~~Diana Rogers~~
P. Hamilton

PUBLIC WORKS DEPARTMENT

NEW SOUTH WALES

NIMBIN SEWERAGE
REVIEW OF ENVIRONMENTAL FACTORS

Prepared for

Lismore City Council

August, 1991

Report No. Li 159

CONTRACTORS - SIX MONTHLY RETURN

1.7.93 - 31.12.93

CONTRACTS MORE THAN $30,000

NORTH COAST REGION

Total Number : **11**

Total Cost : **$ 582 699**

Total Paid this Reporting Period : **$ 275 952**

Name of Contractor	Purpose	Period of Engagement	Total Cost of Contract $	Total Paid this Period $
Faircloth and Reynolds Pty. Ltd.	Repair & service of mechanical ventilation systems and emergency lighting	February 92 to February 95	60 000	21 526
R.A.C.E. Services	Repair & service of mechanical ventilation systems and emergency lighting	February 92 to February 95	60 000	19 244
Statewide Gas Pty. Ltd.	Inspection and certification of bulk LPG vessels	June 93 to June 98	55 500	11 508
R A Brian	Transport of students with a disability	1.2.93 to 17.12.93	55 326	31 841
B Goode	Transport of students with a disability	1.2.93 to 17.12.93	40 165	21 911
P & G O'Brien	Transport of students with a disability	1.2.93 to 17.12.93	42 506	23 473
J Wooster	Transport of students with a disability	1.2.93 to 17.12.93	44 497	24 344
Grafton-Yamba Bus Co.	Transport of students with a disability	1.2.93 to 17.12.93	45 416	25 765
Murwillumbah Taxi	Transport of students with a disability	1.2.93 to 17.12.93	42 169	22 377
Deluxe Taxi Lismore	Transport of students with a disability	1.2.93 to 17.12.93	99 500	52 186
Challenge Foundation	Transport of students with a disability	1.2.93 to 17.12.93	37 620	21 777

5.0 SCHEME ALTERNATIVES

5.1 Introduction:

During the Concept Phase for this scheme a number of alternatives for sewage transport treatment and effluent disposal were considered.

The range of alternatives examined for each component of the scheme are summarised as follows:

a) Effluent Disposal
   i) Land Disposal
      - Pasture for Livestock
      - Forestry
      - Horticulture crops

   ii) Effluent Re-Use
      - Siviculture or forestry
      - Irrigation for Pasture

   iii) Waterways
      - Wetlands
      - Creeks/Rivers

b) Treatment:
   i) Land application
   ii) Wetlands, natural and artificial
   iii) Lagoons, aerated or non aerated
   iv) Biofiltration systems
   v) Activated Sludge Systems
   vi) Package treatment plants
   vii) Oxidation Ponds

c) Reticulation:
   i) Pumped Common Effluent Drainage System (Fig 2,iii)
   ii) Conventional Gravity Reticulation System (Fig 2,i)
      - 2 alternative layouts
   iii) Common Effluent Drainage System (Fig 2,ii)
      - 2 alternatives

These options were presented in detail in Report No Li 153 'Nimbin Sewerage Strategy Report" - February, 1989. (Reference 1).

A further alternative on site treatment and disposal method was also considered and was the subject of a separate report titled "Nimbin Sewerage On-Site Sewage Treatment and Effluent Disposal Feasibility Study" March 1991. (Reference 5).

NORTH COAST REGION - UTILITIES QUESTIONNAIRE

The expenditure information requested in Parts 1 to 10 is to be for accounts **PAID** in the financial year ie. 1 December to 30 November.

1. **Electricity Consumption/Expenditure** Actual Expenditure

   1991 _____

   1992 _____

   1993 _____

2. **Water Consumption** Actual Expenditure

   1991 _____

   1992 _____

   1993 _____

   Schools with no connected water should indicate costs incurred for water cartage. Reasons for substantial variances year to year:

   _____

   _____

3. **Sewerage** (includes sanitary disposal/Rentokil)

   No sewer connected
   OR
   Actual Expenditure

   1991 _____

   1992 _____

   1993 _____

4. **Garbage/Waste Disposal** Actual Expenditure

   1991 _____

   1992 _____

   1993 _____

Total rates expenditure (2 + 3 + 4) Actual Expenditure

1991 _____

1992 _____

1993 _____

5.2 Discussion of Alternatives

i) Effluent Disposal

Three alternatives were considered effluent re-use, disposal to land or disposal to waterway.

The potential value of effluent as a resource is well recognised, the most common use being the watering of golf courses and reserves and the irrigation of pastures. For the re-use of effluent to be economic it must provide some income or allow for a reduction in costs or provide some other economic benefit. Effluent re-use in the Nimbin area would be restricted to forestry or pasture irrigation. Although both these alternatives would be possible in the Nimbin area, two major considerations render total effluent re-use all year round impractical. The high cost of land aquisition and/or irrigation system installation and maintenance, combined with the inability to re-use effluent during moderate to high rainfall periods make this disposal system uneconomic.

Land disposal allows the effluent to either percolate through the soil or be released to the atmosphere by evaporation or the action of vegetation. Factors which mitigate against this use at Nimbin are high annual average rainfall and low permeability clay soils. This is not considered a viable option for the total volume of effluent.

Disposal to waterways has been the traditional practice in Australia and around the world. Historically this has been a cheap and convenient approach. However increased demands on the use of our waterways and streams has caused closer attention to the consequences of such disposal.

The State Pollution Control Commission is responsible for setting the standards to protect the State's water resources. All naturally occurring waters have the capacity to receive and purify some amount of pollutants without substantial effect on the receiving environment.

The most environmentally acceptable disposal alternative is Goolmangar Creek. The basic factor affecting the creek's ability to assimilate treated effluent is the level of natural flow in the Creek. Streamflow records indicate that during dry periods flow within the creek decreases to low levels and has ceased to flow on occasions.

In order to assess the capacity of Goolmangar Creek to assimilate effluent loading a 20 month sampling programme to determine the existing water quality was undertaken. The results were presented in the 1989 Strategy Report.

Forms\Utility.que

4 pages

NORTH COAST REGION UTILITIES QUESTIONNAIRE

SCHOOL DETAILS:

School: _____

Address: _____

_____

Phone: _____ Fax: _____

Class of School: _____

Principal: _____

Cleaning Times: Morning _____ am to _____ am

Evening _____ pm to _____ pm

Student Enrolment: 1991 _____ Staffing E.F.T. 1991 _____
1992 _____ 1992 _____
1993 _____ 1993 _____

ACCOMMODATION:

Indicate significant changes in accommodation which have occurred in the three year period which may have effected the utilities consumption.

1991 _____

1992 _____

1993 _____

Disposal of effluent to Goolmangar Creek is considered the only economic long term disposal option. However the Creek is not considered to be a suitable disposal alternative during low creek flows. The reduced assimilative capacity in drought periods would result in effluent disposal adversely affecting the creek. It is considered essential that provision must be made for land disposal of effluent during the dry times.

ii) Sewage Treatment

The level of treatment required is determined by the need to produce an effluent which will not adversely effect the environment. Based on studies of Goolmangar Creek and close liaison with the State Pollution Control Commission the quality of effluent discharged to the Creek will need to meet the following general criteria.

- Nitrogen (Total) less than 15mg/L
- Ammonia (NH_3) less than 1mg/L
- Nitrates (NO_3) less than 10mg/L
- Phosphorus (Total) less than 1mg/L
- Biochemical Oxygen Demand (BOD) less than 20mg/L
- Suspended Solids (SS) less than 30mg/L

The majority of modern conventional treatment techniques will achieve these criteria except for Total Nitrogen and Phosphorus levels.

Land application is not a viable long term solution because of high rainfall and low permeability soils around Nimbin.

Wetlands can be a low capital and operating cost alternative. However they have limited and variable ability to remove Phosphorus and are still considered at the developmental stage. The system is not suited to the Nimbin situation and it is most unlikely that the SPCC would approve a wetland proposal.

Lagoons consist of large shallow ponds in which natural processes breakdown influent organic matter. These are not considered suitable at Nimbin because of the large flood free area required, moderate quality of effluent produced and their low capacity for Phosphorus removal.

Biofiltration Systems were favoured historically with the most common being trickling filters. This system has a low operating cost but over the last few decades has lost popularity to the activated sludge system. Biofiltration is not considered suitable because of higher capital cost and incapatability with current nutrient removal systems.

The intermittent extended aeration type (EAT) activated sludge process has proved to be an economical method for schemes such as Nimbin due to the limited number of process units required. This process will meet all the SPCC effluent quality criteria except for phosphorus removal which can be readily added. This is the method considered most appropriate and recommended for Nimbin.

Package treatment plants are available which operate on the extended aeration form of the activated sludge process. The aeration basins are made from steel or concrete and are several metres deep thus occupying a relatively small land area. The main disadvantage of these plants is their higher running costs and the need for operator skill to keep the plant at optimum performance.

A good quality effluent is produced with biological nitrogen removal being possible. Phosphorus removal is achieved by Biological or Chemical processes. Biological removal is possible only at a high capital cost and requires sophisticated control.

Chemical removal involves dosing with lime, iron or aluminium salts. The salts cause chemical precipitates containing phosphorus to form, which settle out in the sludge. An effluent quality in the order of 1mg/L of phosphorus can readily be achieved. This system is more economic for small treatment facilities and is proposed for Nimbin.

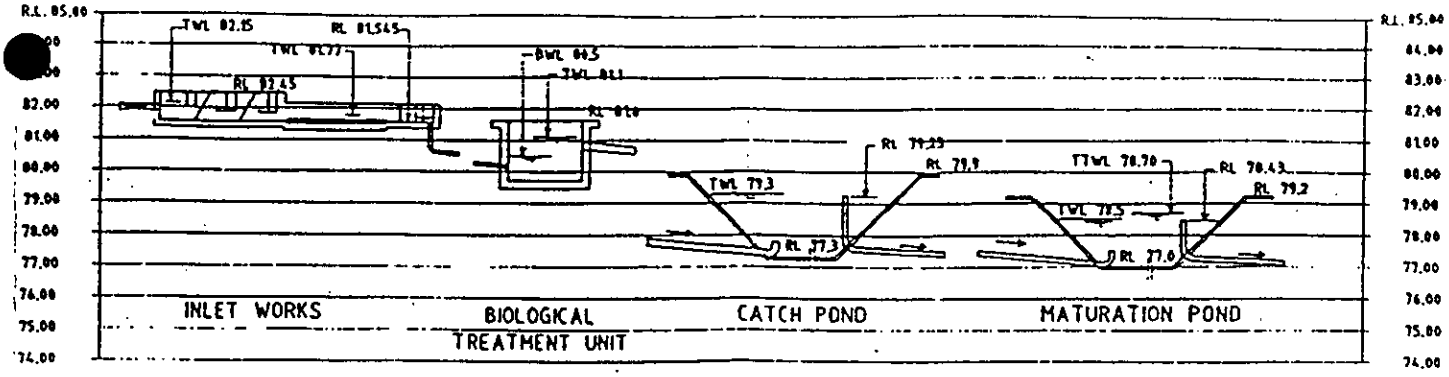
A general layout plan for the proposed works is shown in Figure 1.

On site sewage treatment and effluent disposal systems were examined in a feasibility study prepared by Nimbin On-Site Sewerage Community Consultative Committee.

