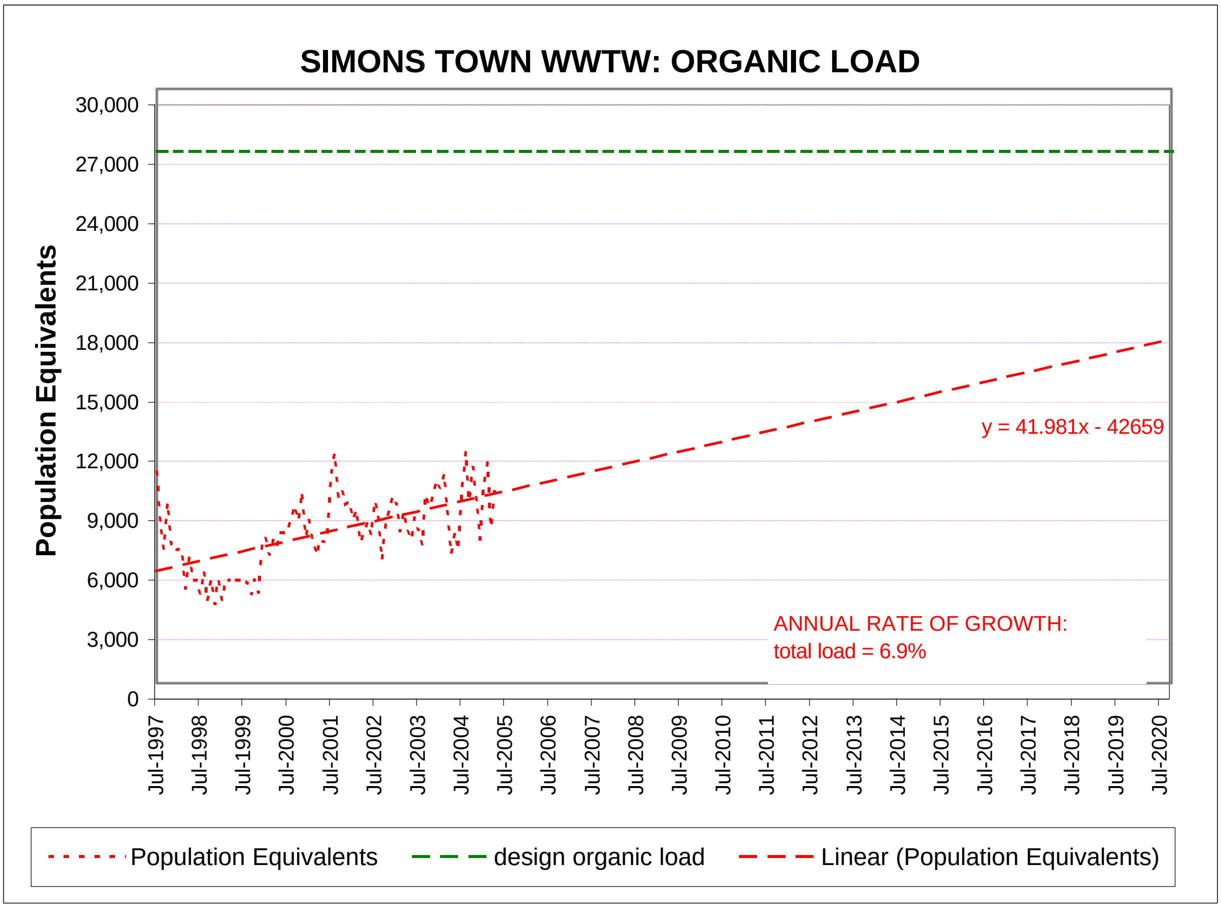
SCOTTSDENE WASTEWATER TREATMENT WORKS



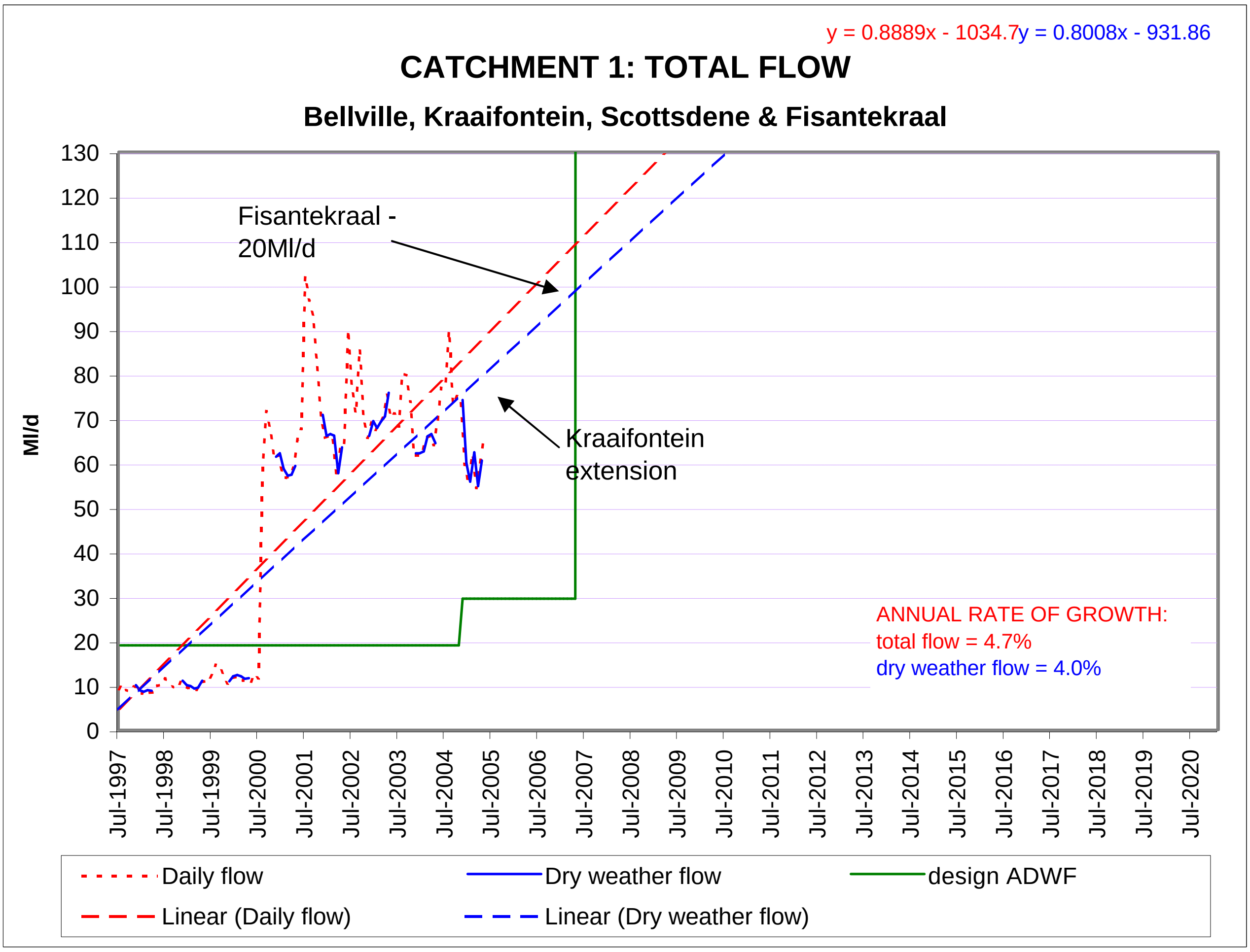


SIMONS TOWN WASTEWATER TREATMENT WORKS

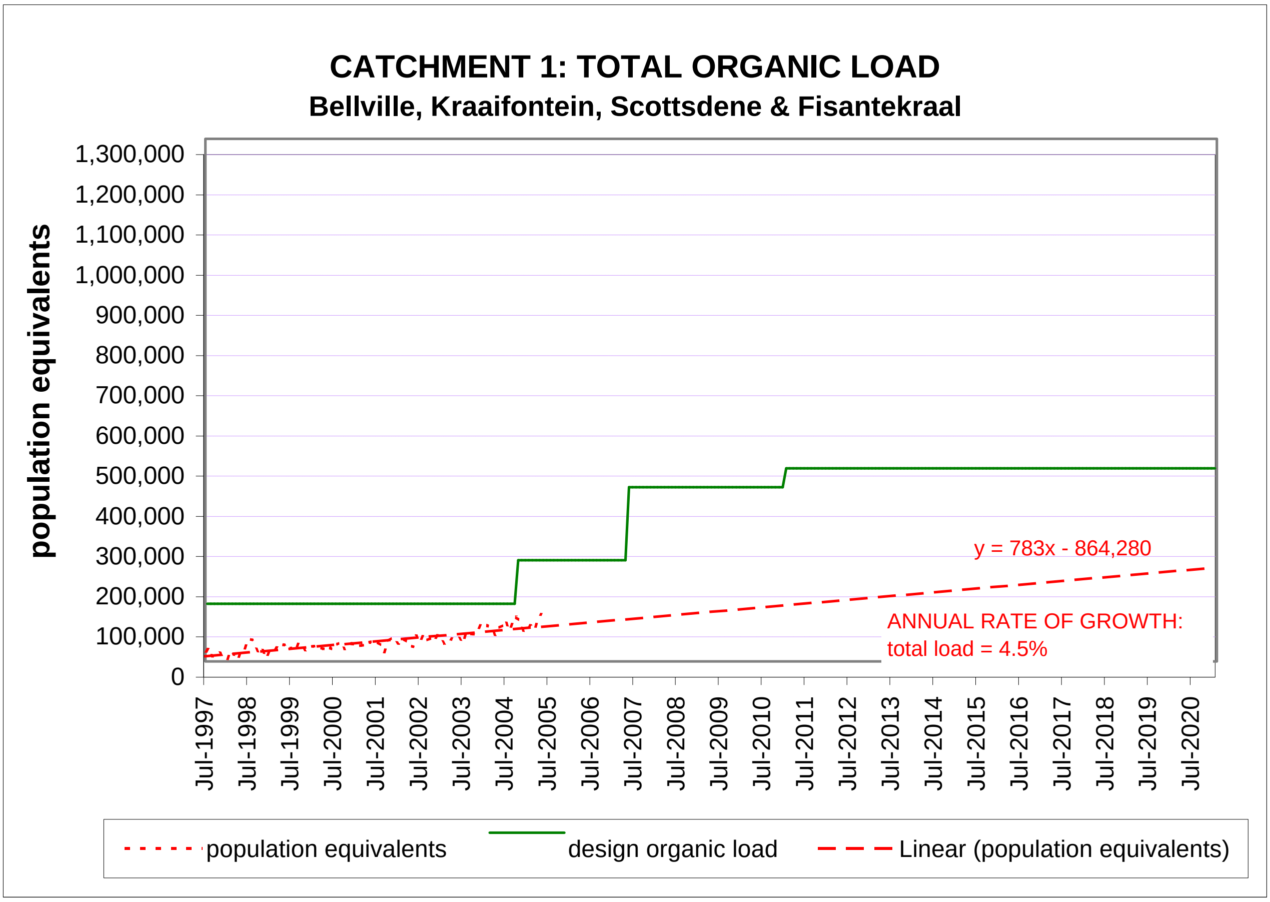




CATCHMENT 1

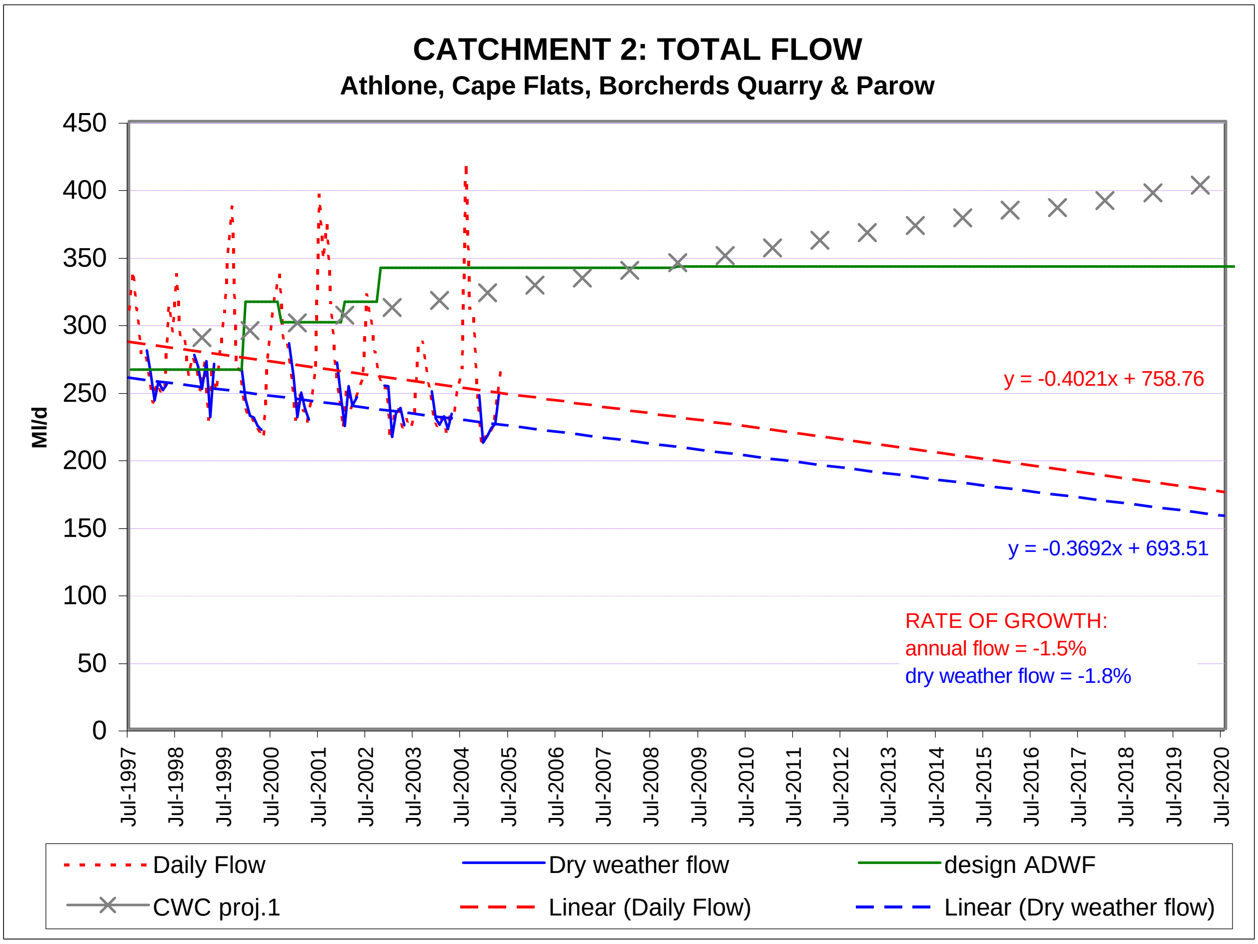


y = 0.8889x - 1034.7y = 0.8008x - 931.86
CATCHMENT 1: TOTAL FLOW
Bellville, Kraaifontein, Scottsdene & Fisantekraal
Ml/d
Fisantekraal - 20Ml/d
Kraaifontein extension
ANNUAL RATE OF GROWTH:
total flow = 4.7%
dry weather flow = 4.0%
Daily flow
Dry weather flow
design ADWF
Linear (Daily flow)
Linear (Dry weather flow)

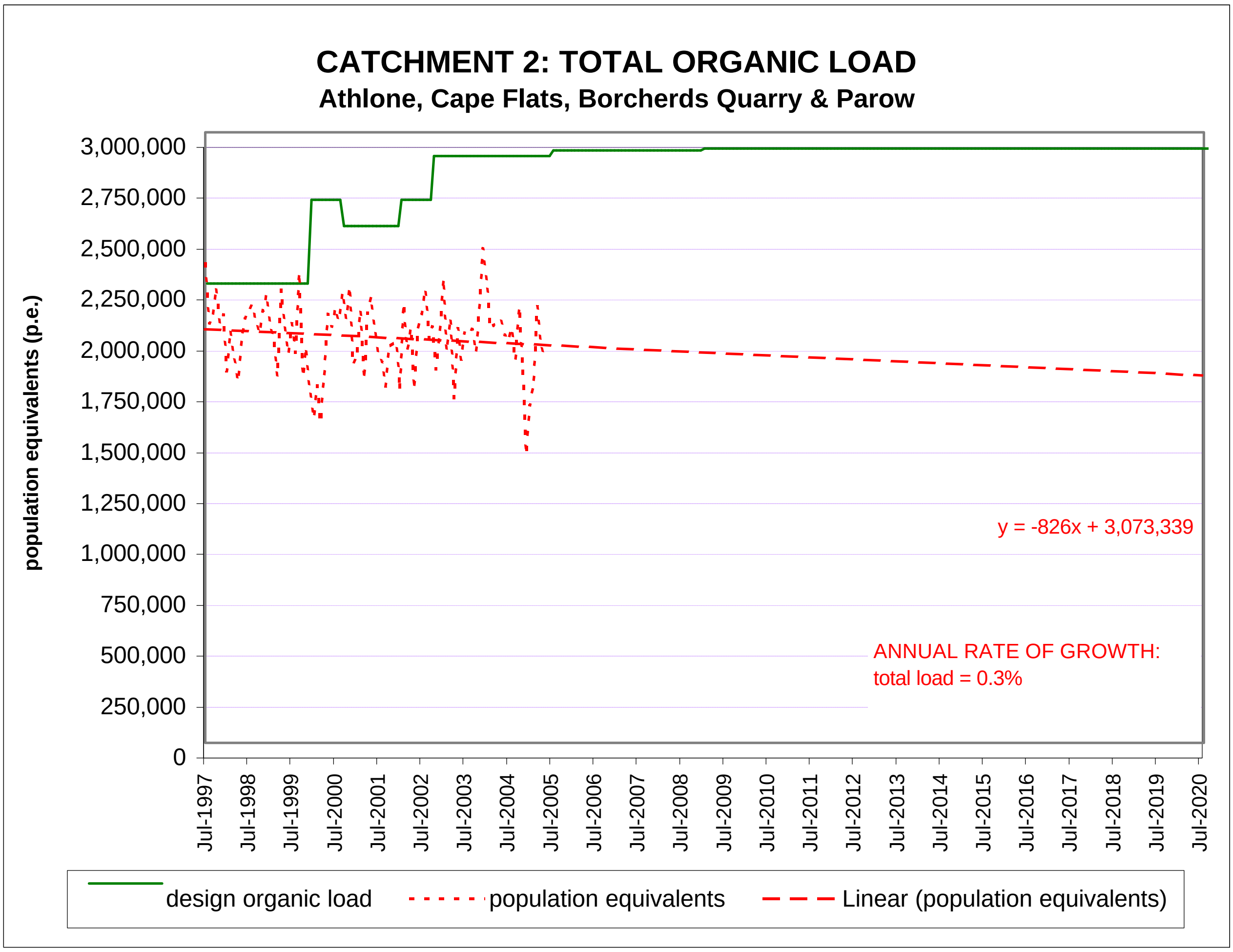


CATCHMENT 1: TOTAL ORGANIC LOAD
Bellville, Kraaifontein, Scottsdene & Fisantekraal
population equivalents
y = 783x - 864,280
ANNUAL RATE OF GROWTH:
total load = 4.5%
population equivalents
design organic load
Linear (population equivalents)

CATCHMENT 2

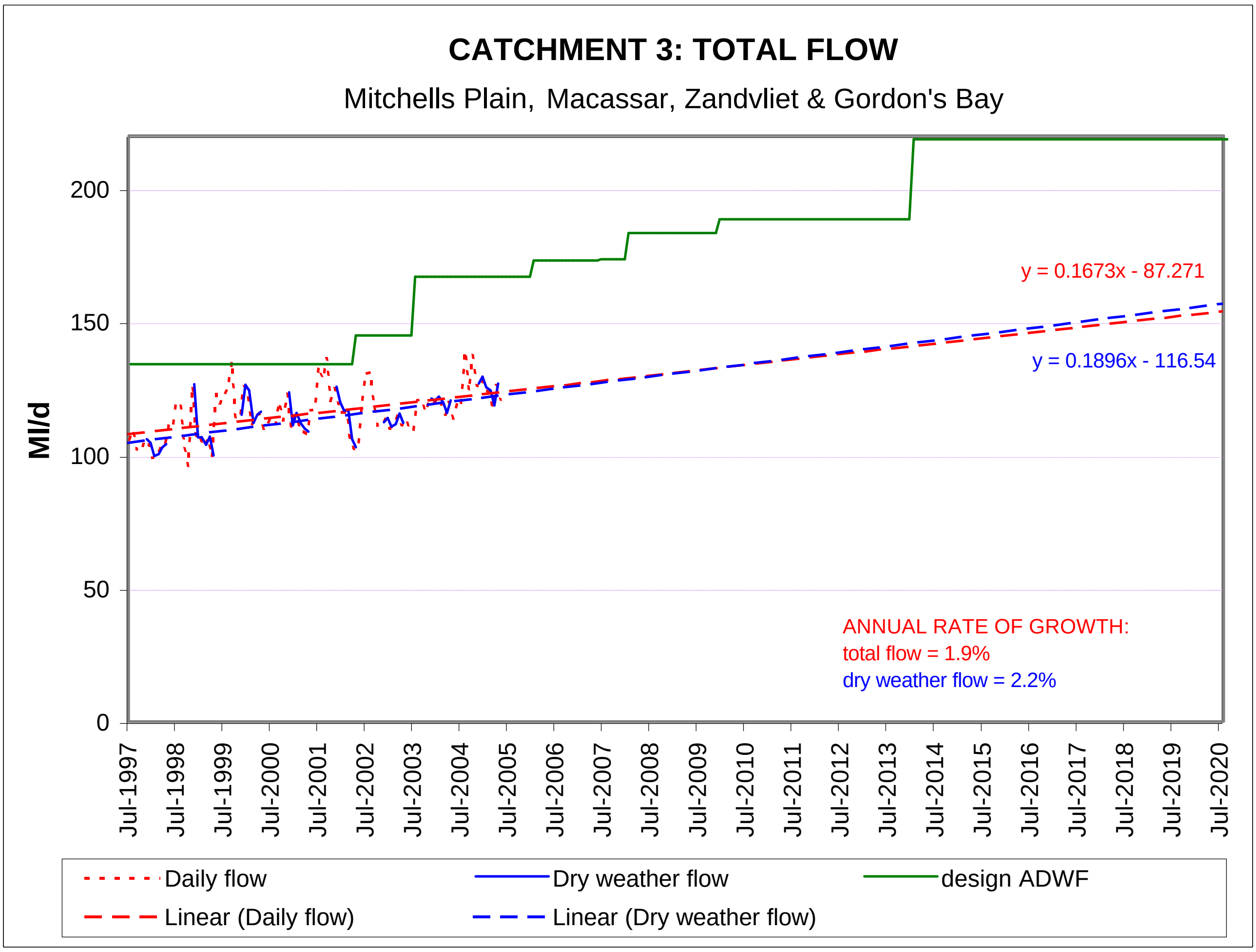


CATCHMENT 2: TOTAL FLOW
Athlone, Cape Flats, Borcherds Quarry & Parow
Ml/d
450
400
350
300
250
200
150
100
50
0
y = -0.4021x + 758.76
y = -0.3692x + 693.51
RATE OF GROWTH:
annual flow = -1.5%
dry weather flow = -1.8%
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
Jul-2003
Jul-2004
Jul-2005
Jul-2006
Jul-2007
Jul-2008
Jul-2009
Jul-2010
Jul-2011
Jul-2012
Jul-2013
Jul-2014
Jul-2015
Jul-2016
Jul-2017
Jul-2018
Jul-2019
Jul-2020
Daily Flow
Dry weather flow
design ADWF
CWC proj.1
Linear (Daily Flow)
Linear (Dry weather flow)

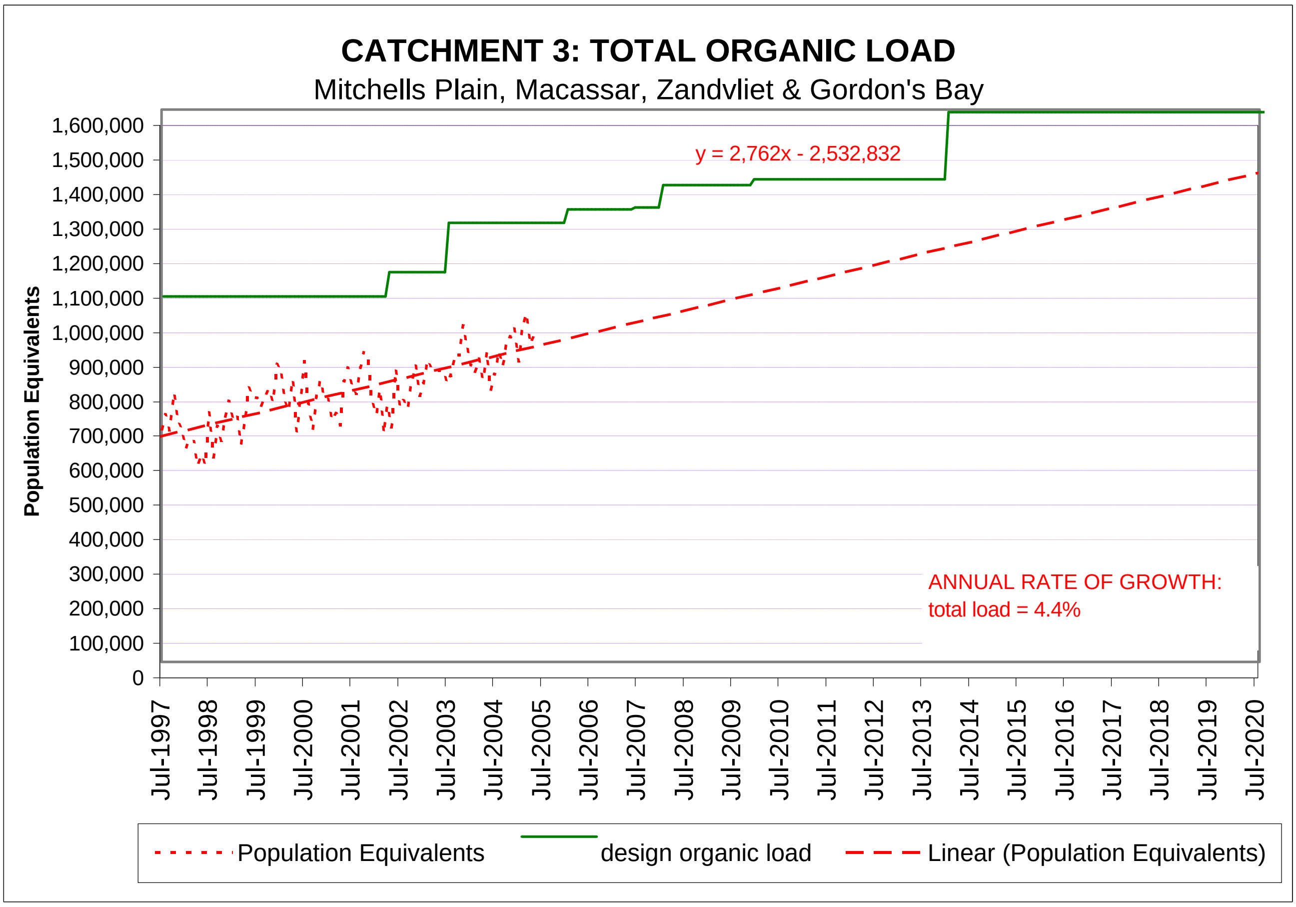


CATCHMENT 2: TOTAL ORGANIC LOAD
Athlone, Cape Flats, Borcherds Quarry & Parow
population equivalents (p.e.)
3,000,000
2,750,000
2,500,000
2,250,000
2,000,000
1,750,000
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
y = -826x + 3,073,339
ANNUAL RATE OF GROWTH:
total load = 0.3%
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
Jul-2003
Jul-2004
Jul-2005
Jul-2006
Jul-2007
Jul-2008
Jul-2009
Jul-2010
Jul-2011
Jul-2012
Jul-2013
Jul-2014
Jul-2015
Jul-2016
Jul-2017
Jul-2018
Jul-2019
Jul-2020
design organic load
population equivalents
Linear (population equivalents)

