HEALTH DEPARTMENT OF WESTERN AUSTRALIA

PROPOSAL FOR A NON-HAZARDOUS INDUSTRIAL LIQUID WASTES TREATMENT PLANT AT FORRESTDALE

PUBLIC ENVIRONMENTAL REPORT

AUGUST 1989

SINCLAIR KNIGHT & PARTNERS
CONSULTING ENGINEERS

Sinclair Knight & Partners Pty Ltd
Peninsula Place
57 Labouchere Road
South Perth WA 6151
Australia
Telephone (09) 367 8588
Facsimile (09) 474 1409
Telex AA26462

6085

HEALTH DEPARTMENT OF WESTERN AUSTRALIA

NON-HAZARDOUS INDUSTRIAL WASTE TREATMENT PLANT, FORRESTDALE

PUBLIC ENVIRONMENTAL REPORT

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

The Public Environmental Report (PER) for the proposed non-hazardous Industrial Liquid Waste Treatment Plant, Forrestdale has been prepared by Sinclair Knight & Partners for the Health Department of Western Australia in accordance with Western Australian Government procedures. The report will be available for comment for 8 weeks, beginning on 4 September 1989 and finishing on 27 October 1989.

Comments from government agencies and from the public will assist the Environmental Protection Authority to prepare an Assessment Report in which it will make recommendations to Government.

Following receipt of comments from government agencies and the public, the Environmental Protection Authority will discuss the issues raised with the Proponent, and may ask for further information. The Environmental Protection Authority will then prepare its Assessment Report with recommendations to Government, taking into account issues raised in the Public submissions.

WHY WRITE A SUBMISSION?

A submission is a way to provide information, express your opinion and put forward your suggested course of action, including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received will be acknowledged.

DEVELOPING A SUBMISSION

You may agree or disagree, or comment on, the general issues discussed in the PER or specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific proposals in the PER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

POINTS TO KEEP IN MIND

By keeping the following points in mind, you will make it easier for your submission to be analysed.

Attempt to list points so that the issues raised are clear. A summary of your submission is helpful. Refer each point to the appropriate section or chapter in the PER. If you discuss sections of the PER, keep them distinct and separate, so that there is no confusion as to which section you are considering.

Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Please indicate whether your submission can be quoted, in part or in full, by the Environmental Protection Authority in its Assessment Report.

REMEMBER TO INCLUDE:

Your name, address, date.

The closing date for submission is 27 October 1989.

Submissions should be addressed to:

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH WA 6000
Attention: Dr V Talbot

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

HEALTH DEPARTMENT OF WESTERN AUSTRALIA

NON-HAZARDOUS INDUSTRIAL WASTE TREATMENT PLANT, FORRESTDALE

PUBLIC ENVIRONMENTAL REPORT

SUMMARY

Currently, all industrial liquid wastes generated in the Perth metropolitan area (except those classified as intractable or extremely hazardous) are disposed of into a large open lagoon at the Kelvin Road landfill site in Gosnells. In view of the perceived environmental effects of continuing with this arrangement, the site is due to cease receiving liquid waste from 30 November 1989.

The Health Department of Western Australia, who is the Proponent, proposes to establish a treatment facility for industrial liquid waste at a suitable site in the Perth metropolitan area to replace the Kelvin Road site. The facility will be developed on the old Water Authority Wastewater Treatment Plant site at Forrestdale, which is currently leased by the Proponent for its Metropolitan Septage Treatment Plant operation.

The salient features of the Industrial Waste Treatment Plant, hereafter referred to as the Plant, are listed as follows:

- The Plant will receive liquid waste and sludge of a non-hazardous nature, transported from industrial sources within the metropolitan area by road tanker. Hazardous wastes that are scheduled for delivery to the Plant will require treatment at source by the generator, to render these safe for transport prior to removal.
- The common location with the Metropolitan Septage Plant will allow for improved monitoring of waste quality and quantity through a single logging system. It will further assist in controlling the mixing of wastes in the septage and industrial classifications.
- The transporters of the waste and the waste generators themselves are required to be licensed with the Proponent and meet certain requirements with respect to transport, safety and protection of the environment.
- The site chosen is suitable for the discharge of treated effluent to the Water Authority sewerage system. Acceptance of this effluent into the sewerage system will require compliance with the criteria for discharge set by Water Authority.
- The treatment process proposed is designed to precipitate heavy metals as their insoluble hydroxides by lime dosing, remove oily substances and settle sludges from the wastes. Clarified effluent will be pumped into the final clarifiers of the adjacent Septage Treatment Plant, where it will mix with the final effluent from the Septage Plant. It will then be pumped into the Water Authority sewerage diversion pump station located in the north west corner of the site, for discharge to the Woodman Point Wastewater Treatment Plant.
- Dewatered sludges will be carted in a safe and stable condition to an approved landfill site for burial.

- Other waste streams to be removed from the site include coarse screenings, grit separated from the incoming flow and recovered oil. The screenings and grit will be carted in bins to a designated landfill site, whilst recovered oil will be carted in tankers and sold to an oil recycling merchant.

- The Plant will be open to receive waste 6 days per week, 10 hours per day on weekdays, 9 hours on Saturdays, but not on Sundays and public holidays. These hours of operation are the same as for the adjacent Septage Plant. Expected quantities of waste to be treated are 26,000 kL per year, at an average of 100 kL/day and peak of 200 kL/day delivery to the site.

- A sampling program from all waste sources is currently in progress with analysis being carried out in the existing Cleanaway on-site laboratory to ensure that correct pretreatment at source can be stipulated or that special treatment which may be required is identified.

- All waste delivered to the site will be recorded and identified using an official docket system completed by the generator and the transporter. A sample will be taken from each tanker load for analysis in the laboratory to ensure acceptability for treatment.

- No suitable location within the metropolitan area could be found for a new site that met the selection criteria. Established sites that met the criteria were the Woodman Point and Forrestdale Wastewater Treatment Plants. The Forrestdale site was finally chosen ahead of the Woodman Point site because it satisfied all of the criteria and proved more economical to develop than the Woodman Point site. This has enabled the minimum charge to be kept closer to the current industrial waste discharge fee at the Kelvin Road site in Gosnells.

- The site was chosen to minimise social and environmental impact and to avoid the duplication of infrastructure required by both the septage and industrial waste treatment facilities. Extensive odour control and spillage containment measures have been incorporated in the Plant design to minimise its effect on the environment.

- The proposal will result in between 25% and 33% increase in total tanker vehicle movements to and from the Forrestdale site, with an average of 10 tanker arrivals per day at the Plant. Generally the approach routes are of high standard and adequate capacity to handle this increase with minimal environmental, social or traffic impacts.

- The environmentally sensitive Forrestdale Lake and Nature Reserve, which is a birdlife sanctuary of international significance, will be safe from contamination if a tanker accident along the nearby stretch of Forrest Road should occur, as all surface runoff from the road and surrounding Forrestdale housing estate is directed away to the north in the Water Authority stormwater drains. The same applies to runoff from the Water Authority site on which the Plant will be located.

- The proposal includes strict measures to contain any spillages, washwater drainage and contaminated runoff within the process. All tanks and in-ground liquid retaining structures, either existing or new, will have a high level of structural integrity against leakage. Regular monitoring of the site perimeter drain will be carried out to detect pollution.

- The Proponent will meet regularly with a Community Liaison Committee consisting of local representatives from the residents association and the Armadale City Council. This will provide a forum for expression of community concerns and can address problems that may arise from the operation.

- The existing site is isolated from nearby residences in a semi-rural area, with the nearest dwellings further than 500m away. The proposal will to a large extent utilise existing buildings and in-ground structures to the south of the Septage Plant. Above ground new structures will not exceed 5m in height, compared with at least three structures exceeding 8m height on the adjacent Septage Plant site. Since the visual impact of the Septage Plant is low, the additional impact on the surrounding area of the proposal will be minimal.

- The Proponent is actively involved in the emergency procedures for responding to chemical spills and accidents and is represented on the coordination committee for the overseeing and development of these procedures. An emergency assistance scheme is already in place and special equipment is available for rapid containment, neutralisation and recovery of spilled wastes to prevent pollutants from entering waterways or underground aquifers.

It can therefore be concluded that the proposed Plant will not significantly affect the amenity or social character of the area nor will it have any detrimental effect on the Forrestdale Lake and Nature Reserve to the west. Adequate safeguards and measures are proposed to prevent escape of odours and polluted effluent into the surrounding environment. The treatment process is suitable for producing effluent of acceptable quality for discharge to the sewer and dewatered solids safe for disposal at a designated landfill site.

1. INTRODUCTION

1.1 PROPONENT FOR THE PROJECT

The Proponent for the project is the Health Department of WA (the Proponent). An urgent requirement has arisen in Perth for a modern, environmentally acceptable facility to treat industrial liquid waste generated by industry in the Perth metropolitan area.

The Proponent has the responsibility for the development of this facility. Notification of the project has been made to the Environmental Protection Authority, which has set the level of assessment for the proposal and required the Proponent to undertake the necessary arrangements for a Public Environmental Report (PER).

This document identifies and addresses issues relevant to the proposal. The report has been prepared in accordance with the guidelines issued by the Environmental Protection Authority. A copy of the guidelines is included under Appendix D.

1.2 BACKGROUND TO THE PROJECT

Industry in the Perth Metropolitan Area currently generates approximately 26ML per year of liquid waste which is not suitable for direct discharge to the sewer, the environment or the Septage Treatment Plant in Forrestdale. The present arrangement for disposal of these wastes is by cartage in road tanker vehicles to the City of Gosnells landfill site on Kelvin Road in Orange Grove. The waste is discharged from the tankers into a large lagoon which is kept highly alkaline with lime and caustic. Further lime is added on an "as needs" basis to the waste to neutralise acids and to precipitate metals and suspended solids. The content of the lagoon is maintained at a constant level by pumping from below the surface into a large evaporation basin.

This disposal system is operated by the City of Gosnells under the auspices of the Proponent. It is the last remaining tip site still accepting liquid industrial waste in Perth. Considerable opposition has been raised in recent years to the continued operation of the site as a liquid waste acceptor, mainly from local residents who have detected contamination of nearby creeks and land on several occasions. The City of Gosnells eventually gave notice to the Proponent in June, 1988 that the tip site would be closed to industrial liquid waste at the end of November 1989.

The Proponent therefore called for expressions of interest for the financing, design, construction and operation of a new Industrial Waste Treatment Plant (the Plant) to replace the Kelvin Road site. The nominated sites for the Plant were the old Water Authority of Western Australia (the Water Authority) wastewater treatment plant site at Woodman Point in Henderson and the Water Authority site in Forrestdale. The Woodman Point site was chosen to allow all tenderers to quote on an equal basis as one of the tenderers operated the Septage Treatment Plant at Forrestdale.

In April 1989 the Proponent called tenders from the two companies who were adjudged to have submitted the most suitable proposals in their September 1988 expressions of interest. The tender enquiry was based on similar criteria for waste treatment, but with the important difference that only non-hazardous wastes would be accepted into the proposed facility for treatment. It was felt that this would allay residents' fears, which were mainly centred around the possibility of tanker accidents producing spillage of hazardous waste and consequent danger to health and degradation of the environment.

Cleanaway currently operates the Metropolitan Septage Plant at Forrestdale on the old Water Authority Westfield Wastewater Treatment Plant site under contract to the Proponent. Cleanaway, a division of the wholly owned Australian public company, Brambles Holdings Ltd, therefore submitted a main bid for the Henderson site as well as an alternative tender with the Forrestdale site as the base for the Plant. Since Cleanaway's main bid was lower than the other tenderer's bid, the Proponent was in a position to consider the alternative offer at the Forrestdale location. This offer was more attractive on both economic and social benefit criteria and conformed with the requirements of the Proponent for the facility.

Accordingly, on 6 June 1989 the Proponent accepted Cleanaway's alternative bid to develop the Plant on the same site as the Metropolitan Septage Treatment Plant, in Forrestdale. The Proponent was subsequently issued with guidelines for the PER by the Environmental Protection Authority and Sinclair Knight and Partners were commissioned to produce the Report.

1.3 BRIEF DETAILS AND TIMING OF THE PROPOSAL

The contract entered into between the Proponent and Cleanaway is for Cleanaway to finance, design, construct and operate for a period of 10 years, a plant to receive and treat 26000 kL per year of non-hazardous industrial waste. The plant will be located on the Water Authority's site already leased by the Proponent for the operation of the Perth Metropolitan Septage Treatment Plant. The Septage Plant receives between 300 and 400 kL per day on average of tankered septic tank waste, which is treated in a lime stabilisation process. Solids are separated and dewatered while the clarified effluent is discharge to the Water Authority sewerage system via an existing sewage diversion pump station on the site.

