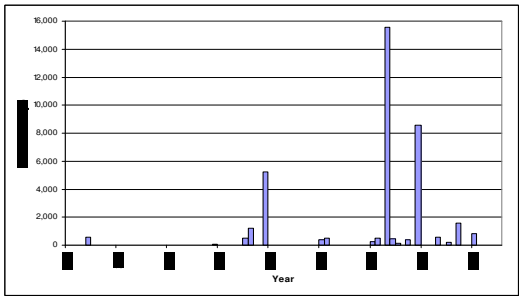
1.0 Lincoln Sewage Scheme

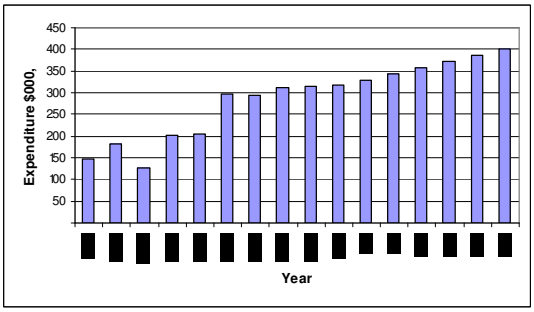
1.1 Executive Summary

Description		Quantity
Population Served		2300
Deprivation Index		3
Physical Statistics	Reticulation Length (km)	37.55
	Manholes	174
	Pump Stations	10
Value ($)	Replacement	$10,614,750
	Depreciated Replacement	$8,210,756
Flows	Annual average over 5 years	313,000 m^3/day
	Average daily	857 m^3/day
	Peak daily	1,904 m^3/day – influenced by buffering capacity of ponds
	Minimum daily	- m^3/day
Treatment	Aeration followed by oxidation pond	
Disposal	To Christchurch City	
Infiltration		Unknown
Properties	Connected	763
	Not connected	117

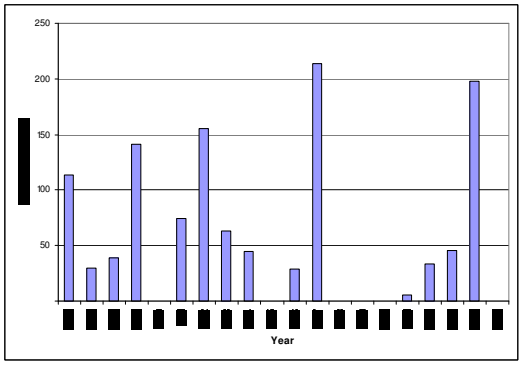
Pipework Replacement Dates



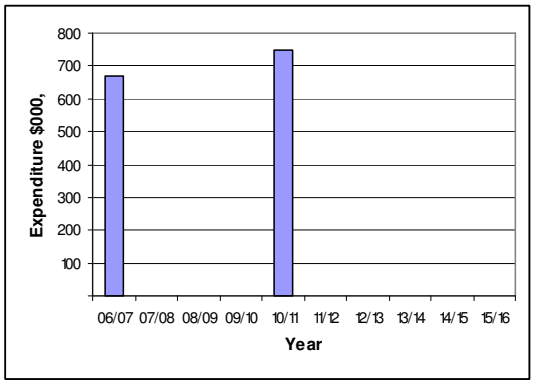
Operating and Maintenance Financial Requirements



Renewals Financial Requirements



New Capital Financial Requirements



The key issues for the Lincoln wastewater services are:

- Increase growth within township that has required the rationalisation of pumping system
- Upgrade of treatment system by 2010/11
- Minimise infiltration thereby reducing Christchurch City Council flow charges

1.2 Introduction

1.2.1 Overview and History

In 1964 the installation of the reticulation within the Township of Lincoln was commenced with wastewater being treated by a Pasveer sewage treatment plant. This plant was installed to treat Lincoln College wastewater in 1959. The plant was taken over by the then Ellesmere County Council from the Lincoln College in 1970.

In 1986 an oxidation pond with discharge to the LII pond was installed with subsequent closure of the Pasveer treatment plant.

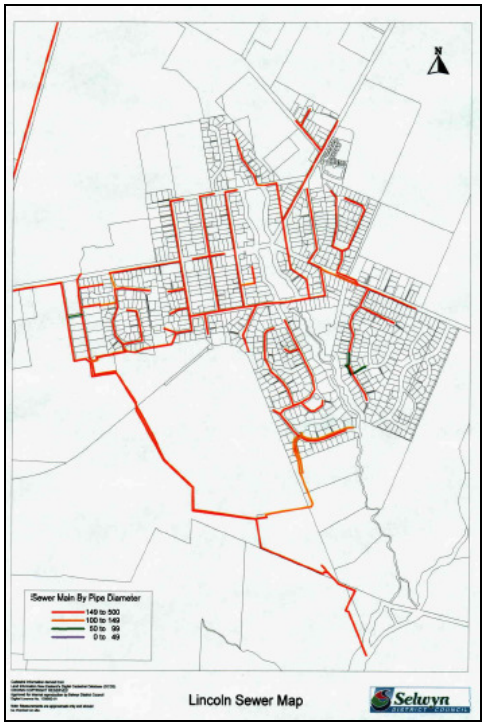
In early 1991 a Council Project Team recommended and received approval for the installation of aeration tanks that could be converted to Sequential Batch Reactor (SBR). Three aeration tanks were installed and commissioned in 1993.