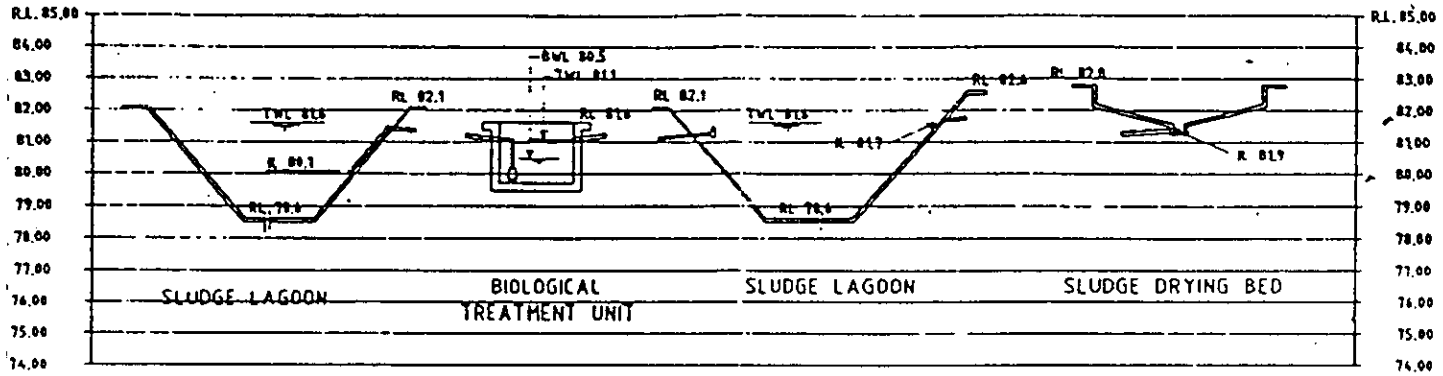
"The study aimed to identify alternative options for on-site treatment of sewage and disposal of effluent within Nimbin".

In addition the study's aim was to identify design loading criteria for on-site systems, survey existing on-site treatment and disposal methods, identify suitable options and identify management processes operation of on-site systems.

The findings of the study indicated the need for major improvements to existing septic systems in Nimbin to overcome potential health and pollution problems. The study did not identify any practical on-site treatment and ~~disposal systems suitable for every~~ Nimbin village property. However the use of a composite scheme of on-site treatment and disposal and off-site disposal was viewed as feasible.



EFFLUENT LINE



SLUDGE / SUPERNATANT LINE

HYDRAULIC PROFILE

PROCESS DESIGN CRITERIA

N (EP)

400

600

1000

N TO TENEMENT RATIO

EP	600 EP	1000 EP
L/s	2.20 L/s	3.67 L/s
L/s	6.60 L/s	9.85 L/s
L/s	18.00 L/s	29.14 L/s

T's)

/EP/d
/EP/d
/EP/d
0/EP/d

STEM

2.0m
250 m³
1 DAY

ND

STAGE 1	FUTURE
1	1
1.5m	1.5m
4480 m³	2800 m³
600/1000	1000
30/18	12

INLET WORKS

1. MANUALLY RAKED BAR SCREEN
   - CLEAR SPACING BETWEEN BARS 20mm
   - MAXIMUM VELOCITY 1.5m/s
2. GRIT CHANNEL
   - HORIZONTAL VELOCITY 0.3m/s
   - SETTLING VELOCITY 0.0184m/s
3. FLOW MEASUREMENT (RECTANGULAR FLUME)
   - MAX. FLOW 34L/s
   - THROAT WIDTH 300mm

SLUDGE MANAGEMENT SYSTEM

1. SLUDGE LAGOONS

NUMBER	2	
TWL DEPTH	3.0m	
VOLUME (BELOW T.W.L.)	210 m³	
LOADING	2.5 EP/m³	(EACH)
CAPACITY EP	525 EP	(EACH)

2. SLUDGE DRYING BEDS

	STAGE 1	FUTURE
NUMBER	1	1
DESIGN BASIS	5 EP/m²	5 EP/m²
AREA	120 m²	80 m²
CAPACITY (EP)	600	400

BIOLOGICAL TREATMENT UNIT

TYPE: PACKAGE TRATMENT PLANT
PROCESS: EXTENDED AERATION ACTIVATED SLUDGE PROCESS

INTERMITTENTLY DECANTED SYSTEM

VOLUME T.W.L. - B.W.L.	1400m³
MLSS CONCENTRATION mg/L	3500-5000
FOOD TO MICROORGANISM RATIO $\left(\frac{kg\ BOD}{kg\ MLSS}\right)$ (NOMINAL)	0.04
SVI DESIGN	150ml/g
DEPTH TO SLUDGE BLANKET (AFTER 30min. SETTLING WITH SVI= 150)	1.0m
OXYGEN REQUIREMENT (kg/d)	2.4 x BOD
AERATION MOTOR SERVICE FACTOR	1.2
MEAN OVERFLOW RATE	14 L/s/m

CONTINUOUSLY DECANTED SYSTEM

AERATION TANK

MLSS CONCENTRATION mg/L	3000-4000
FOOD TO MICROORGANISM RATIO $\left(\frac{kg\ BOD}{kg\ MLSS}\right)$ (NOMINAL)	0.04
SVI DESIGN	150ml/g
MIN. HYDRAULIC DETENTION TIME (AT ADWF)	36 hrs
OXYGEN REQUIREMENT (kg/d)	2.4 x BOD_5
AERATION MOTOR SERVICE FACTOR	1.2

CLARIFIER

MAX. OVERFLOW RATE (AT PEAK FLOW)	24 $m^3/m^2/d$
MAX. SOLIDS FLUX LOADING	6 $kg/m^2/hr$

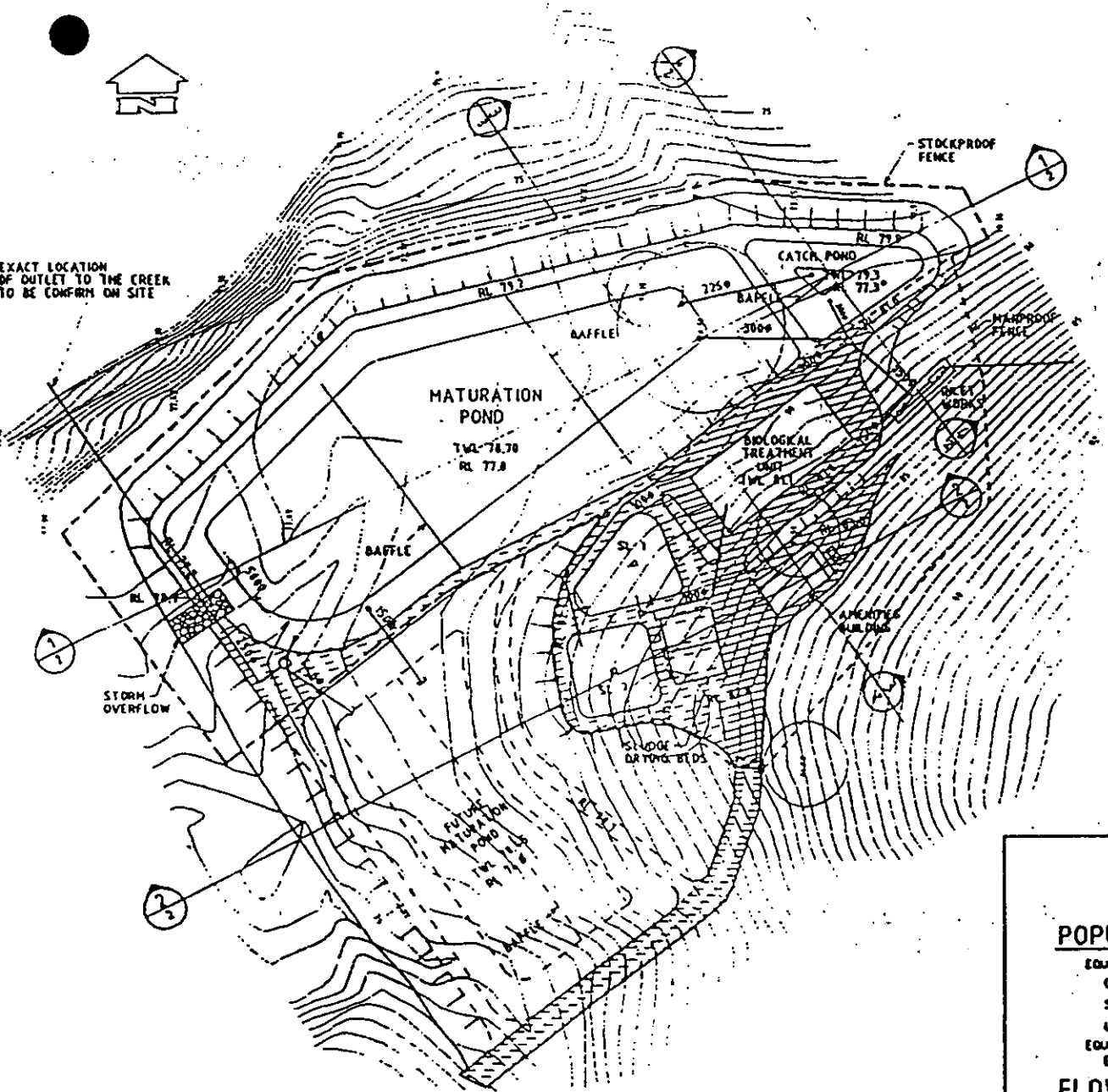
RETURN ACTIVATED SLUDGE PUMP

PUMP RATE	1.5 - 0.5 ADWF

PUBLIC WORKS

NIMBIN SEWERAGE SCHEME
WASTEWATER TREATMENT WORKS
GENERAL ARRANGEMENT
HYDRAULIC PROFILE AND
PROCESS DESIGN CRITERIA

FIG. 1



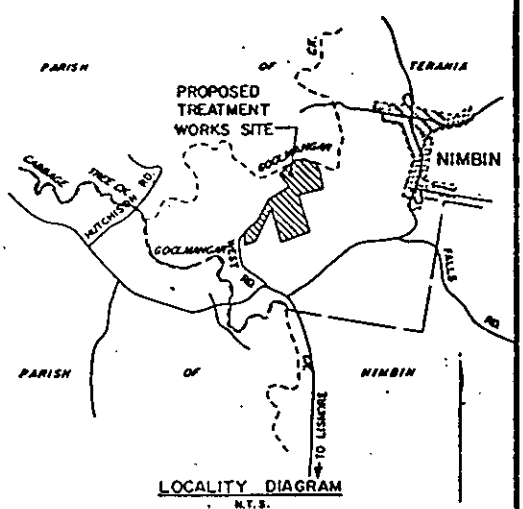
PLAN - GENERAL ARRANGEMENT

SCALE 1:500

1:500 0 10 20 30 40 50 m

LEGEND

- STAGE 1 WORKS
- FUTURE WORKS
- SEALED ROADWORKS
- UNSEALED ROADWORKS



LOCALITY DIAGRAM
N.T.S.

POPULATION

EQUIVALENT POPULATION (EP)
CURRENT
STAGE 1
ULTIMATE
EQUIVALENT POPULATION TO
EP / ET = 3.8

FLOWS

	400 EP
A.D.W.F.	1.76 L/s
P.D.W.F.	5.31 L/s
DESIGN W.W.F.	14.59 L/s

LOADING (EAT's)

$B.O.D_5$	70 g/EP/d
S.S.	70 g/EP/d
NH_4 -N	12 g/EP/d
T - P	2.4 g/EP/d

EFFLUENT SYSTEM

1. CATCH POND
   - NUMBER
   - TWL DEPTH
   - VOLUME (BELOW T.W.L.)
   - DETENTION AT ADWF (FOR 1000 EP)
2. MATURATION POND
   - NUMBER
   - TWL DEPTH
   - VOLUME (BELOW T.W.L.)
   - DESIGN CAPACITY (EP)
   - DETENTION AT ADWF

DESIGNED
DRAWN
CHECKED

DETAILS OF AMENDMENTS | APPROVED | DATE

(iii) Sewage Reticulation/Transport System

Three methods of sewage collection were examined for Nimbin.