CATCHMENT 3

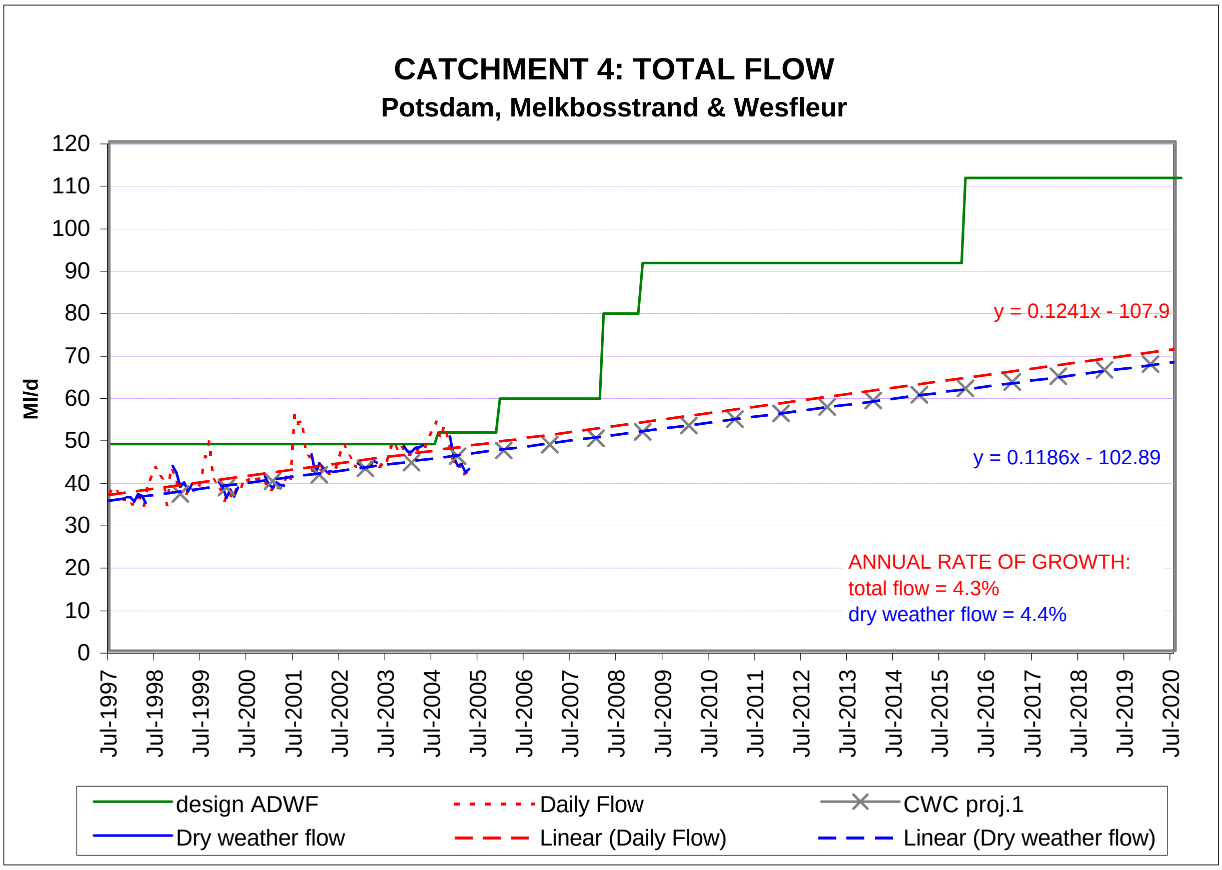


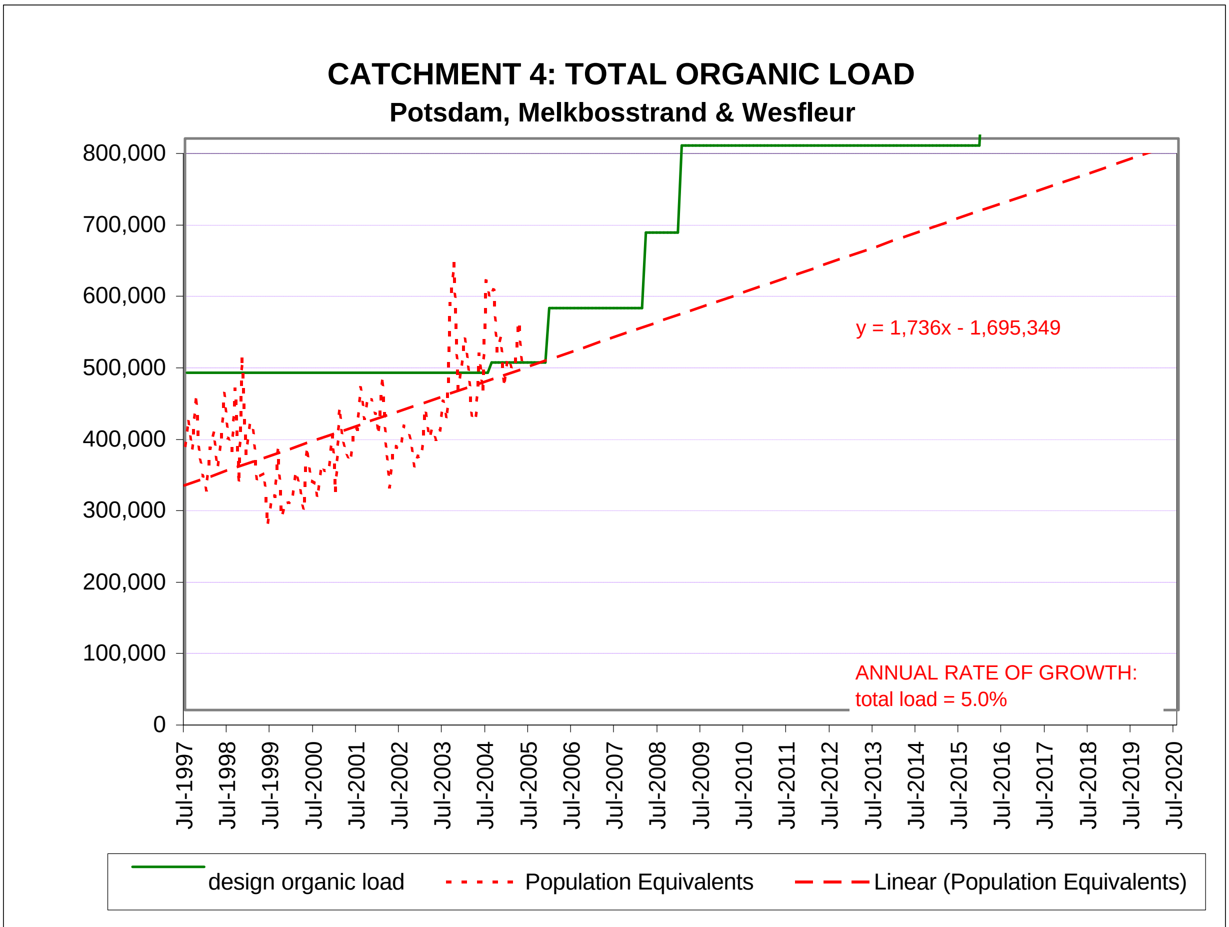
CATCHMENT 3: TOTAL FLOW
Mitchells Plain, Macassar, Zandvliet & Gordon's Bay
Ml/d
y = 0.1673x - 87.271
y = 0.1896x - 116.54
ANNUAL RATE OF GROWTH:
total flow = 1.9%
dry weather flow = 2.2%
Daily flow
Dry weather flow
design ADWF
Linear (Daily flow)
Linear (Dry weather flow)



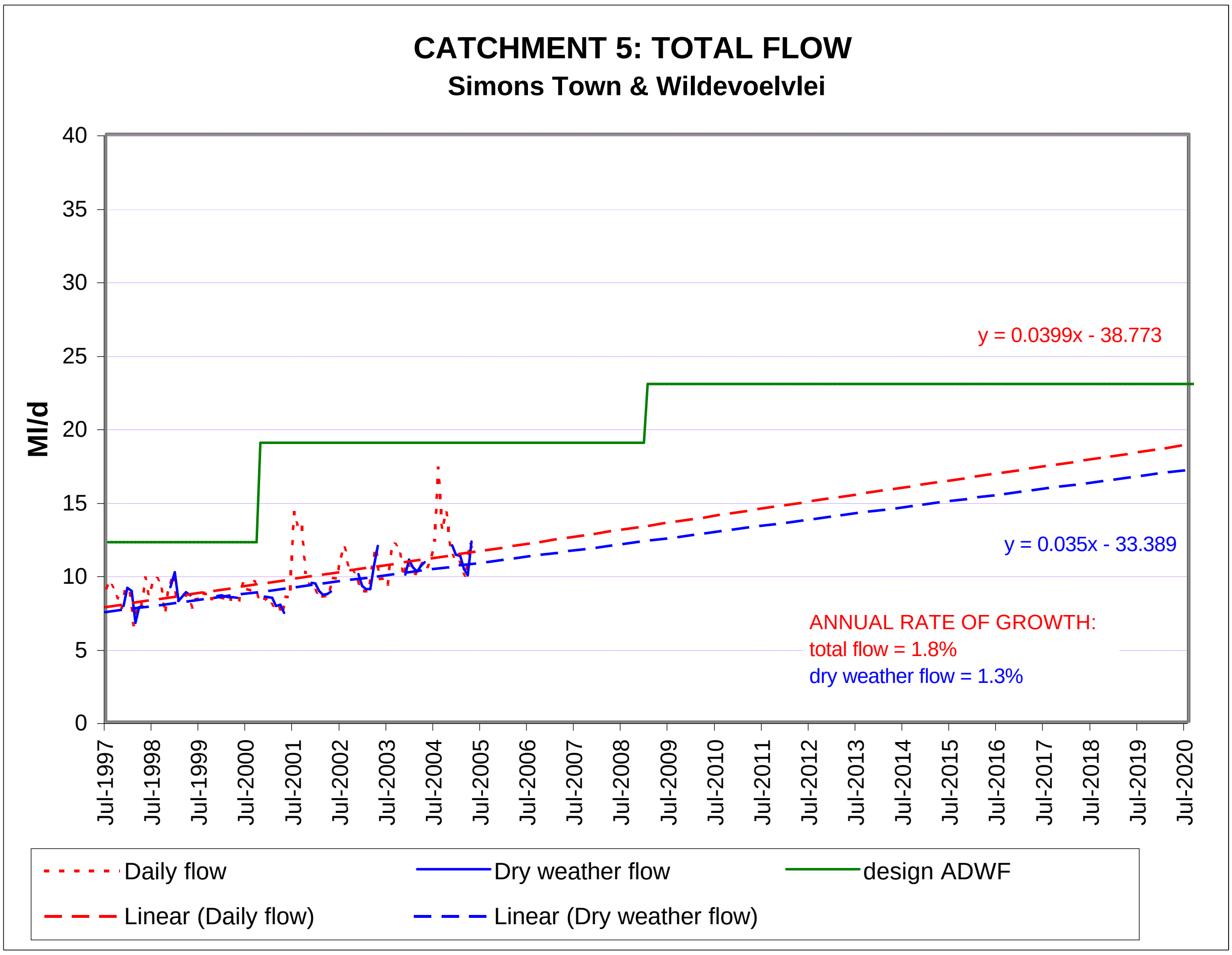
CATCHMENT 3: TOTAL ORGANIC LOAD
Mitchells Plain, Macassar, Zandvliet & Gordon's Bay
Population Equivalents
y = 2,762x - 2,532,832
ANNUAL RATE OF GROWTH:
total load = 4.4%
Population Equivalents
design organic load
Linear (Population Equivalents)

CATCHMENT 4:

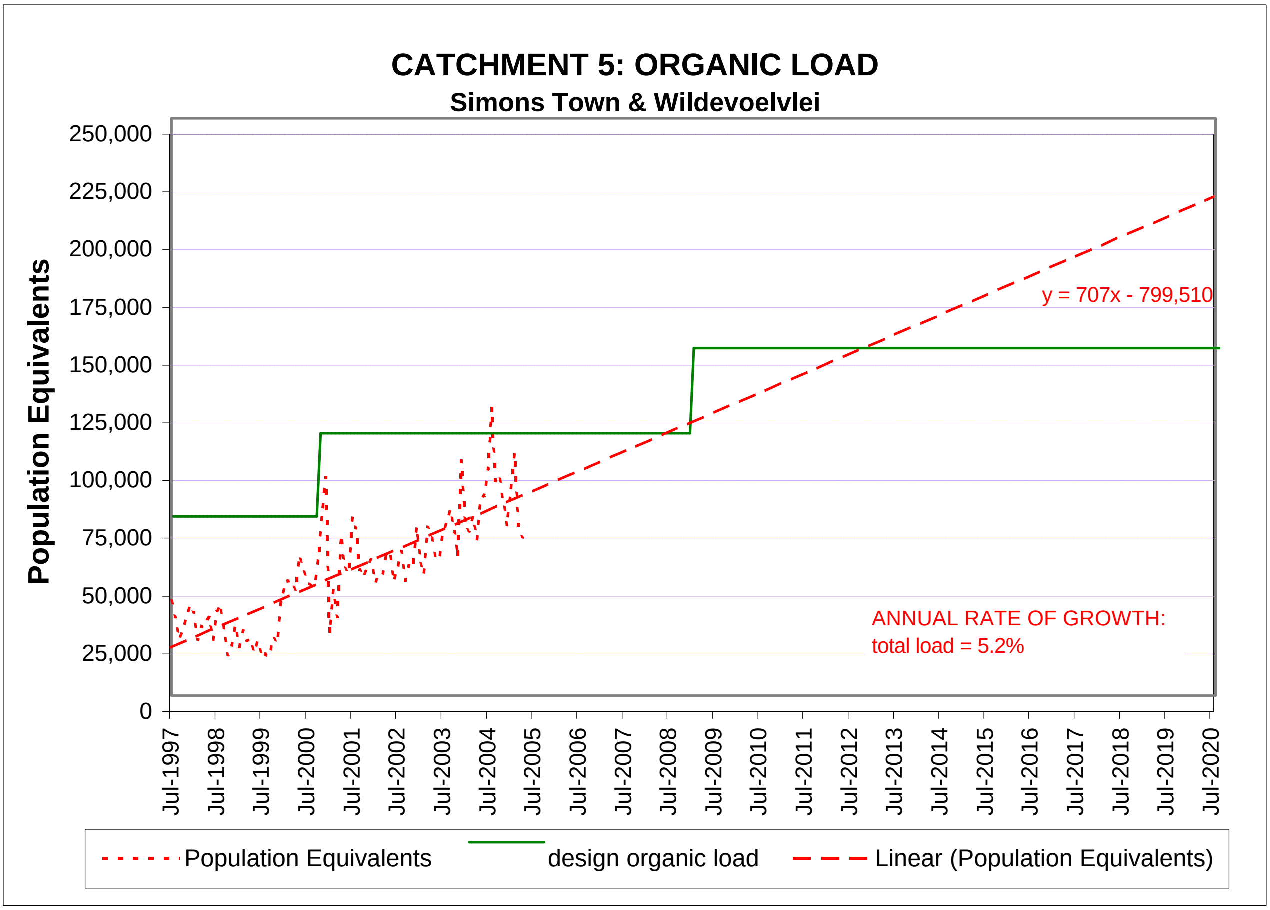

CATCHMENT 4: TOTAL FLOW
Potsdam, Melkbosstrand & Wesfleur
Ml/d
0
10
20
30
40
50
60
70
80
90
100
110
120
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
Jul-2003
Jul-2004
Jul-2005
Jul-2006
Jul-2007
Jul-2008
Jul-2009
Jul-2010
Jul-2011
Jul-2012
Jul-2013
Jul-2014
Jul-2015
Jul-2016
Jul-2017
Jul-2018
Jul-2019
Jul-2020
y = 0.1241x - 107.9
y = 0.1186x - 102.89
ANNUAL RATE OF GROWTH:
total flow = 4.3%
dry weather flow = 4.4%
design ADWF
Daily Flow
CWC proj.1
Dry weather flow
Linear (Daily Flow)
Linear (Dry weather flow)


CATCHMENT 4: TOTAL ORGANIC LOAD
Potsdam, Melkbosstrand & Wesfleur
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
Jul-2003
Jul-2004
Jul-2005
Jul-2006
Jul-2007
Jul-2008
Jul-2009
Jul-2010
Jul-2011
Jul-2012
Jul-2013
Jul-2014
Jul-2015
Jul-2016
Jul-2017
Jul-2018
Jul-2019
Jul-2020
y = 1,736x - 1,695,349
ANNUAL RATE OF GROWTH:
total load = 5.0%
design organic load
Population Equivalents
Linear (Population Equivalents)

CATCHMENT 5

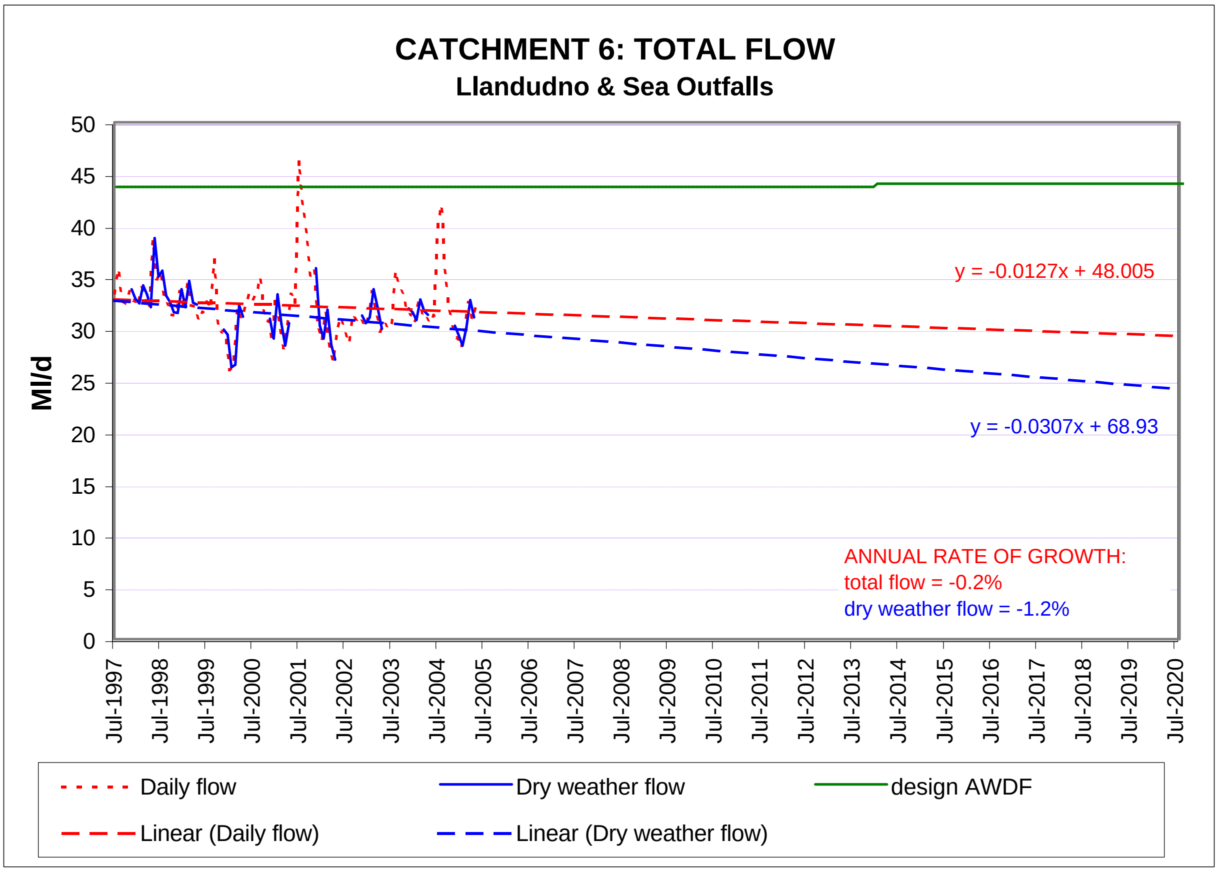


CATCHMENT 5: TOTAL FLOW
Simons Town & Wildevoelvlei
Ml/d
40
35
30
25
20
15
10
5
0
y = 0.0399x - 38.773
y = 0.035x - 33.389
ANNUAL RATE OF GROWTH:
total flow = 1.8%
dry weather flow = 1.3%
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
Jul-2003
Jul-2004
Jul-2005
Jul-2006
Jul-2007
Jul-2008
Jul-2009
Jul-2010
Jul-2011
Jul-2012
Jul-2013
Jul-2014
Jul-2015
Jul-2016
Jul-2017
Jul-2018
Jul-2019
Jul-2020
Daily flow
Dry weather flow
design ADWF
Linear (Daily flow)
Linear (Dry weather flow)

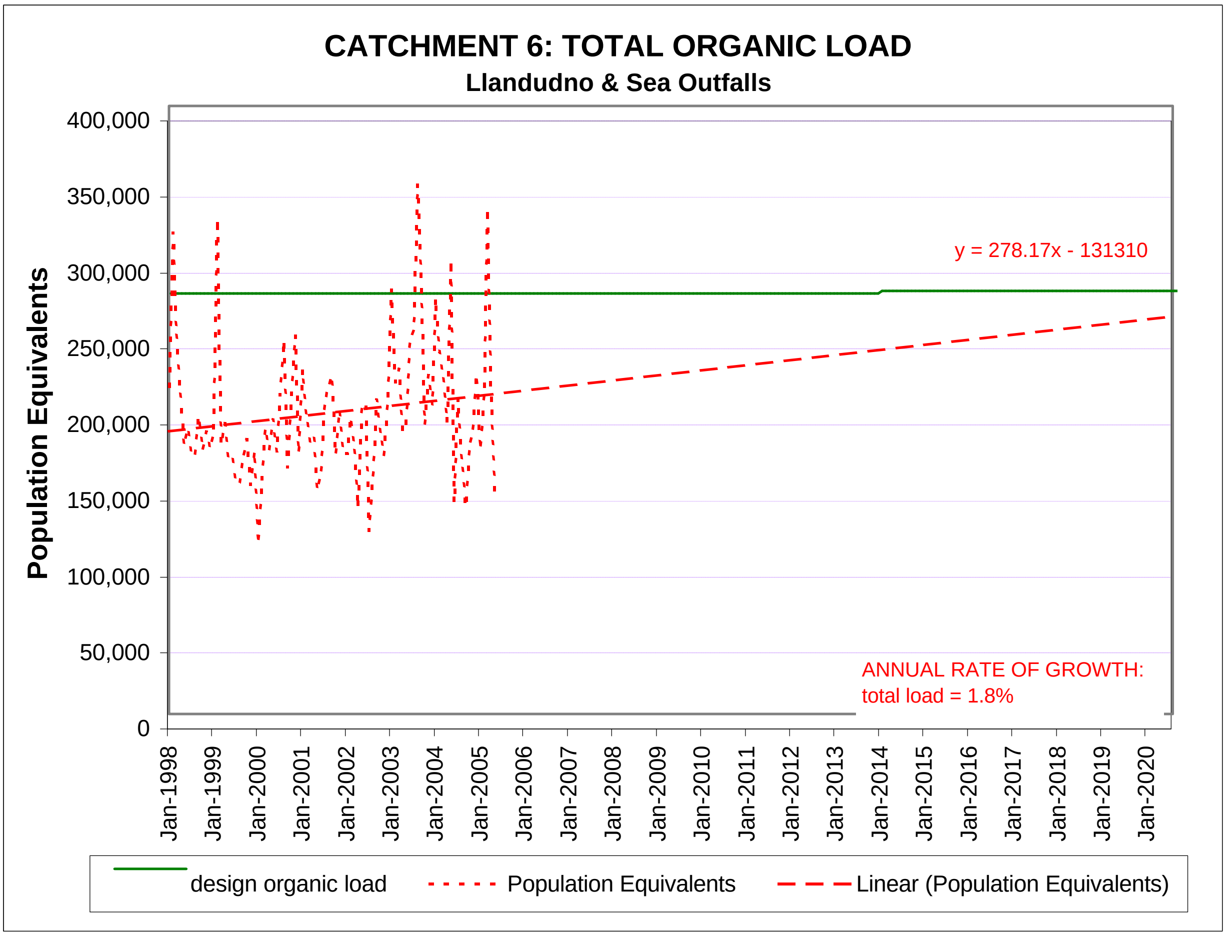


CATCHMENT 5: ORGANIC LOAD
Simons Town & Wildevoelvlei
Population Equivalents
250,000
225,000
200,000
175,000
150,000
125,000
100,000
75,000
50,000
25,000
0
y = 707x - 799,510
ANNUAL RATE OF GROWTH:
total load = 5.2%
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
Jul-2003
Jul-2004
Jul-2005
Jul-2006
Jul-2007
Jul-2008
Jul-2009
Jul-2010
Jul-2011
Jul-2012
Jul-2013
Jul-2014
Jul-2015
Jul-2016
Jul-2017
Jul-2018
Jul-2019
Jul-2020
Population Equivalents
design organic load
Linear (Population Equivalents)