A Council led Project Team was set up in the mid 1990's to consider the options for wastewater treatment and disposal as the consent for discharge to the Lll was due to expire. Following extensive public consultation it was agreed that the discharge from the oxidation ponds be pumped to the Christchurch City for treatment in the Bromley sewerage treatment plant.

An agreement between Selwyn District Council and Christchurch City Council was signed in November 1997 allowing pumping of treated wastewater from Lincoln Sewage Treatment Plant to Christchurch City's Sewer reticulation. In 1998 construction was completed of the pump station and rising main from Lincoln through to Christchurch city sewer reticulation.

A master plan for reticulation and pumping to cope with the long term development of Lincoln was developed in 2004/05. This was further reviewed in 2006.

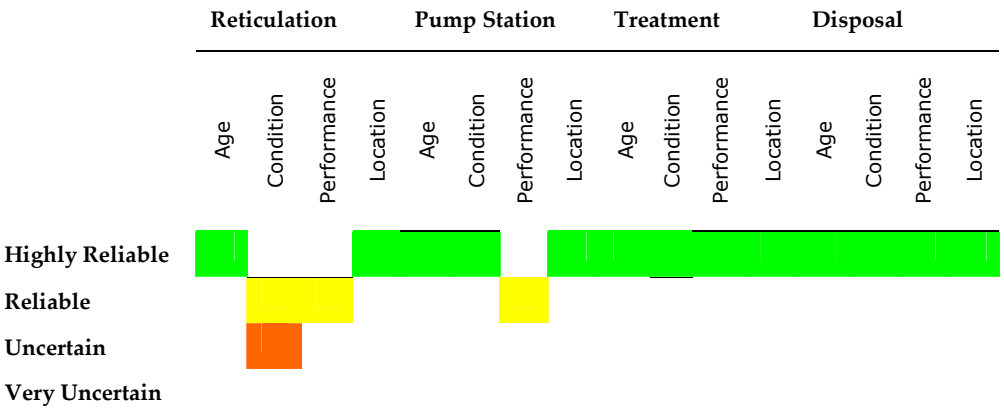
Wastewater Map



1.2.2 Knowledge of Assets

The following table details the confidence in information for facilities and reticulation.

Table 1-1: Data Confidence



1.2.3 Criticality

The following is a preliminary assessment of the critical assets within the scheme.

Table 1-2: Critical Assets

Facility or Main	Location	Reason
Barker St Pump Station	Barker St	Majority of wastewater for township passes through this pump station
Marion Pl pump station	Marion Pl	Majority of wastewater for township passes through this pump station

1.2.4 Design

The Lincoln sewage treatment plant currently has the capacity to treat sewage generated by an equivalent population of 6,600 people. This is via three aeration tanks followed by an oxidation pond. The treated sewage is then discharged to Christchurch City sewerage scheme. The Agreement for the discharge to the City, limits the volume of the sewage discharged to the flow equivalent to that generated by a population of 7,500 people, until such time as the Southern Interceptor Sewer in the City is upgraded. This is understood z to be available by 2010/11. The wastewater discharge standard for the discharge to the City is 50g/m^3 BOD and 50g/m^3 suspended solids.

The current treatment allowance is approximately 6,573 pe. This is made up of:

Residential		2,323
Schools and shops		312
Lincoln University	1200	
CANESIS (wool research)	500	
Agriculture and Science Centres	800	
Total		5,134

Spare capacity as at November 2005 1466 p.e.

1.3 Treatment and Disposal

1.3.1 Overview

Treatment is two staged.

- Aeration tanks (3 of) for remove majority of BOD
- Oxidation Pond for reduction of suspended solids, faecals coliforms and B.O.D.
- Wastewater from the oxidation pond is pumped to Christchurch City, pumping is only permitted between 11 pm and 4 am at a maximum rate of 50 L/sec

1.3.2 Treatment and Disposal

The following table is an overview of the treatment and disposal components.