The Plant will utilise a similar technology to precipitate heavy metals out of solution, treat unstable oil emulsions, separate suspended solids and dewater the collected sludges for cartage to a designated landfill site.

Tanker loads of industrial wastes, neutralised acid and oily wastes will arrive at the Septage Plant Gatehouse where samples will be taken, before the Gateman directs the tankers to the Plant Receivals Area. The Plant operator will supervise discharging of the waste from the tankers into one of two receivals sumps by back hatch direct discharge, enclosed pipe drainage or pump-out. The drained liquid waste will be screened of coarse matter, then pumped into one of two lime reaction vessels, where it will be treated with lime slurry. After dosing and mixing is completed to the correct pH, the mixture will either be pumped to an oil separation facility in the case of oily wastes, or direct to a grit removal device. Recovered oil will be concentrated and sold to a recycling merchant. After degritting, the waste will be pumped to an existing in-ground clarifier to settle precipitated solids and sludges. Clarified overflow will be directed to a second adjacent existing clarifier, after any excess oily matter is skimmed off.

Settled sludges will be pumped or drained to a Dewatering Facility where they will be dosed with a polyelectrolyte flocculant and dewatered in two decanter solid bowl centrifuges. Cake will be conveyed into bins for off-site disposal. Centrate liquor will be returned to the clarifier.

Clarified effluent will be recycled for washdown and chemical dosing dilution and the excess effluent will be discharged into the final effluent stream of the adjacent Septage Treatment Plant. The combined final effluent stream will be monitored for pH, various metals, biological oxygen demand, suspended solids, oil and grease and toxic or inflammable substances. The results will be used by the Water Authority in assessing quality/quantity charges on the Proponent for accepting their effluent. The effluent will be pumped into the sewerage system and eventually reach the Woodman Point Wastewater Treatment Plant.

In view of the decision by the Gosnells City Council to close the Kelvin Road landfill site to liquid wastes at the end of November 1989, time is of the essence in bringing the Plant to a state of completion in readiness to receive industrial waste. The earliest practical completion date prior to wet commissioning of the full plant, is estimated to be mid-December, i.e. at Christmas shut-down by industry. Assuming that over the shut-down period little effective work will be achieved, the earliest realistic date of opening the Plant to waste dischargers will be at the end of January 1990. This programme is very tight and assumes no significant delays in design, approvals and in the supply of fabricated equipment.

SKP believe that to attempt to shorten the programme for design, procurement and construction would be counterproductive and lead to problems in installation and commissioning of mechanical and process control equipment.

It is therefore unlikely that the new Plant will be open prior to the closure of the Kelvin Road Tip Site. Three options are available in this eventuality:-

a) Redirect liquid wastes from Kelvin Road to other waste disposal sites until the Plant is ready to receive them.

b) Design and construct a temporary receivals and treatment system at the Metropolitan Septage Treatment Plant, to separate and store solids in existing concrete tanks and pump limed effluent overflow to the Septage Plant Final Clarifier for disposal.

c) Extend the life of the Kelvin Road lagoon until the new plant is ready to open.

d) A combination of one or more of the above options.

Option (a) on its own stands little chance of acceptance by existing landfill site operators and would very likely antagonise local residents.

Option (b) could be acceptable as a contingency plan but would be costly in both establishment and in removal at the end of its life of stored waste sludges. It would also be difficult to control the escape of odours, although the concrete tanks that would be utilised have a smaller surface area than the Kelvin Road ponds.

Clearly, Option (c) is the most preferable, as this site currently has the facilities to cope with the quantity of waste and adequately contain it for the short period of extension required.

The Proponent will, when a more accurate construction timing is available, negotiate with relevant authorities to find a short term interim solution. This may require the combination of two or three of the options listed above.

1.4 RELEVANT STATUTORY REQUIREMENTS AND APPROVALS

The environmental impact assessment process involves a number of stages defined in the Environmental Protection Act of 1986, as shown in Figure 1.1 and briefly described below.

Where a proposal is perceived by a decision making authority (in this case the Proponent) to have any impact on the environment, it is incumbent on that authority to formally notify the Environmental Protection Authority of the proposal.

The Minister nominates the proponent and authorises the Environmental Protection Authority to study the proponent's referral and decide on the appropriate level of assessment to be applied to the proposal. There are basically three levels of formal assessment:

(i) Notice of Intent; for proposals that are adjudged to have minor impact on the environment or unlikely to raise serious social or economic issues in the community.

(ii) Public Environmental Report; for proposals that may have significant impacts on the environment and which require input and comment from affected public groups.

(iii) Environmental Review and Management Plan; generally reserved for proposals that are likely to have major impacts on the environment and community; where detailed studies of effects of emissions, discharges and potential hazards are required to fully address issues of public concern.

The proponent prepares the documentation for the notified level of assessment (in this case, this PER) and submits it to the Environmental Protection Authority. The Environmental Protection Authority examines the document, and provided it is suitable for public review, requires the proponent to make copies of the PER available to the public for comment, to enable them to make submissions to the Authority.

After the public review period, the Environmental Protection Authority prepares a summary of all submissions received and invites the proponent to supply further information and explanations in response to any issues raised. The Environmental Protection Authority then undertakes its assessment of the proposal, and reports its findings to the Minister for the Environment. The Minister publishes the Environmental Protection Authority report as soon as possible with any conditions he has set for implementation of the proposal. Appeals against the Environmental Protection Authority report may be made by any interested party and submitted within 14 days. After the appeals have been determined by the Minister he then consults with decision making authorities prior to setting the Ministerial conditions for the project. After these have been set, they are appealable by the proponent. Any appeals are determined by the Minister, after which the Chief Executive Officer of the Environmental Protection Authority may then issue a works approval for the project to proceed.

In addition to obtaining initial environmental approval in terms of the Environmental Protection Act of 1986 as described above, the Proponent will also be required to ensure that the development and operation of the project complies with the provisions of the Occupational Health Safety and Welfare Amendment Act of 1987 and the Health (Licensing of Liquid Wastes) Regulations of 1987.

1.5 SCOPE, PURPOSE & STRUCTURE OF THE PER

The purpose of this PER is to provide to the public detailed information about the Health Department's proposal for a new Industrial Waste Treatment Plant in Perth and an opportunity to comment on any aspects of the proposal which they consider to be relevant.

The scope of this PER will cover all aspects of the proposal relevant from environmental, health, social and economic considerations and any other benefits and detrimental effects related to the proposal. Specific issues and procedures evaluated and described include:

- The need for the new Plant and site selection criteria.
- Characteristics and origin of the wastes involved and associated hazards.
- Methods of transportation of the wastes and associated risks.
- Procedures for prevention and clean-up of accidents and spills.
- Environmental impacts of the Plant and transportation of waste.
- Treatment process description and supporting infrastructure for the Plant.
- Safety provisions, monitoring of the treatment process and spillage containment on site.
- Environmental monitoring programme.

2. NEED FOR THE PROPOSAL

2.1 OVERVIEW OF THE EXISTING INDUSTRIAL WASTE SITUATION IN PERTH

Industry in Perth has traditionally disposed of high strength liquid industrial wastes and sludges at open lagoons at a number of sites around the metropolitan area. These lagoons were generally located at municipal tip sites that were administered by the Local Authority concerned, under the auspices of the Proponent. The lagoons in some cases were constructed in semi-permeable ground, which allowed excess liquid to drain into the soil and create a polluting plume beneath the site. In other cases excess liquids were removed and evaporated in large shallow basins.

It had become obvious to the Proponent that continued disposal by lagooning of wastes that were too polluted for acceptance into the Water Authority sewerage system, was unacceptable. The main reasons for this were:-

- Residential development was increasingly encroaching on previously remote lagoon sites and with it public concern over such systems.
- There was little chance of containing fugitive odours and wind transported aerosols of volatile substances in the wastes.
- The cost of land and construction of facilities to provide acceptable containment of liquids in sealed lagoons and evaporation basins, as well as non-hazardous operation and tanker washout facilities, was becoming excessive.
- The capacity of a dwindling number of sites to handle a growing volume of waste was rapidly being exceeded. This had led to a number of overflows, wall breeches and seepage into the ground, with contamination of the surrounding environment.
- Little, or no effective treatment was being carried out on the waste, which was merely being contained in some cases.
- The Proponent was being put to considerable effort in attempting to police the system against illegal dumping and in monitoring quality and quantity of waste transported to the various sites.

Stricter environmental control stipulated by the Environmental Protection Authority, Water Authority and Health Department, combined with increased public concern and complaints over the management of the sites gradually led to all of the lagoon sites being closed, except for the City of Gosnells Kelvin Road landfill site. The City of Gosnells decided to close this site to liquid waste as from 30 November 1989, in the face of strong protests and lobbying by local resident action groups in the nearby suburbs of Maddington, Kenwick and Orange Grove. This decision left the Proponent with the dilemma of not having anywhere suitable to direct 26,000 kL per annum of liquid industrial waste for adequate treatment and disposal.

2.2 WASTE CHARACTERISTICS AND APPROPRIATE TREATMENT

After several investigations into the type and characteristics of the waste being dumped, the Proponent concluded that the bulk of the liquids and sludge discharged are non-hazardous and could be treated by relatively simple physical-chemical processes, under properly controlled conditions, to produce an effluent of acceptable quality for discharge to the sewerage system. Dewatered solids could also be disposed of in a stable condition to a designated solid waste landfill site.

More than 50% of the industrial waste currently generated in Perth consists of unstable oil and water emulsions or mixtures that are relatively easy to separate. These are derived mainly from service stations, waste oil recyclers, car wash companies, etc.

The remaining wastes are generated by more than 200 industries around Perth, including laboratories, paint distributors, machining shops, galvanisers, platers, etc. Many of these industries produce liquid waste at the rate of less than 50kL p.a. individually. In total approximately 26,000 kL of waste is produced per year.

Some of the wastes are, in their present form, potentially hazardous for transport and for a plant without specially designed handling equipment and treatment facilities. These include cyanide wastes and hexavalent chromium from electroplating industries, highly volatile solvent mixtures from paint manufacturers, degreasing tank bottoms, and other toxic organics. In addition to their toxicity, some of these were present in high enough concentration for the mixtures to be ignitable. Such substances can be classified by the Australian Dangerous Goods Code and special precautions in the construction of transport vehicles and in handling are required. The Proponent has deemed that wastes classified under this code shall not be permitted into the proposed Plant for treatment and disposal, unless the consignor has rendered them non-hazardous by carrying out suitable treatment at the point of origin. The Proponent will enforce such conditions through the Health (Licensing of Liquid Waste) Regulations 1987 and to the satisfaction of the Environmental Protection Authority.

The Proponent therefore formulated the concept of a modern compact plant, with simple proven process technology to provide effective treatment and disposal for up to 26,000 kL per annum of non-hazardous industrial waste.

Details of waste characteristics and plant design criteria are contained in Appendix B to this Report.

2.3 BENEFITS AND COSTS TO THE COMMUNITY

The proposal can be shown to have benefits on both the local and regional level.

Perth, of all of Australia's major cities, has the lowest charges for disposal of tankered industrial waste. This is a reflection of the low level of treatment provided at the receiving sites. Inevitably the cost of disposal will rise with the installation of a properly controlled, environmentally safe facility. The new facility will still allow for treatment at under $40 per kL. By comparison, the cost of treating industrial wastes in Sydney, Melbourne and Adelaide is close to or over $100 per kL.

In terms of distance for the tankers to travel to discharge wastes, the proposed site at Forrestdale is further away from the industrial areas to the east of Albany Highway (such as Midland, Welshpool, Belmont) than the Kelvin Road site. Tanker loads from these areas are estimated to amount to over 50% of the total number of tanker vehicle movements. However, an estimated 30% to 40% of the loads comes from areas closer to the proposed site such as Kwinana, South Fremantle, Canning Vale, Jandakot. The balance of the loads which will arrive from northern areas such as Osborne Park, Balcatta, and Wanneroo, will be less sensitive to the distance variation than eastern or western areas.

At the local level, one of the concerns to the area around Forrestdale is the increased tanker traffic generated on the approach roads. This is however offset by the benefit of removing almost all tanker traffic from the areas surrounding the Kelvin Road site in Orange Grove. Another major area of concern to local residents is the environmentally significant Forrestdale Lake and Nature Reserve immediately to the south of Forrest Road. Only marginal increases in tanker traffic are expected along this road, as it already is used by tankers carrying waste from the western areas such as Henderson, Coogee, and Jandakot to Kelvin Road. Since only a few tankers per day (5 to 10) are currently using this route, the added risk of accidents causing public danger and environmental damage along Forrest Road due to this proposal is therefore seen as slight.