CATCHMENT 6

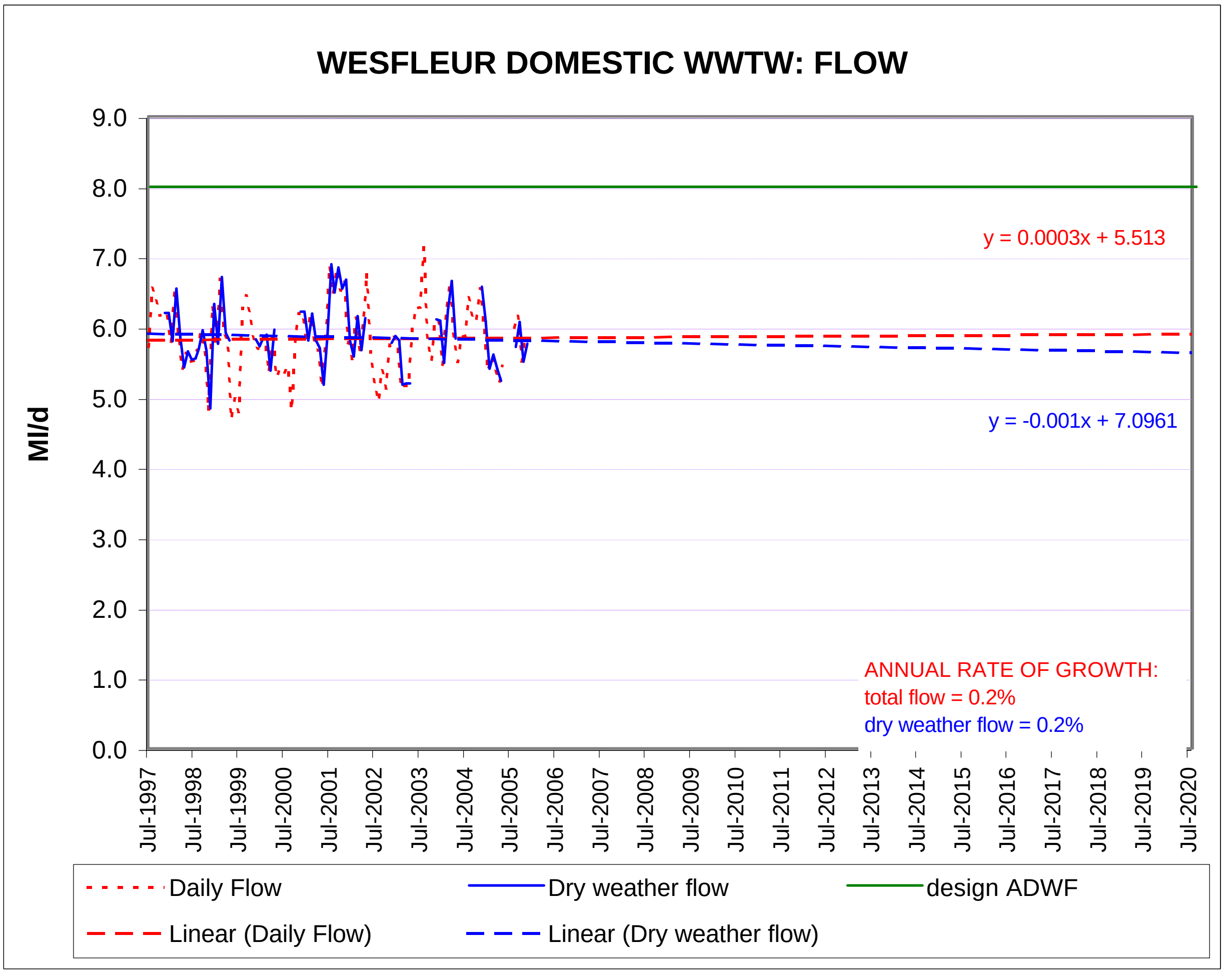


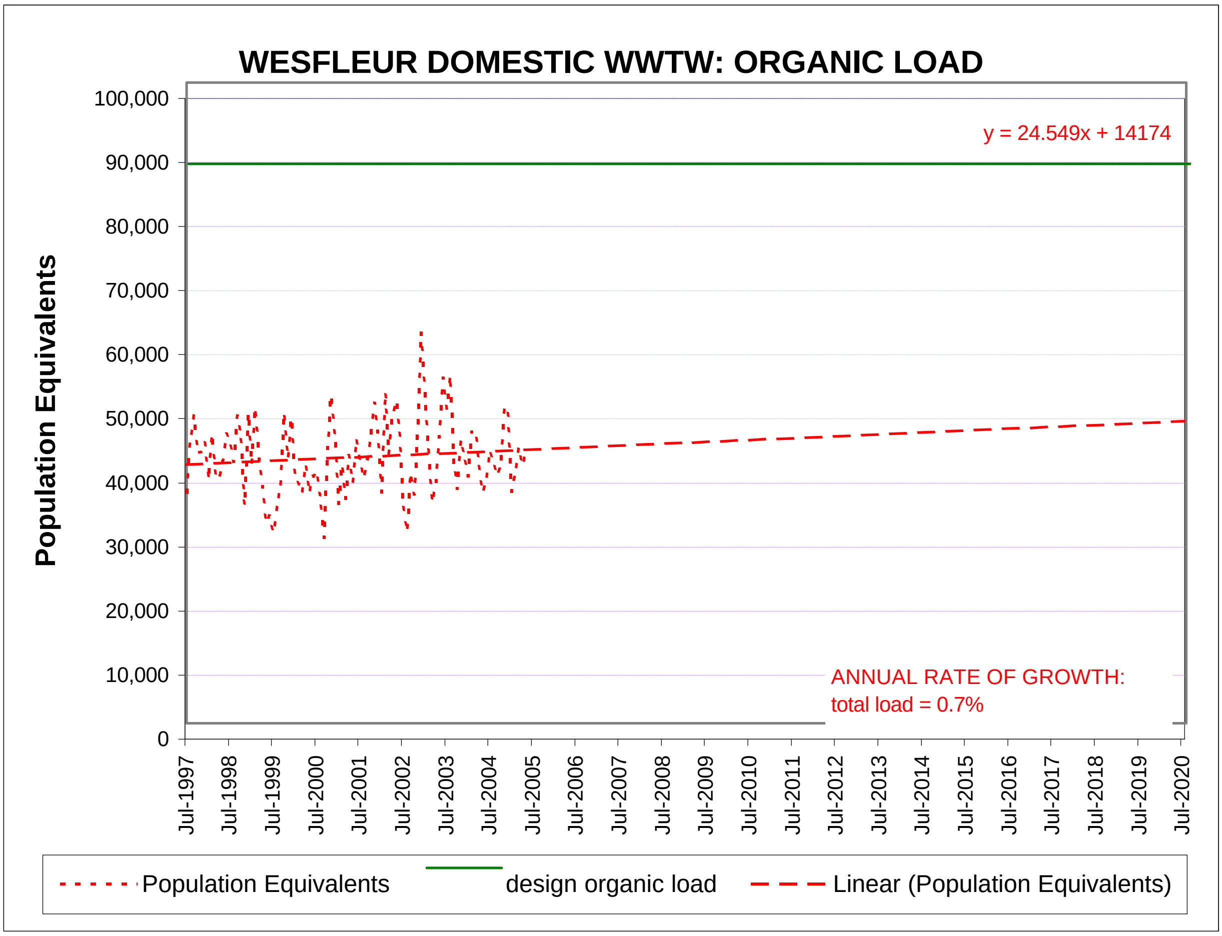
CATCHMENT 6: TOTAL FLOW
Llandudno & Sea Outfalls
Ml/d
50
45
40
35
30
25
20
15
10
5
0
y = -0.0127x + 48.005
y = -0.0307x + 68.93
ANNUAL RATE OF GROWTH:
total flow = -0.2%
dry weather flow = -1.2%
Jul-1997
Jul-1998
Jul-1999
Jul-2000
Jul-2001
Jul-2002
Jul-2003
Jul-2004
Jul-2005
Jul-2006
Jul-2007
Jul-2008
Jul-2009
Jul-2010
Jul-2011
Jul-2012
Jul-2013
Jul-2014
Jul-2015
Jul-2016
Jul-2017
Jul-2018
Jul-2019
Jul-2020
Daily flow
Dry weather flow
design AWDF
Linear (Daily flow)
Linear (Dry weather flow)



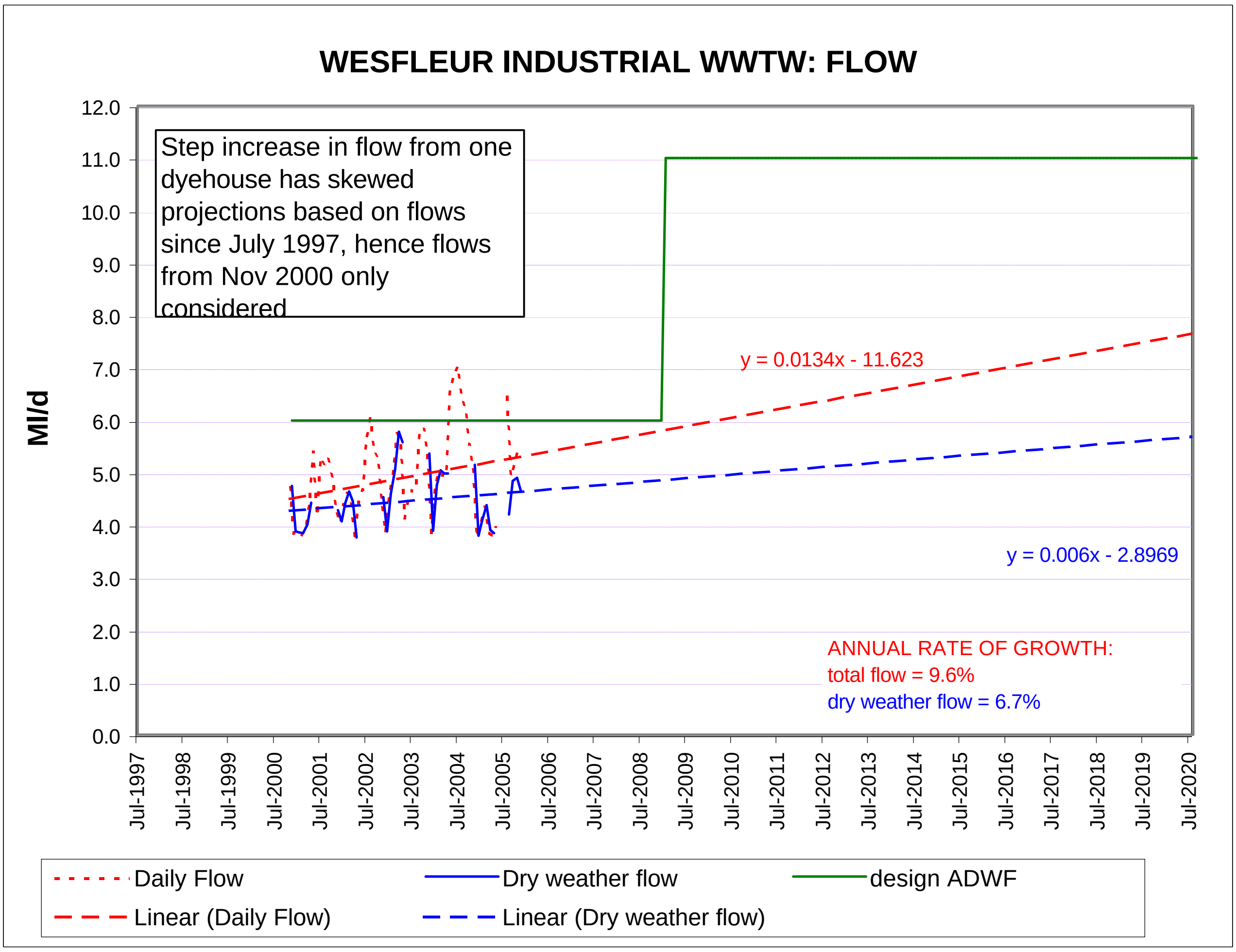
CATCHMENT 6: TOTAL ORGANIC LOAD
Llandudno & Sea Outfalls
Population Equivalents
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
y = 278.17x - 131310
ANNUAL RATE OF GROWTH:
total load = 1.8%
Jan-1998
Jan-1999
Jan-2000
Jan-2001
Jan-2002
Jan-2003
Jan-2004
Jan-2005
Jan-2006
Jan-2007
Jan-2008
Jan-2009
Jan-2010
Jan-2011
Jan-2012
Jan-2013
Jan-2014
Jan-2015
Jan-2016
Jan-2017
Jan-2018
Jan-2019
Jan-2020
design organic load
Population Equivalents
Linear (Population Equivalents)

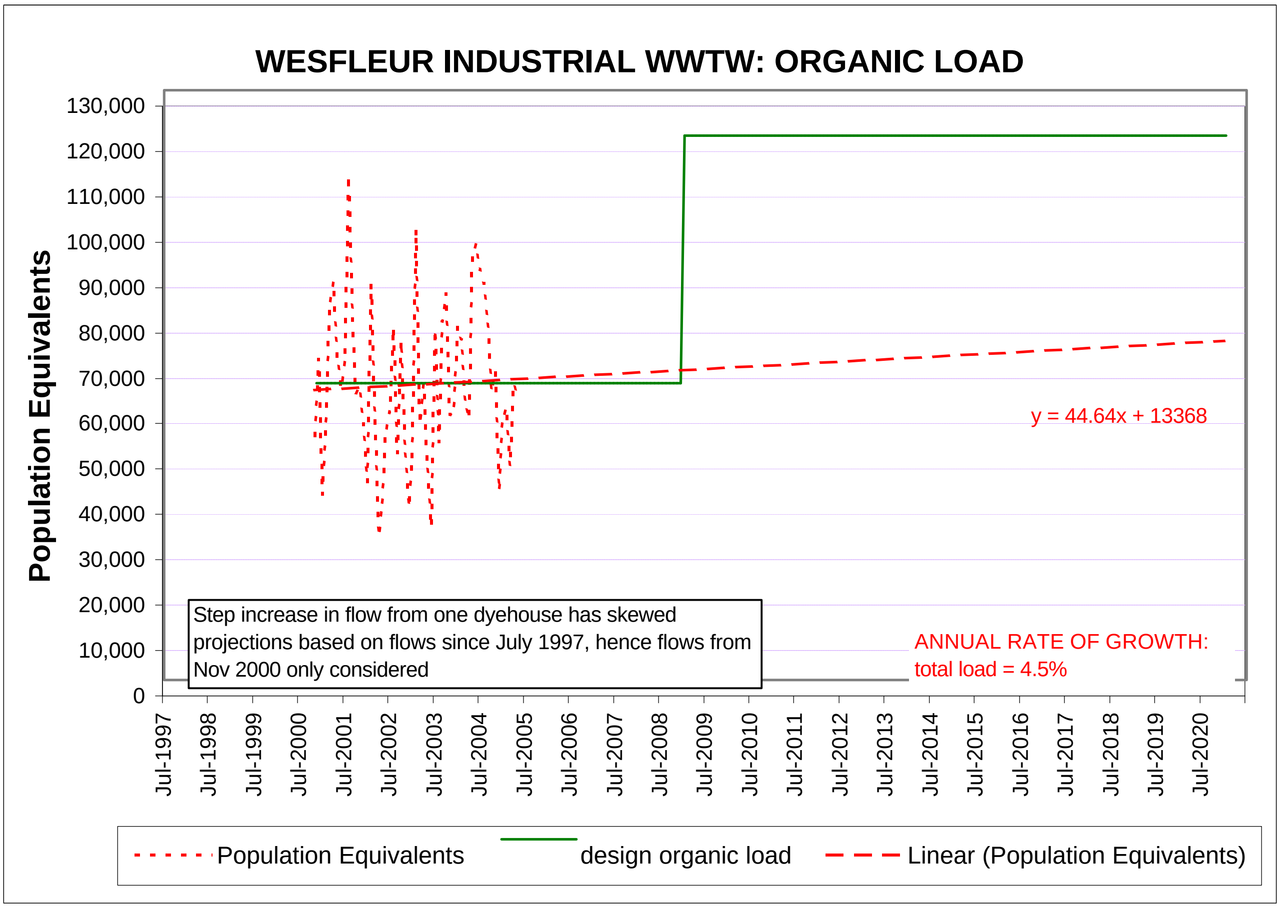
WESFLEUR DOMESTIC WASTEWATER TREATMENT WORKS



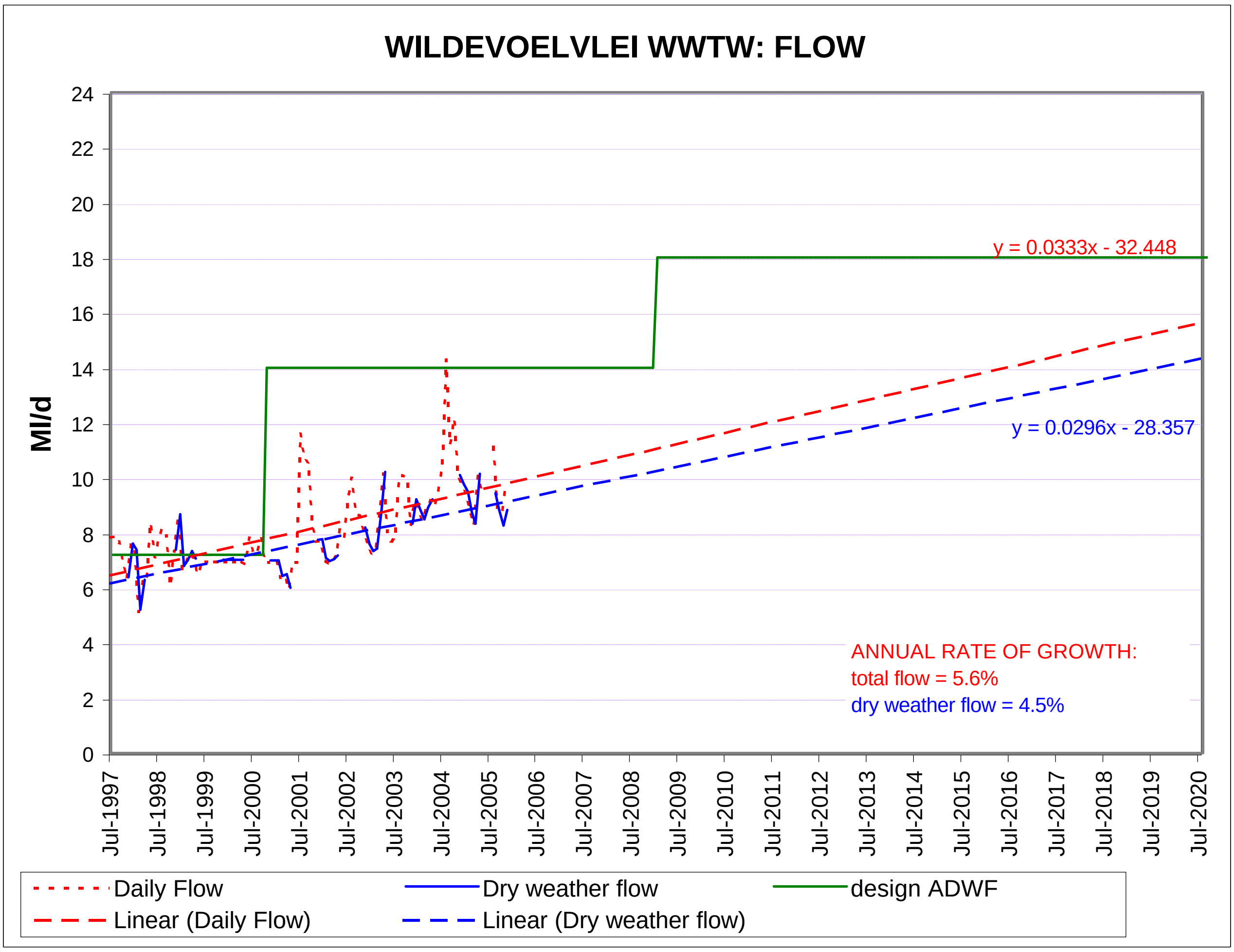


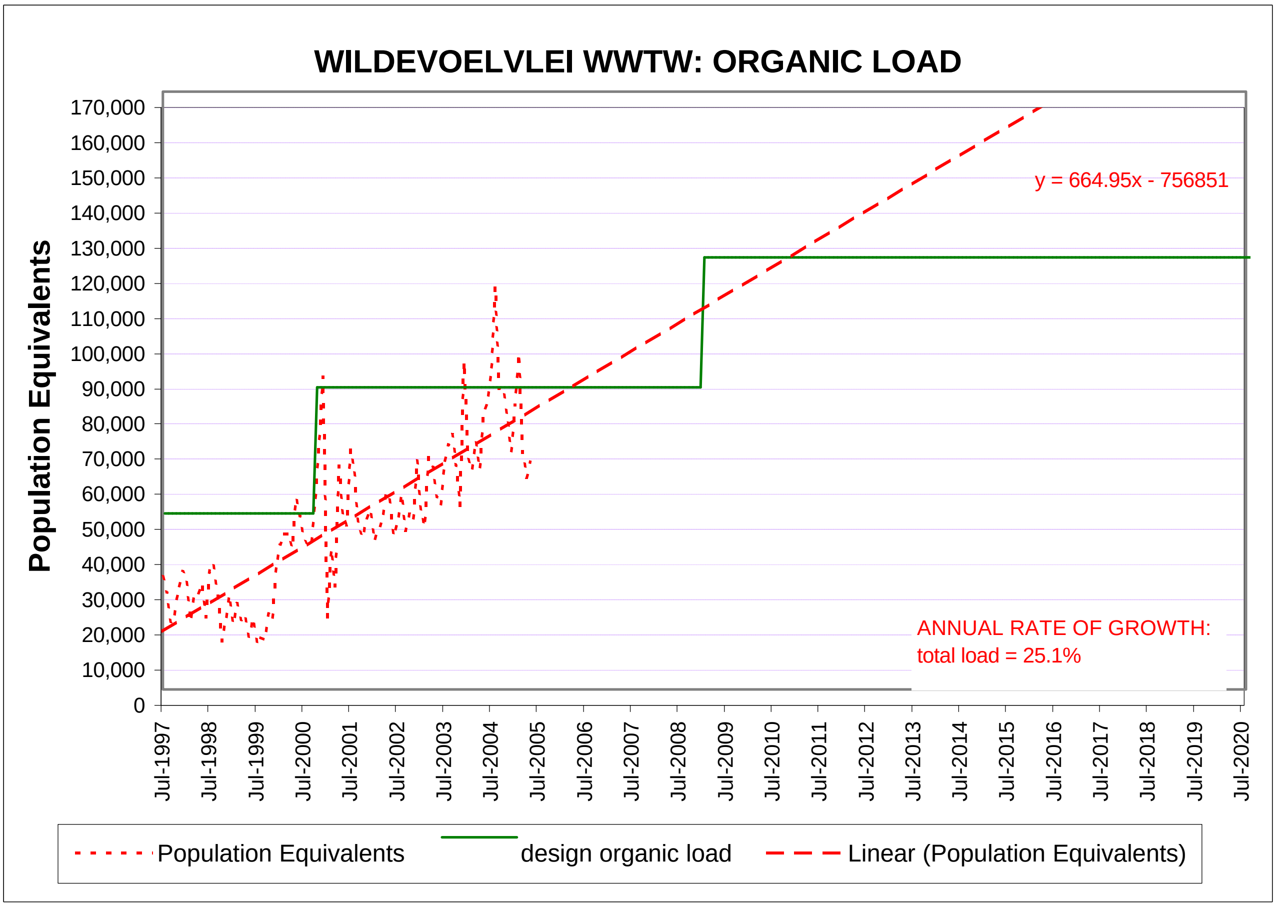
WESFLEUR INDUSTRIAL WASTEWATER TREATMENT WORKS



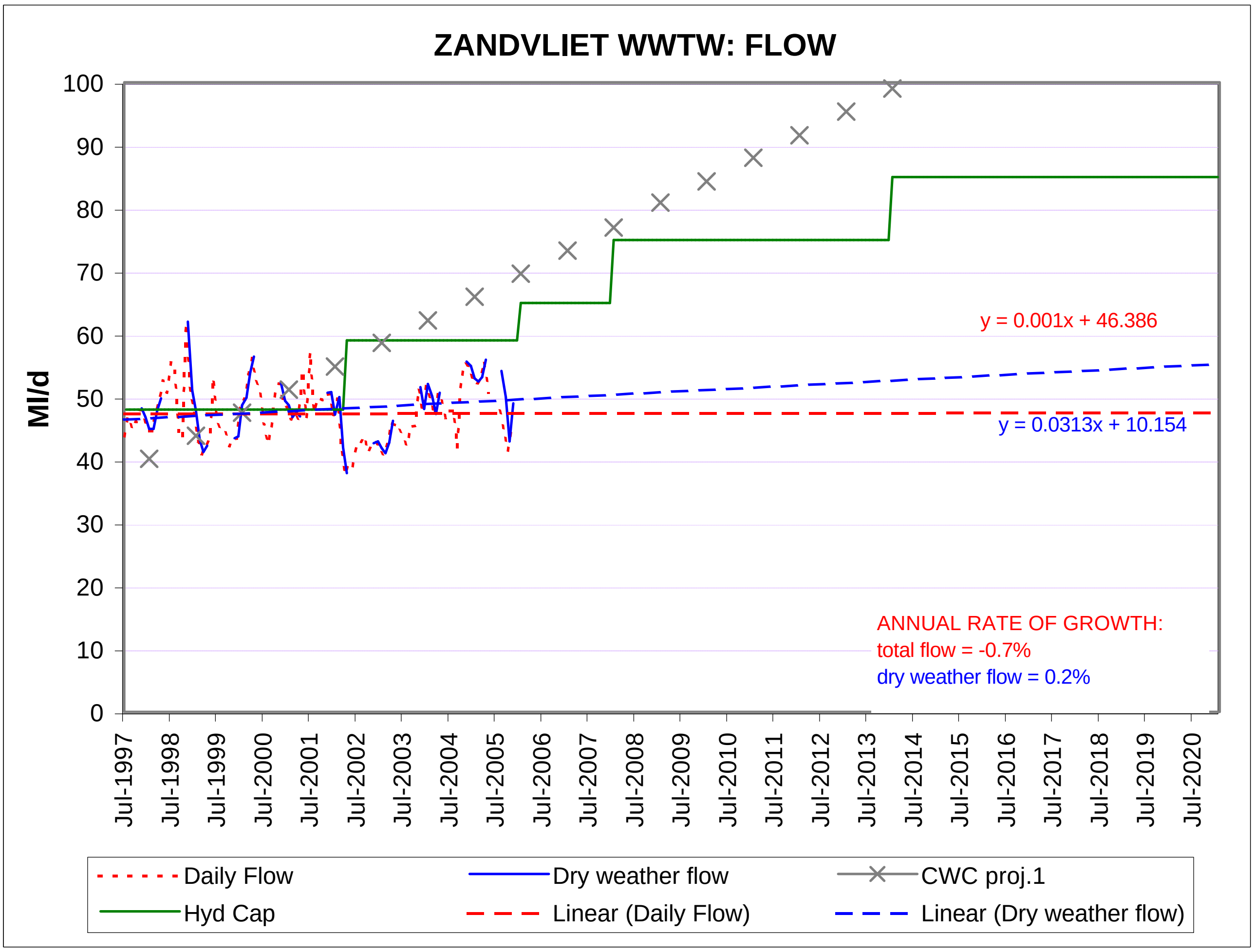


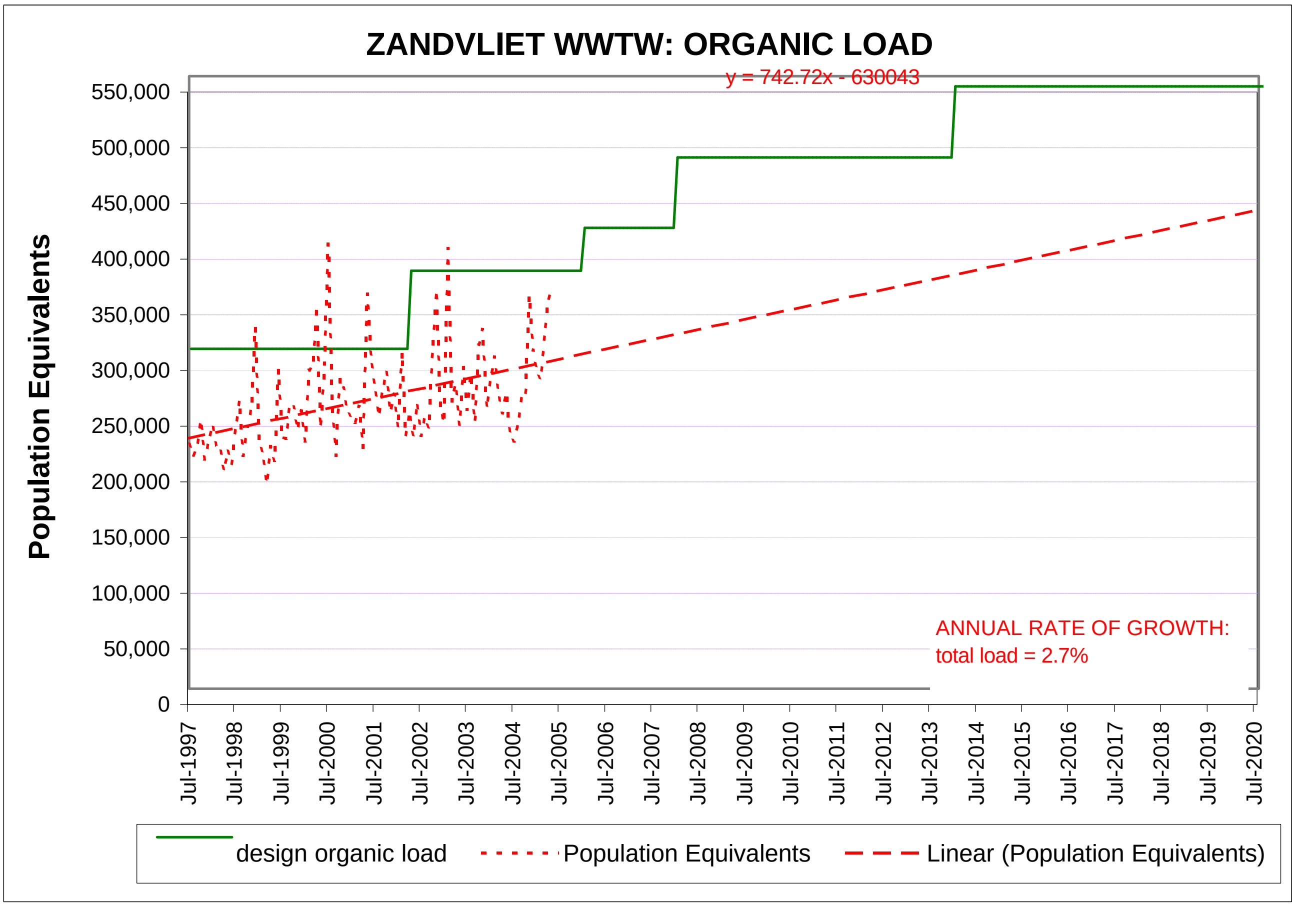
WILDEVOELVLEI WASTEWATER TREATMENT WORKS