Treatment Area	Description	Year installed	Condition	Performance	Criticality
Aeration Tanks	Three aeration tanks with aerators	1991	1	1	Low
Oxidation Pond	Single stage pond of 3.2Ha	1986	1	1	Medium
Pump station	For disposal of treated wastewater to Christchurch	1998	1	1	Medium

1 = Very Good (Industry Standard) 2 = Good 3 =Moderate 4 =Poor 5 =Very Poor

1.3.3 Sludge Handling Facilities

Sludge handling facilities that treat the sludge from the SBR will be required to allow treatment capacity to increase beyond 7,500 pe.

1.3.4 Issues

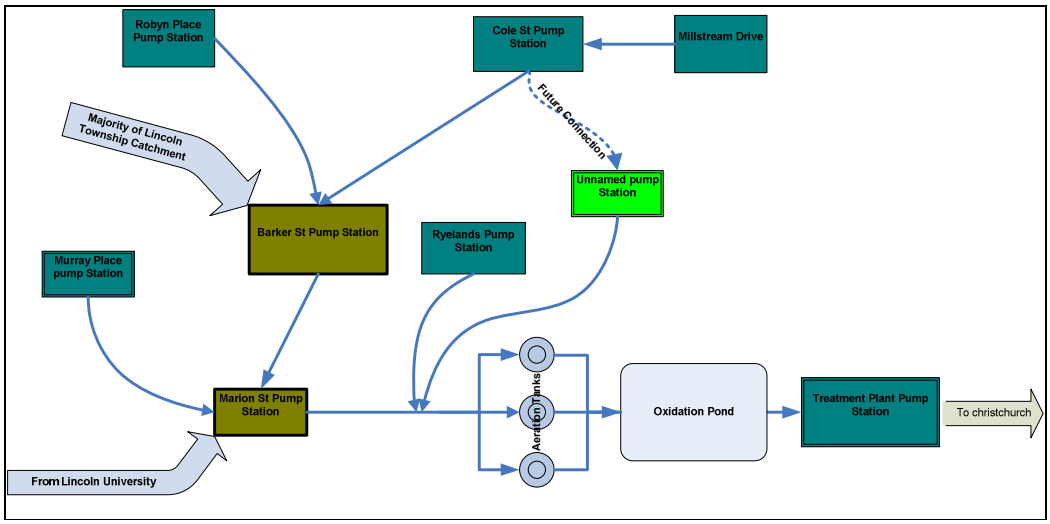
The issues for treatment and disposal are:

- Timing and requirement to upgrade aeration tanks to SBR
- Constraints on flows to Christchurch until 2010/11
- High cost of disposal requires ensuring infiltration levels are kept low
- Aerators on aeration tanks are of poor design and require continual maintenance (these will become obsolete when change to SBR occurs)

1.4 Pump Stations

1.4.1 Overview

The basic configuration of the pumping system is the conveyance of wastewater to a number of pump stations with centralisation of the flow at the Marion St pump station before transfer to the existing wastewater treatment plant with subsequent transfer to the Christchurch.



1.4.2 Pump Station Details

The following table is an overview of the nine pump stations within the Lincoln scheme.

Table 1-3: Schedule of Pump Stations

Pump Station	Description	Year installed or Upgraded	Capacity (L/sec)	Condition	Performance	Criticality
Treatment Plant Pump Station	Pumps oxidation pond wastewater to Christchurch	1998	-	1	1	L
Marion Pl Pump Station	Pumps main catchment, Lincoln University catchment and Murray Place to WWTP	1986, 1994 & 1999	-	1	1	H
Barker St Pump station	Pumps main catchment into Marion Place	1964 & 1997	19.2	3	3	H
Murray Place Pump Station	Pumps into Marion Place	1975 & 1997	6.4	3	3	L
Robyn Place Pump Station	Pumps into main catchment	1985 &1997	5.0	3	3	L
Coles St Pump station	Pumps into main catchment	1975 & 1975	6.4	4	4	L
Millstream Dr Pump Station	Pumps to Coles St	1998	-	1	1	L
Ryelands Pump station	Pumps directly to WWTP	2003	7.2	1	1	L
Lincoln Dale Pump Station	Pumps directly to WWTP	2005	14	1	1	L

1 = Very Good (Industry Standard) 2 = Good 3 =Moderate 4 =Poor 5 =Very Poor

1.4.3 Pump Station Issues

Issues for the Lincoln pump stations are detailed in Section 6.5

1.5 Reticulation and Pump Station Master Plan

A Lincoln Wastewater Master Plan[1] has been developed to service the future growth of the community while conforming to long term objectives to:

a)

- Minimise the number of pumping station
- Best utilise existing assets, and
- Minimise the amount of infrastructure by combining the services for new development areas

b) Staged development of infrastructure was considered as part of this Master Plan and incorporated where feasible. This is critical where future growth areas may not all develop at once. The plan for the Western Lincoln Urban Area involves:

- Construction of "Lincoln University" Block pumping station
- Gravity connections from Murray Place PS, Barker Street PS and Marion Place PS
- Decommission Murray Place PS, Barker Street PS and Marion Place PS
- Internal infrastructure as and when required

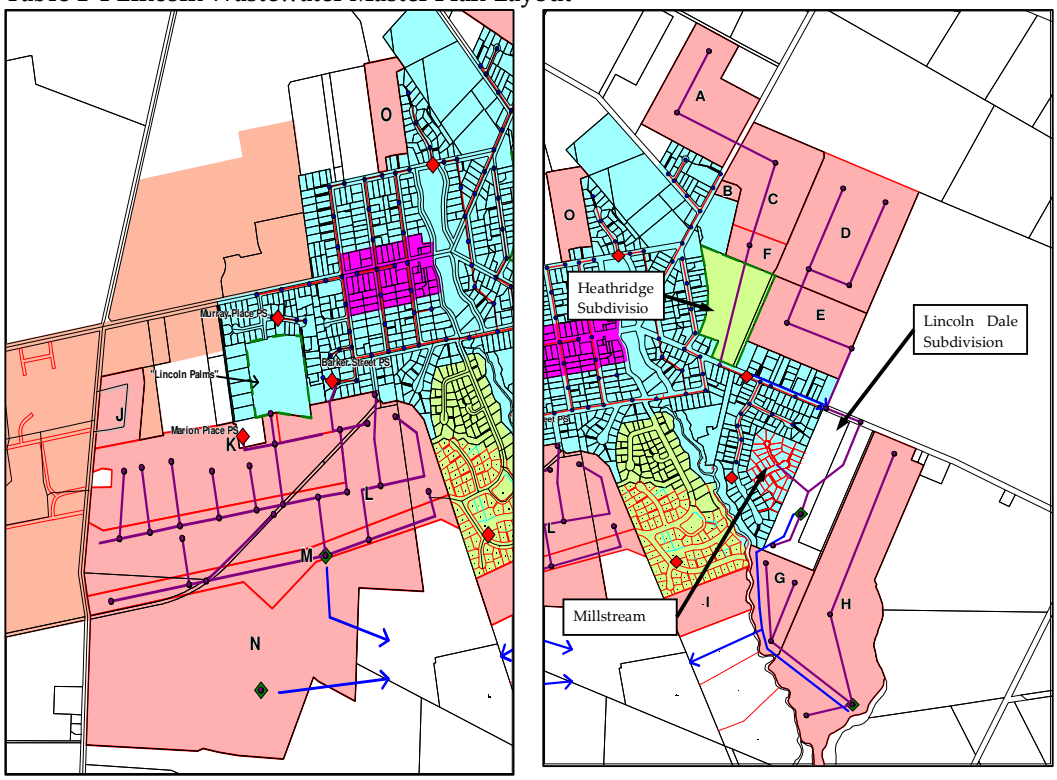
c) The plan for Eastern Lincoln Urban Area (without pumping station) involves:
Construction of "Lincoln Dale" pumping station

- Gravity connections through north eastern blocks to "Lincoln Dale"
- Initial PS Rising Main connection through Ryelands Subdivision
- Construction of a south eastern pumping station (if required)
- Combined Rising Main (if required)
- Connection of Coles Street PS rising main to "Lincoln Dale" infrastructure, including adjacent areas feeding through "Brown's Block"
- Connection of central north block to existing infrastructure on North Belt
- Connection of the northern most area to existing infrastructure on James Street

These works are generally now complete. Table 1-4 details the Wastewater Master Plan

[1] Lincoln Wastewater Collection System Master Plan Development Report: February 2005

Table 1-4 Lincoln Wastewater Master Plan Layout



1.6 Supply Reticulation

1.6.1 Overview

A schedule of the pipe asset statistics is shown in Table 6.5 below.

Table 1-5: Schedule of Pipework Length (m)

Diameter mm	AC	CC-SR	MPVC	PE-MD	UPVC	Total
80	0	0	0	0	63	63
100	181	100	984	0	142	1,407
150	1,413	4,266	0	0	2,731	8,410
160	0	0	0	8,541	84	8,625
200	0	0	0	0	1,280	1,280
225	520	1,048	0	0	619	2,186
250	0	0	10,114	0	4,914	15,028
300	0	0	547	0	0	547
Total	**2,113**	**5,415**	**11,645**	**8,541**	**9,833**	**37,547**

1.6.2 Condition

The condition of mains installed in the mid 1970's' has not been rated but will be assessed in 2006/07. This will be undertaken by scoring the condition using the CCTV that was carried out in 2003. The requirement for additional CCTV will be assessed on completion of the above works.