The Pumped Common Effluent Drainage is detailed schematically in Figure 2 iii. Although such a system has a lower installation cost several management problems occur. The pumps are located on private property and would require access by Council for maintenance. This access plus the resolution of responsibility for power costs require legal resolution. Council have agreed that this option should not be considered.

The two other alternatives considered were the Conventional Gravity and Common Effluent Drainage Systems. A schematic detail of each arrangement is provided in Figure 2i and 2ii. For each of these systems two alternative reticulation layouts were investigated. In each case the alternative layouts proved to be very similar in cost.

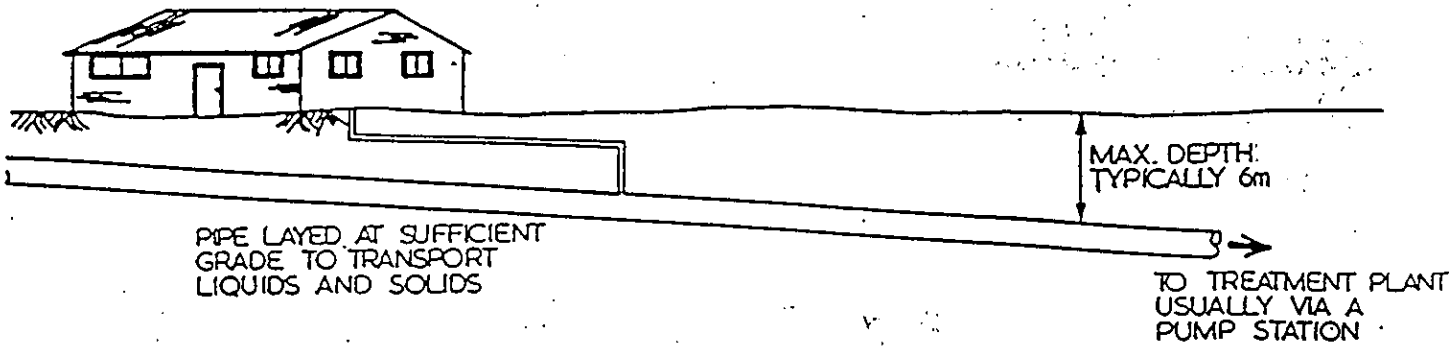
The capital cost of the common effluent drainage (CED) system is cheaper than the conventional system. However there are several disadvantages related to maintenance and operation of a system relying on the continued operation of septic systems. They must be pumped out regularly, defective tanks must be repaired or replaced, new houses must install septic tanks and odour and corrosion problems due to septic effluent are more severe.

Although the conventional system has a higher capital cost it provides a highly reliable, low maintenance sewage transport system which justifies the extra cost.

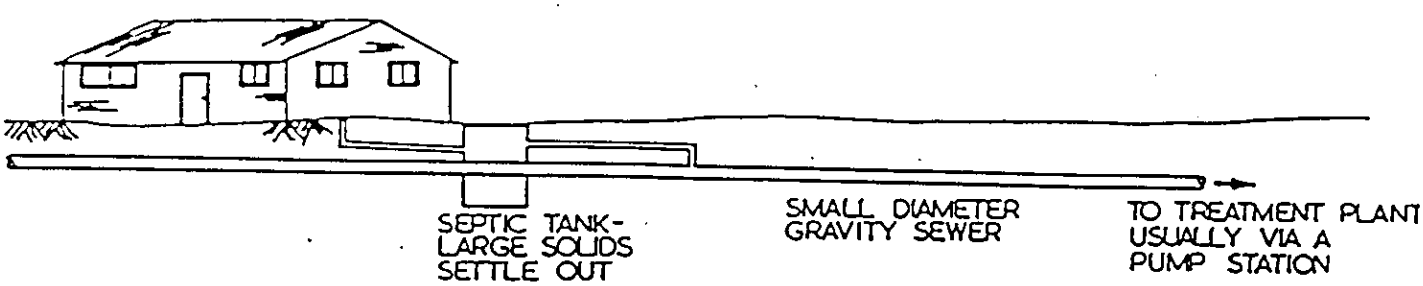
After allowing for the anticipated higher maintenance costs for the CED system, the overall costs of both systems are comparable.

The conventional gravity sewer system is proposed for use at Nimbin.

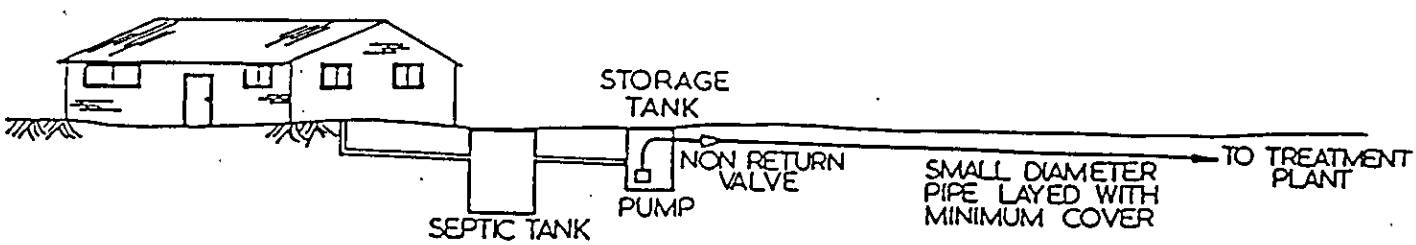
I) CONVENTION GRAVITY SYSTEM



II) COMMON EFFLUENT DISPOSAL SYSTEM (CED)



III) SEPTIC TANK EFFLUENT PUMPING



ALTERNATIVE DRAINAGE SYSTEMS

FIG. 2

6.0 THE PROPOSED SCHEME

Following careful consideration of all disposal, treatment and transport alternatives the scheme proposed for Nimbin is detailed as follows:

(a) Sewage Reticulation - conventional gravity reticulation system with 2 pump stations and 3 catchments.

(b) Sewage Treatment - "Package Type" plant utilising the activated sludge process. The plant to use the Intermittent Extended Aeration technique incorporating nutrient removal.

(c) Effluent Disposal - disposal of tertiary treated effluent to land and to Goolmangar Creek. Disposal to land as an alternative is to be maximised in drought periods when flow in Goolmanger Creek is low.

Chapters 7, 8 and 9 of this report will discuss the environmental impacts of the proposed scheme components as well as detail the safeguards built into the system to minimise its effect on the environment.

7.0 TRANSPORT SYSTEM - ENVIRONMENTAL IMPACTS & SAFEGUARDS

7.1 Introduction

The topography of Nimbin allows for easy division of the village into catchment zones. Within each zone sewage flows by gravity through a system of pipes and manholes to a pump station. The pump station is located at the lowest point within each catchment. Sewage is then pumped and delivered by a rising or pressure main into another catchment zone or directly to the treatment works.

A number of alternative sewage transport systems and layouts were examined. The preferred option is the Conventional Gravity System incorporating 3 catchment zones and 2 pump stations.

7.2 System Description

A layout of the proposed system is provided in Figure 3.

The layout creates 3 catchment zones by dividing Nimbin along the main north-south ridge line. The eastern zone gravitates via graded 100mm, 150mm and 225mm pipelines to Pump Station No.1 located in Sibley Street. Flows collected in the station are then pumped via a 150mm diameter rising/pressure main to discharge into catchment 3.

Flows within catchment 2, which is the North-West section of Nimbin, gravitate to Pump Station No.2 and are directed via a 150mm rising main into catchment 3. Pump Station 2 is located on private property adjacent to Mulgum Creek and South East of the Youth Hostel.

All flows originating from Catchment Zone 1, 2 and 3 are directed via a graded gravity main to the sewage treatment works.

Each pump station is provided with an emergency overflow which allows for controlled discharge of sewage should pump station failure occur.

7.3 Environmental Impacts

The main components of the sewage transport system are underground pressure and gravity pipelines, manholes, submersible pump stations and emergency overflows.

These components may have short, and/or long term environmental impacts.

(i) Short Term:

Construction of the transport system may extend over a period of 12 months and will comprise trench excavation and laying of pipelines, manhole construction, and construction of pumping stations.

Trench excavation, pipe laying and manhole construction will have the most effect on residents. Wherever possible pipelines have been located at the rear of properties to minimise disturbance.

The construction activities will generate dust and noise. Work will be performed during daylight hours and equipment will include wheeled backhoes, front end loaders, tracked machines and trucks. Strict control on the generation of dust will be enforced. All equipment on the works will be equipped with appropriate silencers to Road and Traffic Authority requirements.

Trenching and pipelaying will also result in a short term visual impact.

Only short lengths of trench will be open at any one time (maximum 100 metres). At the end of work each day, trenches would be backfilled so that only about 10 metres of trench would be open overnight. Any trenches left open will be appropriately barricaded. Lighting will also be provided to warn of hazards at night.

Trench depths will average 1.5 metres. A geotechnical investigation of subsoil conditions over the reticulation area has revealed that hard rock should not be encountered. This will eliminate the need for drilling and blasting, allow smaller excavation machines to be used and minimise disturbance to properties.

Construction of these works will progress on 1 or a number of fronts as the pipelines are built. This will ensure that disturbance at any one location should occur for a period of less than 2 weeks. All disturbance to lawns, fences etc will be restored promptly on completion of operation.

Works will be undertaken by private contractor under a detailed specification. The specification places very strict requirements on the contractor in relation to the timing and quality of restoration. Restoration is specified as follows.

"All surfaces, services and/or improvements which are disturbed, destroyed or damaged by work under the Contract shall be replaced, repaired, reinstated or otherwise restored, as near as practicable to their pre-existing condition. Improvements shall be deemed to include shrubs, gardens, retaining walls, fences and all other structures."

In addition very strict requirements will be in force in relation to the timing of restoration.

Disturbance to existing vegetation will be kept to a strict minimum.

"Restoration work on surfaces, services and improvements shall be carried out progressively as pipelaying and manhole construction proceeds. Except for pavements, restoration of surfaces and improvements shall be carried out within five (5) working days after trench backfilling for each manhole length and within five (5) working days after completion of construction to ground surface level of each manhole.

Likewise, maintenance of restoration shall be carried out within five (5) working days of the need for such maintenance becoming apparent."

Trenching and pipelaying along existing roads will cause some disturbance to traffic. However this will only occur for short periods of time with the contractor being responsible for all traffic control.

The construction time for each pump station will be approximately 3-4 months. During this period excavation, concrete forming and pouring and mechanical and electrical equipment installation will occur.

Noise and dust will be generated by men and machines during the works but will be intermittent and not of significance. Rock blasting is not expected during construction. The area disturbed by the works will be kept to a minimum with restoration undertaken on completion.

Pump Station 1 is sited in the Sibley Street road reserve approximately 25 metres from the nearest residence. Pump Station 2 is sited on private property well away from existing housing.

Safety barricades will be provided around each work site in non working hours to protect the public.

(ii) Long Term

The long term affects of pipelines and manholes will be negligible. Referral to figure 3 will indicate that pipeline routes have been selected to cause minimal limitations to future use of each property whilst minimising connection costs.

Due to the high standard of restoration required by the contracts, pipeline routes will be difficult to locate after allowance of a reasonable time for vegetation growth.

The only visual impact will be the tops of concrete manholes. Manholes will be constructed with a top level with the surrounding ground surface level. They will therefore be visible as a circular concrete surface almost 1 metre in diameter.

The design of the pump stations consist of 2 submersible electric pumps in a buried concrete pit. The pumps have minimal noise generation. The nearest residents to both pump stations 1 and 2 will not be aware of pump operation even during the quiet night time hours.