Other concerns to the local community would be perceived loss of amenity due to:

- escape of pollutants to the surrounding area due to lack of containment of spillages, burst pipes, tank overflows, etc on the Plant site.
- escape of odours.
- noise generation.
- visual impact of the Plant.

As can be seen in the description of the proposed process and plant infrastructure in the appendices of this report, effective measures have been incorporated which will reduce the impact of such effects to acceptable levels.

Benefits arising out of this proposal to the community as a whole can be described as follows:

- closure of a liquid waste disposal site that is considered by the City of Gosnells to be no longer acceptable.
- production of an effluent which after discharge to sewer and further treatment at the Woodman Point Wastewater Treatment Plant will have minimal effect on the quality of the Cape Peron effluent outfall.
- provision of a facility which will be safer for operators and waste tanker drivers.
- better controls over environmental effects through improved treatment and containment features.

- improved identification of and information on wastes and their characteristics through extensive on site sampling and testing routines.

- capacity to accept and treat future increased volumes of industrial waste with no added stress on the environment.

- employment of additional local residents to operate the plant.

2.4 ACCEPTING LIQUID WASTES FROM THE COOGEE INDUSTRIAL AREA

The Coogee Special Industrial Area houses a wide range of animal product process industries including

- Abattoirs
- Skin processors
- Wool processing (fellmongery)
- Tanneries
- Fish processors

These industries typically discharge significant volumes of high strength, predominantly biological wastes. Several of the Coogee companies discharge direct to Cockburn Sound via ocean outfalls, a practice which is now generally regarded as environmentally undesirable.

Various studies have been carried out into the upgrading of the Coogee area and resolving the discharge problem. The State Government policy for the area indicates a preference for effluent disposal to the Water Authority sewerage system after appropriate treatment, or to a recycling network. One of the studies, "Coogee Biotechnology Park - A Concept" by Peter Newman, Neal Ryan and Pat Carnegie of Murdoch University, received wide circulation and public comment. This led to a feasibility study being commissioned by the Government into establishment of bioprocessing and biotechnology activities in the region. It was envisaged that effluent from the park might be acceptable for disposal at the Plant, were this to be located at the Woodman Point site.

In view of the large volumes of effluent produced by industries such as these, tankering of the effluent would be uneconomical. The alternative would be to pump the combined effluent to a nearby site such as at Woodman Point. The situation is made more difficult by the very high BOD and grease levels of much of this waste, often with BOD values in excess of 15,000 p.p.m. This makes it unsuitable for treatment in the Plant, which is not designed to treat biological waste.

Furthermore, the effluent from some of these industries would be difficult to handle or unsuitable for treatment in the Septage Plant, because of high concentration of chemicals such as sulphides and chromium, as well as difficulty to remove soluble biological and grease content. The distance factor to the Forrestdale site virtually eliminates the prospect of pumping the effluent to the proposed Plant.

It is therefore concluded that this proposal for the Plant has no part to play in the future disposal of effluent from animal processing industries in Coogee.

Other solutions need to be incorporated in strategies being developed for these industries.

3. EVALUATION OF ALTERNATIVE SITES

In order to find a suitable site for locating a plant to treat the wastes a number of important criteria had to be satisfied:

- A suitably sized and shaped parcel of land to enable the necessary plant and infrastructure and tanker access to be accommodated.
- Existence of a buffer zone of at least 300m separating the plant and tanker operations from any built up area and dwellings.
- Power, water, telecommunication facilities to be available.
- Easy means of disposing of treated effluent in an acceptable manner.
- Free of adverse ground conditions, such as high watertable, waterlogged or unstable soil.
- Low potential for significant environmental impacts.
- Accessible by high standard major routes from inland, coastal and northern areas, free of traffic conflict points.
- Approach routes which avoid heavily built-up areas and environmentally sensitive sites.
- Adequate provision for security.
- Low land purchase or lease value and low development cost to enable an economically feasible operation to be set up, based on waste charges acceptable to industry and the tanker operators.

Land which could be considered suitable for a new "Greenfield" site for the Plant, in terms of the above criteria, was not available within the Metropolitan Area.

Sites that could typically be adapted to satisfy the above criteria are the Water Authority wastewater treatment plant sites. Since the Water Authority would not permit currently operating plants to be modified to accept such wastes (for obvious reasons), it was necessary for the Proponent to identify a disused or superseded site for the purpose.

Such sites generally have the added advantage of existing water retaining structures, buildings and items such as pumps, pipework and solids dewatering equipment, that can be modified and re-used in a liquid waste plant to minimise the capital costs.

Three such potential locations were investigated by the Proponent for development and operation of the Plant on a commercial basis by a suitable waste handling contractor. These were:

- Canning Vale Wastewater Treatment Plant
- Woodman Point Wastewater Treatment Plant in Cockburn
- Westfield Wastewater Treatment Plant in Forrestdale

The Canning Vale site, located within the fast developing Canning Vale industrial area was not in use, and may have proved a suitable site more centrally located than the other two. However, neither the Canning City Council nor the Water Authority were in favour of developing this site due to the population density of the area.

Both the Woodman Point and the Westfield sites featured small Wastewater Treatment Plant facilities in unobtrusive locations, some distance from built up areas. The Woodman Point site had previously been operated as a primary treatment works, which was later upgraded by the addition of two package treatment plants to provide secondary treatment for sewage in the Cockburn area. The Woodman Point Plant site consists of disused and superseded primary treatment facilities which are located within an excavated limestone area to the north of the new Woodman Point Wastewater Treatment Plant.

The old site, which has been out of commission for about 6 years, is accessed from Cockburn Road, separately from the main new Wastewater Treatment Plant.

The old Westfield Wastewater Treatment Plant at Forrestdale, which is located approximately 2 kilometres to the east of Forrestdale Lake, is accessed exclusively from Waterworks Road. This short road meets Armadale Road 200m to the west of the Lake Road intersection. The Treatment Plant was originally constructed in the late 1960's to service the Armadale and Westfield areas. However, following rapid growth in these areas and the nearby Gosnells and Maddington districts difficulties were experienced with the onsite effluent disposal system. Consequently a pump station was constructed on the north-west corner of the site in 1983 and effluent was diverted via a pressure main to the Woodman Point sewerage system. Gradual decommissioning of the Westfield Wastewater Treatment Plant occurred over the subsequent years with total closure occurring in mid 1988. In 1987 the site was earmarked for modification to accommodate the new Metropolitan Septage Treatment Plant.

The Septage Plant at the Westfield site was constructed and commissioned by October 1988 and has been receiving and treating all of Perth's septic wastes and some other biodegradable wastes since that date. The plant receives between 25 and 40 tanker loads of liquid waste per day, (equal to 300-500 kL per day) with capacity to receive and treat up to 600 kL per day.

There are a number of advantages to be realised in siting the Plant at the Forrestdale (Westfield) site over the Woodman Point site. These are outlined below:

- A centralised treatment site for both septage and industrial liquids will streamline operational and administrative procedures. All arrivals will register at the Septage Plant Gatehouse with a single docketing system in force.
- The Plant is an extension of the Septage Plant maximising the use of the existing infrastructure and equipment, and therefore minimising the capital cost.
- Road access and approaches to the site have already been upgraded for anticipated increases in traffic volumes due to the Septage Plant operation.

- Facilities for continuous monitoring and recording of effluent quality already exist at the Septage Plant which will serve the Plant as well.

- The geographical location of the Forrestdale site will minimise tanker turnaround times by comparison to the Woodman Point site.

- Only minimal additional staff will be required to operate the industrial liquids plant because of the existing staffing structure at the Septage Treatment Plant.

- Emergency procedures in the event of a power failure have already been provided in the form of a high capacity standby generator, which has capacity to serve both plants.

- The Septage Plant has been fully operational for some time and operation, maintenance and administrative procedures are already established.

- Centralised treatment facilities will avoid the situation where tanker loads of either category of liquid waste are delivered to the wrong site and required to proceed to the other plant to discharge. This situation would encourage illegal dumping by drivers whose loads are rejected at both sites due to lack of communication or clear definition of responsibility in borderline cases.

- The charge for accepting waste at the Septage Plant site is approximately 25% lower than the equivalent rate for Woodman Point, based on best available cost estimates for the same treatment process at both locations.

The area leased by the Proponent for the Septage Plant from the Water Authority and on which the Plant will be located, is approximately 300m x 150m. The area of the combined facilities corresponds to the original fenced Westfield Wastewater Treatment Plant. The Plant can easily be accommodated to the south of the existing Septage Plant without interfering with its function on an area of approximately 60 x 75m, or 8000m^2. A site of this size is more than adequate for the proposal since neither effluent nor solids will be stored on site as is the case for lagooning and evaporation basins. The extra space available could be utilised for providing more sophisticated treatment equipment in future should this prove necessary.

4. DETAILS OF THE PROPOSED LOCATION

4.1 DESCRIPTION OF THE SITE AND SURROUNDING LAND USE

The proposed site in Forrestdale is located on the site being lot 78 of Janda District in the City of Armadale. The location of the Water Authority site is shown in Figure 4.1. Adjacent land to the east, bounded by Armadale Road and Waterworks Road is owned by the Water Authority and the City of Armadale. This land is vacant and has been used in the past as an effluent disposal area and a spoil site for surplus soil and rubble from construction sites.

To the south-east and south-west of the Plant site the Water Authority property is bounded by large blocks of semi-rural zoned land between Forrest and Twelfth Roads. Where dwellings have been erected on some of the blocks they are located close to Twelfth Road, further than 500m from the nearest corner of the Plant site. The land on these blocks is low lying, subject to surface flooding during the wet season and interspersed with grass cover, scrub and low trees. It is used as grazing land for horses and cattle.

To the north-west of the Water Authority property is land which has been developed as residential estate, bounded by Armadale Road. The nearest residence is approximately 300m from the closest structure on the Water Authority site, which happens to be the Water Authority diversion pump station. This pump station and some of the other taller structures on the Water Authority site are visible from the residences along Keane Road, but their visual impact is considered to be less intrusive by the residents than a set of SEC transmission lines on large steel pylons, erected on an SEC easement which runs between the estate and the Water Authority site.

The area to the immediate north of Armadale Road in the vicinity of the Water Authority site consists of semi-rural land used for grazing, and a block of land owned by the Water Authority and previously used for disposal of effluent.

4.2 SITE DRAINAGE AND OTHER EXISTING SERVICES

The site of the old Westfield Wastewater Treatment Plant is on high ground relative to the surrounding land, which ensures that it will not flood during the wet season. The Water Authority block is surrounded on the south east, south west and northern boundaries by a ditch drain which discharges into a main drain called the Forrestdale Drain. This main drain directs surplus water from the area (including overflow from Forrestdale Lake) north-eastwards, underneath Armadale Road and eventually discharges into the Southern River to the east of Ranford Road. All surface water collected in catchpits on the Water Authority site, or runoff from other grassed areas on the block is directed via pipes into the perimeter drain.

The treatment plant site is fed with 415V 3-phase power via a transformer located adjacent the main switchroom in the approximate centre of the site. Potable water is supplied to and distributed around the site via a 100mm diameter high pressure steel water main. An elevated steel storage tank can store water on site for use in gland sealing and other process situations requiring a break-pressure in the potable water supply. A bore pump is installed and connected to a reticulation system around the grounds for irrigation. A general layout of the site is shown on Figure 4.2.

Other usable services existing on site include a Telecom line, a network of bitumen sealed access roads with turning and parking areas and a 2m high perimeter security fence.

4.3 LOCATION OF EXISTING STRUCTURES AND PROCESS FACILITIES

Figure 4.2 shows the layout of the existing Water Authority Wastewater Treatment Plant and the recently installed Metropolitan Septage Plant. A number of the existing structures and buildings were incorporated into the Septage Plant design. There are 11 brick and concrete buildings on the site, of which two (Chlorination Building and the Diversion Pump Station) are still in use by the Water Authority for maintaining the wastewater bypass system to Woodman Point. In addition there are three adjoining storage sheds of corrugated iron construction, steel roof shelters over the Receivals Area and the Sludge Discharge area of the Septage Plant and other minor zincalume clad shelter structures housing control cabinets and the Standby Generator. Other major above ground structures include 6 circular tanks utilised in the Septage Plant process, a 3-stage updraft odour scrubber, a hydrated lime silo, a degritting screw and an abandoned multiple hearth incinerator with fuel oil storage tanks.