Samples of a pipe rubber ring have been taken to ascertain if there is any bacterial degeneration occurring. Tests showed no deterioration of the rubber ring tested in 2000.

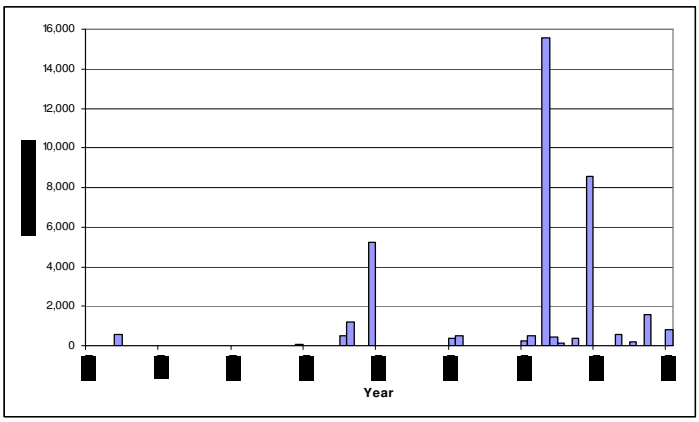
1.6.3 Performance

The Performance of the reticulation is considered by Council engineers as good to moderate as there are capacity issues that will be resolved with the implementation of the "Lincoln Wastewater Master Plan".

1.6.4 Pipe Network Replacement Date

Table 1-6 details the expected year of mains replacement.

Table 1-6 Pipework Replacement Dates



1.6.5 Infiltration

Detailed investigation of inflow and infiltration in the Lincoln wastewater collection has not been undertaken. Due to the high costs associated with pumping wastewater to Christchurch it is important that the level of infiltration is known so that an assessment on the viability for reductions can be assessed.

Ryelands subdivision has had high rates of infiltration and is still subject to maintenance provisions on the developer. The resolution of the high level of infiltration from this subdivision has yet to be resolved by the developer.

1.6.6 Property Inspections

Every property was inspected by "Infiltrol Ltd" in 1993 with the next inspections programmed to be completed in 2005/06.

1.6.7 Reticulation and Pumping Issues

The issues for Lincoln reticulation and associated pump stations are the growth in the community and the associated increase in demands on the infrastructure. Infrastructure servicing has been on a subdivision–by-subdivision basis. Since 2004 the Lincoln Wastewater Master Plan [2] has been developed for the long term growth of the community that encompasses the following long term objectives:

- Minimise pump stations
- Utilise existing assets
- Combine assets

[2] Lincoln Wastewater Collection System Master Plan Development Report (February 2005) by MWH

Completion of the Lincoln Wastewater Master Plan is dependent on the Lincoln University subdivisions occurring.

1.7 Environmental Management and Agreements

1.7.1 Consenting Issues

There are no requirements for resource consents.

1.7.2 Agreements

An agreement between Selwyn District Council and Christchurch City Council was signed in November 1997 allowing pumping of treated wastewater from Lincoln Sewage Treatment Plant to Christchurch City's Sewer reticulation. The period of pumping was from 6pm to 4am at a maximum flow rate of 50L/sec. The requirements on pumping time will be in place until such time as the Southern Interceptor Sewer in the City is upgraded. This is expected to be by 2010/11.

1.8 Maintenance and Operating

1.8.1 Maintenance Contract

Maintenance of the reticulation and general work around the treatment plant is carried out by SICON Ltd under Maintenance Contract 849. The Lincoln sewerage system (including the treatment plant) Operation Manual has been assessed as poor. Enhancement of the existing manual is programmed for 2006/07.

1.8.2 Maintenance Issues

The issues for the maintenance of the Lincoln Wastewater Services are:

- Security of WWTP and Oxidation Pond due to close proximity of new residential and rural residential housing

1.8.3 SCADA

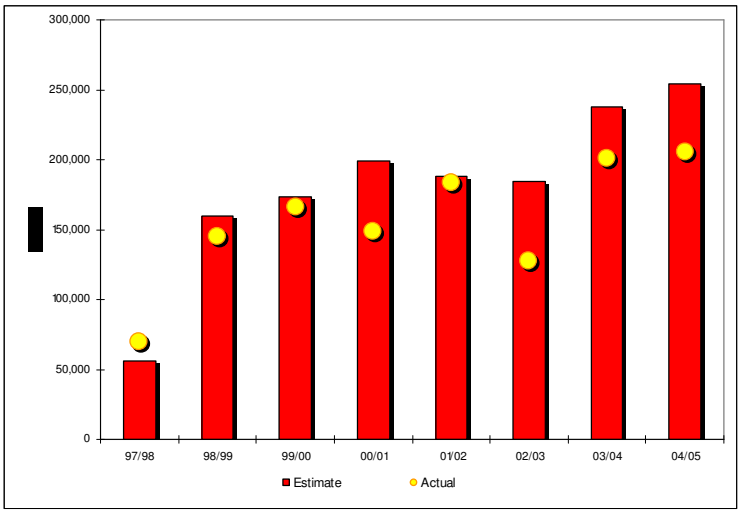
The pump stations and treatment plant are monitored by Council's SCADA system and has the following alarm and monitoring capacity:

Site Name	Phase Failure	Pump Operation	Well Level and High Alarm	Total Outflow	Generator Operation	Dissolved Oxygen
Barker St Pump Station	Y	Y	Y	Y	-	-
Edward St Pump Station	Y	Y	Y	Y	-	-
Hazeldean Drive Level Monitoring Site (ChCh)	Y	Y	Y	Y	-	-
Lincolndale Pump Station	Y	Y	Y	Y	-	-
Roblyn Pl Pump Station	Y	Y	-	-	-	-
WWTP Pump Station	Y	Y	-	-	-	-
Marion Pl Pump Station	Y	Y	Y	Y	Y	
Mill Stream Pump Station	Y	Y	Y	-	-	-
Outlet Pump Station	Y	Y		Y	-	Y
Ryelands Pump Station	Y	Y	Y	Y	-	-

1.8.4 Actual Operating versus Estimated Costs

The following table details the comparison between annual estimates and actual annual costs.

Table 1-7: Actual Costs versus Estimates 1997/98 – 2004/05



1.8.5 Future Maintenance Financial Programme

Table 1-8 details the maintenance and operating costs (excluding depreciation).

1.9 Renewals Capital Expenditure

1.9.1 Overview

Table 1-9 details the renewals programme for the period 2006/07 to 2026/27.

Table 1-8: Future Operating and Maintenance Financial Requirements 2006/15

Excluding: Depreciation and Loan Interest

	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Expenses										
Support Services	24673	40278	40061	39559	41541	43282	46330	48322	49883	51940
Consultants Fees	15421	15638	15854	15994	16840	17685	18589	19494	20398	21302
Consultants Fees - other	1542	1564	1585	1599	1684	1768	1859	1949	2040	2130
Insurance and Rates	3922	3922	3922	3922	3922	3922	3922	3922	3922	3922
Interest - Loans	44615	44615	44615	44615	44615	44615	44615	44615	44615	44615
CCC Disposal Fees	113089	114675	116261	117291	123490	129689	136321	142953	149584	156216
Electricity	29814	30233	30651	30922	32556	34191	35939	37688	39436	41184
Mtce - Pump Station	20562	20850	21138	21326	22453	23580	24786	25991	27197	28403
Mtce - Reticulation	10753	10904	11054	11152	11742	12331	12962	13592	14223	14853
Mtce - Treatment Area	10281	10425	10569	10663	11226	11790	12393	12996	13599	14201
Routine Checks	7197	7298	7398	7464	7858	8253	8675	9097	9519	9941
Monitoring Water Quality	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
Total Expenses	293869	312400	315109	316507	329927	343106	358390	372618	386415	400708

Scheme Improvements

Operations Manuals & Procedures	10,000									
Improvement Plan items	35,000									
Security Fencing at STP	10,000	50,000								
Property Inspections						5,000				
IP I1 CCTV		7,500								
IP3 Pipe Performance/Condition Rating	15,000									
Investigation STP U/G 7,500 pe		15,000								
Total Scheme Improvements	70,000	57,500	0	0	0	5,000	0	0	0	0

Table 1-9: Future Renewals 2006/07 to 2026/27 ($000,)

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Edward St PS	PUMP UNIT SUBMERSIBLE 2	6																			
	SCADA SYSTEM						10														
	SCADA RT						1														
	WET WELL																			4	
	EXTERNAL CABINET									4											
	ELECTRICAL SWITCHBOARD	18																			
	PUMP UNIT SUBMERSIBLE 1	6																			
Treatment Plant PS	ELECTRICAL SWITCHBOARD												150								
	VARIABLE SPEED DRIVE 1		7										7								
	VARIABLE SPEED DRIVE 2		7										7								
	VARIABLE SPEED DRIVE 3		7										7								
	PUMP UNIT SURFACE 1							27													
	PUMP UNIT SURFACE 2							27													
	PUMP UNIT SURFACE 3							27													
	FLOW METER							5													
	SCADA SYSTEM							10													
	SCADA RT							1													
	SCADA RT				1															1	
	WATER PUMP				6															6	
	AIR TANK ON WATER SUPPLY DELIVE																			4	
	SUBMERSIBLE GRINDER				6															6	
Millstream Dr PS	PUMP UNIT SUBMERSIBLE 1							6													
	PUMP UNIT SUBMERSIBLE 2							6													
	SCADA SYSTEM							10													
	SCADA RT							1													
	ELECTRICAL SWITCHBOARD												18								
Roblyn Pl PS	EXTERNAL CABINET																			4	
	ELECTRICAL SWITCHBOARD	18																		18	
	PUMP UNIT SUBMERSIBLE 1	6																		6	
	PUMP UNIT SUBMERSIBLE 2	6																		6	
	SCADA SYSTEM						10														
	SCADA RT						1														
Marion St PS	WASH PUMP	12																			
	WATER TANK									2											
	STORE SHED									17											
	FENCING/HARD STAND AREA																			6	
	PUMP UNIT SUBMERSIBLE 1			27															27		