ZANDVLIET WASTEWATER TREATMENT WORKS





APPENDIX D

CCT WWTW
Effluent Quality Data

WASTEWATER TREATMENT WORKS FINAL EFFLUENT SUMMARY REPORT

PLANT	Date	Flow	TSS	COD	Ammonia	Nitrate	ortho-phosphate	E.coli
		Ml/d	mg/l	mg/l	mgN/l	mgN/l	mgP/l	per 100ml
Athlone	14-Jun-05	124.0	16	70	1.1	4.3	0.2	4000
Bellville	14-Jun-05	54.1	21	59	2.4	7.6	1.4	20000
Borcherds Quarry	14-Jun-05	32.0	6	55	26.0	4.5	5.3	3000
Cape Flats	*13-Jun-05*	*185.0*	*18*	*44*	*3.8*	*2.0*	*5.2*	*100*
Gordons Bay	13-Jun-05	5.2	38	81	0.9	18.5	7.4	5
Klipheuwel	13-Jun-05	-	17	66	6.9	26.8	12.2	5
Kraaifontein	14-Jun-05	18.5	5	42	2.8	10.5	6.6	250
Llandudno	13-Jun-05	0.3	11	71	1.8	17.2	6.4	15000
Macassar	*12-Jun-05*	*55.6*	*4*	*49*	*3.3*	*9.0*	*4.7*	*10*
Millers Point	13-Jun-05	-	12	70	3.8	5.7	11.0	70000
Melkbosstrand	14-Jun-05	3.1	2	39	1	13.6	7.8	360
Mitchells Plain	*13-Jun-05*	*33*	*6*	*30*	*5.2*	*9.4*	*7.4*	*3000*
Oudekraal	13-Jun-05	-	2	33	0.6	18.8	3.7	5
Parow	14-Jun-05	1.1	21	85	9.8	15.8	5.9	200000
Potsdam ASP	14-Jun-05	17.5	33	79	1.0	3.7	0.7	12000
Potsdam BIO	14-Jun-05	17.5	11	96	14.0	5.7	6.1	410000
Scottsdene	14-Jun-05	8.1	20	52	5.5	8.5	8.8	30
Simons Town	13-Jun-05	2.7	18	71	2.8	17.4	2.6	20
Wesfleur DOM	14-Jun-05	6.0	9	42	0.9	11.1	7.7	100
Wesfleur IND	14-Jun-05	4.2	8	58	3.2	4.0	5.1	700
Wildevoelvlei	13-Jun-05	14.0	2	31	0.5	3.6	5.9	5
Zandvliet	*13-Jun-05*	*-*	*11*	*40*	*2.6*	*15.3*	*2.6*	*30*
Camps Bay	13-Jun-05	2.4	182	558	21.2			
Green Point	13-Jun-05	29.3	277	714	30.4			
Hout Bay	13-Jun-05	4.0	218	502	44.7			
Total Ave Flow Ml/day		617.6						

Green = compliance with 2010 General Standards

Black = compliance with current 1984 General Standards

Red = failure with current General Standard

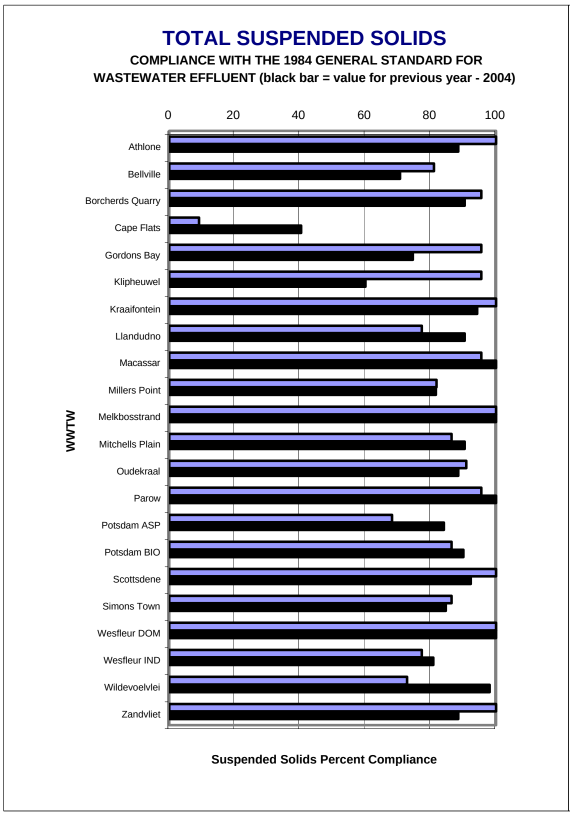
Blue = ammonia compliance with the 2005 interim Standard (for ammonia)

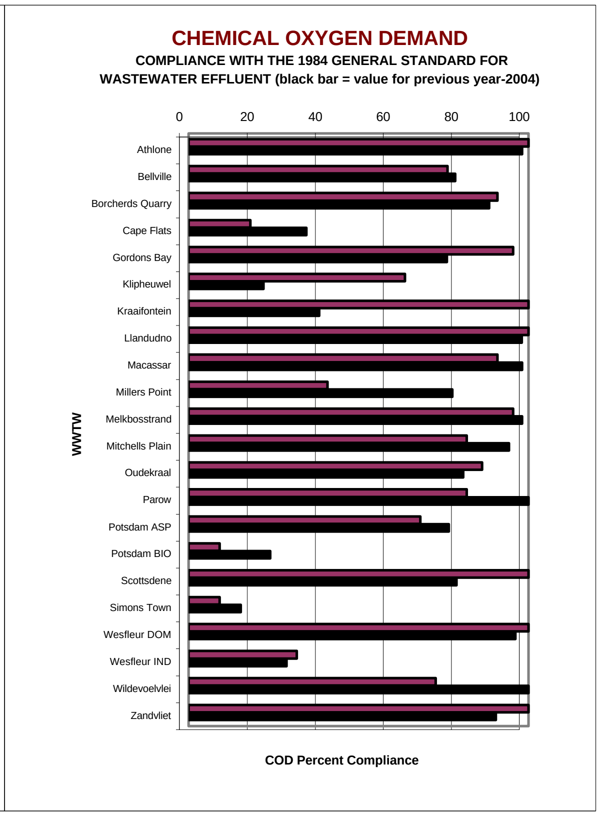
to enable the statistical calculations to be carried out:

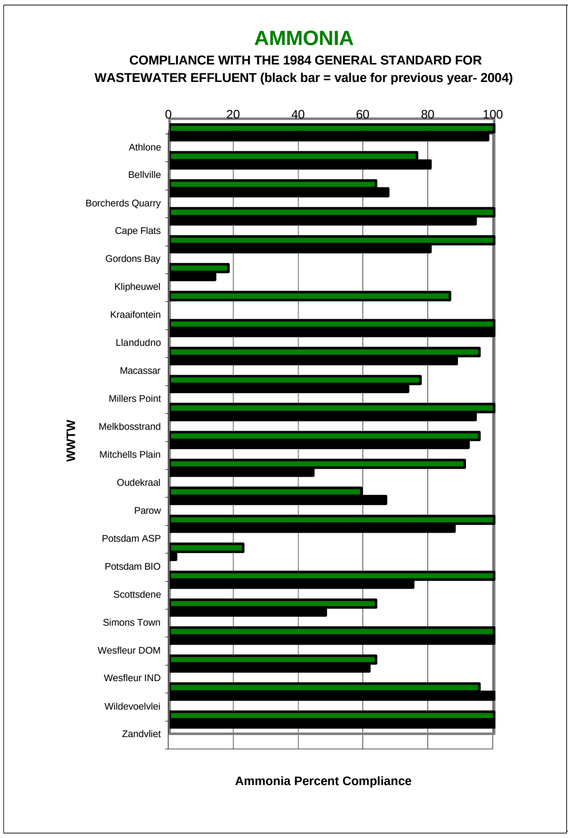
values with ">" have been doubled {applies mainly to E.coli results}

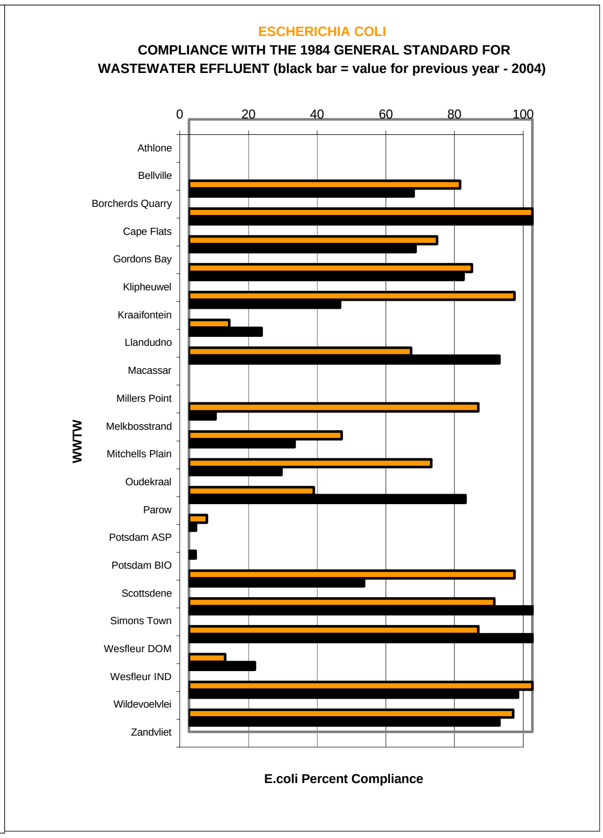
values with "<" have been halved {applies mainly to E.coli results and Ammonia results where the detection limit is 0.4 mgN/l}

WASTEWATER COMPLIANCE DASHBOARD









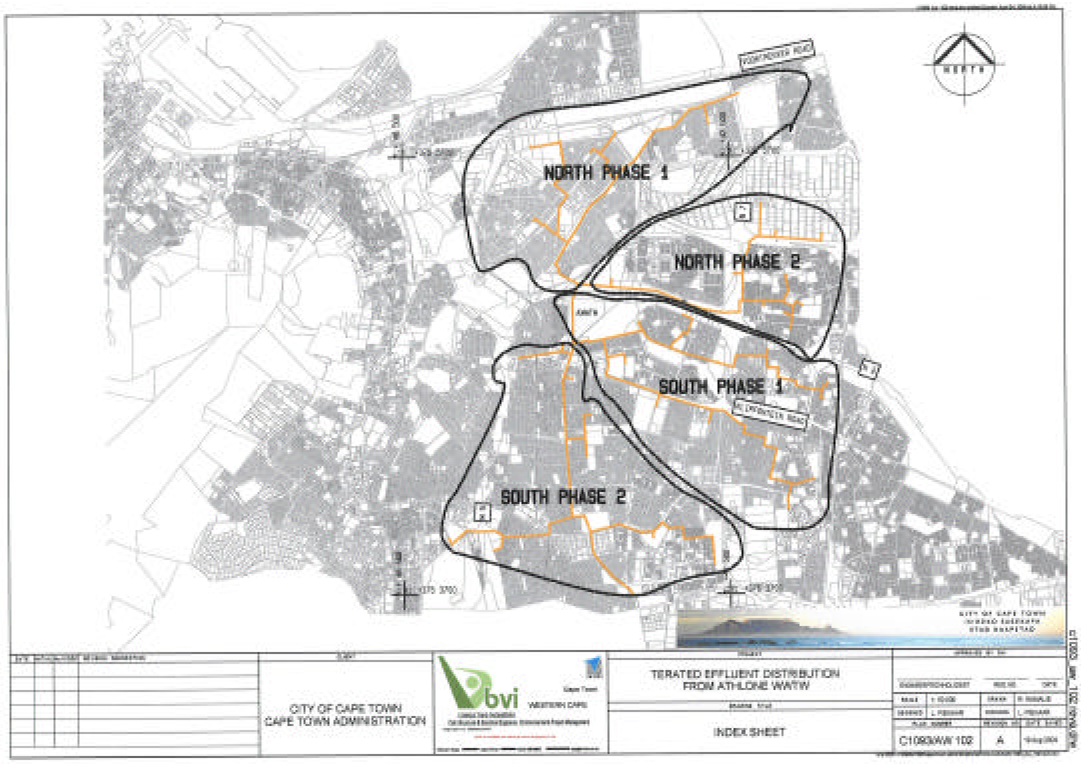
no bar indicates zero compliance

January 2004 to December 2004

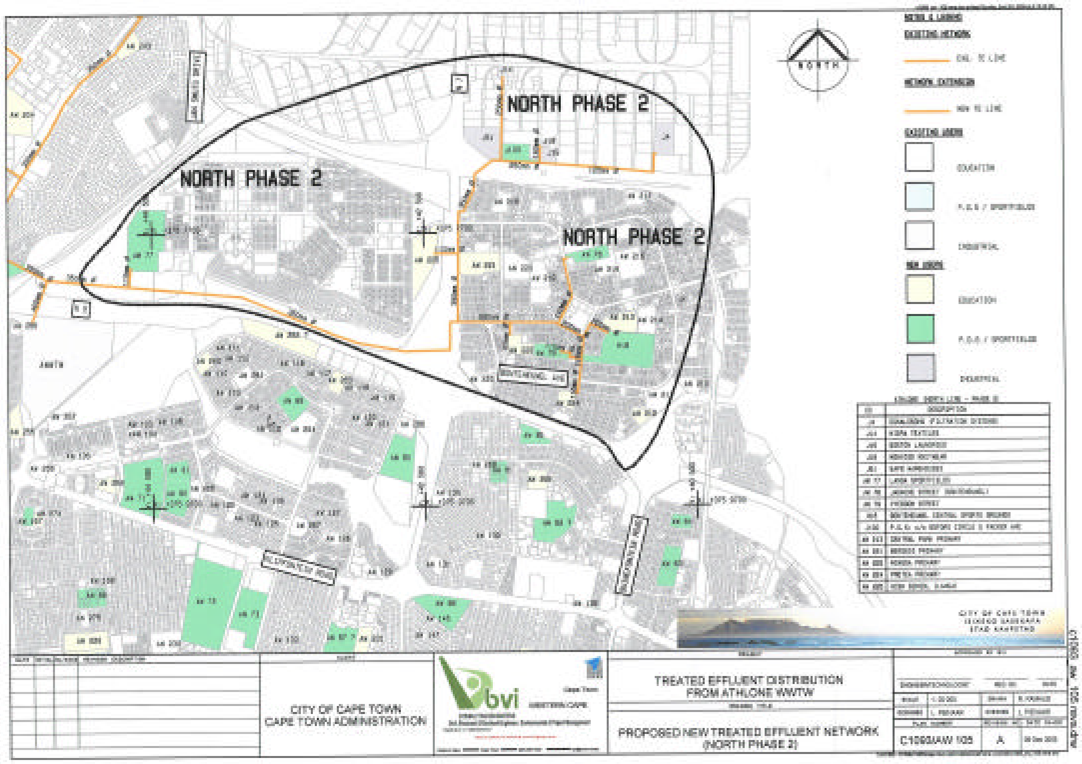
	PLANT	TSS	COD	NH3	E.coli	Average
1	Wildevoelvlei	98	100	100	96	99
2	Wesfleur DOM	98	98	100	98	99
3	Zandvliet	96	96	98	90	95
4	Borcherds Quarry	100	100	90	78	92
5	Gordons Bay	98	98	98	71	91
6	Macassar	98	92	85	88	91
7	Melkbosstrand	96	98	94	54	86
8	Parow	98	90	67	86	85
9	Cape Flats	54	56	100	100	77
10	Mitchells Plain	83	90	90	35	75
11	Potsdam ASP	100	98	90	2	73
12	Simons Town	90	17	83	84	69
13	Scottsdene	90	94	73	16	69
14	Oudekraal	84	54	58	69	66
15	Llandudno	84	71	84	21	65
16	Bellville	90	88	65	0	61
17	Millers Point	92	73	69	0	59
18	Athlone	96	44	79	0	55
19	Klipheuwel	88	22	2	83	49
20	Kraaifontein	78	35	16	39	42
21	Wesfleur IND	80	14	53	6	38
22	Potsdam BIO	90	17	2	0	27
	AVERAGE COMPLIANCE	90	70	73	51	71
		2004				

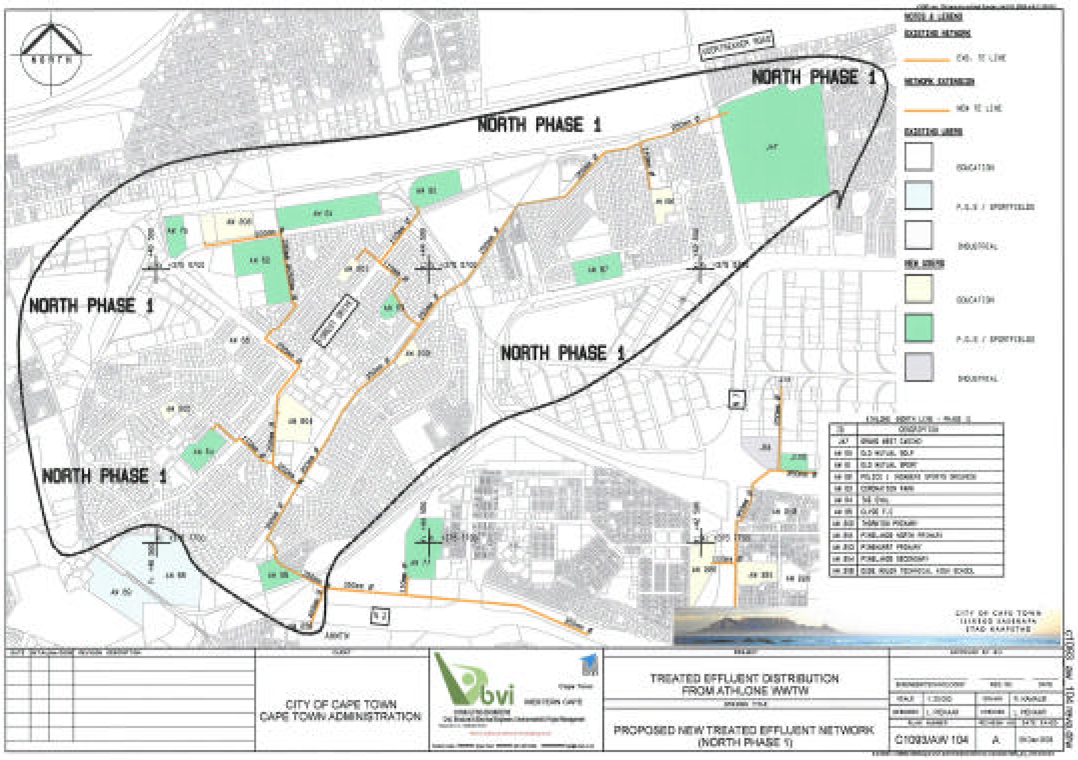
APPENDIX E

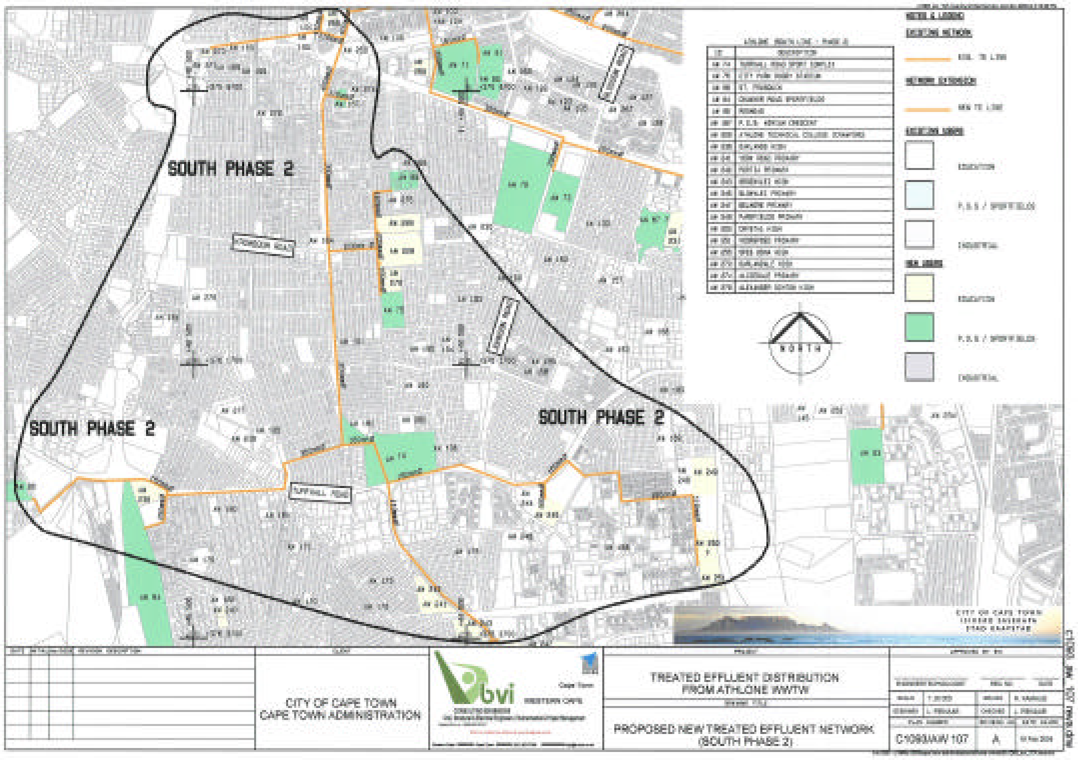
Layout Schematics of Potential Treated Effluent Schemes in the CCT



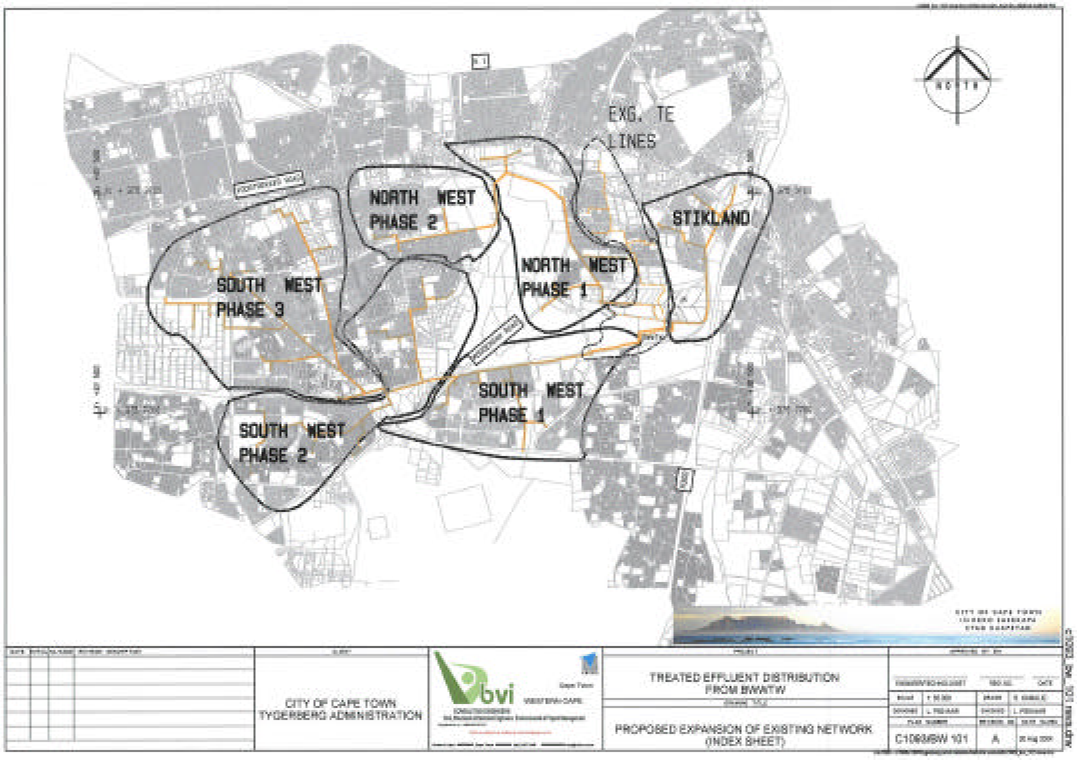
NORTH
VOORTREKKER ROAD
NORTH PHASE 1
NORTH PHASE 2
SOUTH PHASE 1
SOUTH PHASE 2
CITY OF CAPE TOWN
CAPE TOWN ADMINISTRATION
bvi
Cape Town
WESTERN CAPE
TERATED EFFLUENT DISTRIBUTION
FROM ATHLONE WWTW
INDEX SHEET
C1093/AW 102
A