In-ground concrete water retaining structures include two disused circular grit tanks, two rectangular spiral flow degritting tanks, 4 rectangular primary settling tanks converted to septage storage and secondary clarifiers, disused aeration tanks and 4 circular secondary clarifiers.

It is intended to utilise two of the in-ground circular secondary clarifiers as well as the brick and concrete building which was the activated sludge pump station of the old Wastewater Treatment Plant.

4.4 LOCATION OF THE PROPOSED PLANT

The layout of the Plant is shown on Figure 4.3. New structures that will be built for the process include the Receivals Building for incoming waste and the in-ground screenings facilities and transfer pumping station. A primary treatment area with a concrete floor slab draining to a pumping sump and a bund wall surround will be constructed adjacent the Receivals Area. The bunded area will contain above ground steel tanks for lime slurry storage, reaction vessels, oil separation and skimmed oil storage, and a reclaimed effluent storage tank. A grit screw classifier and hydrocyclone will also be located within this primary treatment area. Provision is made for a grit and screenings roll-on/roll-off bin to be located between the bunded area and the screenings facility.

Two above ground steel tanks will be installed in a separate bunded area adjacent to the back of the Receivals Building.

One of the existing old secondary clarifiers will be adapted for use as the sludge settling tank and effluent clarifier. Another adjacent clarifier will be used to store clarified effluent prior to pumping it to the Septage Plant Final Clarifiers, or to the Reclaimed Effluent Storage Tank.

Sludge drawn from the base of the Settling Tank/Clarifier will be dewatered by centrifuges housed inside the old Activated Sludge Pump Station. This building will also contain the sludge pumps and the polymer batching and dosing facilities. Dewatered sludge will be conveyed from the building to two adjacent roll-on/roll-off bins.

The proposed treatment processes and facilities to be installed are more fully detailed in Appendices A and B of this Report.

5. TRANSPORT OF LIQUID WASTE TO THE PLANT

5.1 NATURE OF THE LIQUID WASTE

The type and general characteristics of the industrial liquid wastes currently generated in Perth and tankered to the Kelvin Road site, have been outlined above in Section 2.2.

Classification

The Health Department classifies waste into 13 categories which cover the full range of waste types generated. Categories 1 to 4 include biological wastes that are not considered for acceptance and treatment at the Plant. Certain of these wastes including septic tank and grease trap pumpouts are already accepted into the adjacent Septage Plant for treatment.

The remaining 9 categories describe industrial liquid wastes as follows:

Category	Waste Containing
5	paints and resins
6	oils and emulsions
7	solvents
8	other organic chemicals
9	acids
10	alkalis
11	neutral salts
12	cyanide
13	other inorganic chemicals

Apart from listing liquid waste in accordance with the categories shown above the waste can be classified as:-

(a) Acceptance for treatment at the Septage Plant.
(b) Acceptance for treatment at the Plant.
(c) As for (a) but pretreatment required.
(d) As for (b) but pretreatment required.
(e) Not acceptable for treatment.

These classifications are defined as follows:-

(a) Septic tank and grease trap pumpouts as well as many other biodegradable liquid wastes.

(b) Pumpouts from oil separators, neutralised acids, alkalis, non-hazardous slurries, etc.

(c) Woolscouring, rendering and chicken processing wastes. Due to the emulsified and concentrated nature of these wastes the Septage Plant is currently not capable of treating such materials to a standard acceptable for "sewer discharge".

The Proponent is investigating treatment methods, either on site at the producers or at the Septage Plant.

(d) Liquid wastes with low pH or containing toxic materials such as cyanide, hexavalent chromium, sulphides, solvents and others. All industries known or suspected of producing such wastes are currently being investigated and sampled by the Proponent.

Under the Health (Licensing of Liquid Wastes) Regulations 1987, conditions of treatment will be imposed at source to ensure that the wastes are non-hazardous for transport and treatment at the Plant. These treatment processes will be discussed with the Environmental Protection Authority and in place before the Plant is commissioned. Even after treatment these wastes must be processed further before being acceptable for discharge to sewer. The Plant provides for this.

(e) PCBs, DDT and other intractable wastes as well as radioactive waste. No waste of this nature will be allowed into the Plant.

Only secure storage is currently available for intractable wastes.

Solids Content

The solids content of the wastes can be expected to vary considerably. In April 1989, 35 industrial waste samples were taken from tankers discharging at the Kelvin Road lagoon. The samples were collected over two separate two day periods. The solids concentrations of the samples varied from zero to 50% by weight. While samples taken from the pipe outlet at the bottom of a tanker can be expected to have increased solids concentrations due to settlement prior to discharge, the variation does indicate the wide range to be expected. Based on observed build-up of solids in the lagoon at Kelvin Road over a 1 year period by the City of Gosnells staff and experience from trade waste facilities in other states, it is estimated that the average solids concentration in the waste will be in the range 3% to 4% by weight. The long term trend would most likely see a decrease in the total effluent volume with a corresponding increase in solids content of wastes. This tendency can be anticipated as disposal charges increase and generators seek to minimise the costs of disposal by reducing the volume of liquid waste.

pH

The pH range of 23 samples collected at Kelvin Road in December 1988 was between 5 and 12.8, with the majority of samples in the alkaline category (pH greater than 7). Analysis for pH of the 35 samples taken from tankers discharging at Kelvin Road in April 1989 confirmed this picture, with most samples in the alkaline range. The range of this set of samples was pH 4.2 to 12.1.

Samples collected by the Proponent in June 1989 showed a much wider range of pH with values ranging from less than 1 to 13.6. Most of these samples came from industries considered to produce wastes more noxious than average. It is the intention of the Proponent to require such industries to pretreat these wastes before collection by tankers for discharge at the proposed Plant.

Flammability

Wastes that are classified as Class 3 Dangerous Goods in the Australian Dangerous Goods Code, or combustible liquids as defined in Australian Standard AS1940, will not be accepted for treatment at the Plant.

Toxic Wastes

The proposed treatment process is not designed to treat toxic wastes and remove toxicity from the effluent discharged to sewer. Effluent quality criteria stipulated by the Water Authority prohibit the introduction of toxic substances into the sewerage system. Wastes containing toxic substances that cannot be removed in the treatment process cannot therefore be accepted into the Plant. This includes liquids classified as poisonous, harmful or infectious in the Australian Dangerous Goods Code under Class 6.

Heavy Metals

Wastes from metal finishing industries such as electroplating shops, galvanisers, commercial laboratories, etc. have been sampled, and exhibited typically high values of various heavy metals. Examples of the more noxious wastes sampled in June 1989 containing high metal concentrations are shown in Appendix B.

Most of these solutions were highly acidic and would require pH correction treatment before they could be considered suitable for transportation.

5.2 TYPICAL WASTES FOR WHICH THE PLANT IS DESIGNED

The Plant has been designed for the following liquid waste treatment:

- Removal of solids.
- Precipitation of heavy metals as their insoluble hydroxides.
- Separation of oil from oily wastes and concentration and storage of the recovered oil for resale.
- Clarification of treated liquid wastes by settlement of suspended solids in long retention clarifiers to achieve a quality consistent with discharge to sewer.
- Dewatering and removal to a landfill site of settled sludges in a stable condition.

Typical industrial wastes that will be effectively treated in the above manner include the following aqueous wastes:

- Waste contaminated with oil from service stations, machine shops and other sources generating unstable emulsions and oil/water mixtures.
- Spent acid solutions which have been adjusted to pH 7 or above and other neutral salts and sludges.
- Wastes from electroplating and other metal finishing industries that may have high concentrations of heavy metals, such as zinc, lead, tin, copper, cadmium, silver, iron, manganese, cobalt. These wastes will also be adjusted to pH 7 and above, to limit the degree of solubility of the metals during transportation. Chromium waste solutions will require pretreatment at source to convert the chromium from the toxic hexavalent form to the less dangerous and readily treatable trivalent form. Cyanide solutions already require pretreatment at the generator's site to oxidise the cyanide before such waste will be accepted for treatment at the Plant.

- Other industrial wastes from laboratories and chemical companies which are both safe to transport and can be treated to produce an acceptable quality effluent for discharge to the Water Authority sewer.

The Proponent has a liquid waste licensing system in operation and this will be applied to wastes tankered to the Plant. This requires a liquid waste producer to hold a licence on an annual basis. All premises producing more than 1000L per year (except from septic tanks) are required to be licensed. Each producer is provided with a docket book with detachable dockets on which details of each consignment of waste are recorded. The docket will be submitted to the Plant operators by the tanker driver on arrival. This licence will be issued on the condition that the discharger meets the requirements for safety of transport to and suitability of treatment of his waste at the Plant. Samples of the waste will be taken at least annually from the premises by the Proponent for analysis, to ensure compliance with the licence conditions.

5.3 INTEGRITY OF THE TANKER TRANSPORT SYSTEM

Some wastes are regarded as dangerous goods under the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code). This requires that the consignor and the transporter observe guidelines issued by the Mines Department of WA with regard to hazard identification symbols, vehicle design and safety equipment and procedures for dealing with emergencies. These guidelines are already known to the waste cartage contractors through the Road Transport Association and training courses held by the Mines Department. There is no legislation in place which requires tankers and drivers to comply with standards of safety and design for cartage of liquid wastes in general in road tankers. However, the Health (Licensing of Liquid Waste) Regulations of 1987 stipulate that the vehicle be of sound construction and kept in good repair as well as being constructed and used in a manner to prevent spillage.

Guidelines that will define minimum acceptable standards of tanker vehicle construction for safe operation are desirable. The Proponent is developing a set of guidelines for liquid waste transport in consultation with the Mines Department and the Road Transport Association.

5.4 ENVIRONMENTAL IMPACT OF TRANSPORT OF LIQUID WASTES

The public image of liquid waste transport by road tanker is largely influenced by the perceived dangers to health and environment due to accidents involving spills of chemicals. The proposal will not alter the general situation with respect to environmental risks of tanker transport. Most of the routes from the major industrial centres which generate the bulk of the liquid waste are already used by tankers conveying septage to the Forrestdale site. The increase in tanker traffic entering and leaving the site will be between 25% and 33% on average, based on annual volumes expected. It is important to realise, however, that the increased traffic will be transporting <u>non-hazardous</u> liquid waste. Serious risks such as fire, spillage of highly reactive substances, toxic fumes, etc. would not exist.

The site is well served by good standard access roads to the west, east and north, that have adequate capacity to carry the tanker traffic generated by both the Metropolitan Septage Plant and the proposed Plant. In general these are arterial routes or freeways, with few instances of dense residential development close to the traffic lanes. The existing and future tanker traffic to the site is therefore not seen as having a major impact on people or residences near the main access routes.

Access to the site itself, where the concentration of tanker movements will be highest, is in an area of semi-rural development. There are few residences in the immediate vicinity. The section of Armadale Road from approximately 200m to the west of the Waterworks Road intersection (which is the entrance road to the site) up to the Wungong Bridge east of the Lake Road intersection, has been upgraded and widened, to avoid traffic conflict situations arising from incoming and outgoing tanker movements.

One aspect of concern to residents in the general area of the site, is the possible effect the liquid waste transportation to the site may have on the Forrestdale Nature Reserve. This reserve, which includes the Forrestdale Lake, is located to the south of Forrest Road and about 1.5km to the west of the proposed Plant site. The northern reaches of the reserve are within 250m of Forrest Road, which carries tanker traffic from the south-western and coastal areas.

The reserve is an important wetland conservation area because of the proliferation and diversity of bird life it supports, including 10,000 waterfowl, migrating waders and several rare species. The reserve is recognised locally, nationally and internationally as a significant refuge and habitat for waterbirds.

The lake is listed on the National Estate and is registered in terms of the RAMSAR convention, an international treaty designed to protect wetlands of the world. It is important therefore that the likelihood of runoff from the surrounding developed areas and nearby roads contaminating the shallow waters of the lake and foreshore reed beds is prevented as far as possible. The land surrounding the lake is very flat and tends to become inundated in the wet season.

Drainage from both sides of Forrest Road including the Forrestdale housing development is, however, diverted to the north side of the road into what is known as Bailey's Branch Drain, which joins the Main Forrestdale Drain and eventually discharges to the Southern River. There is consequently minimal risk of any spillage entering the lake from Forrest Road but it could eventually enter the Southern River some four kilometres away. The emergency response scheme will cope with such spillages.

Current docket records at the Kelvin Road site indicate that only a minority of the regular industrial waste dischargers are situated in the southern coastal industrial belt. This implies that the number of industrial waste tankers that will travel eastwards along Forrest Road to reach the proposed Plant is small (between 2 and 4 per day on average). The stretch of Forrest Road in the vicinity of the northern reaches of Forrestdale Lake is straight, with good visibility in both directions and no busy intersections. This reduces the potential for conflict situations leading to tanker accidents.