The visual impact of the stations is also minimal. The station structure will be visible only as a circular concrete roof approx 2 metres in diameter with a top level approx 300mm above the natural surface level. In addition a stainless steel electrical control cabinet will be provided on a brick plinth. A vertical vent pipe will also be installed. The station will not detract from visual aspects of the natural surroundings.

It should be noted that Pump Station 2 will not be visible from either the Youth Hostel or the Tennis Courts.

Power supply to Pump Station 1 will be provided underground from an existing power pole. Overhead power supply will be necessary for Pump Station 2. Installation of power poles will be necessary to extend the existing power supply systems approximately 150 metres. The visual impact of power supply will be minimal.

Each station is provided with a duty and standby pump which provides for 100% standby should a fault develop in one pump. However failure of the station will occur during power stoppages. To account for this eventuality each station is provided with an emergency overflow. Each overflow is licensed by the State Pollution Control Commission. A requirement of this license is that the sewerage reticulation system shall have sufficient storage capacity to store not less than eight hours flow at average dry weather flow conditions before an overflow occurs. The overflows discharge to natural watercourses adjacent to each pump station. The frequency of discharges will be rare and their environmental effect negligible.

In summary the long term environmental effects of the reticulation system will be minimal. The construction of the reticulation will have a major beneficial environmental effect, by removing septic tank overflow from within the town, and enabling treatment to be centralised at one controlled location. Also, with the conventional gravity system, septic tanks, sullage traps and absorption trenches may be decommissioned. This would be best achieved by pumping out the septic tanks, removing the concrete lid and walls to below ground level and filling with imported soil. The area could then be grassed. No work would be required on the absorption trenches.

8.0 SEWAGE TREATMENT WORKS - ENVIRONMENTAL IMPACTS & SAFEGUARDS

8.1 Introduction

The sewage treatment works is the facility constructed for the treatment of raw sewage.

As detailed in Chapter 5.0 of this report a total of 7 different treatment techniques were considered prior to adoption of a preferred method.

The adopted alternative is to treat sewage by the activated sludge process using the Intermittent Extended Aeration technique, and incorporating nutrient removal. It is proposed that the plant will be a "Package Type" plant which offers the optimum in treatment costs and land requirements. The main process modules of the package plant will be designed to cater for an equivalent population of 1,000 persons.

Nutrient removal will be included in the treatment process to protect the receiving waters. Nitrogen will be removed biologically by suitably controlling the process, and phosphorus will be chemically removed by the addition of alum and lime to the aeration chamber. In addition, a 20 day retention pond will be provided to ensure disinfection of the effluent prior to discharge.

The adopted location of the site for the works is 700 metres west of Nimbin adjacent to Goolmangar Creek. The site offers the best optimal mix of available land, costs and environmental considerations.

Too close?
Aboriginal significance?
see pg 42

8.2 Works Description

A layout of the proposed works is shown in Figure 1. The works consists of a number of individual treatment units which will be briefly described.

(i) Inlet Works

Measurement of flow is necessary through any modern treatment works in order to monitor inflow to the works and control the nutrient removal dosing equipment. To achieve measurement a flume will be provided with an upstream grit channel and two manually raked course screens. A by-pass is also incorporated to a catch pond, permitting shutdown of the plant for unusual maintenance.

(ii) Package Treatment Plant

A Package Treatment Plant operating on the extended aeration activated sludge process will be provided. Such a process will ensure the production of an effluent satisfying the quality limits detailed in Section 5.2 of this review. The tanks will be of reinforced concrete construction complying with the relevant Australian Standard for water retaining structures.

(iii) Sludge Lagoons

Two sludge lagoons are to be provided to receive waste activated sludge from the biological treatment unit. The sludge lagoon will provide storage and further treatment and thickening of the waste activated sludge. A minimum of two sludge lagoons are required for satisfactory sludge management. A pontoon mounted sludge pump/mixer assembly will be provided to facilitate sludge removal from the lagoons.

(iv) Sludge Drying Beds

Matured sludge is to be pumped from the sludge lagoon and applied to the sludge drying beds. Two sludge drying beds of simple low cost construction are proposed for the treatment works.

(v) Maturation Ponds

Disinfection of the effluent is provided in a maturation pond. A catch pond is included in the ponding system to capture any sludge which may be entrained in the effluent. Pipe work around the catch pond will be arranged so as to isolate the catch pond when required. The maturation pond will be provided with baffles to minimize short circuiting.

An outlet weir is to be provided in the maturation pond to direct the overflow to the effluent pumping station. This outlet weir will be set at 1.5 m height to provide required detention time of 30 days.

An overflow weir will be provided at the effluent pumping station to direct the discharge to Goolmangar Creek. The weir level will be set at 1.6 m height so that the storage between the two weir levels will be adequate to store effluent to facilitate intermittent pumping of effluent for irrigation.

Provision also will be made to include a second effluent maturation pond in future when the load on the works rises above 600 EP.

An emergency overflow with stone pitching will be provided to allow flood waters to enter and leave the maturation pond without causing structural damage to the embankment. The top of the embankment will be lower than the predicted 1 in 100 year flood level.

The creek bank at the location of the outfall from the maturation pond will be restored to avoid erosion.

(vi) Effluent Pumping Station

An effluent pumping station will be provided for land disposal of effluent. An electrically driven pump will be provided in the station to allow irrigation of effluent over the land disposal area during dry times. It is intended that use of this disposal option be maximised. Therefore the criteria for its utilisation will not only be based on low flows within Goolmangar Creek. Favourable weather and ground conditions will be a consideration, which will result in significantly greater volumes of effluent being discharged to the land.

Provision has been made for additional storage of effluent to be re-used in between the high and low weirs of the maturation pond. * re-used for what ?

(vii) Amenities Building

The proposed amenities building provides basic amenities for the treatment works operators as well as rooms for the installation of electrical controls for the packaged treatment plant, chemical storage and handling and storage of miscellaneous equipment for the treatment works.

A Laboratory is also provided within the building to allow for testing of treated effluent to determine its conformity to discharge requirements and thus ensure correct operation of the plant.

A break pressure tank and pressure vessel assembly will be provided to supply water services around the treatment works.

(viii) Land Disposal Area & Irrigation System

An area of approx. 6 ha, south west of the treatment works, has been identified for land disposal of effluent. Land disposal will be maximised by provision of an irrigation system. The system's design and operation has been specified by the N.S.W. Agriculture and Fisheries Department. (Reference 6).

8.3 SYSTEM OPERATION

The following represents a brief summary of the intended mode of operation of the treatment works.

(i) Inlet Works

All flows will be screened at the manually raked bar screen. When the first screen is extensively clogged, wastewater will bypass the first screen to the second screen. When the second screen is also extensively clogged the second screen also will be bypassed without overtopping the side walls.

The flume located downstream of the screen will measure flows, provide depth control required for effective screen operation and will provide a control signal for the chemical dosing equipment.

Screenings and grit will be regularly removed and disposed of at the treatment works site by burial.

(ii) Biological Treatment Unit

Screened raw wastewater will be gravitated to the inlet of the packaged treatment plant. Operating details for the packaged treatment plant will be provided by the successful tenderer. Operation of the treatment plant will be automated so that the operator attendance will be minimal.

The packaged treatment plant is to include facilities for addition of chemicals for phosphorus removal and control of the pH. These facilities will also be designed according to the supplier's recommendation and Department's acceptance. However, pH must be maintained within a range of 6.5 to 8.0 and effluent total phosphorus concentration from the treatment works must be less than 1 mg/L.

(iii) Sludge Handling

Mixed liquor will be wasted to the sludge lagoons. Sludge lagoons will be used in a rotational basis to achieve storage, maturation and thickening before desludging. Supernatant from the sludge lagoons will be gravitated to the aeration tank.

Matured sludge will be pumped from the sludge lagoons and will be applied onto the sludge drying beds. The result will be a dried sludge cake. In recognition of the value of the sludge cake as a soil conditioner Council will be looking to utilise this ~~resource on Council~~ property such as parks and gardens. Other avenues for use of the dried sludge will also be explored with community and other interest groups. Phosphorus present in the sludge will be chemically bound and will only be suitable as a soil conditioning agent but not as a source of nutrient.

(iv) Effluent Disinfection and Disposal

Effluent from the biological treatment unit will be gravitated to the catch pond to capture any sludge carried over with the effluent and thence to the maturation pond. The catch pond inlet/outlet pipe work will be arranged in such a manner to permit isolation of the catch pond when required.

Flows from the catch pond will be directed to the maturation pond which will provide 30 days detention time at ADWF. The maturation pond will be provided with outlet weirs to direct the overflow to the effluent pumping station. An outlet weir will be provided at a higher level to direct excess flow to the Goolmangar Creek.

Storage ~~between the high/low level weirs is equivalent~~ to two days storage at ADWF. Land application of effluent is to be undertaken as required by the SPCC as a means to minimize pollutant load into the Goolmangar Creek. Land application will be necessary during periods of extended dry weather and associated low flows in the creek. Utilisation of land disposal will be maximised.

DEPARTMENT OF SCHOOL EDUCATION

NORTH COAST REGION

1994 ANCILLARY STAFF PROFESSIONAL DEVELOPMENT COORDINATORS CONFERENCE

6-7 JUNE 1994

WOOLGOOLGA RSL CLUB

DAY 1

12 Noon	Registration
12.15 pm	LUNCH
1.00 pm	Welcome, Introductions, 1993 Conference Outcomes Kerry Dogan - Program Manager Ancillary Staff Professional Development John Kelly - Training & Development Coordinator
2.00 pm	Keynote Address - "Customer Service in School Education" Danielle Scott - Community Liaison Officer
3.00 - 3.15 pm	AFTERNOON TEA
4.15 - 5.30 pm	ERC Outcomes Reports (15 minutes/ERC)
5.30 - 6.30 pm	FREE TIME
6.30 pm	Pre-Dinner Drinks
7.00 pm	DINNER
7.45 pm	Team Building Exercise
9.00 pm	CLOSE

8.4 ENVIRONMENTAL IMPACTS

(i) Short Term

Short term environmental effects are related solely to the period required to construct the works. They arise from the construction technique used and the labour, plant, equipment and materials utilised to construct the works. The effects can be visual or related to noise.

The work site is located 700 metres west of the village adjacent to Goolmangar Creek. Geotechnical Investigations of sub soil conditions indicates no rock within the depths proposed for construction and minimal groundwater.

NOISE - Noise will be generated by equipment used to construct the plant during the course of the construction period. Construction is expected to take ten months. The type of equipment required for the work will include tracked and rubber typed earthmoving equipment and other plant used for the transport, forming and pouring of concrete. Work will only be undertaken during normal working hours.

The site is located 400 metres from the nearest dwelling and there will be negligible effect on the residence or the village which is further away.

The distance of the site from the town area and nearby dwelling will result in negligible environmental effects due to noise.

Note that an access road will be constructed into the works site off West Road to the S-W of the plant. The access road alignment was determined in close consultation with the landowner and will be constructed prior to commencement of on site works. The adopted alignment of the road will result in an increase in noise level at the house mainly during the arrival and departure of trucks delivering materials such as pipes and concrete etc. However this traffic will be on a very intermittent basis.

DUST Dust generated at the works site will not be of concern due to the remoteness from existing development. The access road into the site will be of gravel construction. However the initial section past the existing cottage will be sealed with a one coat tar seal to eliminate any dust problem. Maintenance of this road, particularly the sealed section, will be the responsibility of the contractor undertaking construction of the works.