NORTH PHASE 2
NORTH PHASE 2
NORTH PHASE 2
NORTH
EDUCATION
P.O.S / SPORTFIELDS
INDUSTRIAL
CITY OF CAPE TOWN
CAPE TOWN ADMINISTRATION
bvi
TREATED EFFLUENT DISTRIBUTION
FROM ATHLONE WWTW
PROPOSED NEW TREATED EFFLUENT NETWORK
(NORTH PHASE 2)
C1090/AW 105
A

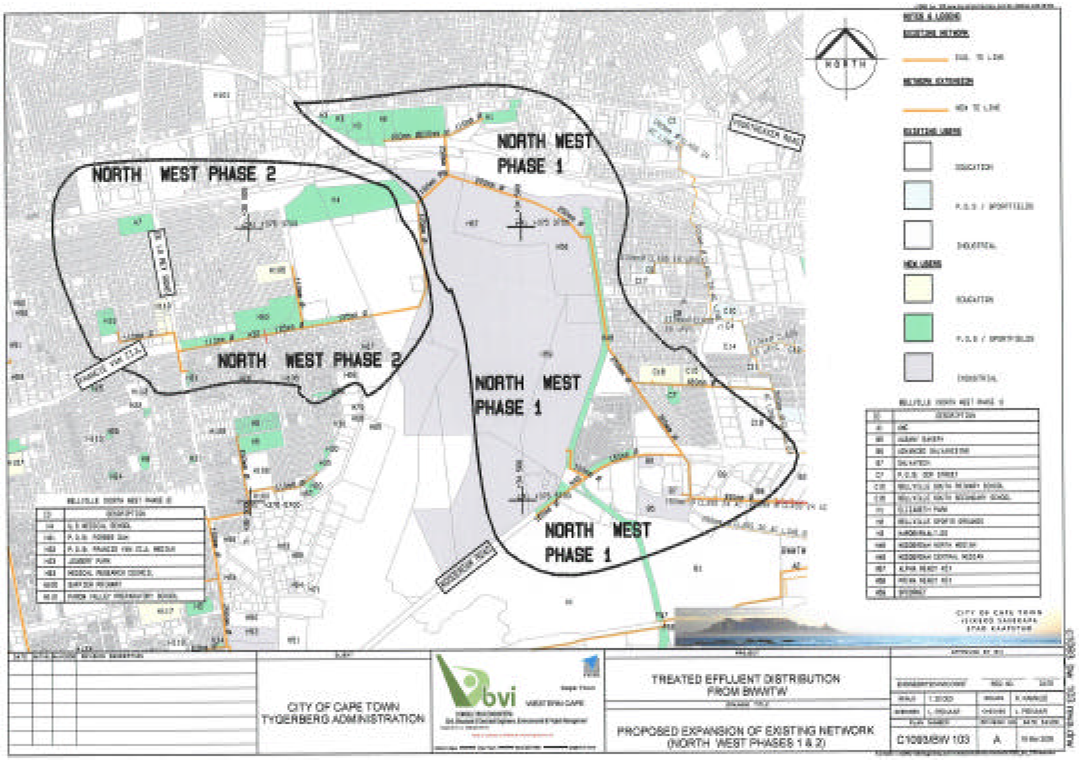

NORTH PHASE 1
NORTH PHASE 1
NORTH PHASE 1
NORTH PHASE 1
NORTH PHASE 1
CITY OF CAPE TOWN
CAPE TOWN ADMINISTRATION
bvi
WESTERN CAPE
TREATED EFFLUENT DISTRIBUTION
FROM ATHLONE WWTW
PROPOSED NEW TREATED EFFLUENT NETWORK
(NORTH PHASE 1)
C1093/AW 104
A



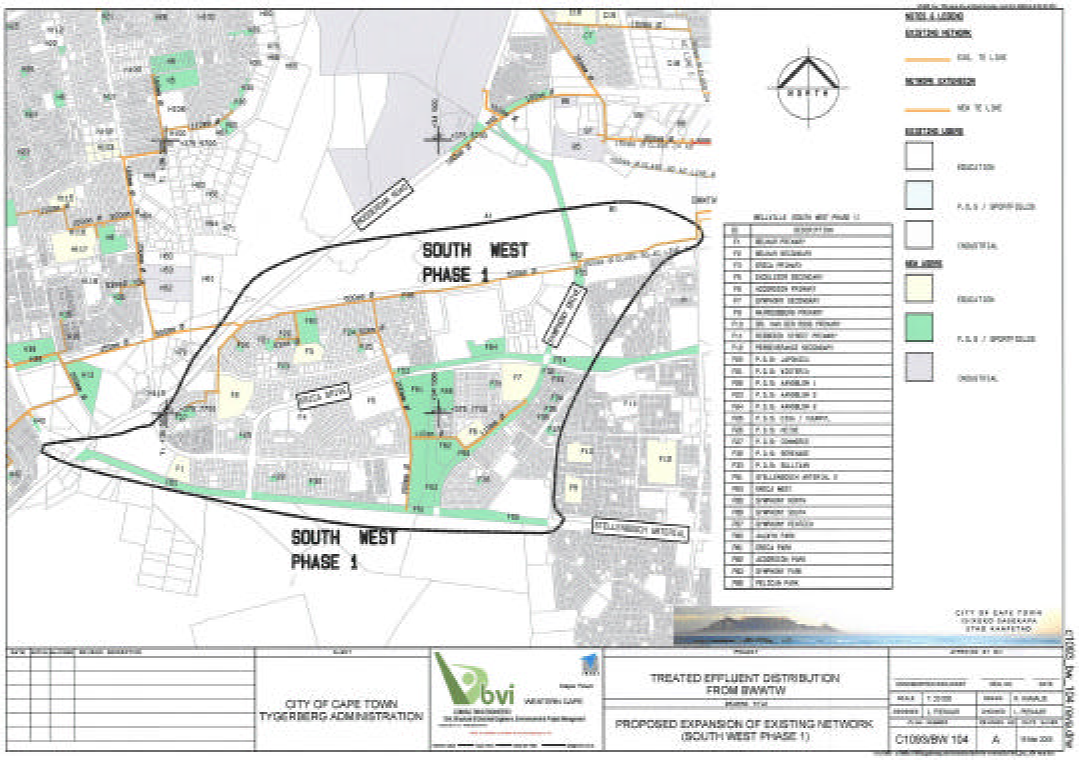
SOUTH PHASE 2
SOUTH PHASE 2
SOUTH PHASE 2
NORTH
CITY OF CAPE TOWN
CAPE TOWN ADMINISTRATION
bvi
Cape Town
WESTERN CAPE
TREATED EFFLUENT DISTRIBUTION
FROM ATHLONE WWTW
PROPOSED NEW TREATED EFFLUENT NETWORK
(SOUTH PHASE 2)
C1093/AW 107
A
C1093_AW_107 rev.a.dw



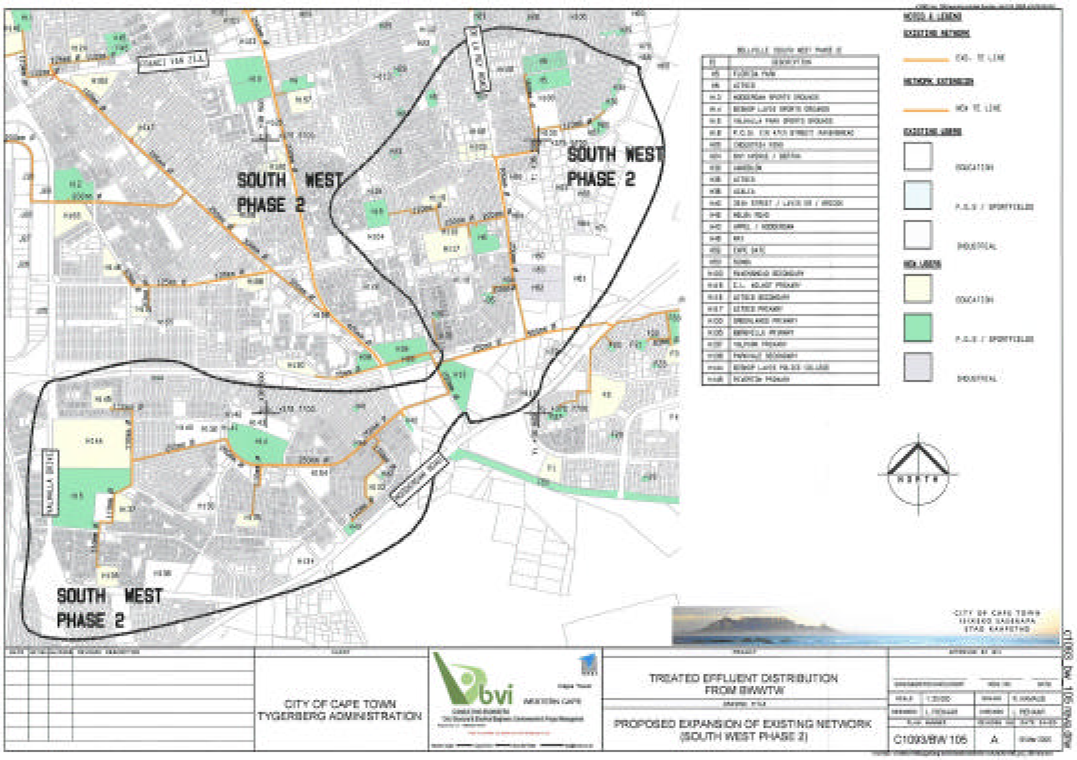
EXG. TE
LINES
NORTH WEST
PHASE 2
NORTH WEST
PHASE 1
STIKLAND
SOUTH WEST
PHASE 3
SOUTH WEST
PHASE 1
SOUTH WEST
PHASE 2
CITY OF CAPE TOWN
TYGERBERG ADMINISTRATION
bvi
WESTERN CAPE
TREATED EFFLUENT DISTRIBUTION
FROM BWWTW
PROPOSED EXPANSION OF EXISTING NETWORK
(INDEX SHEET)
C1093/BW 101
A

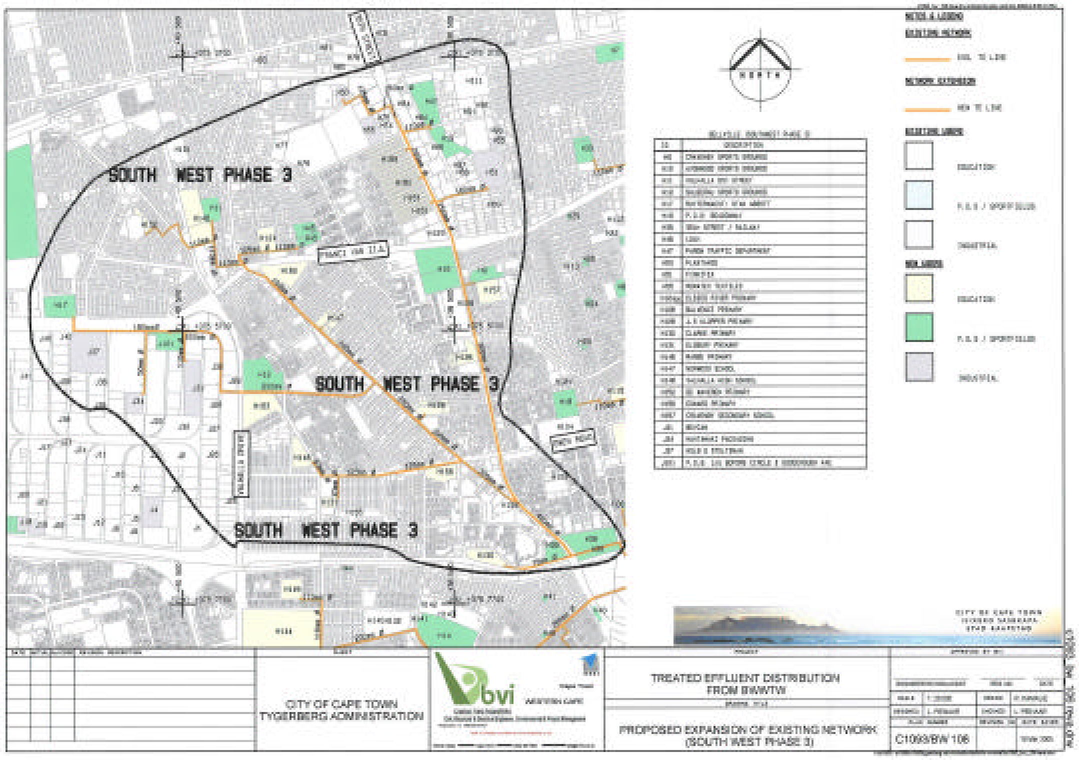


NORTH
NORTH WEST PHASE 1
NORTH WEST PHASE 2
NORTH WEST PHASE 1
NORTH WEST PHASE 2
NORTH WEST PHASE 1
NORTH WEST PHASE 1
EDUCATION
INDUSTRIAL
EDUCATION
INDUSTRIAL
CITY OF CAPE TOWN
TYGERBERG ADMINISTRATION
bvi
TREATED EFFLUENT DISTRIBUTION
FROM BWWTW
PROPOSED EXPANSION OF EXISTING NETWORK
(NORTH WEST PHASES 1 & 2)
C1093/BW 103
A



NORTH
SOUTH WEST PHASE 1
ERICA DRIVE
STELLENBOSCH ARTERIAL
SOUTH WEST PHASE 1
EDUCATION
INDUSTRIAL
EDUCATION
INDUSTRIAL
CITY OF CAPE TOWN
TYGERBERG ADMINISTRATION
bvi
WESTERN CAPE
TREATED EFFLUENT DISTRIBUTION
FROM BWWTW
PROPOSED EXPANSION OF EXISTING NETWORK
(SOUTH WEST PHASE 1)
C1093/BW 104
A


SOUTH WEST PHASE 2
SOUTH WEST PHASE 2
SOUTH WEST PHASE 2
NORTH
CITY OF CAPE TOWN
TREATED EFFLUENT DISTRIBUTION FROM BWWTW
CITY OF CAPE TOWN
TYGERBERG ADMINISTRATION
bvi
WESTERN CAPE
PROPOSED EXPANSION OF EXISTING NETWORK
(SOUTH WEST PHASE 2)
C1093/BW 105
A



SOUTH WEST PHASE 3
SOUTH WEST PHASE 3
SOUTH WEST PHASE 3
NORTH
NOTES & LEGEND
EXISTING NETWORK
NETWORK EXTENSION
EXISTING USERS
EDUCATION
P.O.S / SPORTFIELDS
INDUSTRIAL
NEW USERS
EDUCATION
P.O.S / SPORTFIELDS
INDUSTRIAL
CITY OF CAPE TOWN
TYGERBERG ADMINISTRATION
bvi
WESTERN CAPE
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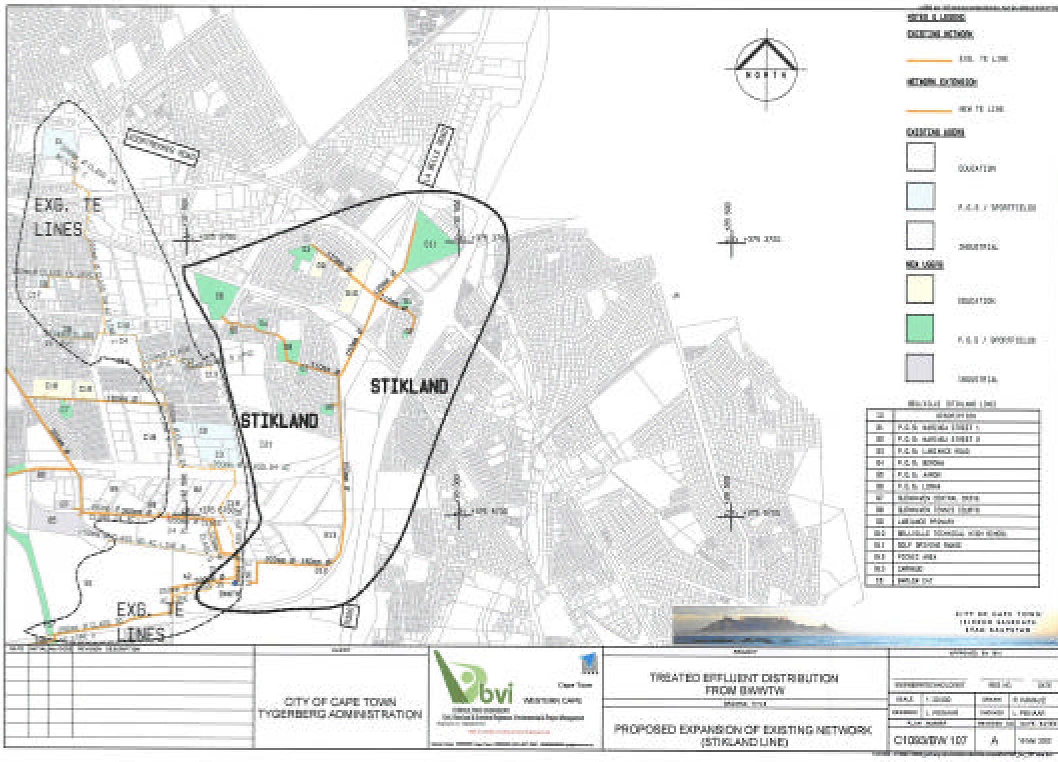
FROM BWWTW
PROPOSED EXPANSION OF EXISTING NETWORK
(SOUTH WEST PHASE 3)
C1093/BW 106



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INDUSTRIAL
NEW USERS
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P.O.S / SPORTFIELDS
INDUSTRIAL
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STIKLAND
STIKLAND
EXG. TE LINES
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TYGERBERG ADMINISTRATION
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C1090/BW 107
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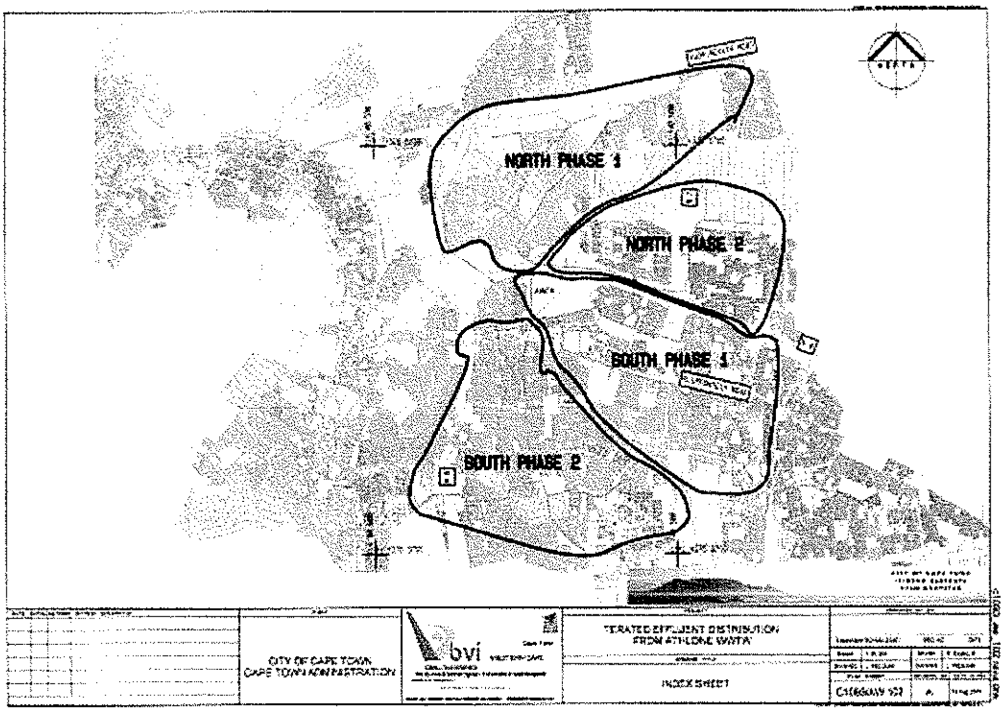
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NORTH PHASE 2
SOUTH PHASE 1
SOUTH PHASE 2
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CAPE TOWN ADMINISTRATION
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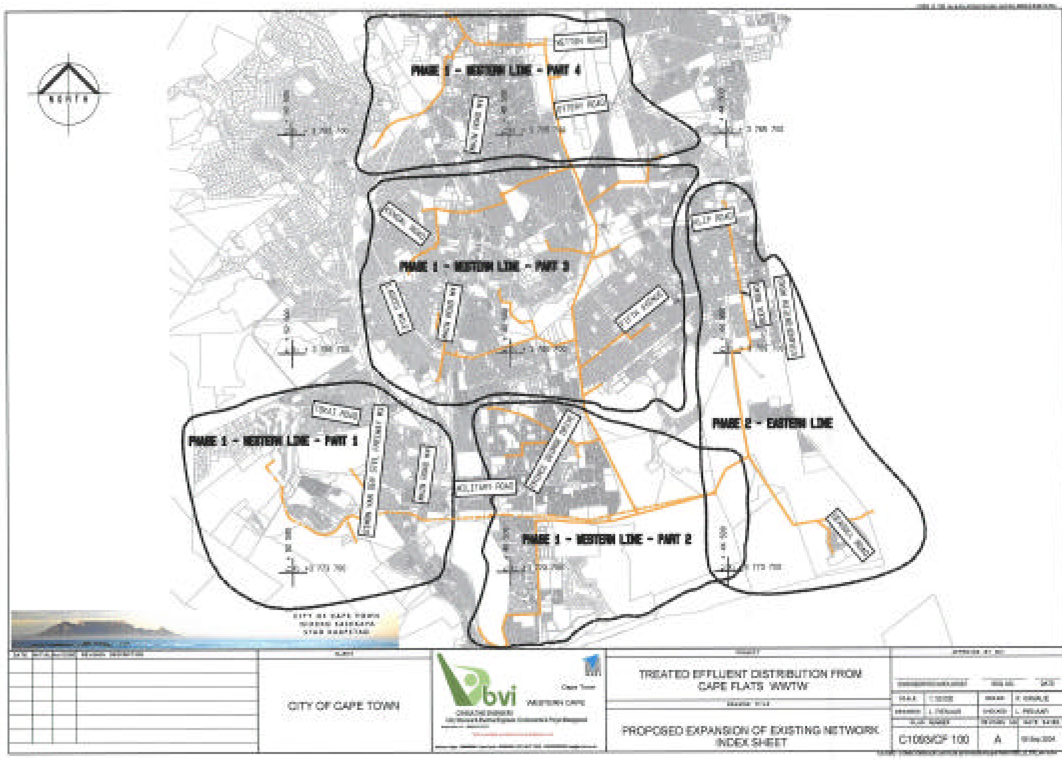
FROM ATHLONE WWTW
INDEX SHEET