Another issue of potential environmental significance is the fact that tankers from industrial waste sources to the west of the proposed Plant will traverse the Jandakot Underground Water Pollution Control and Public Water Supply Area, (commonly referred to as the "Jandakot Mound"). The Jandakot Mound is bounded by Nicholson Road to the east, Frankland Avenue to the west, Govan Road (north) and Anketell Road (south). The area is obviously sensitive to waste spillage of any description, but particularly to chemicals and solutions that would not be removed by filtration or other natural degradation processes and would enter the underground aquifer.

Tankers travelling from the southern coastal industrial areas to Kelvin Road have for many years used the section of Forrest Road that bisects the Jandakot Mound. The new Plant will reduce the existing risk of hazardous waste pollution in the area, since hazardous wastes will not be accepted at the plant for treatment.

5.5 EMERGENCY PROCEDURES

In the event of tanker accidents involving hazardous waste spills, a rapid response scheme is in place to deal with hazard containment and environmental clean-up. This scheme has been developed by the WA Hazardous Materials Emergency Management Co-ordination Committee.

The committee includes:

- Police Department as co-ordinators and controlling authority.
- WA Fire Brigade as combat authority at the danger zone of the accident/spill.
- Health Department to advise on safety measures for the protection of health, identify the optimum clean-up procedure and supervise disposal of the waste.
- Mines Department to investigate circumstances leading to the incident and take legal action if required.
- Other authorities such as Water Authority, Environmental Protection Authority, DOHSWA, etc. to assist and advise on protection of waterways, services and other sensitive environmental issues.

In addition to the Fire Brigade's extensive amount of emergency equipment, the Proponent has at its disposal a tactical response trailer unit, located at the WA Fire Brigade Training Centre in Belmont. This unit can rapidly be towed to the scene of an accident and enable commencement of containment and clean-up procedures. This unit will carry safety gear such as protective suits, breathing apparatus, limited amounts of chemicals such as lime and other reagents for safe neutralisation or fixation of spilled chemical substances, fire fighting foams, liquid absorbing chemicals, bunding and spill containment devices.

Whilst the above strategies are primarily instituted for dealing with hazardous situations, spills of non-hazardous liquid waste that may have environmentally damaging effects will also be handled in this manner.

5.6 ROAD VERSUS RAIL TRANSPORTATION OF WASTES

Transportation of liquids by rail tankers is an alternative which is considered safer than road tanker transportation, particularly in the instance of hazardous substances such as cyanide, strong corrosives and flammable solvents or fuels.

Advantages applicable to rail transport of liquid wastes include:

- avoidance of traffic conflict situations at intersections or on unsuitable roads.
- lower potential for accidents due to driver error or external influences.

- larger volumes can be transported in a single trip.

- easier to record quantities and track distribution of waste with fewer opportunities for illegal dumping.

- lower risks to the public in general in the event of spills as rail reserves are usually easy to isolate at the scene of an accident.

There are also several disadvantages when comparing rail with road tankering systems:

- Rail tanker clean-out facilities for wastes containing sludges and high percentages of settleable solids would need to be provided at the destination site.

- Since the existing rail system does not adequately serve several industrial areas such as Osborne Park, Wanneroo, Belmont, Willetton and Jandakot, among others, a loading transfer station would be required to which road tankers carrying liquid wastes would travel. This would increase the risk of spillages through extra handling, and road tanker clean-out facilities would still be required.

- The Plant would need to be located convenient to a rail access route to avoid the need for a second transfer station. The only site which could meet this requirement as well as satisfy other criteria for effluent disposal and infrastructure is the Canning Vale Wastewater Treatment Plant. This is not however considered a viable option.

In view of the lack of a suitable readily available location served by rail and the likely high cost of providing an adequately managed system of waste collection from industries remote from rail for transfer to the Plant, this option is not considered suitable.

6. SITE AND EFFLUENT IMPACTS & MANAGEMENT

6.1 IMPACTS ON THE ENVIRONMENT

This section of the report addresses potential environmental effects, public safety issues, and management procedures and systems to ensure efficient and effective operation of the plant, to minimise impacts on the environment. The potential environmental impacts are:

- visual intrusion
- odours
- spillages of waste
- noise
- traffic due to tankers
- groundwater and surface water contamination
- detrimental effects on fauna and flora
- fire risk

Visually, the Plant will have a very small impact, as the site is already developed as a treatment plant site with low prominence on the landscape and skyline. Planting of trees effectively screens the site from the north and east. The Plant will be developed within the confines of the old Wastewater Treatment Plant, which is surrounded by a buffer of vacant land. The land surrounding this buffer strip is either Water Authority land or semi-rural large blocks with no residences within 500m of the fenced treatment plant site.

Occurrence of offensive odours is unlikely to be a problem in view of the containment measures incorporated in the design to prevent detectability beyond the site boundaries. Where it is clear that odours are not being adequately contained, Proponent will require Cleanaway to rectify the situation without delay. The problem of odours generated from leaking valves and hosepipes on the back of tankers is policed by the Proponent, who require tanker drivers to maintain their vehicles free of such defects under the Health (Licensing of Liquid Wastes) Regulations, 1987.

It is statistically inevitable that spillages of waste will occur. The system in place to deal with these spills is to achieve rapid containment, passivation where necessary and removal of the contaminants through a quick response strategy and organisation. Any spillages at the Plant will occur within bunded and sealed areas which drain to process sumps. All tanker discharge and washdown areas are sealed and graded to fall to collector drains. Splash containing walls and enclosure of the discharge bays at Receivals with an efficient odour extraction system will prevent escape of aerosols and spillage.

Noise impact of the proposal is expected to be minimal in view of the various accoustic shielding measures to be installed on the site. Furthermore, as the distance to nearest dwellings is greater than 300m noise is not expected to be a sensitive issue. The major sources of noise on the plant will be from:

- Tanker manoeuvring into the Receivals Bays
- Induced draft fans for control of odours
- Centrifuges
- Roll-on/roll-off bin articulated vehicles
- Process Control system alarms

Noises from vehicle manoeuvring and odour control fans will be no more intrusive than those from the adjacent Septage Plant, which have little impact on the neighbourhood. The centrifuges are high speed machines which can generate high levels of noise under certain conditions. These units will, however be enclosed in sound-proofing canopies and housed in the Dewatering Building. The building is a solid brick and concrete structure with excellent acoustic confining properties.

One of the most intrusive noise sources which initially resulted in complaints from the local residents in the case of the Septage Plant was the audible alarms from three process controller units. In order to prevent further occurrence of this problem, alarms will be kept to the minimum audible level necessary under prevailing operating conditions to ensure detection. Alarms will also sound for short periods only and have visible flashing beacons as backup. This system has cleared up the nuisance from the Septage Plant alarms.

Traffic due to tanker movements will be marginally increased in the area of the Plant due to the estimated ten extra tankers per day travelling to the site. The approach roads are of sufficiently high standard and carrying capacity to accept the additional heavy vehicle movements without creating undesirable traffic situations. Should the number of tanker loads to the combined facility increase significantly in the future, some sections of Ranford Road (from the Lake Road intersection to Anstey Road and from Southern River Road to Nicholson Road) may need to be upgraded to the same standard as the rest of the route. These sections are pin-pointed for upgrading in the near future, in any event.

Groundwater or surface water pollution is a significant issue in the area, which is low lying and is seasonally inundated. The treatment plant site is slightly raised above the surrounding land to the south-east and south-west which makes it safe from such inundation. The potential does therefore exist for runoff of contaminated waters to spread to adjacent land. The site is however designed to confine all sources of contaminated runoff within the process areas.

A cut-off perimeter drain prevents direct overland runoff draining onto the surrounding grass and bushland. This collected stormwater is discharged into the Forrestdale Main Drain at the north-western corner of the site. The main drain conveys the runoff from the area to the Canning River catchment to the north-east.

Fauna such as bird life, rabbits, snakes, bobtail lizards and other common species found in the coastal bushland, are not endangered by the proposal, which is to be developed on an existing established site. The only danger to wildlife would come from increased tanker movements along Waterworks Road which already has taken traffic due to the Septage Plant operations. This report has shown that the environmentally sensitive area of Forrestdale Lake Nature Reserve will not be affected by the proposal (see Section 5.4). Flora of the area is predominantly grassland used for grazing and some native tree cover. This would not be at risk unless major pollution of the area were to occur, which is extremely unlikely.

The probability of a major fire getting out of control on the plant site is unlikely due to the layout of the various facilities and the fact that the liquid waste will be non-flammable in the form in which it is delivered. One area of potential fire risk, however, is the stored oil removed from the oily wastes in the concentration tank. The oil storage tank will be fully enclosed and kept separate from any buildings or other equipment. The oil is unlikely to be highly volatile, consisting mainly of old engine and lubricating oils from service stations, etc. In other respects the Plant will be provided with fire protection equipment including foam and dry carbon dioxide extinguishers for electrical fires and hydrants and hose reels for general protection and will meet the requirements of the WA Fire Brigade.

There is some risk of a fire originating on the site spreading to the surrounding vegetation along north and north-eastern boundaries, where there is denser scrub and tree cover. The Plant itself will not, however, represent a major fire hazard to the surrounding area since there is no high-storey canopy of flammable vegetation within reach of the perimeter fence to spread a fire. The surrounding land adjacent the perimeter fence in the vicinity of the Plant is free of trees or bush to support a fire.

6.2 PROCEDURES IN THE EVENT OF SYSTEM FAILURE

There are several possible failure modes which will prevent normal operation of the Plant and require the adoption of contingency measures. These include:

- SEC power failure or black-out
- Control system malfunction
- Major process component malfunction
- Final effluent discharge inhibit
- Lime system malfunction

The ability to run the plant fully on standby power using the Septage Plant diesel fired generator set is provided. This generator is already connected to the electrical supply and has sufficient power output to enable both the Septage Plant and Plant to continue to operate when SEC power is unavailable. This protects the system against SEC power interruptions. Facilities to manually run all drives independently will cover the majority of malfunctions. Duty/Standby equipment or cross-connections to normally dedicated process lines will provide the necessary backup for individual component failure.

In the event of a shut-down of the Water Authority Diversion Pump Station, the final effluent from the Plant can be stored together with the Septage Plant effluent in the old disused aeration tanks, which have a combined capacity of 1300m^3. Should there be problems with pumping the Plant effluent to the Septage Plant final clarifiers, it can be diverted to the two disused clarifiers for storage.

Malfunctions with the Septage Plant Lime system can be overcome by ordering tanker loads of lime slurry or lime putty from one of the lime suppliers in Perth and pumping this into the Plant slurry storage tank. There will be ample time to make such arrangements because of the large buffer capacity of the Plant.

6.3 SECURITY AND SAFETY

The site is fully fenced with a mesh and barbed wire security fence. Gates at the entrance are locked during off-shift periods. A security firm regularly patrols the grounds and buildings of the site at night and over weekends.

The Plant will incorporate adequate provision for personnel safety and equipment protection. Areas addressed specifically are:

- Protection against risk of fire or explosion due to sparking of motors, instrumentation, etc. Although wastes received are specified as being non-hazardous, protection or intrinsically safe equipment is considered necessary for those components or areas where flammable gases or volatile substances could collect and impose hazards. This includes the odour control unit at Receivals, Screens, reactor feed pumps and sumps, reactor tanks, oil pumps and off-specification tanks.

- Ventilation of the enclosed Receivals Bays, at a minimum of 12 air changes/hour; ventilation of the below-ground structure housing the pumping well and screens.

- Provision of emergency dowsing shower and wash basin for the lime storage and dosing area. This will also serve the off-spec tanks and Receivals Area.

- Provision of emergency lock-off stop or lanyard switches on all drives.

- Provision of handrails and safety chains on all walkways, platforms and raised access areas.

- The control system is designed to logically shut off upstream or downstream drives as appropriate, to prevent equipment damage or waste product spillage and raise alarms to alert the operator to malfunctions.

6.4 MONITORING REQUIREMENTS

The Proponent will undertake regular drain inspections both within the site and in the perimeter drains to determine whether contamination is occurring from surface runoff. Any evidence of this will require sampling and testing of water and/or soil in the drains to identify the pollutant and its source. Should this be proven to come from the Septage Plant or the Plant, the Proponent will take the necessary steps to clean the contaminated water and/or soil and prevent pollution from recurring.