DEPARTMENT OF SCHOOL EDUCATION

NORTH COAST REGION

1994 ANCILLARY STAFF PROFESSIONAL

DEVELOPMENT COORDINATORS CONFERENCE

6-7 JUNE 1994

WOOLGOOLGA RSL CLUB

DAY 2

8.30 am - 9.30 am	Plans from Needs Survey (Workshop) Kerry Dogan, John Kelly
9.30 - 10.00 am	Plenary Session "Needs" Plans for 1994
10.00 - 10.15 am	MORNING TEA
10.15 - 11.30 am	What Course Manuals are Available Kerry Dogan, John Kelly * Over to You * Teachers Aide (Special) * Oasis * Technology Centre, Ballina * Administrative Leadership Certificate * Existing Courses * CPDE Modules - Neville Jennings
11.30 - 12 Noon	Possible Strategies for Courses that are needed Kerry Dogan, John Kelly
12 Noon - 1.00 pm	Development Plan 1994-1995
1.00 pm	LUNCH/CLOSE

RUNOFF The treatment works site slopes generally toward Goolmangar Creek. The potential does exist, should heavy rainfall occur during the early construction phase of the work, for runoff to carry quantities of sediment into the creek. Earthworks will be carried out in such a manner as to prevent this from occurring. In addition all embankments will be topsoiled and vegetated as soon as possible to prevent scouring.

CLEARING The area proposed for the works has been cleared for grazing. No extensive clearing will be required for either the works or proposed access road. Five isolated trees will be removed. Due to the rural nature of the area and significant tree vegetation in all directions the loss of the 5 trees will not be significant.

what trees?

In summary no short term environmental effects of significance will occur during construction.

(ii) LONG TERM

The existance and operation of the treatment works will result in a number of long term environmental effects.

VISUAL The proposed treatment works site is located in a rural setting west of Nimbin village. The site is bounded in all direction by natural features which isolate the works from view. To the east a natural ridge line prevent the works being seen from anywhere in the village area. A tree line along Goolmangar Creek prevents a view of the works from the north. Elevated land to the south and another treeline to the west also hide the development. Only one isolated residence will have a restricted view of the works, and that will be from a distance of 500 metres.

A close view will not be obtrusive on the environment. The works will consist of a brick amenities building and a number of concrete structures. The largest concrete structure is the treatment unit being approx. 30m x 12m. The remaining development will be earth walled ponds with grassed embankments. Construction of the works will require some cut and fill earthworks and the removal of 5 isolated trees of small environmental significance. The works will be landscaped with assorted trees on completion of construction. An access road will be constructed to the site. The road will not require the removal of any trees and ~~will not be visually obtrusive~~.

An area of land to the south of the works has been identified as suitable for spray irrigation of treated tertiary effluent. No visual effect other than a greening of existing pasture land will be the result.

ASSESSMENT OF BASIC SKILLS

for

STUDENTS WITH INTELLECTUAL DISABILITY

TEACHERS' PACKAGE

(First Edition)

This package was developed as a Metropolitan East Key Group project May 1993. It was written by Gayle Richardson, Lorraine Hartley, Lynn Hewitt, Loraine Hedges and David Horne.

NOISE Small electric motors, up to 10kw might be located in the open. Based on current designs and the topography of the site it is envisaged that noise levels from these motors and the treatment process will be insignificant at 400 metres.

FLORA & FAUNA The area has already been cleared for grazing and only 5 isolated trees will be removed. Upon completion the works site will be grassed and landscape trees planted.

The maturation ponds will provide a habitat for water birds and result in a net increase of birdlife in the area.

ODOURS The sewage treatment process is an aerobic process. The aeration unit responsible for sewage treatment produces virtually no odours. Some odour may be produced by the sludge lagoons and sludge drying beds. However these odours will be of a minor nature in the vicinity of the plant only. The prevailing N-E to S-E winds in summer will not cause odour problems at any residences. Note that the village is over 700 metres east of the works.

FLOODING To keep construction costs to a minimum, it is proposed that the tertiary ponds be located on flat flood prone land adjacent to Goolmangar Creek. The 1 in 100 year flood level is estimated to be RL 79.4m. All other treatment works units will be constructed well above flood level. The treatment works construction will not affect flooding either upstream or downstream of the site.

BUFFER ZONES Following construction of the plant a 400 metre wide buffer zone will be established. The zoning will allow use of the buffer zone area for flora and fauna reserves, grazing, agricultural use, forestry, commercial plant nurseries, recreation, effluent disposal or public road reserves. Urban residential development should be precluded. The nearest existing residence is located 400 metres from the proposed works site.

MONEY USAGE 1 - Clarke Road Money Program

SCREENING TEST - Written

"Triple M"

Name: _____ **Date:** _____

1. Write these numbers in order from 1 to 10.

2 9 7 3 5 1 8 4 6 10

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

2. Circle the prices you could pay with $1.00.

65c $1.25 30c $6.75 90c $1.50

3. What number is one more than:

6 ____ 1 ____ 8 ____ 4 ____

4. Circle the prices you could pay with $2.00.

$2.05 $1.45 $3.80 $1.15 $1.95

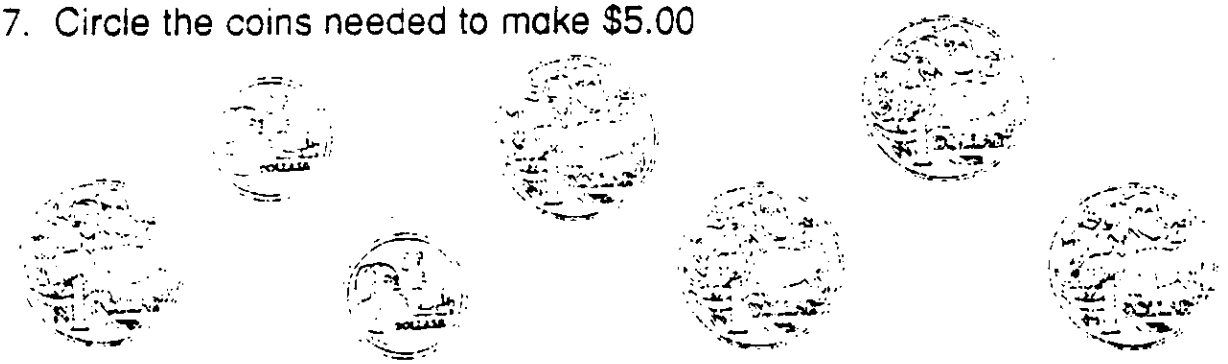
5. Circle the prices you could pay with $7.00.

$7.10 $8.20 $6.35 $7.40 $6.55

6. Circle the prices you could pay with $8.00.

$7. 60 $8.70 $7.85 $8.05 $7.25

7. Circle the coins needed to make $5.00



FENCING Fencing of the works will be completed prior to commissioning. A manproof fence will be erected to isolate the inlet works, biological and sludge treatment facilities and the amenities block. A stockproof fence will be provided around the effluent ponds. These fences are provided for health and safety reasons.

TRAFFIC Provision of the works will not generate significant levels of vehicle traffic to and from the plant. Access will be required daily by the works operator and intermittently for maintenance and delivery of chemicals. This traffic will not inconvenience the residence at the end of West's Road. No night time access should be required.

OPERATION - MANNING LEVELS

The package type treatment plant proposed requires mimimal attendance. It is intended that operation of both the treatment works and pump stations would be monitored by a Council employee on an intermittent basis. There is no specialist knowledge required to run the system with control systems allowing for automatic operation.

Fail safe systems will be provided should stoppage of automatic operation occur.

A telemetry system will be installed to automatically monitor both pump stations and the treatment works. The telemetry system will identify any problems, should they occur and provide a warning signal which would be followed up by Council staff. This system will operate 24 hours per day.

In the unlikely event that the telemetry system fails to operate a further backup system exists within the treatment process.

Wastewater directed to the plant will continue to be discharged to the biological treatment unit. This unit will act as a sedimentation tank and allow solids to settle out of the incoming wastewater. These solids will be stored. Wastewater will then be directed to the effluent pond catchpond which will allow for further solids settlement and retention.

Short term (up to 2 days) interruption to the treatment process will not cause environmental problems.

MONEY PROGRAM ASSESSMENT & TRACKING SHEET

STUDENT:..... DATE OF INITIAL ASSESSMENT:..... SHEET No. 3

Coins or notes used. E.g.s	Amounts		5a.Mixed denom. coins/ notes. Exact amount.			5b.Mixed coin/notes.More than enough for 2nd coin			5c.Mixed coin/notes.More than enough for both coin		
	oral	writ'n	Test: + or -	Date started	Date mastered	Test: + or -	Date started	Date mastered	Test: + or -	Date started	Date mastered
10c + 20c	a. b.	a. b.	a. b.			a. b.			a. b.		
10c + 5c	a. b.	a. b.	a. b.			a. b.			a. b.		
2c + 1c	a. b.	a. b.	a. b.			a. b.			a. b.		
20c + 50c	a. b.	a. b.	a. b.			a. b.			a. b.		
$2 + $1	a. b.	a. b.	a. b.			a. b.			a. b.		
$10 + $5	a. b.	a. b.	a. b.			a. b.			a. b.		
$20 + $5	a. b.	a. b.	a. b.			a. b.			a. b.		
$50 + $20	a. b.	a. b.	a. b.			a. b.			a. b.		
	a.	a.	a.			a.			a.		

General power failure will stop plant operation. However under this circumstance the reticulation pump stations would also not operate. This would mean a large decrease in the volume of wastewater directed to the works. The reticulation system provides storage of up to 8 hours under dry weather conditions. This stored wastewater would be directed to the plant once power was restored. Power failure over 8 hours would see the emergency overflows referred to in Section 7.3 operate.

The whole system will automatically re-start when power is restored.

POWER SUPPLY Overhead power supply will be required to the treatment works site. The route to be taken has not been finalised. However, if the existing power supply grid has the capacity the most desirable route would be along the proposed access road to the works. The visual impact of this will be minimal.

In summary the existance and operation of the treatment works will have only minimal effect on the environment. The plant is shielded from existing development by existing natural features and its operation will be such as to create very minor intrusion into the natural environment of the area. The creation of a water bird habitat provided by the maturation ponds and efficient treatment of wastewater are regarded as net ~~plusses to~~ the environment.

MONEY PROGRAM ASSESSMENT & TRACKING SHEET

STUDENT:..... DATE OF INITIAL ASSESSMENT:..... SHEET No. 1

	1. Match coin/note to coin/note.			2. Match a coin to coin card: single/mixed coins			3. Ask for a single coin or note.		
Coins/notes	Test: + or -	Date started	Date mastered	Test: + or -	Date started	Date mastered	Test: + or -	Date started	Date mastered
1. Single denom. coins & notes:									
a. 1 cent.....	a.			a.			a.		
b. 2 "	b.			b.			b.		
c. 5 "	c.			c.			c.		
d. 10 "	d.			d.			d.		
e. 20 "	e.			e.			e.		
f. 50 "	f.			f.			f.		
g. $1 coin.....	g.			g.			g.		
h. $2 "	h.			h.			h.		
i. $5 note....	i			i.			i.		
j. $10a note...	j.			j.			j.		
k. $10b note...	k.			k.			k.		
l. $20 " ...	l.			l.			l.		
m. $50 " ...	m.			m.			m.		
n. $100 " ...	n.			n.			n.		
2. Mixed coin cards.E.g.,									
a. 60c	a.			a.			a.		
b.	b.			b.			b.		
c.	c.			c.			c.		
d.	d.			d.			d.		
e.	e.			e.			e.		
f.	f.			f.			f.		

9.0 EFFLUENT DISPOSAL - ENVIRONMENTAL IMPACTS AND SAFEGUARDS

9.1 Introduction

The objectives of effluent disposal is the return of the wastewater to the water cycle with minimum adverse effects on the environment. The receiving environment has a natural assimilative capacity which can cope with and purify effluent, depending on the level of treatment provided.

In NSW, legislation exists controlling community wastewater schemes and effluent disposal in particular.