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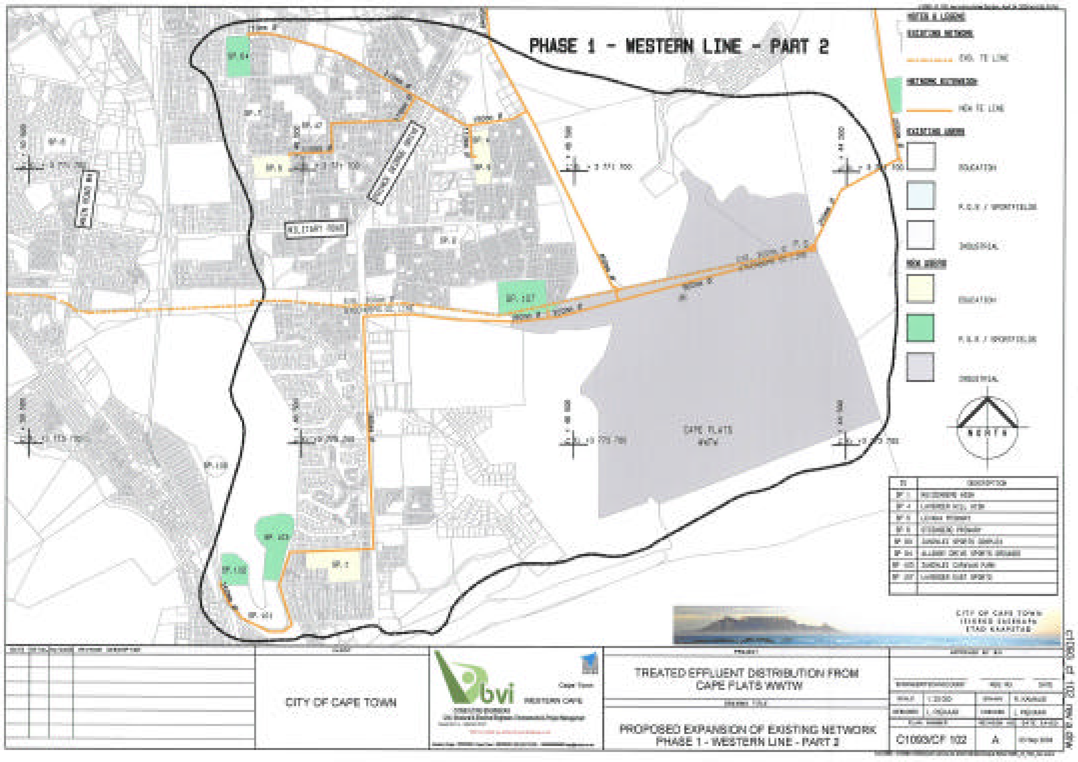
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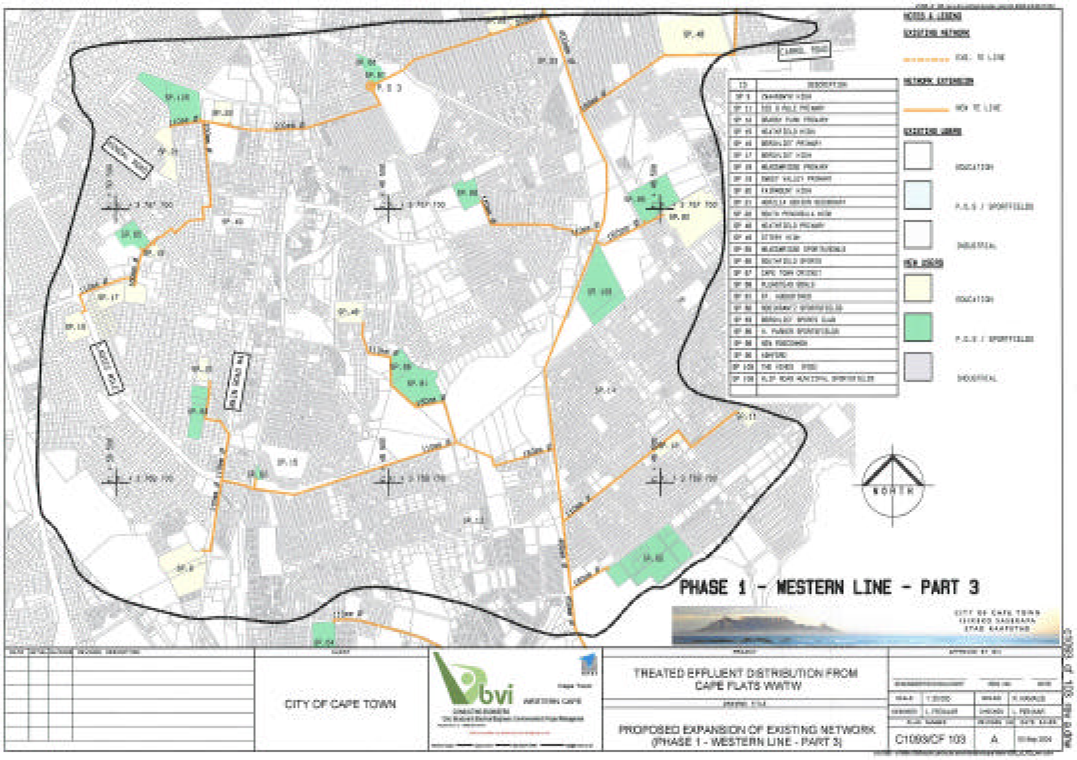
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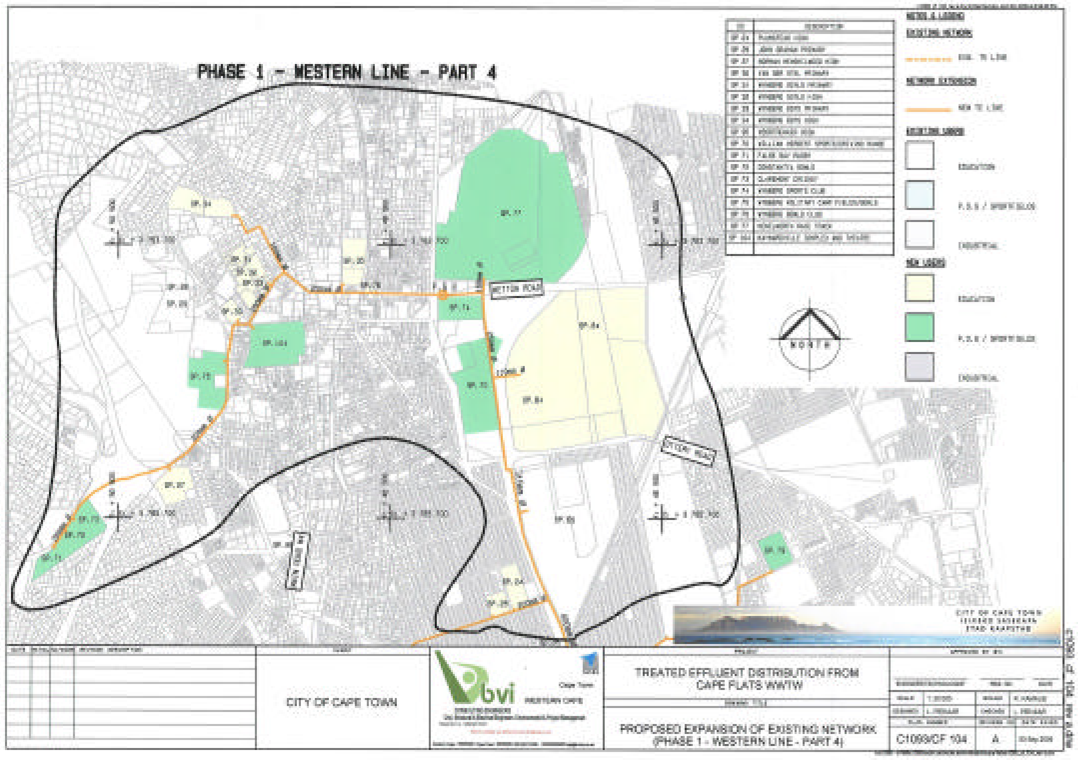
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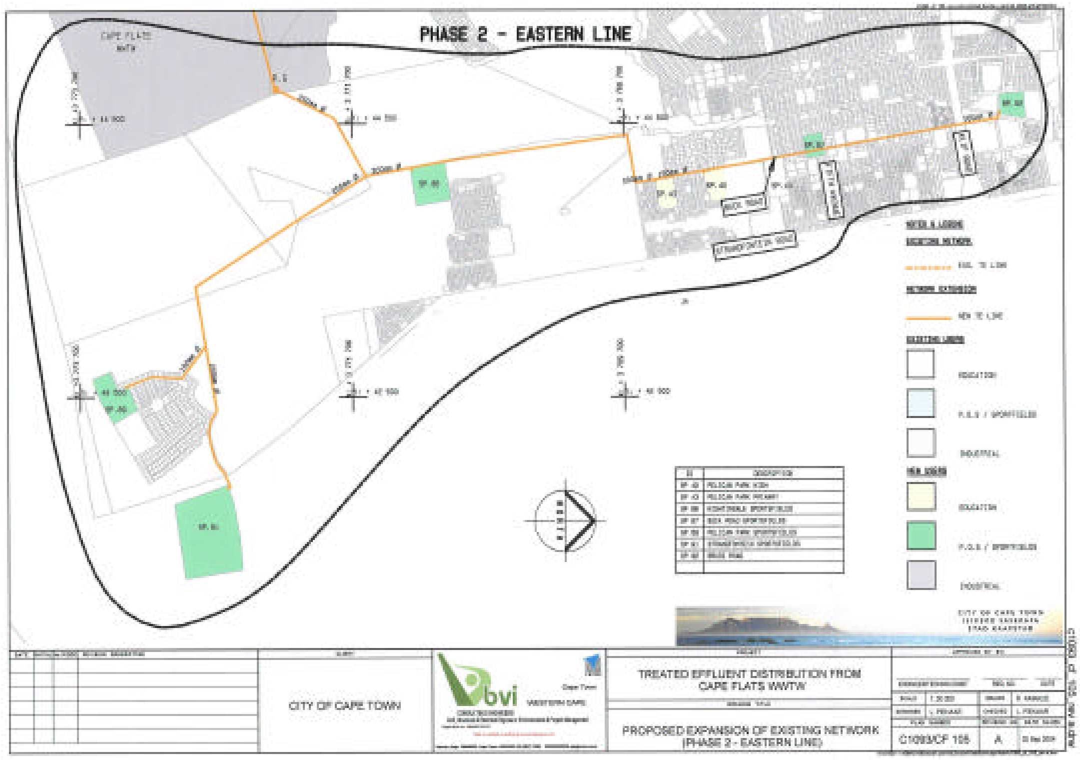
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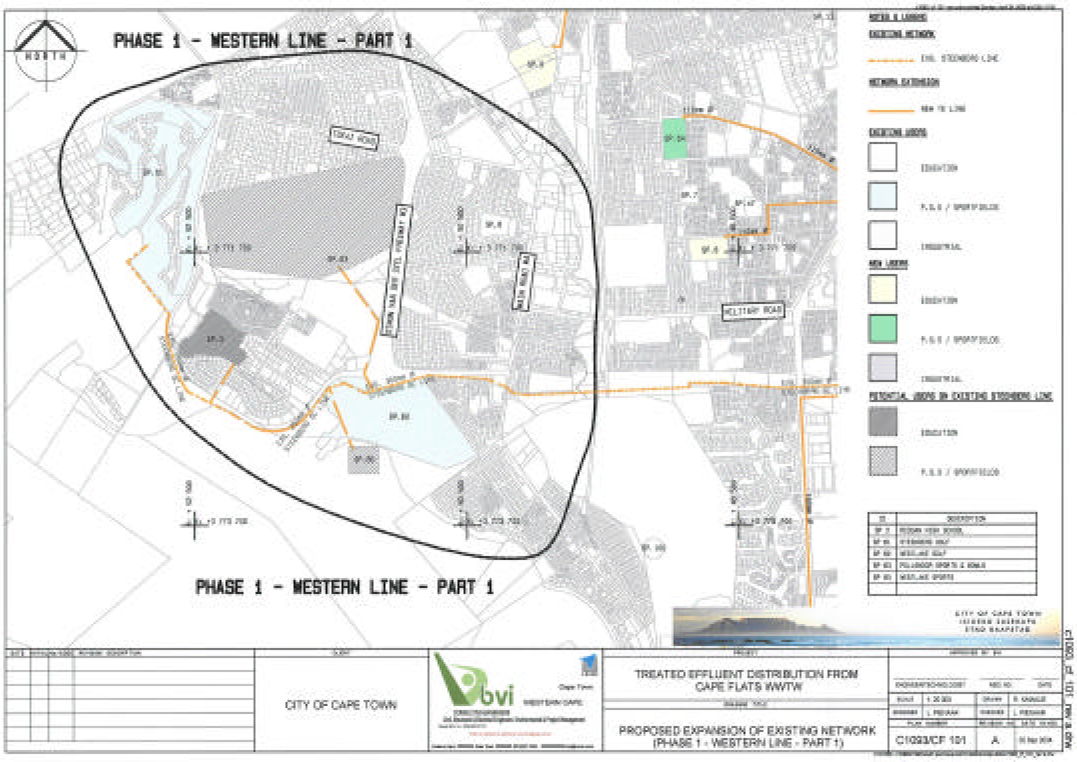
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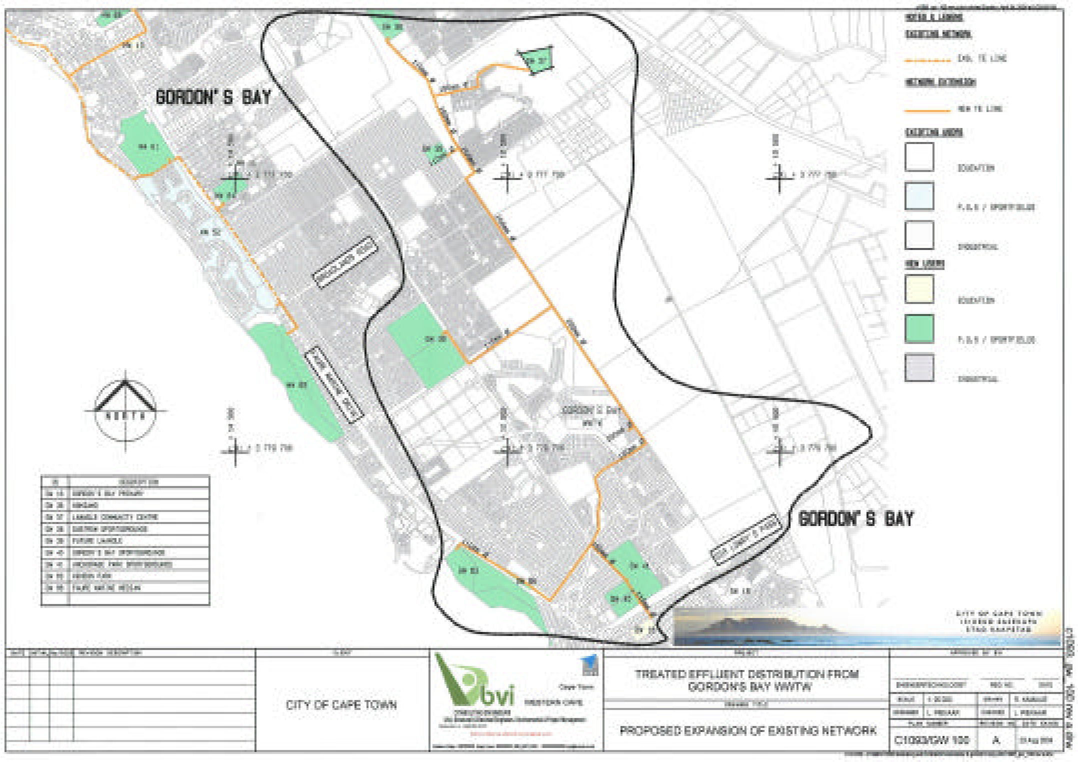
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GORDON'S BAY
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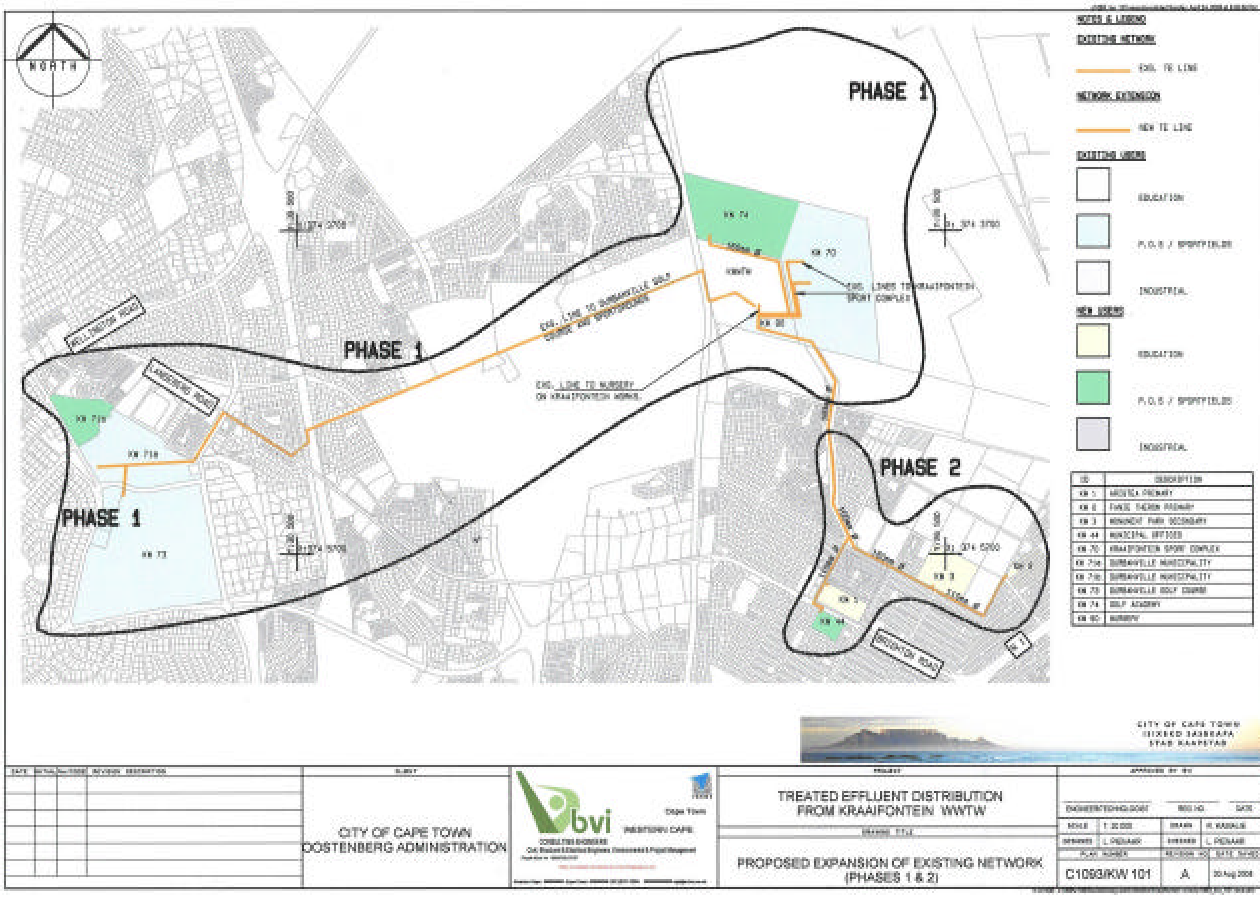
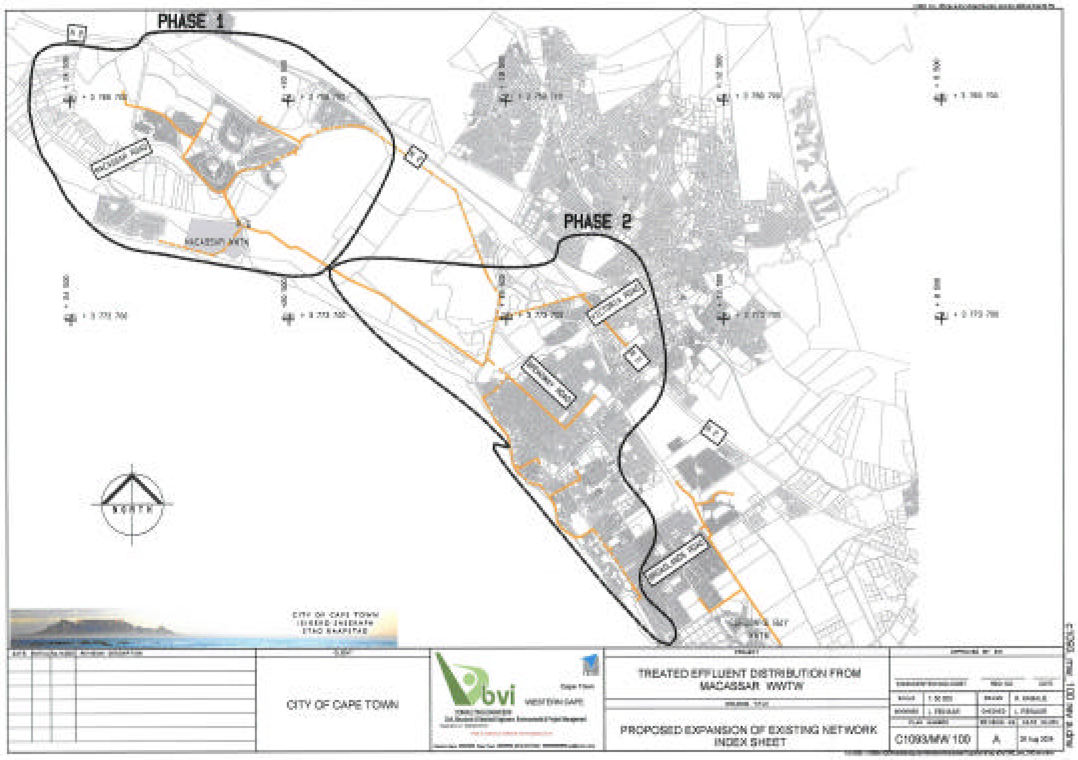


ID	DESCRIPTION
KW 1	ARCSTEA PRIMARY
KW 2	FANIE THERON PRIMARY
KW 3	MONUMENT PARK SECONDARY
KW 44	MUNICIPAL OFFICES
KW 70	KRAAIFONTEIN SPORT COMPLEX
KW 71a	DURBANVILLE MUNICIPALITY
KW 71b	DURBANVILLE MUNICIPALITY
KW 73	DURBANVILLE GOLF COURSE
KW 74	GOLF ACADEMY
KW 80	NURSERY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ISIXEKO SASEKAPA
STAD KAAPSTAD
CITY OF CAPE TOWN
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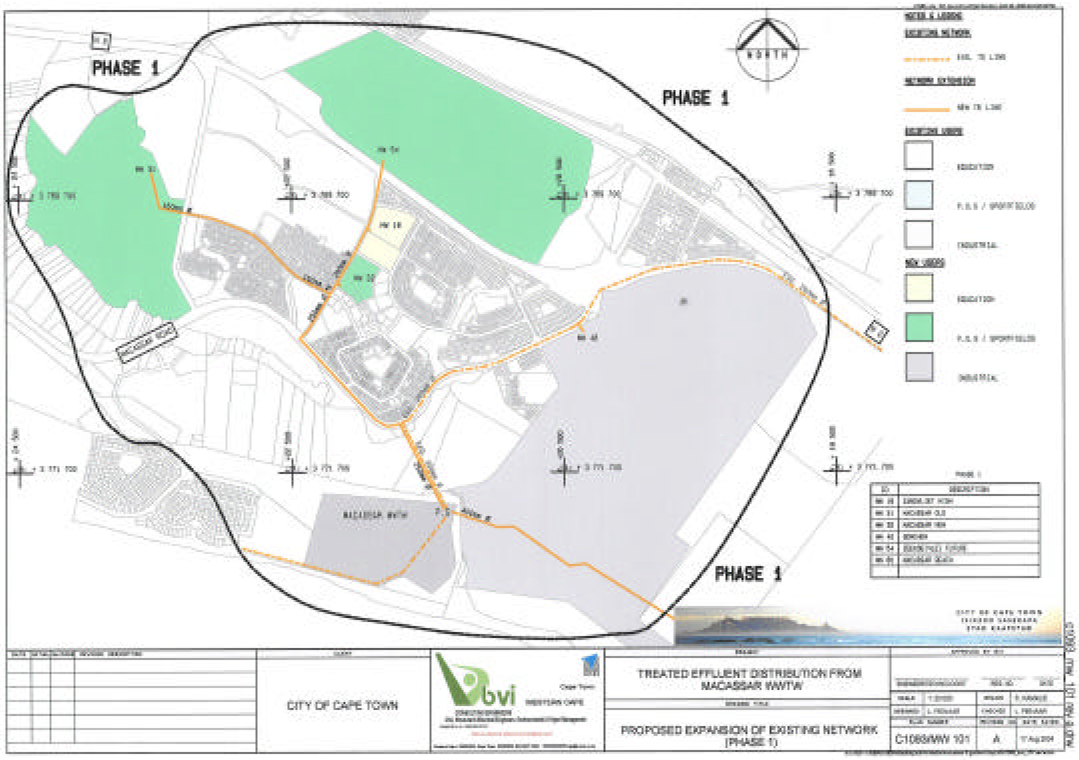
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PHASE 1
PHASE 1
MACASSAR WWTW
CITY OF CAPE TOWN
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PROPOSED EXPANSION OF EXISTING NETWORK (PHASE 1)
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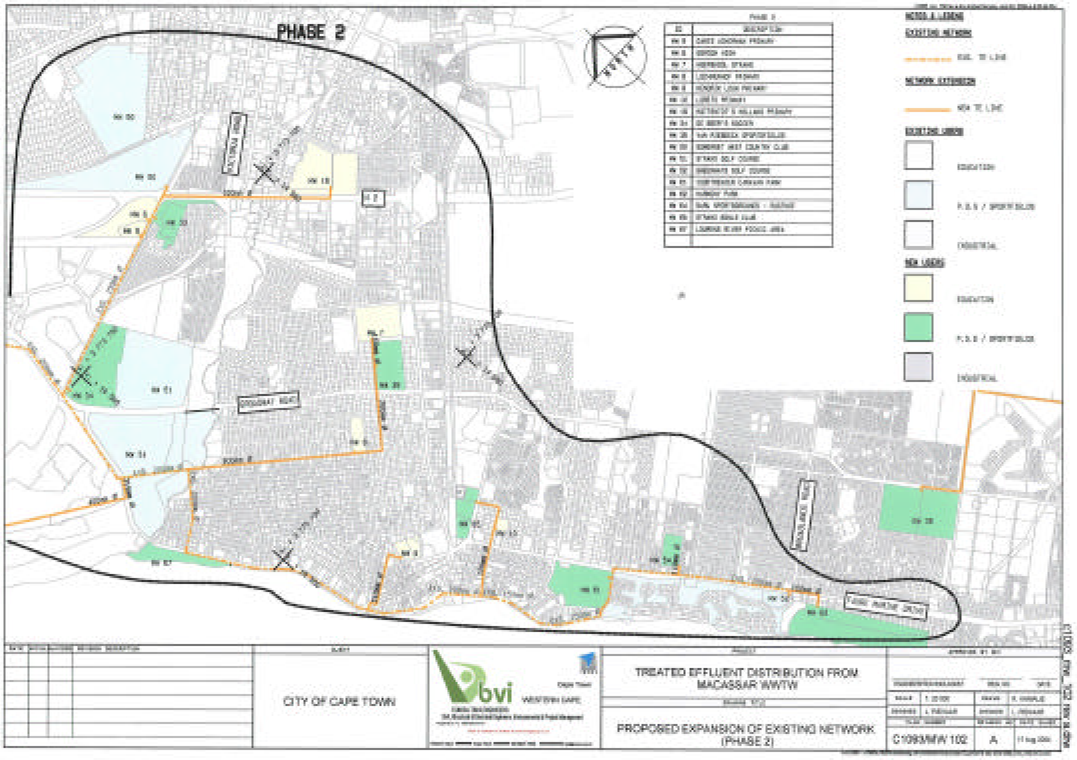

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bvi
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PROPOSED EXPANSION OF EXISTING NETWORK (PHASE 2)
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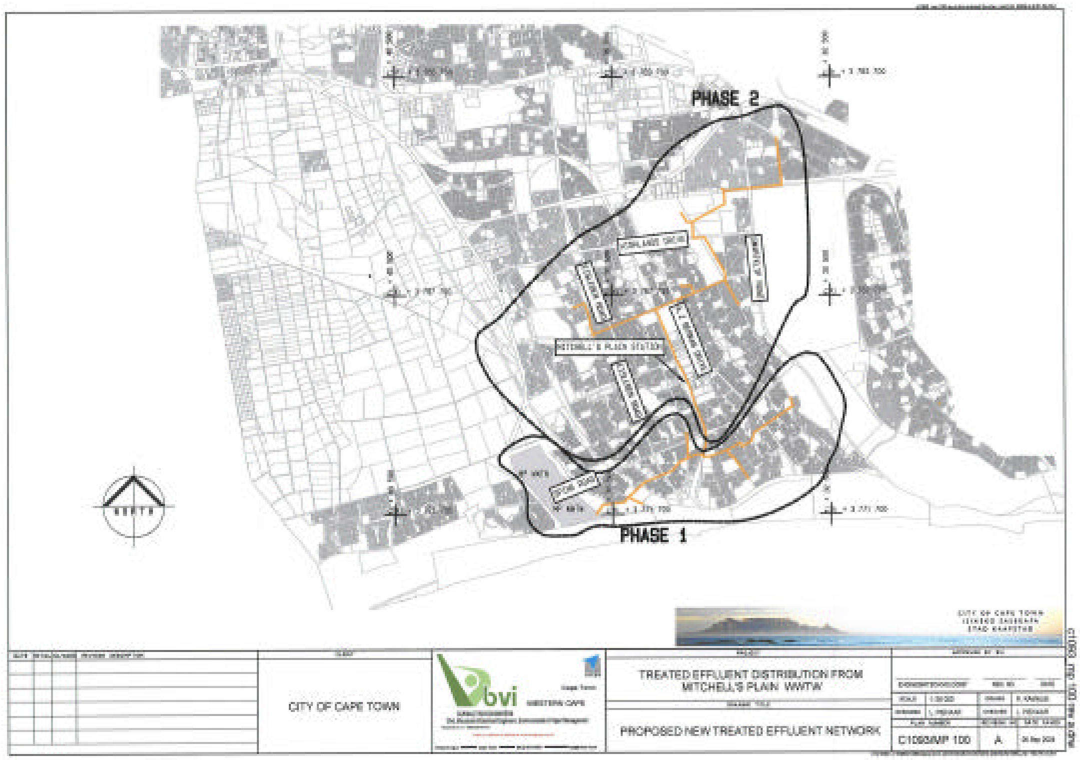