The waste handling and processing will be carried out in areas that are fully sealed against leakage to the ground and bunded against escape from the sealed areas. There is thus minimal potential for infiltration of pollutants to the groundwater. There is an extraction bore adjacent the proposed Dewatering Building which will serve as an indicator for pollution of the groundwater. This will be sampled and tested on a regular basis by the Proponent.

7. CONCLUSION

There is an urgent requirement to replace the existing Kelvin Road Industrial Liquid Waste Disposal Facility which is to be closed at the end of November, 1989, with an alternative facility that meets stringent environmental and public safety criteria. The chosen location is adjacent the existing Metropolitan Septage Plant on the old Westfield Wastewater Treatment Plant site leased by the Proponent from the Water Authority.

This site best satisfies the major siting criteria for the proposed Plant, both in terms of effects on the local area and cost to develop and operate. It has been demonstrated in this PER that the proposal will not impact in a significant way on the environment. Only industrial liquid wastes classified as non-hazardous will be treated at the Plant. Questions of emissions of liquids, odours and noise from the Plant to the surrounding area have been addressed, with adequate provision for containment within the site boundaries.

The concept of transporting wastes from animal processing industries in Coogee and treating these at the Plant is not considered feasible in view of the large volumes and high strength biological characteristics of such waste.

Increased tanker movement resulting from the proposal is not expected to have any significant effect on traffic, as most of the approach routes are good standard roads of adequate vehicle carrying capacity to handle the expected 10 tanker loads per day. The environmentally sensitive Forrestdale Lake Nature Reserve will not be contaminated by spillages which could occur from tankers travelling along Forrest Road to the Plant. In the event of spillage resulting from tanker accidents in the Metropolitan Area, mechanisms exist for early response from the authorities by way of a co-ordinated approach, special mobile equipment and containment and cleanup strategies.

The alternative of rail transportation of the liquid waste cannot be justified because of difficulties in finding a suitable Plant location with the necessary infrastructure and in servicing industrial waste generators remote from rail routes.

Cleanaway will develop and operate the plant under contract to the Proponent for a period of 5 years with the option to review their contract for a further 5 years. The treatment process will consist of proven and easily controlled physical and chemical methods to separate oils, solids, and heavy metals from the liquid wastes. Dewatered solids will be trucked for disposal in a safe, controlled manner. Recovered oil will be sold for recycling. Treated effluent from the Plant will be discharged to the Water Authority sewerage system, together with the effluent from the adjacent Septage Treatment Plant. All effluent discharged will be required to meet the Water Authority quality criteria for acceptance into the sewerage system.

The Proponent will undertake regular sampling and monitoring of all issues which have the potential to cause an environmental impact and this will be carried out to the satisfaction of the Environmental Protection Authority. The Proponent will report regularly to the Environmental Protection Authority and the local residents community association and address any enquiries or concerns related to the proposal.

8. SUMMARY OF COMMITMENTS

The Proponent makes the following commitments to the Environmental Protection Authority relating to this proposal to establish a new Industrial Liquid Wastes Treatment Facility.

1. The Plant will receive only non-hazardous liquid industrial wastes for treatment.

2. All incoming wastes will be recorded and sampled at the site Gatehouse before referral to the Plant.

3. Facilities will be provided for temporary storage of off-specification wastes in two enclosed tanks totalling 50kL.

4. Dewatered sludge will be carted in bins to a designated landfill site for burial.

5. Effluent quality from the Plant will be maintained within standards that enable the Water Authority quality criteria for effluent discharge from the Septage Plant to be satisfied.

6. The Plant effluent quality and flow will be monitored prior to discharge to the sewer. If the quality is unacceptable the effluent will be retreated.

7. The facility will be designed and operated to contain any liquid spillages, contaminated runoff and odours within the site boundaries.

8. All treatment processes and waste handling operations that could generate odours detectable at the site boundary will be enclosed with provision for odour control.

9. All above-ground tanks and liquid waste treatment areas will be bunded or otherwise provided with means of preventing escape of liquids either to the ground or as surface runoff. All contained spillages, washwater and contaminated runoff within the sealed and bunded areas will be returned to the treatment process.

10. The quality of water in the site perimeter drains, as well as groundwater from the production bore adjacent the Dewatering Building will be monitored prior to commissioning and during operation on a regular basis to ensure that no contamination is occurring due to the operation of the Plant. Should any contamination be detected appropriate action will be taken in conjunction with the Environmental Protection Authority.

11. Standby electrical power will be provided by a diesel fired generator set, already installed and connected to the Septage Plant.

12. The Plant equipment and process will be safe from explosion of flammable constituents that could be present in the liquid waste or as vapours in enclosed spaces.

13. Electrical wiring, equipment and instrumentation will be designed and installed in compliance with AS3000 and all other applicable Australian Standards.

14. The Plant will be designed and constructed in accordance with the Occupational Health, Safety and Welfare Regulations, 1988.

15. Fire fighting facilities will be installed to the approval of the WA Fire Brigade.

16. Reports will be provided regularly to the Environmental Protection Authority quarterly on progress of the development of the Plant and annually on the operation of the facility after the plant is commissioned.

17. Representatives of the Proponent will meet regularly with the Community Liaison Committee consisting of representatives of the Forrestdale Community Association and the Armadale City Council to discuss development and operation of the Plant.

9. REFERENCES

- Australian Code for the Transport of Dangerous Goods by Road and Rail.
- Health Act 1911; Health (Licensing of Liquid Waste) Regulations 1987.
- Forrestdale Lake Nature Reserve Management Plan 1987-1992; Dept. of CALM, Perth, 1987.
- Waterbirds in Nature Reserves of S-W Australia 1981-1985; Jaensch, Vervest, Hewish, RAOU Report No.30, 1988.
- Birding Sites Around Perth; R. van Delft, Nedlands UWAP, 1988.
- Occupational Health, Safety and Welfare Regulations 1988.
- Industrial Wastewater Treatment Technology Second Ed, 1985; James W Patterson.
- A Guide to the Environmental Protection Act, 1986; Environmental Protection Authority.
- Coogee Biotechnology Park - A Concept by Peter Newman, Neal Ryan and Pat Carnegie, Murdoch University, 1988.

APPENDIX A - PROCESS DESCRIPTION

APPENDIX A - PROCESS DESCRIPTION

A.1 TREATMENT PROCESS OVERVIEW

The plant is designed with flexibility in mind with the added advantage of being able to readily incorporate additional treatment facilities should they be required in the future.

As detailed in Section 5.1, considerable variation has been observed in each of the various categories of waste delivered to Kelvin Road Tip Site at Gosnells. In order to cope with this variability and to safeguard against mixing of incompatible wastes, two separate routine treatment trains are provided. In addition, the capability to utilise either of two off-specification tanks for separate chemical conditioning, prior to re-introduction of problem wastes to the downstream combined clarification/dewatering processes, is available if required.

In consideration of the highly variable nature of the wastes, the emphasis has been to provide a reliable, simple and rugged treatment system engineered to cope with variations in both physical and chemical composition. It has been demonstrated frequently that highly sophisticated systems cannot provide the reliability or ruggedness required for industrial wastes.

Refer to Figure A.1 for a block diagram of the treatment process.

Since approximately 50% of the incoming wastes is expected to contain oily water, one treatment train is specifically designed to extract and concentrate oils by using a combination of gravity settlement and a plate type separator downstream of the Receivals Bays after screening and pH adjustment to crack the oil emulsions.

The remaining acid and alkali wastes will undergo pH adjustment for metal precipitation in the other treatment train prior to degritting and sedimentation with the underflow from the oily waste treatment system.

Sludges produced during treatment will be dewatered by centrifuges prior to disposal at a secure landfill.

A.2 TANKER ARRIVALS AND ACCEPTANCE

Each incoming tanker will enter the Plant and proceed along the road parallel to the north-eastern fence to the existing Septage Plant Gatehouse. Here the driver will stop and produce the docket for the load, completed by the waste consignor. The Gateman or Sampler will record details of the load and take a sample from the tanker to assess the waste for acceptability. He will routinely test for pH and record odour and colour characteristics. If he is in any doubt as to the contents of the tanker the Plant Chemist will be summoned to conduct an analysis in the laboratory to confirm whether the waste is safely treatable or off-specification.

The sample taken will be transferred to the laboratory for routine analysis to ensure that the quality is consistent with the licensee's approved discharge conditions.

The tanker driver will then proceed with a clearance note to discharge at the Plant Receivals Area. He will follow an anti-clockwise route, by-passing the Septage Receivals Area and along the perimeter road. At the Plant the operator will study the clearance note details and direct the tanker to discharge at the appropriate Receivals Bay.

A.3 RECEIVALS AND PRELIMINARY TREATMENT

Three discharge bays are provided, which will prevent excessive queueing of tankers waiting to discharge.

In view of possible difficulties in handling heavy sludges and grit in the Receivals Bays (especially during the tanker clean-out operation) a through-flush system has been provided at two covered bays, which is suitable for back hatch discharge from tankers. The tankers will reverse into these bays. The wastes will be discharged into wide trenches at the rear of each bay, of sufficient capacity to receive a full tanker load (18kL). A trash rack will intercept gross solids. These will be raked off by the operator and deposited into a 200L bin for removal with other coarse solids and grit removed downstream. The discharge trenches will have sloped floors and drain completely through 150mm pipes with diaphragm valves to control the outflow rate. Facilities for flushing of the pits will be provided to remove any solids deposited. The rear sections of each of the covered bays will have a 1.3m high concrete parapet wall to contain splashing.

The third bay will be a drive-through bay with a lean-to roof only, intended for routine use by long semi-trailer type tankers. Because this bay will not be enclosed for odour control, the tanker will discharge via a 100mm flexible hose connected to a pump or fixed pipe gravity drain via a quick release coupling. The pump or pipe will discharge into a valved manifold which can be set to direct the waste into either of the covered bay discharge trenches. For clean-out purposes, the semi-trailer tanker will reverse into one of the enclosed bays.

The drive-through bay discharge pump will also be used for transferring the wastes to either of the off-specification storage tanks at a rate of at least 20L/s. A high pressure washdown and tanker/pipework flushing system, utilising recycled effluent with potable water make-up, will be provided at each bay.

The discharged waste will gravitate at a controlled rate of flow to primary screens of the self-cleaning rotary drum type, designed to remove coarse solids and grit greater than 3mm in size. These will serve to protect downstream equipment and pipework from blockages and wear. This type of screening has been successfully used at the Metropolitan Waste Disposal Authority industrial waste treatment plant in NSW to remove large grit, stones, rags and other material likely to damage or block downstream pumps and pipework. A facility for lime dosing of the discharged flow prior to screening is included. This will also prevent excessive odours associated with the reject solids.

Effluent passing through the screens will drop into a sump underneath each screen from which it will be pumped by one of two feed pumps to the selected reactor tank for treatment. Each sump is sized to take the full contents of a tanker so that any downstream problem stopping the feed pumps will not result in an overflow at the screen. This will provide up to 4 large tanker loads or 72kL holding capacity upstream of the reactor tanks.

The screens, sumps and submersible feed pumps dry well will be located in a below ground roofed structure, off the back of the Receivals Building.

Screenings discharged from the rotary drum screens will be conveyed on a troughed belt conveyor to a collection bin of the roll on/roll off type for cartage to an approved landfill site. This bin will also serve to collect grit from the downstream process.

A.4 CHEMICAL TREATMENT

Following screening to remove coarse solids, the wastes will be pumped to the reactor tanks for lime dosing. Manifolding of the pump inlets and outlets will permit wastes from any of the receivals bays to be pumped to either reactor tank. Generally, one reactor tank will be dedicated to treating oily wastes with the second reactor tank dedicated to treating acid/alkali wastes.

The reactor tanks will have a 20kL capacity each and turbine mixers for blending lime and maintaining solids in suspension. The monitoring of pH will be achieved by providing a small centrifugal sampling pump pumping to an elevated tank fitted with an overflow weir and drain. The pH probe will be located behind the overflow weir and thus maintained continuously wetted. This prolongs the life of the probe and ensures higher reliability. Drawing off from the bottom of the reactor tank irrespective of the level within the tank ensures continuous pH measurement can be achieved. Access to the pH probe for maintenance and calibration is also simplified. Overflow from the weir box drains back to the reactor tank and provides a convenient sampling location. This system has proven successful on a number of industrial waste treatment plants operating in the batch or semi- batch mode.

The oily wastes reactor tank will operate on a semi-batch basis. Lime will be dosed up to approximately pH12. Numerous jar tests carried out on waste samples have demonstrated that this pH is necessary to crack the oil/water emulsions.