The State Pollution Control Commission sets down guidelines and minimum standards, and licenses the discharge of effluent to receiving waters. Throughout the process of developing proposals for the Nimbin scheme close liaison has been maintained with the SPCC.

9.2 Effluent Disposal - Goolmangar Creek

i) General Principles

It has been traditional practice in communities in Australia and around the world, to take water from rivers for supply and to return the effluent, usually after some treatment. Where conditions are appropriate this can be a cheap, convenient and acceptable approach, and has been practiced throughout NSW for many years. However, increased urbanisation along rivers and competing demands for water have put pressure on rivers and greater attention is now being paid to the consequences of disposal to surface waters.

The authority responsible for establishing standards to protect the quality of the State's water resources is the State Pollution Control Commission (SPCC). The objectives of the SPCC include the management of surface and sub surface water so as to achieve a quality appropriate to the desirable uses of waters by controlling sources of pollution, having regard to technical, social and economic considerations.

It is a difficult task to determine specific controls to be applied to any given discharge, in order to achieve that appropriate quality.

☐ 94 (4) Write down the names of the months in order.

(1) ..... (7) .....

(2) ..... (8) .....

(3) ..... (9) .....

(4) ..... (10) .....

(5) ..... (11) .....

(6) ..... (12) .....

	JANUARY	FEBRUARY	MARCH
Sun	7 14 21 28	4 11 18 25	4 11 18 25
Mon.	1 8 15 22 29	5 12 19 26	5 12 19 26
Tues.	2 9 16 23 30	6 13 20 27	6 13 20 27
Wed.	3 10 17 24 31	7 14 21 28	7 14 21 28
Thu.	4 11 18 25	1 8 15 22	1 8 15 22 29
Fri.	5 12 19 26	2 9 16 23	2 9 16 23 30
Sat.	6 13 20 27	3 10 17 24	3 10 17 24 31

	APRIL	MAY	JUNE
Sun.	1 8 15 22 29	6 13 20 27	3 10 17 24
Mon.	2 9 16 23 30	7 14 21 28	4 11 18 25
Tues.	3 10 17 24	1 8 15 22 29	5 12 19 26
Wed.	4 11 18 25	2 9 16 23 30	6 13 20 27
Thu.	5 12 19 26	3 10 17 24 31	7 14 21 28
Fri	6 13 20 27	4 11 18 25	1 8 15 22 29
Sat.	7 14 21 28	5 12 19 26	2 9 16 23 30

	JULY	AUGUST	SEPTEMBER
Sun	1 8 15 22 29	5 12 19 26	30 2 9 16 23
Mon	2 9 16 23 30	6 13 20 27	3 10 17 24
Tues	3 10 17 24 31	7 14 21 28	4 11 18 25
Wed.	4 11 18 25	1 8 15 22 29	5 12 19 26
Thu	5 12 19 26	2 9 16 23 30	6 13 20 27
Fri	6 13 20 27	3 10 17 24 31	7 14 21 28
Sat	7 14 21 28	4 11 18 25	1 8 15 22 29

	OCTOBER	NOVEMBER	DECEMBER
Sun	7 14 21 28	4 11 18 25	30 2 9 16 23
Mon	1 8 15 22 29	5 12 19 26	31 3 10 17 24
Tues	2 9 16 23 30	6 13 20 27	4 11 18 25
Wed	3 10 17 24 31	7 14 21 28	5 12 19 26
Thu	4 11 18 25	1 8 15 22 29	6 13 20 27
Fri	5 12 19 26	2 9 16 23 30	7 14 21 28
Sat	6 13 20 27	3 10 17 24	1 8 15 22 29

☐ 108 Look at the 1979 calendar and answer the questions.

(1) Which is the first month of the year? .....

(2) Which is the last month of the year? .....

(3) Which is the first day in March? .....

(4) Which is the first day in June? .....

(5) Which months have 30 days?

(a) ..... (b) .....

(c) ..... (d) .....

(6) Which months have 31 days?

(a) ..... (b) .....

(c) ..... (d) .....

(e) ..... (f) .....

(g) .....

All naturally occurring waters have a capacity to receive and purify some amount of added substances without an adverse impact on the receiving environment. In domestic secondary treated effluent (the minimum level of treatment considered reasonable for country NSW schemes) the substances of principal interest are biochemical oxygen demand (BOD), phosphorus, nitrogen, suspended solids (SS) and bacteria.

At the lowest level of effect the amount of added substances will be within the natural bounds of fluctuations in the water body and be virtually undetectable.

At higher levels the added substances will cause a measurable change in ambient concentrations but will not result in any appreciable changes in the condition of the water body. Over some period and/or distance from the discharge the normal balance will be restored by the action of natural processes and the effects of the discharge will no longer be detectable. The ability of a natural system to accept and absorb discharges in this manner is referred to as its assimilative capacity.

If a discharge is of such a quantity or quality as to exceed the assimilative capacity of the water body, then it can cause qualitative changes to the character of the water body. Such changes are usually undesirable and may or may not be reversible in practical terms.

ii) Goolmangar Creek Characteristics

In order to determine a stream's assimilative capacity it is necessary to assess the effect of effluent disposal in relation to:

- Streamflow
- Water Quality - Oxygen Demand
  - Nutrients Phosphorus & Nitrogen
  - Micro organisms
  - Suspended Solids

Studies of streamflow records and a 20 month water sampling and testing programme were undertaken to identify the existing water quality.

- Streamflow - The range and variability of flow in Goolmangar Creek has been investigated based on data obtained from Department of Water Resources gauging station 203015 near Coffee Camp.

This data and inspection of the daily flow records shows that flow in the creek during dry periods decreases to low levels and has ceased to flow on occasion.

- Water Quality - The results of the 20 month sampling are summarised in the following table.

Table 9.1

Goolmangar Creek Water Quality

Quality Parameter	Concentration Max	Min	Average	Maximum Desirable
Total Phosphorus (TP) (mg/L)	0.08	0.03	0.056	0.05
Total Nitrogen (TN) (mg/L)	1.2	0.1	0.32	0.50
Chlorophyll a (mg/L)	0.013	0.001	0.001	0.02
E Coli (org/100 mls)	500	40	158	200

The maximum desirable concentrations are based on advice from the State Pollution Control Commission. The nominated TP and TN levels are "goal" concentration and are based on recommendation in the Australia Environmental Council Report No 19 "Nutrients in Australian Waters".

9.3 Environmental Impacts

i) Oxygen Demand

Oxygen demand in the creek may rise due to 3 characteristics of treated wastewater. Organic materials exerts an oxygen demand as they undergo biodegradation by steam biota. Reducing agents such as ammonia will exert an oxygen demand as they are chemically oxidised. Pollutants such as grease and fats may effect the level of natural oxygenation by inhibiting the transfer of oxygen from the atmosphere into the water.

In normal secondary effluent, the two latter causes of oxygen demand rarely occur. The oxygen demand exterted by the breakdown of organic material is referred to as the Biochemical Oxygen Demand (B.O.D.).

Oxygen to satisfy the demand exerted during the degradation of organic material must be present in sufficient quantities to support the normal range of aquatic life. This supply of oxygen into the stream is satisfied mainly by atmospheric re-aeration. As oxygen level falls, the rate of atmospheric re-aeration increases.

The treatment plant at Nimbin will be designed to produce an ~~effluent with a B.O.D. of 20mg/L or less~~. This will be further reduced by approximately 30% to 70% in the tertiary pond. Extensive experience statewide clearly indicates that oxygen depletion problems are not experienced, except where the effluent constitutes all or most of the flow in the receiving stream. In these cases, the reason is generally eutrophication followed by the death and decay of algae. The disposal of effluent under very low flow conditions is discussed in detail in the next section.

NORTH COAST REGION - UTILITIES QUESTIONNAIRE

The expenditure information requested in Parts 1 to 10 is to be for accounts **PAID** in the financial year ie. 1 December to 30 November.

1. **Electricity Consupmtion/Expenditure** — Actual Expenditure

   1991

   1992

   1993

2. **Water Consumption** — Actual Expenditure

   1991

   1992

   1993

   Schools with no connected water should indicate costs incurred for water cartage. Reasons for substantial variances year to year:

3. **Sewerage**
   (includes sanitary disposal/Rentokil) — No sewer connected **OR** Actual Expenditure

   1991

   1992

   1993

4. **Garbage/Waste Disposal** — Actual Expenditure

   1991

   1992

   1993

Total rates expenditure (2 + 3 + 4) — Actual Expenditure

1991

1992

1993

ii) Nutrients - Phosphorus and Nitrogen

Enrichment of waterway by plant nutrients from wastewater and other discharges can lead to the phenomena of eutrophricaton. In the most extreme form, the nutrients contribute to heavy growths of aquatic plants and algae. Microscopic algae may impart colour and turbidity to the water while larger forms of algae, plants and weeds may grow so thickly as to completely choke the waterway. Such growths also tend to be seasonal and cyclic, with a period of explosive growth being followed by a period of death and decay of the plant material. Oxygen demand exerted as the plant material decays in the waters and around the shoreline often exceeds the oxygen resources of the water body, leading to serious effects on other organisms.

The more extreme effects of eutrophication are most likely to occur in lakes, sluggish streams etc. where nutrients tend to accumulate. In fast flowing streams, the problem is less marked.

Even where eutrophication occurs to a less spectacular extent, growth of microscopic algae can seriously affect the quality, often giving rise to discolouration, unpleasant tastes and odours. Also changes in aquatic flora and fauna may occur.

The main process for assimilation of nutrients, especially phosphorus, is by dilution. Although the nutrients may be taken up by plants, they are subsequently released again upon death and decomposition. Therefore, streams with low flows relative to the quantity of effluent discharged may have their assimilative capacity exceeded.

As noted previously, the flow in Goolmangar Creek has during periods decreased to low levels, and has ceased to flow completely on occasions. During these periods, disposal of effluent to Goolmangar Creek may adversely impact on water quality. Whether this is the case, at what flow this is likely to occur and the extent of the effect, is difficult to assess. Experience has shown that the critical quality parameter which needs to be examined to enable predictions of these aspects, is the phosphorus concentrations in the stream.

Table 9.1 shows that, the existing phosphorus concentration is above the goal criteria. Higher levels of phosphorus concentration occur during high flow periods and is attributed to surface runoff from agricultural land. The phosphorus concentration during periods of low flow (ie. <2 ML/d)averages 0.04 mg/L.

NORTH COAST REGION UTILITIES QUESTIONNAIRE

SCHOOL DETAILS:

School: _____

Address: _____

_____

Phone: _____ Fax: _____

Class of School: _____

Principal: _____

Cleaning Times: Morning _____ am to _____ am

Evening _____ pm to _____ pm

Student Enrolment: 1991 _____ Staffing E.F.T. 1991 _____
1992 _____ 1992 _____
1993 _____ 1993 _____

ACCOMMODATION:

Indicate significant changes in accommodation which have occurred in the three year period which may have effected the utilities consumption.

1991 _____

1992 _____

1993 _____

../2

In order to assess when the flow rate in Goolmangar Creek decreases to such an extent that the effluent is likely to have significant impact, a plot of "phosphorus concentration vs percentage time flow rate" immediately downstream of the discharge point has been prepared for several conditions and is presented graphically on the following pages. These are based on dilution effects, and assume a 7 mg/L or 1 mg/L concentration of phosphorus in the effluent. A phosphorus level of 7 mg/L corresponds to that achieved by normal secondary treatment methods while 1 mg/L is the generally acceptable limit for tertiary treated effluent without resort to extremely high cost techniques. Phosphorus levels lower than those shown in the graphs are expected due to the added assimilative effects in the creek.