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	PUMP UNIT SUBMERSIBLE 2			12															12		
	ELECTRICAL SWITCHBOARD								37												
	VARIABLE SPEED DRIVE	7							7										7		
	SCADA SYSTEM				10															10	
	SCADA RT				1															1	
	FLOW METER							7													
Treatment Plant	AERATOR 1				27															27	
	AERATOR 2				27															27	
	DISCHARGE SYSTEM PRESSURE		3										3								
	SUCTION PRESSURE		3										3								
	OXIDATION POND LEVEL		3										3								
	AERATOR 3				27															27	
	MONITORING EQUIPMENT (LAB)				28															28	
	ELECTRICAL SWITCHBOARD									18											
	SCADA SYSTEM				10															10	
	DISSOLVED OXYGEN ANALYSER								6								6				
	SCADA SYSTEM							10													
	SCADA RT							1													
Murray Pl PS	EXTERNAL CABINET									4											
	WET WELL																			9	
	ELECTRICAL SWITCHBOARD	18																			
	PUMP UNIT SUBMERSIBLE 1	6																			
	SCADA SYSTEM						10														
	SCADA RT						1														
Barker St PS	ELECTRICAL SWITCHBOARD											18									
	PUMP UNIT SUBMERSIBLE 1						12														
	PUMP UNIT SUBMERSIBLE 2						12														
	VARIABLE SPEED DRIVE	11										11									
	FLOW METER						5														
	SCADA SYSTEM						10														
	SCADA RT						1														
	WET WELL								13												
Ryland s PS	ELECTRICAL SWITCHBOARD																	18			
	TRANSDUCER							3										3			
	FLOW METER												5								
	SCADA SYSTEM												10								

		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
	SCADA RT												1								
	BACKUP HIGH LEVEL PROBE							1										1			
	PUMPSET 1							6										6			
	PUMPSET 2							6										6			
	TOTAL	113	29	39	141		74	155	63	45		29	214				6	34	46	198	

Table 1-10: Future Operating, Maintenance Forecasted Cost Trends

Excluding: Depreciation and Loan Interest

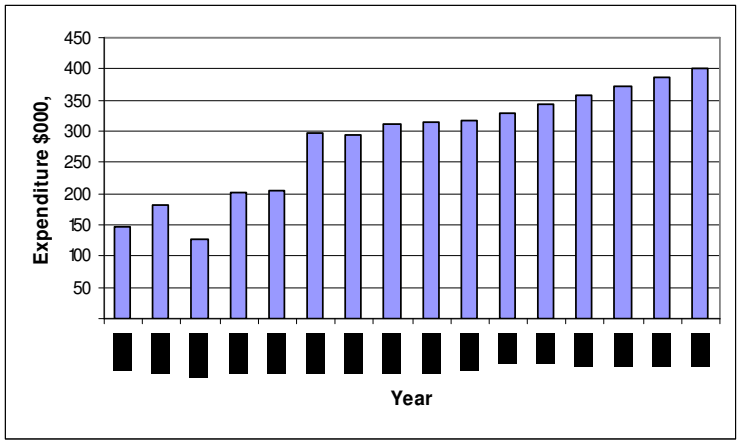
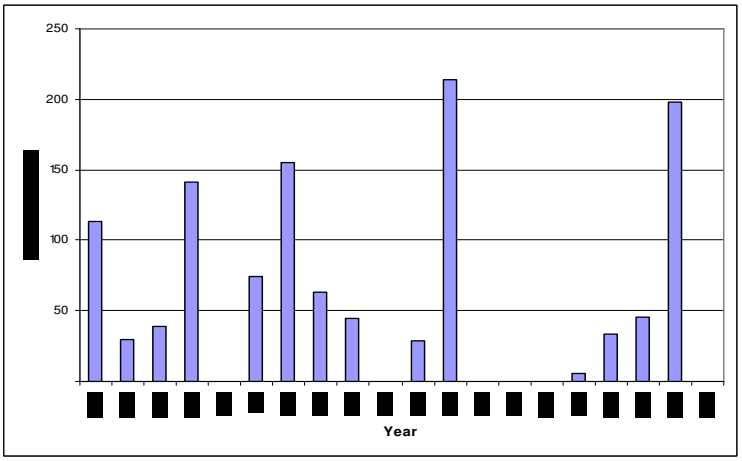