The acid/alkali reactor tank will also operate on a semi-batch basis, however, lime dosing will only be carried out to pH10. This is the optimum pH for precipitation of the heavy metals in the wastes. In some cases where strong ammonia solutions are present, the pH will be raised to 11.5 to avoid the complexing of some metallic ions with the ammonia and the metals remaining in solution.

Either of the reactor tanks can be operated at different pH levels providing considerable flexibility in plant operation. The discharges from the two reactor tanks will be manifolded to permit the dosed wastes to be directed to either the oil interceptor facilities or the grit removal system prior to final clarification, further increasing the process flexibility. Should additional treatment be required, then facilities can be readily incorporated prior to, or downstream of the reactor tank, as suitable provision has been made in the plant layout.

Once the desired pH has been achieved in the reactor tank the discharge pump will commence operation. Should further discharge to the reactor tank occur and the pH of the contents vary outside the allowable tolerance, discharge pumping would be automatically stopped until the pH set point has once again been achieved.

A.5 PHYSICAL TREATMENT

Oily wastes, after lime dosing in the appropriate reactor tank, will be pumped to the oil interceptor for removal of the readily settleable sludges. The interceptor is a narrow, deep, long tank with two hopper-bottomed outlets in line. Most of the heavy sludges will settle into the first hopper which will automatically be pumped out on a preset frequency. The second hopper will be pumped out on a less frequent basis. The supernatant will pass over a weir at the downstream end of the tank and flow to the plate separator for separation of the oil phase. The plate separator is a stack of horizontal closely spaced corrugated plates which encourages coalescence of the oil droplets, thus improving the purity of the oil phase collected. Plate separators are, however, prone to blockages when receiving heavy solids loads and thus the oil interceptor is required upstream to settle the bulk of the incoming sludge.

The oil phase from the plate separator will then be skimmed off and pumped to the oil storage tank where further oil/water separation may occur. Separated water will periodically be drawn off from the bottom of the tank and drained back to the oil interceptor on a manual basis. Recovered oil will be collected by tanker and carted to an oil recycling merchant whenever the storage tank is nearly full. Tests carried out on skimmed oil from the Kelvin Road site indicated that the product would be acceptable to the recycling industry. Cleanaway is currently negotiating with dealers to arrive at pricing and quantity/quality criteria.

Underflow from the plate separator will gravitate to the clarification stage. Sludge from the oil interceptor will be automatically pumped to the grit removal facility which also receives the discharge from the acid/alkali reaction tank.

Within the grit removal system, grit not removed during screening will be separated and concentrated in a hydrocyclone and removed via a screw classifier. Grit removal is considered essential at this stage to prevent excessive wear on the downstream centrifuges used for sludge dewatering. Experience in similar treatment systems has demonstrated that, by providing suitable protection against high grit levels, the performance and reliability of centrifuges is greatly enhanced. The action of the screw classifier also tends to abrade off any oily films which may remain on the grit thus providing a cleansing stage for the grit.

The combined flows following grit removal will then gravitate to the existing in-ground clarifier. Here sludges will be settled for pumping to the sludge storage tank and any oil released during degritting will be separated and collected in the scum system for pumping to the plate separator. To improve settleability and reduce final effluent turbidity, provision has been made for dosing of polyelectrolyte to the clarifier influent.

The influent to the clarifier will have a pH between 10 and 12. As the sludge settles, the equilibrium in the supernatant phase between hydroxides in solution and particulate hydroxides is altered and further precipitation of metal hydroxides occurs. Thus during the settling process metals are progressively precipitated, achieving a high quality effluent (with reducing hydroxide in solution). A final effluent pH of 9-10 is anticipated.

The large surface area of the clarifier and the long detention time provided will ensure that a high quality supernatant is produced. This supernatant will gravitate to the second existing clarifier which acts as a final effluent storage basin prior to pumping as reclaimed effluent for reuse within the process or pumping to the Septage Plant final effluent tank for discharge to sewer.

A flow meter will be installed on the discharge from the Plant upstream of the final effluent discharge into the Septage Plant. The Septage Plant final effluent line already has a fully equipped sampling station for taking samples and recording pH and flow.

A.6 SLUDGE HANDLING

Sludge from the final effluent clarifier will be discharged under gravity to the new sludge storage sump located adjacent the Dewatering Building basement. This sump is approximately 20kL in capacity and will be maintained fully mixed. As coarse solids and the bulk of the grit will have previously been removed from the sludge, potential problems of settlement of heavy material and excessive abrasion will have been significantly reduced.

The sludge is then pumped at a controlled rate into the Dewatering Building where it will be centrifuged in one of two solid bowl centrifuges after addition of a conditioning polyelectrolyte flocculant. The centrifuges will be capable of producing a dry cake with a solids content of 20% to 30% by weight which will be conveyed out of the building and dropped into open roll-off/roll-on bins. These bins will be transported to a landfill site. Centrate from the centrifuges will be returned to the final effluent clarifier for further solids removal.

A.7 CHEMICAL STORAGE AND DOSING FACILITIES

Lime slurry required for treatment will be pumped across from the existing Septage Plant lime batch facility to a fully mixed lime slurry storage tank. Three centrifugal feed pumps are provided to dose lime to each of the reaction tanks and the Receivals Area.

The polymer dosing facilities will comprise 2 x 2m^3 and 1 x 4m^3 batch and storage tanks with manual batch/mixing equipment and duty/standby positive displacement dosing pumps with manual variators. The polymer will be batched at a concentration of approximately 0.4% w/w in water and diluted downstream of the dosing pumps to between 0.05 and 0.1% with reclaimed effluent, for injection into the sludge feed line to each centrifuge. A dosing line will also be laid to the influent line of the clarifier to provide a means of improving settlement of the sludge as well as effluent quality. Laboratory trials and experience elsewhere indicate that a polyelectrolyte dosing rate of 4 to 4.5kg polyelectrolyte per tonne dry solids will be required for the centrifugation process to achieve the required cake solids concentration.

A.8 WASH DOWN

Final effluent will be recycled for reuse in tanker cleanout and washing down at the Receivals Area. A separate pumping facility will be provided for pumping washwater from the storage clarifier, with a potable water standby for those occasions when final effluent level in the clarifier is too low for pumping. The washwater supply pumps will be controlled from the Receivals Bays and will supply up to 6 L/s at high pressure for line blockage clearing.

A hose with a valve will be installed in each bay and a high pressure pumping system capable of delivering 2L/s flow through each hose, for washdown purposes.

A.9 ODOUR CONTROL

In order to meet the Proponent and Environmental Protection Authority requirement of no detectable odours at the site boundary it will be necessary to reduce as far as possible generation and spread of vapours of volatile substances at the Receivals Area, where potential for release is greatest. Other areas where odour generation is expected to occur are within the reactor tanks and the off-spec tanks and at the rotary screens.

It is therefore intended to provide a housing structure for the two open hatch receivals discharge bays. This will consist of a 14m long by 10m wide by 5.4m high roofed enclosure, open at the front for tanker entry & exit. Extractor fans will withdraw foul air from each discharge trench at the rear of the enclosure, where tanker back hatch discharge operations occur, at a total rate of 2,200 L/s. This will exceed 12 air changes/h for the structure and ensure a net inflow velocity through the opening (4.5m high) of 60mm/s. This rate of air change is considered adequate for operators' safety and comfort within the enclosure during the multiple daily short duration tanker dumping and wash down activities, without the need for breathing apparatus.

A hooded intake will be positioned above each discharge trench and ducted via large diameter (400mm) PVC branch pipes and a 750mm common plenum into individual activated carbon scrubber modules.

Each module will consist of a particulate filter and moisture eliminator, followed by a dehumidifier to raise the air temperature to above dew point. The conditioned air will then pass through a double bank of granular activated carbon cells of a type specifically suited to adsorb volatile hydrocarbons and acidic vapours. The air will be drawn through the modules and exhausted to atmosphere by individual induced draft fans. Each ducted system will be isolated from the adjacent system by a slide gate in the plenum. This gives the operator flexibility to run either of the odour control modules to suit the generation conditions within the Receivals Building.

In addition, the reactor tank feed pumpwells, both reactor tanks, screens and off specification tanks will be covered and vented to the intake plenum to avoid escape of gases stripped from zones of aeration and turbulent mixing. Odours from the clarifier and final effluent storage are not expected to be significant.

Activated carbon treatment for odorous gases has been selected as it avoids expensive loss of chemicals, which can occur in other scrubber systems under minimal odour generation conditions. The activated carbon will work to meet the demands of the system rather than being run at high rates to cope with occasional peak odour generation situations. This results in more effective use of the odour removal system. Replacement of the banks of carbon cells will be very much dependent on the degree of odour generation. In order to account for the higher adsorption rate onto the lower bank media, the top bank in each module will be moved down to the bottom bank when the bottom bank of cells is spent and a new set of cells placed in the top bank. In this manner optimum usage of the activated carbon is made whilst maximising odour removal. Expected average useful life of each bank is between 12 and 18 months.

Spare carbon cells will always be kept in store.

A.10 ELECTRICITY SUPPLY

The power supply to the Septage Treatment Plant has been assessed and the power requirements for the Plant estimated. The supply to the site is more than adequate for the additional power demands and supply to the Plant will simply comprise a medium voltage feeder to a distribution board.

The medium voltage distribution board will be housed in the existing old activated sludge pumping station together with the motor control centre and the programmable logic controller (PLC).

Use will be made of existing cable conduits where appropriate and a new series of conduits will be provided to the Receivals Area. Local power reticulation where existing conduits are not available will utilise cable trays located with due regard to relevant regulations and safety considerations.

A.11 ELECTRICAL CONTROL

A.11.1 General

Drives and pumps will generally be manually started from a central control station with automatic shut down from protective devices and process constraints. Protective devices include motor thermal overloads, flow detection on all pumps and conveyor lanyard switches. Automatic start up and shut down sequences will be controlled by the PLC which will also monitor drive status and process parameters such as pH, pressure, tank levels, pipe flow and time. Local push button stations will be provided for drives remote or out of eyesight from the control station.

Audible and visual alarms will alert the operators when excessive levels are reached in the reactor tanks, sludge storage tanks and the effluent storage tanks, low levels in the chemical batch/storage tanks, or in other situations which could result in spillages or danger to personnel.

A.11.2 Off-Specification

Tankers containing off-specification waste will be pumped out using a manually controlled pump. No-flow detection and high tank levels will stop the pump.

A.11.3 Process Control

Liquid wastes draining from the receivals bays follow two paths:- oily wastes and non-oily wastes. The drainage paths will be determined by the Operator, who will control actuated valves on the discharge lines to the two rotary drum screens. The valves will be normally open to permit direct drainage from the Receivals trench to the associated screen.

The rotary screens and reject material conveyor will be manually started and stopped and run continuously. Stoppage of either screen will shut the isolating valve and raise an audible alarm, while stoppage of the conveyor will stop both screens automatically, shut all drain valves and raise an audible alarm. Pumping of screened liquor to the reactor tanks will be controlled by level sensors in each pump sump. A high level in either sump will result in closure of the associated Receivals Bay actuated valve.

Very high level in a reactor tank will cause an audible warning alarm and shut down the feed pump, whereas high level will merely cause the pump to stop. In this manner the process and equipment will be protected from overflows and spillages due to equipment failure or stoppage, or line blockages.

Mixers in the reactor tanks will be controlled automatically to run when the level is above a minimum in the tank and to stop when it is below.

Outflow from each reactor tank will be by a manually controlled transfer pump to the grit removal system or to the oil interceptor in the case of oily wastes.

The pH of the reactor tank contents will be continuously monitored by a pH probe in a recycle stream metering box on top of the tank. If the pH falls below an operator set limit value, lime solution dosing will automatically start and continue until the set point is reached. The two lime dosing pumps will have manually adjusted speed variators fitted. The operator will also be able to lime dose the flow at the receivals discharge trench, or into either reactor tank, or into the off-specification tank pumping main, by manually controlling the dosing pumps.

The grit screw will be started whenever a reactor tank transfer pump starts up and will run for a preset time after both transfer pumps have ceased pumping. Failure of the screw to start will raise an alarm.

Whenever the transfer pumps start, polymer dosing of the feed into the clarifier will automatically commence at a dosing rate preset by the operator on the dosing pump variator. Polymer dilution using reclaimed effluent will commence simultaneously, by opening of a solenoid valve on the dilution supply line.

Settled sludge will be withdrawn intermittently from the clarifier by pumping from the centre outlet to the sludge storage tank. A high level detected in this sump will raise an audible alarm. A mixer will run continuously in the sump but will stop if a low level of sludge is reached.