Graphs 9.1(a) and (b) illustrate the significant advantage of adopting tertiary nutrient removal capabilities which reduce effluent phosphorus levels to 1 mg/L. For example with secondary treated effluent, the net increase of in-stream phosphorus levels above 0.05mg/L could be expected some 30% of the time. This reduces to 4% of the time for tertiary treated effluent. The dilution factor at the flow corresponding to this percentage is 20 to 1.

During periods of very low flow conditions, adverse effect may occur in the creek environment. It is therefore recommended that another disposal method, such as irrigation of pasture land should be used during droughts.

Four percentage of time corresponds to 15 days a year on average. Actually, periods of such low flow are very irregular and may not occur for many years. On the other hand in dry years long periods of low flow may occur. The longest period recorded in the period 1957 to 1985 was 59 continuous days in 1977/78.

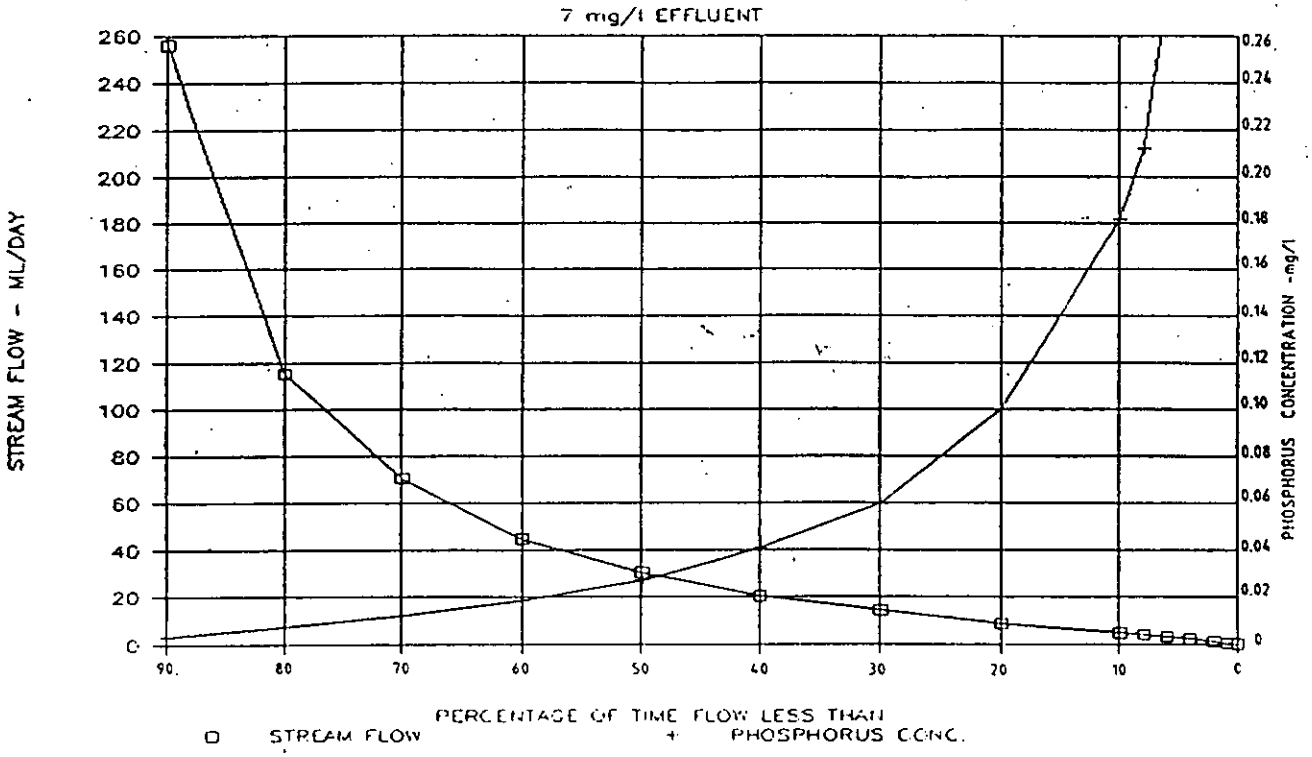
As detailed previously in Table 9.1, the existing background phosphorus levels vary between 0.03 and 0.08 mg/L. Graph 9.2(a) and (b) shows the total concentration of the phosphorus due to the effluent discharge and various background levels. From this graph, it can be seen that the effluent discharge of 1 mg/L has a relatively small effect on the total phosphorus concentration except at very low flows.

For the flow time period of 4% to 10% with 1 mg/L effluent the additional phosphorus concentration decreases from 0.055 mg/L to 0.025mg/L. During these periods, the phosphorus may have some impact. However, examination of the detailed flow records show that the average duration when flow is in this range is 4 days and occurs on average four times a year. Therefore, the infrequent nature and short term duration of the moderately low flow should not be such as to cause significant changes to the creek.

For the remaining 90% of the time, flow is sufficient to dilute the phosphorus in the effluent to acceptable levels and to flush the stream.