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PHASE 1
MITCHELL'S PLAIN STATION
CITY OF CAPE TOWN
TREATED EFFLUENT DISTRIBUTION FROM
MITCHELL'S PLAIN WWTW
PROPOSED NEW TREATED EFFLUENT NETWORK
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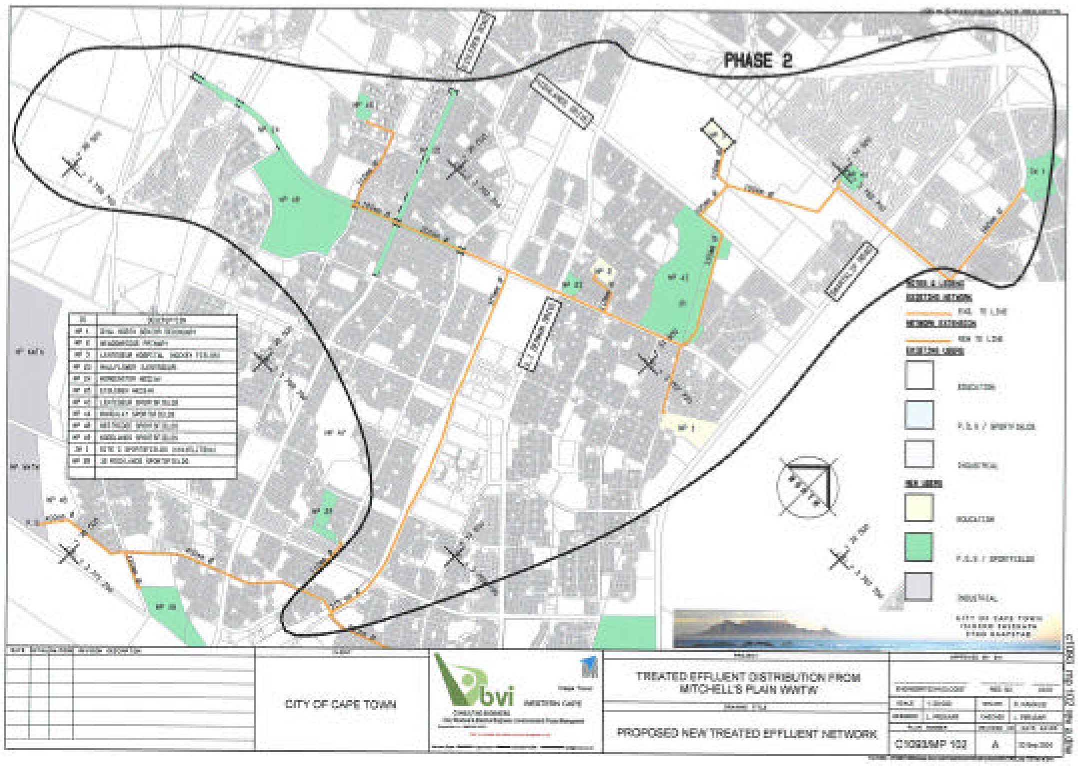
A
WESTERN CAPE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PROPOSED NEW TREATED EFFLUENT NETWORK
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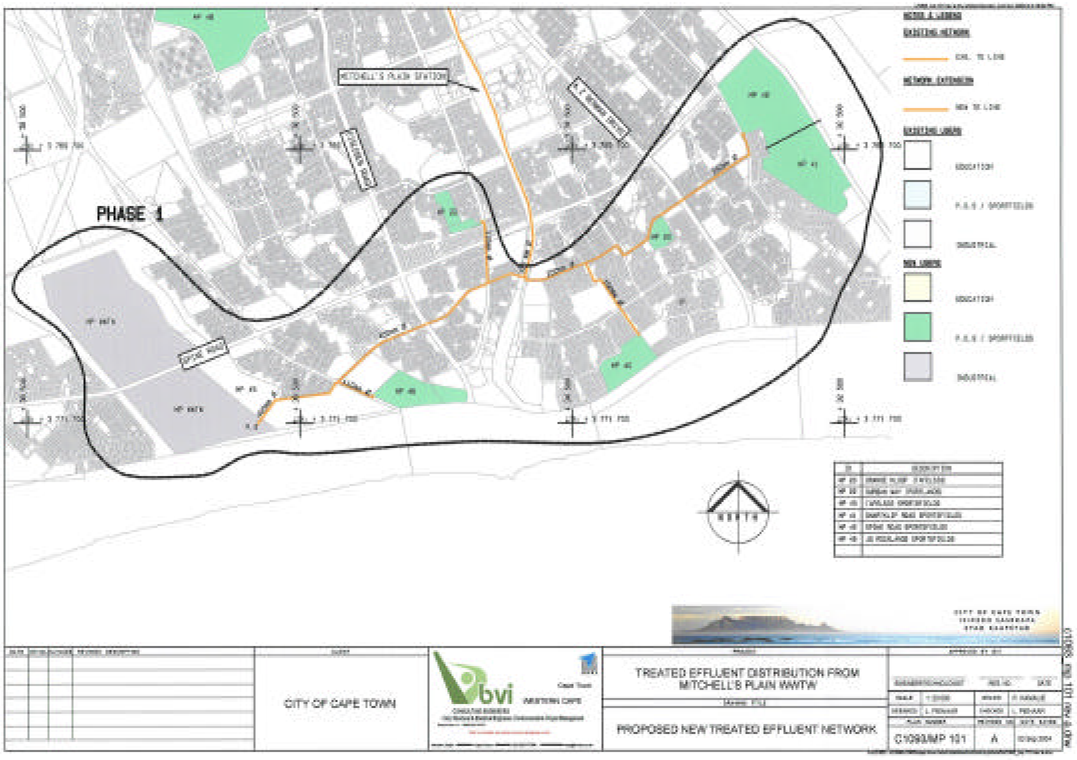
PHASE 1
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TREATED EFFLUENT DISTRIBUTION FROM
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PROPOSED NEW TREATED EFFLUENT NETWORK
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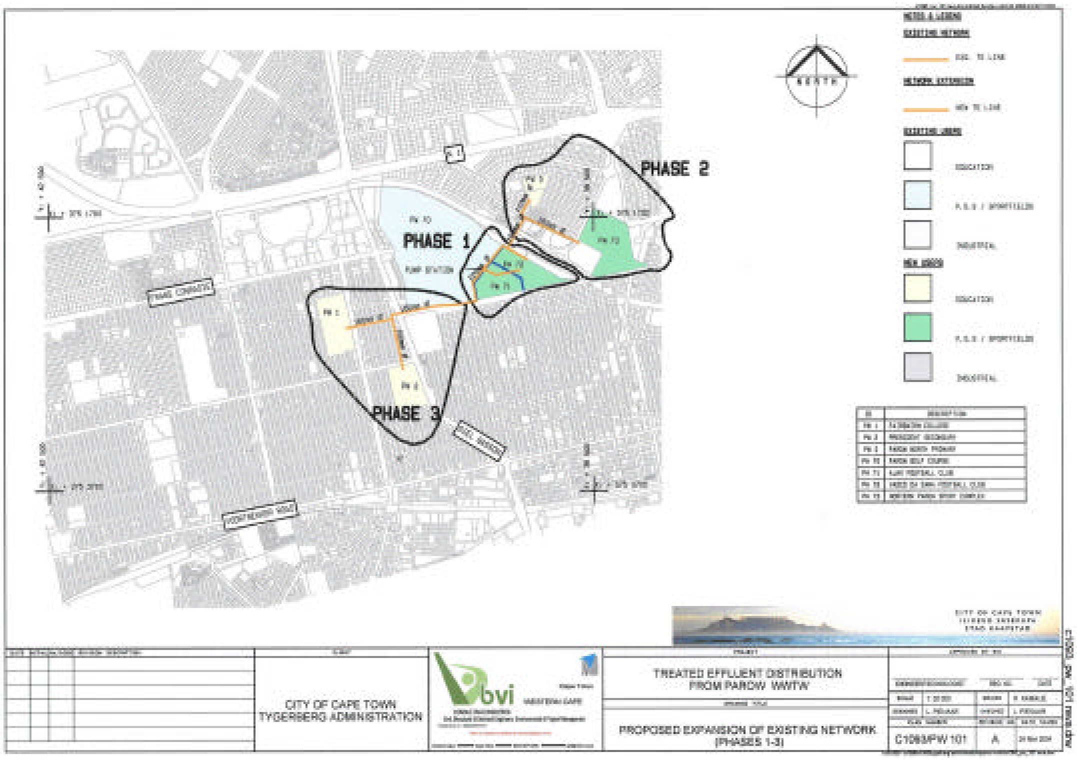

PHASE 1
PHASE 2
PHASE 3
PUMP STATION
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TYGERBERG ADMINISTRATION
bvi
WESTERN CAPE
TREATED EFFLUENT DISTRIBUTION
FROM PAROW WWTW
PROPOSED EXPANSION OF EXISTING NETWORK
(PHASES 1-3)
C1093/PW 101
A

APPENDIX F

Extracts from Guidelines

Table 1: USEPA Reclaimed Water Quality Guidelines		
Type of reuse	**Treatment required**	**Water quality**
Food crops not commercially processed	Secondary Filtration Disinfection	< 2.2 FC/100 mℓ; 1 mg $ℓ^{-1}$ Cl_2 after 30 minutes contact; Turbidity ≤2 NTU; BOD ≤10 mg $ℓ^{-1}$
Food crops commercially processed including orchards and vineyards	Secondary Disinfection	≤200 FC/100 mℓ; 1 mg $ℓ^{-1}$ Cl_2 after 30 minutes contact; TSS ≤30 mg $ℓ^{-1}$; BOD ≤30 mg $ℓ^{-1}$
Nonfood crops, pasture, fodder, fibre and seed	Secondary Disinfection	≤200 FC/100 mℓ; 1 mg $ℓ^{-1}$ Cl_2 after 30 minutes contact; TSS ≤30 mg $ℓ^{-1}$; BOD ≤30 mg $ℓ^{-1}$

For crop irrigation the water quality constituents of concern are salinity, sodium, trace elements (metals), chlorine residual and nutrients (nitrogen). Boron (from detergents) accumulation may also be problematical.

Table 2: Acceptable levels for trace metal and other constituents (DWAF)		
Constituent	**Long-term use > 20 years mg $ℓ^{-1}$**	**Short-term use ≤20 years mg $ℓ^{-1}$**
Aluminium	5.0	20
Arsenic	0.1	2.0
Beryllium	0.1	0.5
Boron	0.75	2.0
Cadmium	0.01	0.05
Chromium	0.1	1.0
Cobalt	0.05	5.0
Copper	0.2	5.0
Fluoride	1.0	15
Iron	5.0	20
Lead	5.0	10
Lithium	2.5	2.5
Manganese	0.2	10
Molybdenum	0.01	0.05
Nickel	0.2	2.0
Selenium	0.02	0.02
Vanadium	0.1	1.0
Zinc	2	10
pH	6.0	-
TDS	500-2000	-
Chlorine residual	< 1	-

USE	APPENDIX: RECYCLED WATER USES IN CALIFORNIA			
	Treatment Levels			
Irrigation	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Food crops where recycled water contacts the edible portion of the crop, including all root crops	**Allowed**	Not allowed	Not allowed	Not allowed
Parks and playgrounds	**Allowed**	Not allowed	Not allowed	Not allowed
School yards	**Allowed**	Not allowed	Not allowed	Not allowed
Residential landscaping	**Allowed**	Not allowed	Not allowed	Not allowed
Unrestricted access golf courses	**Allowed**	Not allowed	Not allowed	Not allowed
Any other irrigation uses not prohibited by other provisions of the California Code of Regulations	**Allowed**	Not allowed	Not allowed	Not allowed
Food crops where edible portion is produced above ground and not contacted by recycled water	**Allowed**	**Allowed**	Not allowed	Not allowed
Cemeteries	**Allowed**	**Allowed**	**Allowed**	Not allowed
Freeway landscaping	**Allowed**	**Allowed**	**Allowed**	Not allowed
Restricted access golf courses	**Allowed**	**Allowed**	**Allowed**	Not allowed
Ornamental nursery stock and sod farms	**Allowed**	**Allowed**	**Allowed**	Not allowed
Pasture for milk animals	**Allowed**	**Allowed**	**Allowed**	Not allowed
Nonedible vegetation with access control to prevent use as a park, playground or school yard	**Allowed**	**Allowed**	**Allowed**	Not allowed
Orchards with no contact between edible portion and recycled water	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Vineyards with no contact between edible portion and recycled water	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Non food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Fodder crops (e.g. alfalfa) and fiber crops (e.g. cotton)	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Seed crops not eaten by humans	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Food crops that undergo commercial pathogen-destroying processing before consumption by humans	**Allowed**	**Allowed**	**Allowed**	**Allowed**
Ornamental nursery stock, sod farms not irrigated less than 14 days before harvest	**Allowed**	**Allowed**	**Allowed**	**Allowed**

	Treatment Levels			
Supply for Cooling or Air Conditioning	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist	**Allowed 3**	Not allowed	Not allowed	Not allowed
Industrial or commercial cooling or air conditioning not involving a cooling tower, evaporative condenser, or sprasying that creates a mist	**Allowed**	**Allowed**	**Allowed**	Not allowed

	Treatment Levels			
Supply for Impoundment	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Non-restricted recreational impoundments, with supplemental monitoring for pathogenic organisms	**Allowed** <u>2</u>	Not allowed	Not allowed	Not allowed
Restricted recreational impoundments and publicly accessible fish hatcheries	**Allowed**	**Allowed**	Not allowed	Not allowed
Landscape impoundments without decorative fountains	**Allowed**	**Allowed**	**Allowed**	Not allowed

	Treatment Levels			
Other Uses	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Groundwater recharge	**Allowed under special case-by-case permits by RWQCBs 4**			
Flushing toilets and urinals	**Allowed**	Not allowed	Not allowed	Not allowed
Priming drain traps	**Allowed**	Not allowed	Not allowed	Not allowed
Industrial process water that may contact workers	**Allowed**	Not allowed	Not allowed	Not allowed
Structural fire fighting	**Allowed**	Not allowed	Not allowed	Not allowed
Decorative fountains	**Allowed**	Not allowed	Not allowed	Not allowed
Commercial laundries	**Allowed**	Not allowed	Not allowed	Not allowed
Consolidation of backfill material around potable water pipelines	**Allowed**	Not allowed	Not allowed	Not allowed
Artificial snow making for commercial outdoor uses	**Allowed**	Not allowed	Not allowed	Not allowed
Commercial car washes not done by hand & excluding the general public from washing process	**Allowed**	Not allowed	Not allowed	Not allowed
Industrial boiler feed	**Allowed**	**Allowed**	**Allowed**	Not allowed
Nonstructural fire fighting	**Allowed**	**Allowed**	**Allowed**	Not allowed
Backfill consolidation around nonpotable piping	**Allowed**	**Allowed**	**Allowed**	Not allowed
Soil compaction	**Allowed**	**Allowed**	**Allowed**	Not allowed
Mixing concrete	**Allowed**	**Allowed**	**Allowed**	Not allowed
Dust control on roads and streets	**Allowed**	**Allowed**	**Allowed**	Not allowed
Cleaning roads, sidewalks and outdoor work areas	**Allowed**	**Allowed**	**Allowed**	Not allowed
Flushing sanitary sewers	**Allowed**	**Allowed**	**Allowed**	**Allowed**

Guide: Permissible utilisation and disposal of treated sewage effluent

DEPARTMENT OF NATIONAL HEALTH AND POPULATION DEVELOPMENT

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Private Bag X 828
Pretoria 0001
Republic of South Africa

30 May 1978

REFERENCE: 11/2/5/3
30 MAY 1978

GUIDE: PERMISSIBLE UTILISATION AND DISPOSAL OF TREATED SEWAGE EFFLUENT

This guide sets out the present policy of the Department and replaces all previous relevant guides. Any person intending to use treated effluent must obtain prior permission to do so from the Regional Director concerned.

This guide is applicable only to treated sewage effluent which is mainly of domestic origin and contains little or no industrial effluent.

The Regional Directors have been empowered to relax the requirements specified in this guide or to impose additional or more stringent requirements in the light of special circumstances in specific cases.

This guide defines the following:

A. Classification of treated effluents
B. Directives for the use of treated effluent for irrigation purposes.
C. Directives for other uses of treated effluents.
D. Methods of disposal and discharge of treated effluents.
E. General directives and precautionary measures.

CLASSIFICATION OF TREATED EFFLUENTS (SEWAGE PURIFICATION WORKS) — A

PS - PRIMARY AND SECONDARY TREATMENT – HUMUS TANK EFFLUENT

Conventional sewage purification according to accepted design criteria[#]. This includes screening and primary settling followed by biological purification such as the biological filterbed process or activated sludge process. Secondary treatment also includes the settling or clarification after biological or alternative purification methods.

PST - PRIMARY, SECONDARY AND TERTIARY TREATMENT

Final effluent complies with the GENERAL STANDARD*, with the E.coli count relaxed to a maximum of 1000 E. coli /100 ml

In addition to the above-mentioned primary and secondary or equivalent treatment one or more tertiary treatments, viz. land treatment, maturation pond, filtration, chlorination or other types of disinfection, etc., should be applied.

STD - PRIMARY, SECONDARY AND TERTIARY TREATMENT

(Compare with PST)

Final effluent complies with the GENERAL STANDARD* viz. inter alia NIL E. coli/100 ml

SP-STD – ADVANCED PURIFICATION

Final effluent complies with at least the SPECIAL STANDARD* and the quality compares favourably with that recommended for drinking water

In addition to the above-mentioned primary, secondary and tertiary treatment, advanced purification also includes special physico-chemical purification or other advanced techniques.

OD – OXIDATION POND SYSTEM

Final effluent contains a maximum of 1 000 E. coli/100ml

The pond system should be designed according to a recognised standard[#] and operated in a nuisance-free manner. The combined retention time of the primary pond and approximately 4 secondary ponds should usually be at least 45 days. This system should drain into an irrigation dam of which the reserve storage capacity during dry weather conditions is at least 12 days. Unless sufficient space is available and the ponds are sufficiently remote from built-up areas, this system is not recommended for communities with a population exceeding 5 000.

Every oxidation pond system which is not able to deliver effluent of the above-mentioned quality should, for the purpose of this guide, be regarded on its merits as no more than equivalent to PS.

SEPTIC TANK EFFLUENT

(Primary settling and limited biological purification)

This effluent must undergo further secondary and tertiary or equivalent treatment before it may be utilised for the purposes indicated in this guide.

For the direct use or disposal, only nuisance-free land treatment or irrigation of fenced-in plantations will be permitted on its merits.

* GENERAL AND SPECIAL STANDARD

Quality requirements for purified sewage effluent as laid down by the Department of Water Affairs – see Government Notice R553 in Government Gazette Extraordinary of April 1962, and any amendments thereto. (E. coli = typical faecal coli).

[#] DESIGN CRITERIA

Design criteria such as those set out in A Guide to the Design of Sewage Purification Works of the Institute of Water Pollution Control (I.W.P.C.), Southern African Branch (November 1973).

THE ABOVE CLASSIFICATION OF TREATED SEWAGE EFFLUENT TYPES IS USED IN THE FOLLOWING TABLES

DIRECTIONS FOR THE UTILISATION OF TREATED EFFLUENTS FOR IRRIGATION					B
IRRIGATION OF	**PS – PRIMARY AND SECONDARY**	**PST – PRIMARY, SECONDARY AND TERTIARY**	**STD – GENERAL STANDARD**	**SP-STD – ADVANCED PURIFICATION**	**OD – OXIDATION POND SYSTEM**
1 • VEGETABLES AND CROPS CONSUMED RAW BY MAN (3 EXCLUDED) • LAWNS AT SWIMMING POOLS, NURSERY SCHOOLS, CHILDREN'S PLAYGROUNDS	• NOT PERMISSIBLE	• NOT PERMISSIBLE	• NOT PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE	• NOT PERMISSIBLE
2 • CROPS FOR HUMAN CONSUMPTION WHICH ARE <u>NOT</u> EATEN RAW (VEGETABLES, FRUIT, SUGAR-CANE) • CULTIVATION OF CUT FLOWERS (SEE ALSO 6)	• NOT PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE • EFFECTIVE DRAINING AND DRYING BEFORE HARVESTING IS ESSENTIAL	• ANY TYPE OF IRRIGATION PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE ON ITS MERITS • EFFECTIVE DRAINING AND DRYING BEFORE HARVESTING IS ESSENTIAL
3 • FRUIT TREES AND VINEYARDS: FOR THE CULTIVATION OF FRUIT WHICH IS EATEN RAW BY MAN (SEE 2 – FRUIT WHICH IS NOT EATEN RAW)	• NOT PERMISSIBLE	• FLOOD IRRIGATION PERMISSIBLE • DRIP AND MICRO-IRRIGATION PERMISSIBLE ON THEIR MERITS PROVIDED FRUITS ARE NOT DIRECTLY EXPOSED TO SPRAY • EFFECTIVE DRAINING AND DRYING BEFORE HARVESTING • FALLEN FRUIT IS UNSUITABLE FOR HUMAN CONSUMPTION	• ANY TYPE OF IRRIGATION PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE	• FLOOD, DRIP AND MICRO-IRRIGATION PERMISSIBLE ON THEIR MERITS PROVIDED FRUITS ARE NOT DIRECTLY EXPOSED TO SPRAY • EFFECTIVE DRAINING AND DRYING BEFORE FRUITS ARE HARVESTED • FALLEN FRUIT IS UNSUITABLE FOR HUMAN CONSUMPTION

IRRIGATION OF	PS – PRIMARY AND SECONDARY	PST – PRIMARY, SECONDARY AND TERTIARY	STD – GENERAL STANDARD	SP-STD – ADVANCED PURIFICATION	OD – OXIDATION POND SYSTEM
4 • GRAZING FOR CATTLE EXCLUDING MILK PRODUCING ANIMALS (SEE 5)	• NOT PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE BUT NOT DURING GRAZING • GRAZING ONLY PERMISSIBLE AFTER EFFECTIVE DRAINING AND DRYING – NO POOLS • NOT PERMISSIBLE AS DRINKING WATER FOR ANIMALS	• ANY TYPE OF IRRIGATION PERMISSIBLE • PERMISSIBLE AS DRINKING WATER FOR ANIMALS	• ANY TYPE OF IRRIGATION PERMISSIBLE • PERMISSIBLE AS DRINKING WATER FOR ANIMALS	• ANY TYPE OF IRRIGATION PERMISSIBLE BUT NOT DURING GRAZING • GRAZING ONLY PERMISSIBLE AFTER EFFECTIVE DRAINING AND DRYING – NO POOLS • NOT PERMISSIBLE AS DRINKING WATER FOR ANIMALS
5 • GRAZING FOR MILK PRODUCING ANIMALS (DEFINITION OF MILK – SECTION I(XV) OF THE HEALTH ACT 1977 (ACT 63 OF 1977)	• NOT PERMISSIBLE	• NOT PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE • PERMISSIBLE AS DRINKING WATER FOR ANIMALS	• ANY TYPE OF IRRIGATION PERMISSIBLE • PERMISSIBLE AS DRINKING WATER FOR ANIMALS	• NOT PERMISSIBLE
6 • CROPS NOT FOR GRAZING, BUT UTILISED AS DRY FODDER • CROP CULTIVATED FOR SEED PURPOSES ONLY • TREE PLANTATIONS • NURSERIES – CUT FLOWERS EXCLUDED (SEE 2) ANY PARK OR SPORTSFIELD ONLY DURING DEVELOPMENT AND BEFORE OPENING THEREFOF	• ANY TYPE OF IRRIGATION PERMISSIBLE ON ITS MERITS • NO OVER-IRRIGATION OR POOL FORMING • NO SMELL NUISANCE • PROPERLY FENCED • NO PUBLIC ALLOWED • NO MEAT ANIMALS, MILK PRODUCING ANIMALS OR POULTRY ALLOWED	• ANY TYPE OF IRRIGATION PERMISSIBLE (SEE ALSO 4 AND 5)	• ANY TYPE OF IRRIGATION PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE (SEE ALSO 4 AND 5)

IRRIGATION OF	PS – PRIMARY AND SECONDARY	PST – PRIMARY, SECONDARY AND TERTIARY	STD – GENERAL STANDARD	SP-STD – ADVANCED PURIFICATION	OD – OXIDATION POND SYSTEM
7 • PARKS AND SPORTSFIELDS (SEE 6) • LAWNS AT SWIMMING POOL EXCLUDED (SEE 1)					
• (i) PARKS, ONLY FOR BEAUTIFYING FLOWERBEDS, TRAFFIC ISLANDS ETC. – I.E.. NOT A RECREATION AREA	• ONLY FLOOD IRRIGATION PERMISSIBLE • NO SPRINKLER IRRIGATION PERMISSIBLE • NO PUBLIC DURING IRRIGATION	• FLOOD IRRIGATION PERMISSIBLE • SPRINKLER IRRIGATION PERMISSIBLE ON ITS' MERITS • NO PUBLIC DURING IRRIGATION	• ANY TYPE OF IRRIGATION PERMISSIBLE • NO PUBLIC DURING IRRIGATION	• ANY TYPE OF IRRIGATION PERMISSIBLE	• FLOOD IRRIGATION PERMISSIBLE • SPRINKLER IRRIGATION PERMISSIBLE ON ITS' MERITS • NO PUBLIC DURING IRRIGATION
• (ii) SPORTSFIELDS WHERE LIMITED CONTACT IS MADE WITH THE SURFACE EG. GOLF COURSES, CRICKET, HOCKEY AND SOCCER FIELDS, ETC.	• NOT PERMISSIBLE	• ANY TYPE OF IRRIGATION PERMISSIBLE • NO OVER-IRRIGATION AND NO POOL FORMING • NO PUBLIC OR PLAYERS DURING IRRIGATION • PUBLIC AND/OR PLAYERS ADMITTED ONLY AFTER EFFECTIVE DRAINING AND DRYING	• ANY TYPE OF IRRIGATION PERMISSIBLE • NO OVER-IRRIGATION AND NO POOL FORMING • NO PUBLIC AND/OR PLAYERS DURING IRRIGATION	• ANY TYPE OF IRRIGATION PERMISSIBLE • NO PUBLIC AND/OR PLAYERS DURING IRRIGATION	• FLOOD IRRIGATION PERMISSIBLE • SPRINKLER IRRIGATION PERMISSIBLE ON ITS' MERITS • NO OVER-IRRIGATION AND NO POOL FORMING • NO PUBLIC AND/OR PLAYERS DURING IRRIGATION • PUBLIC AND/OR PLAYERS ADMITTED ONLY AFTER EFFECTIVE DRAINING AND DRYING

<table>
<tr><th>IRRIGATION OF</th><th>PS – PRIMARY AND SECONDARY</th><th>PST – PRIMARY, SECONDARY AND TERTIARY</th><th>STD – GENERAL STANDARD</th><th>SP-STD – ADVANCED PURIFICATION</th><th>OD – OXIDATION POND SYSTEM</th></tr>
<tr><td rowspan="2">• (iii) SPORTSFIELDS WHERE CONTACT IS OFTEN MADE WITH THE SURFACE , EG. RUGBY FIELDS, ATHLETICS TRACKS, ETC.