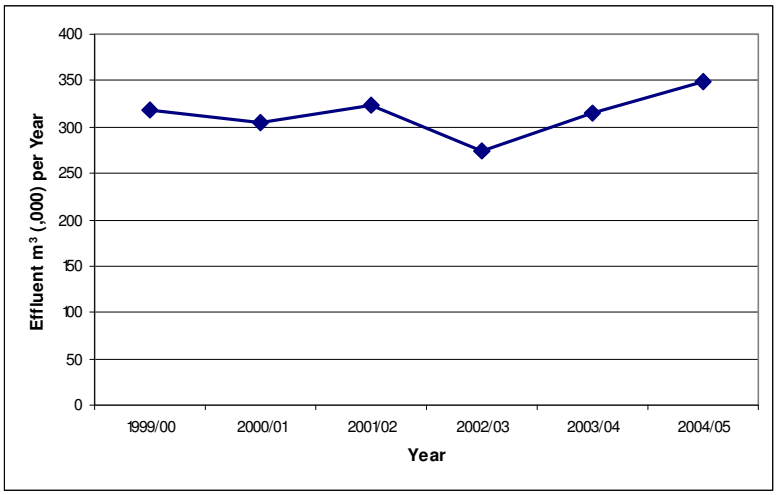
Table 1-11: Projected Replacement Expenditure



1.10 Annual Wastewater Quantities

The following table details the annual wastewater quantities for the Lincoln sewerage scheme.

Table 1-12: Annual Wastewater Quantities

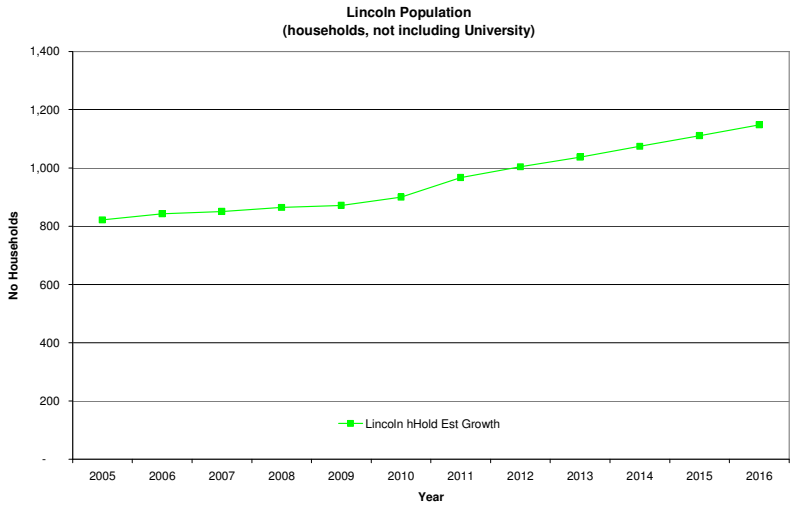


1.11 Future Demand

1.11.1 Future Demand

Population forecasts for all towns and selected rural-residential areas were developed by Max Barber (Planning Consultant) for the Asset Management Department in late 2005. These population predictions will be considered by Council in early 2006 as the official population predictions for the period 30th June 2005 to 30th June 2016. Table 1-13 details the resident population predictions for Lincoln.

Table 1-13 Population Projections 2005/2016 (High Growth Rate)



1.11.2 Future Growth

Table 1-14 details the predicted growth within the township and the capacity requirements.

Table 1-14 Future Growth to year 2010

Area of Township	Capacity	Growth by 2010

	Requirement (p.e.)	%	p.e.
North East	450	96	432
South East	375	75	281
North	120	100	120
West (plan change 55)	2229	50	1115
Total	**3,174**		**1,948**
Capacity at November 2005			5134
Total Capacity by 2010			7,082

Via population reviews (based on actual growth), and actual discharge data confirmation of capacity and upgrade requirements will be determined. However, close management of the Lincoln system will be required.

1.12 Capital Expenditure

Table 1-15 details the capital expenditure required for increased demand for the period 2006/15.

Table 1-15 Capital Expenditure Requirements

	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Sewer Upgrade Township	605,000									
Decommission PS MBM	65,000									
STP Upgrade					750,000					
Keyless Access OSH	2,500									
Total	670,000	0	0	0	750,000	0	0	0	0	0

1.13 Disposal Programme

No disposals of assets are considered necessary over the next 10 years.