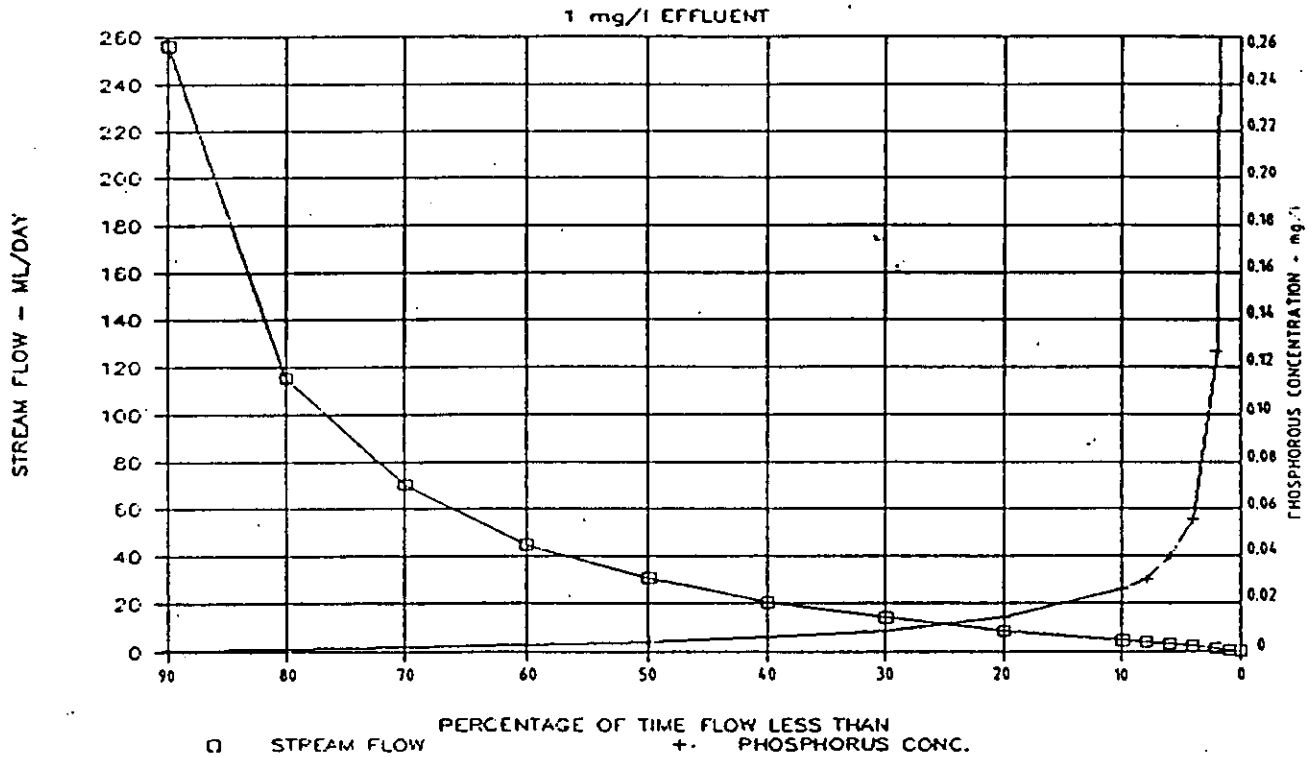
GRAPH 9.1(a) PHOSPHORUS INCREASE

7 mg/l EFFLUENT



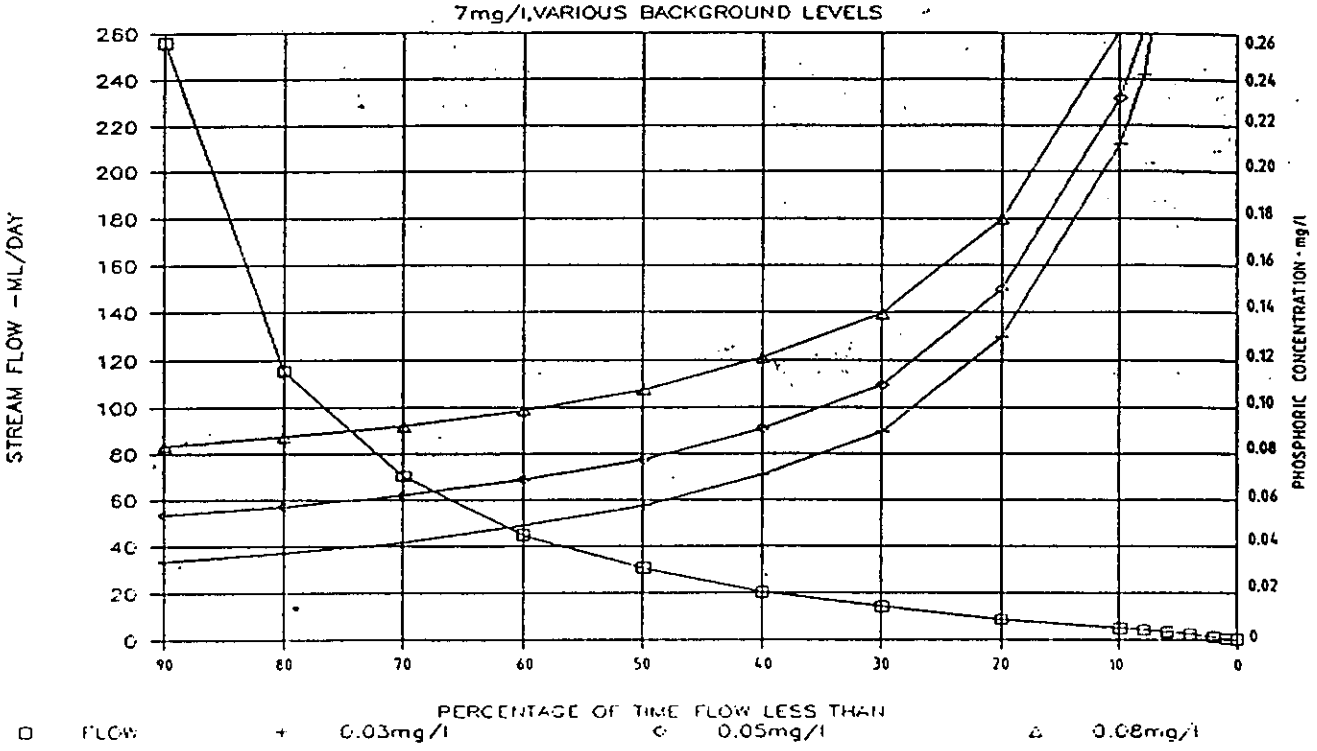
GRAPH 9.1(b) PHOSPHORUS INCREASE

1 mg/l EFFLUENT



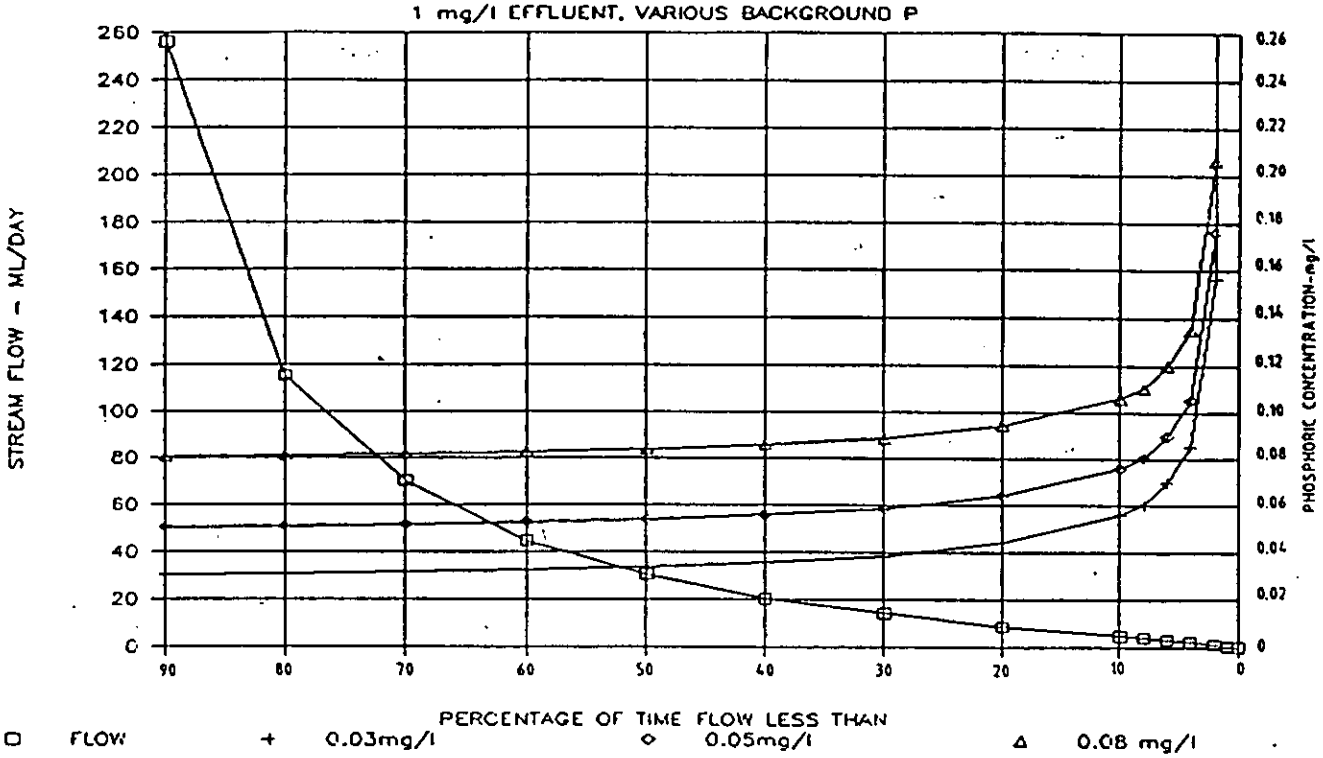
GRAPH 9.2(a) TOTAL PHOSPHORUS CONC.

7mg/l,VARIOUS BACKGROUND LEVELS



GRAPH 9.2(b) TOTAL PHOSPHORUS CONC

1 mg/l EFFLUENT, VARIOUS BACKGROUND P



A similar situation with regard to Nitrogen concentrations applies. Assuming a total nitrogen concentration of 15mg/L in the effluent, the increase of nitrogen in Goolmangar Creek would be 0.75mg/L at the 4% time flow, and for ninety percent of the time, the increase would be less than 0.39mg/L. At these levels, nitrogen is not expected to be a problem either from the point of view of oxygen demand or eutrophication.

It should be noted that an assessment of instream storage volumes suggests that any adverse impact should be identified by reference to the water quality in the initial 375m of stream below the disposal point. This is a ponded portion of the stream containing a volume equal to 90 days effluent from 600 EP.

iii) Micro-Organisms

The main concerns with micro organisms discharged to receiving waters are related to health aspects, either for contact recreational uses or for consumptive use where the water is used as a source of water supply. Of primary concern are pathogenic organisms, principally bacteria and viruses, although by far the greatest numbers of organisms present in human body wastes belong to the coliform group of bacteria. Because of their larger numbers, and also because analytical techniques for estimating their presence are much simpler than those for pathogens, coliforms (specifically faecal coliforms) are widely used as indicators of faecal pollution.

Prior to discharge to Goolmangar Creek, the effluent will be ponded in a tertiary pond for a minimum of 30 days during dry weather. This results in a substantial die off of organisms, and the resulting concentration (generic mean) of faecal coliform organism is less than 750 per 100mL. Upon discharge to Goolmangar Creek, this will be diluted as detailed previously.

At a dilution factor of 20 to 1, the discharge of effluent will result in an increase of 38 organisms per 100 mls. As background levels of faecal coliform already exceed 200 organisms per 100 mls at times, this rise will not significantly influence the amenity of the stream. During low flow periods, the maximum length of stream likely to experience higher coliform levels is estimated to be restricted to 375 m downstream of the disposal point.

After discharge the number of organisms will continue to decrease in numbers, on account of changes in pH, nutrient supply, predation by other organisms, and the continuing disinfection effects of sunlight.

As a result of all these self purification effects, bacterial quality of streams improves with increasing distance downstream of the effluent discharge point.

(iv) Suspended Solids

Suspended solids affect waterways in three main ways:

- Gives the water a turbid appearance and restricts light penetration, which may affect some aquatic life forms.
- Affects the suitability of water for drinking.
- Sedimentation of the settleable fraction may form banks of solids on the stream bed.

The treatment plant at Nimbin will be designed to produce an effluent quality of a maximum of 30mg/L of suspended solids. During abnormal conditions any solids which may carry over from the treatment plant will be retained in a catch pond. Further solids will settle out in the tertiary ponds. The remaining suspended solids will generally be attributal to algae growth in the ponds. The extent of this is difficult to predict for tertiary treated effluent. The net reduction of suspended solids in the tertiary pond is expected to vary from zero to 70% depending on seasonal fluctuations in algae.

After discharge to Goolmangar Creek, the maximum increase will be approximately 1 mg/L. At this low concentration, no adverse effects are envisaged on the creek environment.

(v) Summary

In order to prevent adverse impacts of effluent disposal to Goolmangar Creek it is necessary to ensure low nutrient levels and adequate disinfection is provided at the treatment works prior to discharge.

The sewage treatment method adopted for the scheme will ensure that effluent discharge will not exceed the assimilative capacity of Goolmangar Creek, and no major changes in the environment will occur.

The inclusion of nutrient removal facilities, a package plant producing 20/30 effluent and the use of tertiary ponds will ensure that concentrations of the various pollutants in the effluent is controlled. The net adverse impact of the discharge of effluent to Goolmangar Creek will be minimal due to dilution and assimilative processes.

Studies identified that during extreme droughts, some adverse impact on the creek may occur. Although this is expected to affect only some 375 metres of stream length, the impact was considered undesirable. An alternative method of effluent disposal was therefore considered necessary for dry, low creek flow periods.

Adoption of land disposal of effluent via a pump and irrigation system will eliminate impacts on the creek. An irrigation system will be provided as part of the "scheme package". It will be available for immediate use.

Land disposal of the effluent will not be restricted to periods of low creek flow. To maximise its use a control system has been designed by the N.S.W. Agriculture and Fisheries Department (Reference 6).

The pumps will operate under four control systems.

(i) Soil moisture sensors will be located in the irrigation area and allow irrigation if the soil moisture is below 50% of field capacity. Pumping will stop when soil moisture reached 100%.

(ii) Float switches in the effluent pond will allow pump start up provided soil moistures are below 50% field capacity.

(iii) The pumps will be automatically turned off when it has rained a pre-selected amount.

(iv) Time clock for a pre-set pumping time.

This system will prevent runoff occurring due to overwatering. An application rate of 7.5mm/hr has been adopted in the system design.

Operation of the irrigation system will have no adverse environmental effects. The area proposed for irrigation is cleared grazing land located to the S.W. of the treatment plant. Windbreaks will be planted around the site to intercept possible spray drift to adjoining lands. No existing development will be affected by the land disposal system.

No adverse environmental effects will be exerted on Goolmangar Creek.

11.0 CONSULTATION WITH OTHER AUTHORITIES

All Government authorities likely to have an interest in the scheme were contacted and their comment sought on the current sewage transport, treatment and effluent disposal proposals.

Replies were received from the following organisations and their comments are detailed.

* N.S.W. National Parks and Wildlife Service

No objections to construction of the treatment works on the proposed designated area adjacent to Nimbin. A ground survey did not find surface evidence of Aboriginal occupation. Evidence of aboriginal activity has been found elsewhere in the Nimbin area and the National Parks should be notified if any aboriginal relics are unearthed.

* Department of Health

No objections provided all sewage is disposed of in a manner not likely to create a nuisance or be a danger to public health.

Note that this Department wrote to Lismore City Council on 31st May 1988 and 20th October, 1988 stressing the need for early commencement of the sewerage scheme.

* Water Resources Commission

Noted that the continuation of high water quality in the Goolmangar Creek - Cabbage Tree Creek - Richmond River system be maintained to protect the environment.

The effluent outlet pipe should be located such that effluent discharges cause minimum bank erosion. Also appropriate energy dissipation works should be installed.

* Department of Agriculture

Expressed concern at the effect of effluent disposal during low creek flows. Suggested that effluent should be diverted to irrigate agricultural land during drought periods to avoid nutrient buildup in the creek.

* Soil Conservation Service

Suggested that disturbance of existing stable ground conditions should be restored such that future erosion will not occur. Close attention should be paid to the batter slope of embankments to avoid erosion. Topsoiling closely followed by vegetation should be undertaken on all bare earth areas.

* Department of Mineral Resources

No objections.

* Department of Environment and Planning

The environmental affects of the project should be assessed. In particular the following factors should be addressed.

* the visual prominence of the development
* the pollution risk to Goolmangar Creek
* odours from the Treatment Works

* Telecom Australia

Highlighted 2 areas in Nimbin where telecom cables of major importance are located.

* Department of Lands

No matters of concern.

* Lismore City Council

No special environmental considerations of concern to Council.

* Department of Main Roads

No environmental concerns. Main Roads should be consulted regarding works within the road reserve of Main Road No.142.

*State Pollution Control Commission

The Department of Public Works has maintained a close liaison with the SPCC during development of the scheme.

Conditional approval to the scheme was given on 4th June, 1991.

Throughout the course of this scheme the matters raised by each Government Department have been recognized and incorporated in any proposals.

12.0 REFERENCES

1. "Nimbin Sewerage Strategy Report" prepared for Lismore City Council by N.S.W. Public Works Department February, 1989. Report No. Li153.

2. Nimbin Sewerage Augmentation, Sewage Treatment Works Laboratory Testing and Site Evaluation prepared by N.S.W. Public Works Department Geotechnical Centre. Report No.89199 November, 1989.

3. Proposed Sewage Pump Stations and Sewer & Rising Main Routes at Nimbin. Geotechnical Studies. Report NR684/1-A January 1990 by Coffey Partners International P/L.

4. Nimbin Wastewater Scheme - Wastewater Treatment Works Concept Design Report for Lismore City Council prepared by N.S.W. Public Works Department. March, 1990. Report No.SR113.

5. Nimbin Sewerage. On Site Sewage Treatment and Effluent Disposal Feasibility Study March, 1991 by the Nimbin On-Site Sewerage Community Consultative Committee.

6. Specification for Nimbin Sewage Treatment Plant prepared by Irrigation Management Service, N.S.W. Agriculture and Fisheries.