• SCHOOL GROUNDS

• PUBLIC PARKS – SPECIAL CHILDREN’S PLAYGROUNDS EXCLUDED (SEE 1</td><td rowspan="2">• NOT PERMISSIBLE</td><td>• FLOOD IRRIGATION PERMISSIBLE

• SPRINKLER IRRIGATION PERMISSIBLE ON ITS’ MERITS

• NO OVER-IRRIGATION AND NO POOL FORMING</td><td>• ANY TYPE OF IRRIGATION PERMISSIBLE

• NO OVER-IRRIGATION AND NO POOL FORMING</td><td>• ANY TYPE OF IRRIGATION PERMISSIBLE</td><td>• ONLY FLOOD IRRIGATION PERMISSIBLE

• SPRINKLER IRRIGATION NOT PERMISSIBLE

• NO OVER-IRRIGATION AND NO POOL FORMING</td></tr>
<tr><td colspan="4">• NO PUBLIC OR PLAYERS DURING IRRIGATION

• PUBLIC AND/OR PLAYERS ADMITTED ONLY AFTER EFFECTIVE DRAINING AND DRYING</td></tr>
</table>

<table>
<tr><th colspan="2">IRRIGATION – GENERAL REMARKS AND PRECAUTIONS</th></tr>
<tr><td>a) In order to obviate the irrigation system causing a nuisance in time, evidence must be produced that the type of soil and the size of the surface as well as the type of crop concerned are suitable for irrigation with the proposed quantity and quality of effluent.

b) The piping used for effluent be markedly different from the piping used for drinking water in respect of colour, type of material and construction. This precaution is necessary in order to obviate accidental cross-coupling of piping.

c) In order to prevent persons from unwittingly drinking effluent water or washing with it, the taps, valves and sprayers of the irrigation system must be so designed that only authorised persons can open them or bring them into operation.

d) Every water point where uninformed persons could possibly drink effluent water must be provided with a notice in clearly legible English, Afrikaans and any other appropriate official languages, indicating that it is potentially dangerous to drink the water.</td><td>e) The expression ‘after effective draining and drying” in the above-mentioned table means that the particular act may take place only when no pools or drops of effluent are evident in the irrigation area concerned.

f) All possible precautions should be taken to ensure that no surface or underground water is contaminated by the irrigation water, especially where the latter does not comply with the General Standard. Excessive irrigation must therefore be avoided and the irrigation area protected against stormwater by means of suitable contours and screening walls.

g) Sprinkler irrigation shall be permitted only if <u>no</u> spray is blown over to areas where, such irrigation is forbidden. In this connection the quality of the effluent, the use of such adjoining area and its distance from the irrigation area must be taken into consideration before sprinkler irrigation is permitted.</td></tr>
</table>

<table>
<tr><th colspan="5">DIRECTIVES FOR OTHER USES OF TREATED EFFLUENTS</th><th>C</th></tr>
<tr><th>OTHER USES OF EFFLUENTS</th><th>PS – PRIMARY AND SECONDARY</th><th>PST – PRIMARY, SECONDARY AND TERTIARY</th><th>STD – GENERAL STANDARD</th><th>SP-STD – ADVANCED PURIFICATION</th><th>OD – OXIDATION POND SYSTEM</th></tr>
<tr><td>• INDUSTRIAL AND SUNDRY USES NOT MENTIONED BEFORE</td><td>• PERMISSIBLE ON MERITS IN EXCEPTIONAL CASES ONLY</td><td colspan="3">• EACH CASE WILL BE TREATED ON ITS MERITS
• THE EMPHASIS WILL BE ON THE E.COLI COUNT
• IN GENERAL THE EFFLUENT MUST BE FREE FROM PARASITIC OVA, PATHOGENIC ORGANISMS, TOXIC SUBSTANCE, ETC.</td><td>PERMISSIBLE ON MERITS IN EXCEPTIONAL CASES ONLY</td></tr>
<tr><td>• FOOD INDUSTRY (ALSO COOLING WATER)</td><td>• NOT PERMISSIBLE</td><td>• NOT PERMISSIBLE</td><td>• NOT PERMISSIBLE</td><td>• NOT PERMISSIBLE</td><td>• NOT PERMISSIBLE</td></tr>
<tr><td rowspan="2">• MINES AND INDUSTRIES: ORE TREATMENT, DUST CONTROL ETC.</td><td rowspan="2">• PERMISSIBLE ON MERITS IN EXCEPTIONAL CASES ONLY</td><td>• PERMISSIBLE ON MERITS PROVIDED HUMAN CONTACT IS EXCLUDED.</td><td>• PERMISSIBLE</td><td>• PERMISSIBLE</td><td rowspan="2">• PERMISSIBLE ON MERITS IN EXCEPTIONAL CASES ONLY</td></tr>
<tr><td colspan="3">• ALL TAPS AND WATER DRAW-OFF POINTS IN THE EFFLUENT DISTRIBUTION SYSTEM MUST BE PROVIDE WITH CLEARLY LEGIBLE NOTICES IN ENGLISH, AFRIKAANS AND ANY OTHER APPROPRIATE OFFICIAL LANGUAGES, INDICATING THAT THE WATER IS <u>NOT</u> SUITABLE FOR HUMAN CONSUMPTION.</td></tr>
<tr><td>• HUMAN WASHING PURPOSES</td><td>• NOT PERMISSIBLE</td><td>• NOT PERMISSIBLE</td><td>• NOT PERMISSIBLE</td><td>• PERMISSIBLE ON MERITS

• CLEARLY LEGIBLE NOTICES MUST BE DISPLAYED INDICATING THAT THE WATER IS <u>NOT</u> FIT FOR HUMAN CONSUMPTION OR FOOD PREPARATION</td><td>• NOT PERMISSIBLE</td></tr>
<tr><td>• FLUSH TOILETS</td><td>• NOT PERMISSIBLE</td><td colspan="3">• PERMISSIBLE ON MERITS
• IN ORDER TO PREVENT THE USE OF EFFLUENT FOR UNAUTHORISED PURPOSES, NO OTHER DRAW-OFF BIB-COCKS SHALL BE AFFIXED TO EFFLUENT MAINS</td><td>• NOT PERMISSIBLE</td></tr>
</table>

<table>
<tr><th>OTHER USES OF EFFLUENTS</th><th>PS – PRIMARY AND SECONDARY</th><th>PST – PRIMARY, SECONDARY AND TERTIARY</th><th>STD – GENERAL STANDARD</th><th>SP-STD – ADVANCED PURIFICATION</th><th>OD – OXIDATION POND SYSTEM</th></tr>
<tr><td rowspan="2">• DUST CONTROL ON ROADS</td><td rowspan="2">• NOT PERMISSIBLE</td><td colspan="2">• PERMISSIBLE
• EXCESSIVE SPRAYING AND POOL FORMING MUST BE AVOIDED
• NO SURFACE OR UNDERGROUND WATER MAY BE POLLUTED</td><td>• PERMISSIBLE</td><td rowspan="2">• NOT PERMISSIBLE</td></tr>
<tr><td colspan="3">• NO SMELL NUISANCE MAY BE CREATED
• ANY DIRECT HUMAN CONTACT WITH THE SPRAY MUST BE PREVENTED AS FAR AS IS PRACTICABLE
• STEPS MUST BE TAKEN TO ENSURE THAT NO EFFLUENT IS USED DIRECTLY OR INDIRECTLY FOR DOMESTIC PURPOSES
• CONTAINERS USED FOR THE TRANSPORTATION OF EFFLUENT MUST NOT BE USED THEREAFTER FOR THE TRANSPORTATION OF DRINKING WATER BEFORE THEY HAVE BEEN EFFECTIVELY CLEANED OUT AND DISINFECTED</td></tr>
<tr><td colspan="6">GENERAL REMARKS: IT IS COMPULSORY THAT THE NECESSARY PRECAUTIONARY MEASURES BE TAKEN WITH EACH OF THE ABOVE-MENTIONED USES IN ORDER TO PREVENT THE USE OF THE TREATED EFFLUENT FOR DRINKING OR DOMESTIC PURPOSES. IN ADDITION, IT IS ALSO COMPULSORY THAT THE MATERIAL AND/OR THE COLOUR OF THE EFFLUENT PIPELINE BE SUCH AS TO PREVENT ACCIDENTAL CROSS-COUPLING WITH DRINKING WATER PIPELINES. SEE ALSO (b) UNDER THE HEADING “IRRIGATION – GENERAL REMARKS AND PRECAUTIONS ON PAGE 7.</td></tr>
</table>

METHODS OF DISPOSAL AND DISCHARGE OF TREATED EFFLUENTS					D
METHODS OF DISPOSAL AND DISCHARGE OF EFFLUENTS	**PS – PRIMARY AND SECONDARY**	**PST – PRIMARY, SECONDARY AND TERTIARY**	**STD – GENERAL STANDARD**	**SP-STD – ADVANCED PURIFICATION**	**OD – OXIDATION POND SYSTEM**
1) DISCHARGE INTO RIVERS AND WATER COURSES, EXCLUDING ESTUARIES, DAMS AND LAGOONS – SEE 2	• NOT PERMISSIBLE	• PERMISSIBLE ON MERITS WITH DUE REGARD TO LOCAL CIRCUMSTANCES SUCH AS THE DILUTION FACTOR IN THE RIVER OR STREAM, RAINFALL ETC. • THE PERMISSIBILITY OF DISCHARGE MUST BE DETERMINED WITH DUE REGARD TO THE USE OF THE RIVER WATER DOWNSTREAM • THE DISCHARGE POINT MUST BE DETERMINED WITH DUE REGARD TO THE POSITION OF WATER ABSTRACTION POINT(S) FOR DOMESTIC PURPOSES LOWER DOWN THE RIVER • THE EFFLUENT MUST CONTAIN NO HARMFUL SUBSTANCES IN CONCENTRATIONS DANGEROUS TO HEALTH	• PERMISSIBLE, PROVIDED THE EFFLUENT CONTAINS NO HARMFUL SUBSTANCES IN CONCENTRATIONS DANGEROUS TO HEALTH	• NOT PERMISSIBLE	• NOT PERMISSIBLE
2) DISCHARGE INTO ESTUARIES, DAMS, LAKES, LAGOONS OR OTHER MASSES OF WATER (SEA EXCLUDED – SEE 3)	• NOT PERMISSIBLE	• PERMISSIBLE ON MERITS IF REASONABLE ASSURANCE EXISTS THAT THE QUALITY AND VOLUME ARE SUCH AS NOT TO CAUSE NUISANCES OR HEALTH HAZARDS • ONCE MIXED WITH THE EFFLUENT THE WATER MUST NOT BECOME LESS SUITABLE FOR DOMESTIC USE AND/OR RECREATION • THE EFFLUENT MUST CONTAIN NO HARMFUL SUBSTANCES IN CONCENTRATIONS DANGEROUS TO HEALTH	• PERMISSIBLE, PROVIDED THE EFFLUENT CONTAINS NO HARMFUL SUBSTANCES IN CONCENTRATIONS DANGEROUS TO HEALTH	• PERMISSIBLE	NOT PERMISSIBLE

<table>
<tr><th>METHODS OF DISPOSAL AND DISCHARGE OF EFFLUENTS</th><th>PS – PRIMARY AND SECONDARY</th><th>PST – PRIMARY, SECONDARY AND TERTIARY</th><th>STD – GENERAL STANDARD</th><th>SP-STD – ADVANCED PURIFICATION</th><th>OD – OXIDATION POND SYSTEM</th></tr>
<tr><td rowspan="2">3)
DISCHARGE INTO THE SEA</td><td colspan="2">• ONLY PERMISSIBLE BEYOND THE SURF ZONE
• THE DISCHARGE POINT MUST BE DETERMINED WITH DUE REGARD TO THE QUALITY AND VOLUME OF EFFLUENT, THE SEA CURRENTS, THE DISTRIBUTION AND DILUTION OF EFFLUENT, AND THE PROXIMITY OF PRESENT AND FUTURE BATHING AREAS.</td><td>• PERMISSIBLE
• DISCHARGE INTO THE SURF ZONE MUST BE DETERMINED WITH DUE REGARD TO THE PROXIMITY OF PRESENT AND FUTURE BATHING AREAS AND THE EFFECT ON THE QUALITY OF SEAWATER IN SUCH AREA</td><td rowspan="2">• PERMISSIBLE</td><td rowspan="2">• PERMISSIBLE ON MERITS AS FOR PS AND PST</td></tr>
<tr><td colspan="3">• NO COASTAL AREA MAY BE POLLUTED WITH EFFLUENTS CONTAINING SUBSTANCES WHICH ARE POTENTIALLY HARMFUL TO HEALTH
• THE DISCHARGE OF EFFLUENT MUST NOT CAUSE ANY NUISANCE OR HAVE ANY EFFECT ON MARINE LIFE WHICH MAY ADVERSELY AFFECT MAN DIRECTLY OR INDIRECTLY</td></tr>
<tr><td colspan="6">IN MOST CASES THE INFLUENCE OF THE ABOVE-MENTIONED DISCHARGES IS NOT DIRECTLY PREDICTABLE. IT WOULD THEREFORE USUALLY BE REQUIRED THAT THE NECESSARY INVESTIGATIONS BE MADE TO DETERMINE SUCH INFLUENCE WITH REASONABLE CERTAINTY.</td></tr>
</table>

GENERAL DIRECTIONS AND PRECAUTIONARY MEASURES — E

a) The sewage purification works must be efficiently operated by adequately trained personnel at all times and must, as far as is reasonably practicable, not be overloaded.

b) The person or authority in charge of the purification works must satisfy himself that the quality of the final effluent will at all times be in accordance with the directives as set out in this guide.

c) Regular control tests of representative final effluent samples must be made at least quarterly and records must be kept of such tests.

d) The person or authority in charge of the works must ensure that the quality of the final effluent and the use thereof comply with the directives set out in this guide – also when such effluent is utilised by another person or body. The supply and utilisation of effluent must be terminated if the directives set out in this guide are not complied with.

e) A person or body using the final sewage effluent for a purpose set out in this guide, but not undertaking the purification himself, must satisfy himself that only permissible utilisation practices are maintained and must forthwith discontinue the use thereof should he become aware of any deviation from the directive contained in this guide.

f) Compliance with the requirements for the utilisation of purified sewage effluent as set out in this guide is the individual and joint responsibility of both the supplier and the user of the final effluent.

g) In the case of a use qualified in this guide as permissible on merit, it will be necessary for the relevant uses and methods of use to be thoroughly motivated and investigated. The majority of such cases, stricter supervision and control of the system as well as the quality of the effluent will be required in order to prevent the development of any nuisance or conditions dangerous to health.

APPENDIX G

Summary of Treated Effluent Options Investigated as Part of Other Studies

USE OF TREATED EFFLUENT

Domestic and industrial wastewaters are discharged into sewer networks, which generally convey the wastewater to a wastewater treatment works, where biological treatment of various forms takes place. The treated wastewater is then either discharged into an adjacent watercourse or the sea, often with some negative environmental impact.

The use of treated effluent therefore entails the interception of the treated effluent immediately after discharge from the works, recycling it and using the reclaimed water for other uses, as an alternative to potable water. Possible uses for treated effluent include:

- Urban irrigation of sports fields and public open spaces;
- Use in certain industrial processes;
- Agricultural irrigation;
- Dual reticulation systems for garden watering and toilet flushing;
- Aquifer recharge; and
- Potable use.

The various re-use options presented above would have differing quality requirements to ensure that the treated effluent is fit for purpose with the most economical re-use options generally being those that require the least amount of subsequent treatment. The practicality and costs of using treated effluent from a single water treatment works for a number of re-use options, therefore requires careful consideration.

A total of in excess of 500 Ml/day (182.5 Mm^3/a) of wastewater is treated at the various wastewater treatment works in the Cape Town Metropolitan area, of which approximately 10 % is currently being re-used, primarily for summer irrigation purposes.

Treated effluent therefore represents a significant potential water source, whose development has to a large extent been inhibited by people's aversion to the notion of coming into contact with treated effluent. It must however be noted that there are potential health risks associated with the use of treated effluent, the majority of which can be avoided through good engineering practice.

Previous studies undertaken have indicated that local irrigation, agriculture and industrial use could potentially utilise about 40 % of the effluent treated during summer, with the irrigation and agricultural usages falling away during winter. It can therefore be seen that the use of treated effluent to potable standards is required in order to maximise the exploitation of this source.

The following criteria would impact on the re-use potential of effluent from a particular works:

- Size of supply
- Extent of local demand
- Nature of influent
- Quality of treated wastewater
- Impact on downstream environments
- Intended use of treated effluent

Various re-use options are presented in this document as individual supply augmentation options. However, the collective use of a number of treated effluent re-use options, which may be appropriate to a particular area or wastewater treatment works, may be more appropriate. Therefore, the various options need to be considered as part of an overall strategy for the use of treated effluent.

The locations of the WWTW within the CCT are shown in the Figure below.

Use of Treated Wastewater Local Irrigation and Industrial Use

1. “SCHEME”/OPTION LAYOUT

Potential exists for re-use in proximity to all WWTW and surrounds.

2. “SCHEME”/OPTION DESCRIPTION

Unless otherwise stated, the information presented is taken from the CCT *Investigation into the distribution of treated effluent;* series of reports on the various wastewater treatment works (WWTW) within the CMA, dated November 2003 and August 2004 respectively.

This option entails the use of treated wastewater, primary for the irrigation of sportsfields and public open space, but also for agricultural and industrial purposes, via a separate treated wastewater distribution networks, emanating from existing WWTW’s within the CCT.

Although the investigation undertaken by the CCT resulted in the proposal of a number of specific schemes, one for each of the thirteen (13) WWTW’s investigated; the information has been collated and considered as a collective option for comparison purposes with other augmentation schemes. It must however be noted that some of the individual schemes proposed are more cost effective than others and that some schemes may become less cost effective as they extend further from the WWTW. Each of the complete schemes proposed have been factored into this option.

Finally, it can be noted that, apart form further filtration, no further treatment of the wastewater is considered for this option. Greater potential for the use of treated wastewater for industrial processes may exist, provided that further treatment of the wastewater is considered. This may however not be practical to implement and has therefore not been considered for this option.

3. “SCHEME”/OPTION YIELD

Based on the investigations undertaken, the potential yield for this option was estimated at 34.0 Mm^3/a, which takes into account the seasonal nature of irrigation use.

It can be noted that this study only investigated 13 of the 20 WWTW within the CMA and although it excluded most of the minor WWTW, it did exclude the Borcherds Quarry WWTW, where other investigations have identified a fairly significant potential for the use of treated wastewater for industrial process purposes.

4. UNIT REFERENCE VALUE

The potential financial costs are as follows:

ITEM	Escalated to 2005 (@ 7% /a) (1)
Capital cost (R million)	206.0
Annual operating cost (R million)	2.8[3]
NPV Cost (R million)	195.1
Unit Reference Value (R/m^3)	**0.55**

1) Capital and O&M costs are escalated at 7% pa to 2005
2) URV calculated at an 8% pa discount rate
3) This figure is an annual average of maintenance, overhaul costs and electrical costs over a specific time period.
4) The URV does not include the possible difference in the tariffs between the potable water and the treated effluent.

5. ENVIRONMENTAL

Limited environmental impact is anticipated. A possible impact is the build-up of the salinity levels in the soils with time (or toxins if industrial wastewaters are used). However, as irrigation will only take place during the summer moths, it is anticipated that much of the salinity build-up will be leached out during the winter months.

6. SOCIO-ECONOMIC

This option will provide limited temporary work opportunities but does pose some potential health risks, linked to possible exposure to treated effluent.

7. STRATEGIC

Specific strengths and weaknesses of the option include:

- *Strengths*
  - There is already a demand for treated wastewater, especially in terms of the irrigation of sportsfields and for agriculture. This demand is however largely driven by tariffs and/or the scarcity of water.
  - This option provides a fairly significant yield potential.

- *Weaknesses*
  - Potential health risks e.g. if un-sterilised effluent is used to irrigate sportsfields where contact sports are played.
  - The potential for cross-connection of treated wastewater distributed networks with the potable water network.
  - The potential for the build-up of toxins in the soils, especially if industrial effluent enters the wastewater treatment streams.
  - The current absence of a formal tariff structure and policy for the supply of treated effluent. Unless specific by-laws are passed, this option will largely be demand driven and the tariff structure will determine the attractiveness of this option. Furthermore, there is at present no a policy for the basis for providing a treated wastewater supply e.g. specific return periods or PPP type arrangements.
  - Increased institutional implications in terms of the operation and maintenance of the WWTW (quality of effluent produced), the management of the dual networks and the monitoring of the above. (The demand has decreased in some areas due to ongoing blockages of sprinkler systems and odours).

Use of Treated Wastewater Dual Reticulation Network

1. "SCHEME"/OPTION LAYOUT

Applicable throughout the study area, particularly where new developments are taking place, offering the opportunity for implementation during construction of new infrastructure.

2. "SCHEME"/OPTION DESCRIPTION

Unless otherwise stated, the information presented is taken from CMC's Strategic Evaluation of Bulk Wastewater of June 1999: Report of 25 of 37 – *Water Reclamation; A Strategic Guideline.*

As gardening accounts for approximately 35% of domestic water consumption and toilet flushing a further 29%, the use of lower grade water for these purposes, would result in a significant reduction in potable water use.

This option therefore entails the use of treated effluent, conveyed to domestic users via a separate reticulation network, specifically for gardening and toilet flushing use. This option therefore needs to be considered in conjunction with several of the Water Demand Management Options (i.e. 'use of grey water', 'private boreholes', 'rainwater tanks' and 'user education') and the "local irrigation and industrial" treated effluent use option presented earlier, as the demand management options target the same uses, whilst this option may need to utilise the same reticulation network as the treated effluent option.

3. "SCHEME"/OPTION YIELD

Previous studies have indicated a potential yield of 28.0 Mm^3/a (based on 91 050 erven being reticulated).

4. UNIT REFERENCE VALUE

The potential financial costs are as follows:

ITEM	Escalated to 2005 (@ 7% /a) [1]
Capital cost (R million)	375.4
Annual operating cost (R million)	4.9[3]
NPV Cost (R million)	325.8
Unit Reference Value (R/m^3)	**1.25**

1) The capital and O&M costs have been escalated from 1997 at 7 % pa.
2) URV is calculated at an 8 % pa discount rate.
3) This figure is an annual average of maintenance, electrical and overhaul costs over a specific time period.
4) The URV does not take into account the impact of a possible difference in tariff between treated effluent and potable water.

5. ENVIRONMENTAL

The use of treated effluent will have a positive impact on the environment, as a result of reduced river abstraction and reduced effluent discharge into the environment. However, there is a potential negative impact, as a result of medium to long-term build of pollutants in the soil and possibly the groundwater.

6. SOCIO-ECONOMIC

This option would have a slight positive impact in terms of employment. There are however possible negative health implications linked to the possible exposure to treated effluent (e.g. potable and treated effluent networks being interconnected).

7. STRATEGIC

Specific strengths and weaknesses of the option include:

- *Strengths*
  - Readily implementable for new housing developments, but not for retrofitting existing developments.
  - Could possibly utilise the 'local irrigation' network, if only for toilet flushing (if the quality is appropriate).
  - Could consider closed loops for toilet flushing.

- *Weaknesses*
    - No quality standards in place as yet within South Africa for gardening and toilet use.
    - Potential health hazard.
    - System will only be used during the summer months for gardening purposes.
    - This option will have an institutional implication on municipal staff, both at the wastewater treatment works and on the network supervision staff.

Use of Treated Wastewater Commercial Irrigation - Exchange with irrigation schemes' fresh water allocation

1. "SCHEME"/OPTION LAYOUT

2. "SCHEME"/OPTION DESCRIPTION

Unless otherwise stated, the information presented is taken from the CCT Integrated Water Resource Planning Study of 2001: Report 8 of 12 – *Potential for the use of treated wastewater within the CMA.*

This option entails the exchange of treated domestic wastewater effluent for commercial irrigation with freshwater (untreated) currently being supplied to farmers, in order that the freshwater be available for treatment and subsequent domestic usage.

The Helderberg and Stellenbosch irrigation schemes, which currently receive some 20 Mm^3/a of water from the Riversonderend – Berg River Government Water Scheme, have been identified for the possible large-scale use of treated wastewater.

In order to achieve the above, treated domestic wastewater will need to be pumped from the Zandvliet and Macassar Wastewater Treatment Works (WWTW) via a 45 km long pipeline and against a 350 m head, to a small balancing dam (0.5 Mm^3 capacity) near the exit of the Stellenbosch Tunnel. From the balancing dam, existing infrastructure will be used for the distribution and irrigation of the wastewater.

Due to the nature of the irrigation demands and the limited area available for storage at the Stellenboschberg Tunnel exit, the scheme proposed is based on the summer usage of treated wastewater only.

It must be noted that this option entails no additional treatment of the wastewater to that currently being provided at the respective WWTW's. These WWTW treat predominantly domestic effluent.

3. "SCHEME"/OPTION YIELD

During previous investigation, it was considered that farmers would only be willing to exchange 25% of their allocation, implying a probable yield of 5.0 Mm^3/a.

4. UNIT REFERENCE VALUE

The potential financial costs are as follows:

ITEM	Escalated to 2005 (@ 7% /a) [(1)]
Capital cost (R million)	134.0
Annual operating cost (R million)	2.4[3]
NPV Cost (R million)	114.0
Unit Reference Value (R/m^3)	**2.77**

1) Capital and O&M costs escalated at 7% pa to 2005
2) URV calculated at an 8% pa discount rate
3) This figure is an annual average of maintenance and overhaul costs over a specific time period.
4) The URV does not take into account the impact of any possible differences in the tariffs between the freshwater and the treated wastewater.

5. ENVIRONMENTAL

Limited environmental impact is anticipated. A possible impact is the build-up of the salinity levels in the soils with time. However, as irrigation will only take place during the summer months, it is anticipated that much of the salinity build-up will be leached out during the winter months.

6. SOCIO-ECONOMIC

This option will provide limited temporary work opportunities but does pose some potential health risks, where crops irrigated with wastewater are eaten raw or where workers are in direct contact with the wastewater (e.g. where overhead sprays are used).

7. STRATEGIC

Specific strengths and weaknesses of the option include:

- *Strengths*
  - Potentially a relatively large treated wastewater consumer.

- *Weaknesses*
  - There is a general public aversion to the idea of being exposed to wastewater.
  - The ability to reach agreements with the farmers may be problematic.
  - Possible negative international perceptions which could reduce the marketability of the produce.
  - The salinity of the treated wastewater and the possible impacts on the soils and the crops.
  - Increased institutional implications due to the need for effective monitoring.
  - Guidelines from the Department of Health which advise against the use of treated wastewater for crops which are eaten raw.
  - Relatively long implementation period.