Centrifugation of the sludge will be controlled to follow a logical sequence of start up and shut down of associated drives, including:

- Sludge feed pumps
- Centrifuge drives
- Polymer dosing and dilution
- Sludge cake conveyors

The sequence will be manually started and will stop if any of the interlocks are activated.

For example:

- Conveyor fault or stoppage by lanyard trip wire stops sludge feed pumps and polymer dosing, raises alarm.
- Centrifuge drive fault or stoppage stops associated feed pump and dosing train, raises alarm.
- Polymer dosing no-flow or sludge feed stoppage raises an alarm only.
- Normal shut down of either centrifuge will shut off its feed pump and dosing train. If both centrifuges are shut down the conveyors will continue to run for a preset time to clear, then stop.

Final effluent will be automatically pumped from the storage basin between high and low level limits into the discharge rising main to the Septage Plant. Recycled effluent pumping will be controlled by high and low level sensors in the Reclaimed Effluent Holding Tank at the Receivals Area.

Oil and scum removed from the top surface of the clarifier will be automatically pumped to the oil plate separator from a collection sump with high and low level sensors.

Underflow from oily wastes entering the oil interceptor tank will be pumped out intermittently to the grit removal system under automatic timer control and the pumps automatically stopped on reaching low liquid level in the tank. Transfer of separated oil from separator to storage tank will be manually controlled.

A.12 ULTIMATE CAPACITY

The plant will have the hydraulic capacity to handle peak loadings of 200kL/day, with the average throughput expected to be 100kL/day. This will enable the expected annual flows of 26ML/annum to be handled comfortably, with considerably higher annual flows treatable by operating extended hours on sludge dewatering.

There are no current plans to provide for a higher capacity, but should circumstances require this the plant is capable of being augmented. The most likely requirement would be provision of higher throughput centrifuges or a preliminary sludge thickening device.

A.13 STAFFING AND OPERATING TIMES

The proposed Plant is within easy reach of the Septage Plant, with close communication required in dealing with incoming waste at the Gatehouse and to maintain proper function of several process links. The full administration, maintenance and laboratory services of the Septage Plant will be available to back up the Plant operation.

One new operator will be engaged full time to operate the Plant and a full time laboratory technician employed to cope with the increased workload of sample analysis and performance monitoring of the two plants.

The Septage Plant currently employs 5 operators and a senior hand to run and maintain the existing plant. When necessary, one or more of these operators will be available to assist the Plant operator during busy periods or if plant malfunctions occur.

It is intended to operate the plant six days a week for 52 weeks a year, excluding Sundays and public holidays.

Hours of operation will be:

Monday to Friday:	0700 to 1700.
Saturday:	0800 to 1700.

These hours are the same as for the Septage Plant.

APPENDIX B - WASTE CHARACTERISTICS AND PLANT DESIGN CRITERIA

APPENDIX B - WASTE CHARACTERISTICS AND PLANT DESIGN CRITERIA

This section sets out the basis used for arriving at the waste characteristics used for design and the various design criteria. It also discusses the selection of treatment processes and final disposal of treated waste.

B.1 SAMPLING AND LABORATORY ANALYSIS

A number of sampling and analysis programmes on industrial liquid waste in Perth has been conducted since early 1988. These programmes have included samples taken from the Kelvin Road lagoon, from the discharge valves of tankers and from the waste generators process effluent streams.

The samples have been individually or compositely tested for a wide range of characteristics and properties, including:

Physical	Chemical
pH	B.O.D_5 and C.O.D.
Total solids	Metals concentration
Suspended solids	Metals precipitation by lime addition
Colour and odour	
Oil content	Oil quality
Settleability	
Dewaterability of sludges	
Oil separation	

Typical results from some of the more noxious wastes sampled are shown below:

Metal	Concentration (mg/L)	pH of Sample
Lead	400	- 0.5
Mercury	20	- 0.5
Tin	69	2.5
Nickel	1000	- 0.5
Cadmium	400	0.1
Copper	340	2.5
Silver	700	4.7
Chromium 3+	2000	4.4
Chromium 6+	2400	2.4

It should be noted that the samples in the above table were all acidic, some extremely so, and would all require pretreatment for pH adjustment prior to transportation to the Plant.

B.2 TREATABILITY STUDIES

Lime treatment was found to give the best overall results in removing oil and grease, metals in solution and suspended solids. Dosing with lime to pH12 or above is effective in cracking unstable oil/water emulsions, with the free oil separating as a surface layer. The lime is also effective at these high pH's in removing suspended solids to produce a clear supernatant under quiescent settling conditions. The lime does not significantly reduce the settled sludge volume.

Limed composite samples of the waste were centrifuged using a laboratory centrifuge to simulate the full scale dewatering process. The dosage rate of lime was 6g/L. Some of the limed samples were centrifuged after the addition of a polyelectrolyte flocculant to assess the improvement in the dewaterability of the sludge. The results showed a 40% increase in solids concentration in the polymer dosed samples compared to the limed only samples. Flocculation after polymer dosing was extremely rapid with full floc formation occurring within 1 minute of dosing. A dosage rate of polyelectrolyte of 4kg per tonne of sludge dry solids appeared to give the best results.

It is interesting to note that the range of sludge thicknesses achieved (ie: 20% to 29% $^{w}/_{w}$ dry solids) is consistent with the results obtained from the centrifuges operating at the full scale Metropolitan Waste Disposal Authority Trade Waste Treatment Plant in N.S.W. The sludge dryness from its centrifuges is highly variable but generally a sludge of 20-30% $^{w}/_{w}$ dry solids is produced.

The tests demonstrated that polyelectrolyte flocculant dosing at an appropriate rate is effective in increasing the sludge dryness achieved from centrifugation. Polyelectrolyte dosing also offers a number of additional advantages. The supernatant from the polyelectrolyte dosed samples was significantly clearer than that for the samples not dosed. The dosed samples also were free of a surface float of oily residue which occurred on the undosed samples.

Samples of waste collected in June 1989 from the more noxious industries that had high concentrations of metals (see "Heavy Metals under Section 5.1), were limed to pH 10, dosed with polyelectrolyte and settled. The supernatant was then decanted and analysed for removal of the various metals. The results showed that the concentrations of all of the heavy metals except copper, cadmium, zinc and molybdenum were lowered to within the Water Authority maximum concentration limits for discharge to the sewer. The copper was found to have complexed with ammonia (which was present at a high concentration in the composite supernatant) and remained in solution at the high pH. In a second composite sample with the ammonia driven off, the residual copper after settling was less than 0.5mg/L. The cadmium, zinc and molybdenum residual levels were only marginally higher than the permitted limits.

After maximum removal of metals and dilution of the small percentage of higher metal content waste effluent with the bulk of the treated industrial waste effluent, the concentration of these metals would be well inside the discharge to sewer limits. Where high ammonia concentrations are detected, the ammonia will be driven off by raising the pH to above 11.5, to prevent complexing of metal ions in solution such as copper, nickel and silver. Further dilution of the industrial effluent from the Plant will occur through mixing with the Septage Plant final effluent before discharge to the sewerage system. The average ratio of industrial to septage effluents will be approximately 1:4.

B.3 EFFLUENT QUALITY CRITERIA

Based on the above treatability studies and information and experience gained from other eastern states industrial waste treatment facilities, the Proponent is confident of meeting the Water Authority discharge limits currently imposed on the Septage Plant effluent, through the 3 - phase separation and lime clarification process described.

A minimum pH limit of 8.0 has been assumed for effluent discharge in this design. This is similar to that allowed at the Metropolitan Septage Treatment Plant by the Water Authority, since the alkaline effluent assists in preventing sulphide attack on the sewers. The maximum pH will be in the range 9 to 11, which will depend on the alkalinity of the incoming waste and the degree of metal hydroxides removal in the clarifier. The impact on the sewer of the Plant effluent will be considerably lessened by mixing with the Septage Plant final effluent prior to discharge.

B.4 QUANTITIES OF EFFLUENT AND SLUDGES

Effluent from the storage basin will either be reused for washdown and polymer dilution purposes, or discharged to the sewer. Average daily volumes of 100kL of waste received are expected to consist of 96% to 97% liquid, the bulk of which will be discharged as effluent. The effluent will also contain lime slurry and polymer solution batching water. The slurry will be pumped from the Septage Plant lime batching facility which uses reclaimed effluent or potable water for slurrying the powdered lime. The polymer batching system uses potable water to make up the 0.4% dosing solution.

Assuming an average dosage of 6kg of lime per kL of waste and approx. 4kg of polyelectrolyte per tonne of sludge solids, the additional liquid input for dosing purposes will be, on average, approximately 8kL per day. Assuming an average mass of 5 tonnes of all solids removed from the process daily at 20% solids concentration, the quantity of liquid leaving in the sludge will be 20kL per day. The net average quantity of effluent discharged is therefore

$$100 + 8 - 20 = 88\text{kL/day}$$

Apart from the solids that are settled or suspended in the waste, some additional solids will be removed in the treatment process through precipitation of metal sludges, etc. and addition of reagents such as lime and flocculants. The total solids quantity removed in the treatment process is conservatively estimated at between 4.5% and 6% by weight of the incoming waste. This amounts to an annual dry weight of 1170 to 1560 tonnes of solids from the Plant process for disposal. Assuming an average of 20% solids concentration in dewatered sludge for disposal, an annual production of 5,800m^3 to 7,800m^3 of sludge can be expected. This equates to a daily output of 20 to 25m^3 of dewatered sludge for disposal.

B.5 DESIGN CRITERIA FOR PLANT SELECTION AND SIZING

B.5.1 Receivals Area

Most of the tankers arriving at the plant will be fixed chassis types which carry between 9 and 18kL of waste with a few semi-trailer tankers (or B-Doubles) which have capacities up to about 27kL. The semi-trailer (larger than 18kL) size tankers will be required to discharge via the 100mm diameter closed pipe or receivals discharge pump from the drive-through bay, to avoid overloading the discharge trenches, screens, or reactor tank feed pump sumps. Discharging from the tanker via the closed hose connection in this manner will limit the flow rate to between 20 and 30L/s.

Discharging from the back hatch of a smaller fixed chassis tanker will take between two and four minutes only, depending on size. Since this will give instantaneous flow rates into the discharge trench of more than 100L/s, the trench will serve as a flow equalising basin to avoid flooding the screens and downstream sumps. The outflow valve of the trench will be adjustable to limit the flow rate to not more than 30L/s to the associated screen. The reactor tank feed pump sumps will each be sized at 18kL to allow extra holding capacity at Receivals in the event of unavailable downstream reactor tank capacity.

B.5.2 Screening of Wastes

The screening process fulfills an important role in preventing downstream blockages of pipes, valves etc. with rags, plastic and other fibrous solids. For this reason bar screens are not suitable. Alternatives considered included wedgewire DSM type screens and rotary drum screens. The rotary drum type was selected as it has a much lower head requirement and is easier to keep clean than the DSM. The spiral flight inside the drum and the drum rotation serve to dewater the collected screenings effectively over the length of the drum. Spray bars will clean the outside of the screen mesh using reclaimed effluent and further assist in separating coarse solids from the waste passing through to the sump below.

The screened solids will be conveyed on a neoprene belt troughed conveyor collecting from both screen chutes. The conveyor will leave the screens and pumping chamber at a 22° slope to achieve sufficient height to discharge over an adjacent roll-on/roll-off bin.

B.5.3 Reactor Tanks and Lime Treatment

The screened wastes will be pumped from the sumps at a rate of 30L/s, which should enable a steady state inflow/outflow condition to be maintained at Receivals. The reactor tanks will each be sized to take 20kL. These will be constructed of steel 3m in diameter and approximately 3.5m high with conical bases. The batch process will take between 25 and 30 minutes to process 18kL, based on 10 minutes feed time, 4 to 5 minutes lime dosing time (at a nominal 6kg/kL) which can run concurrently with feed pumping, and 15 minutes pump-out time at 20L/s. Non-oily waste will be limed to between pH10 and 11 (or higher if ammonia is present) and then pumped to the grit classifier.

The reactor tanks will be mixed by turbine mixers, which will run continuously whenever the level in the tank is above a low level cut-out.

The lime slurry will be pumped from the existing Septage Plant batching facility via a 50mm diameter spiral reinforced flexible polyethylene pipe with access points at regular intervals containing valved spigots, to enable easy cleaning and washout of the lime transfer line. The lime transfer pump will be a positive displacement type pumping at 3L/s to a slurry holding tank adjacent the reactor tanks. The lime will be flushed out with reclaimed effluent after each fill of the holding tank. The tank will have a holding capacity of approximately 6kL. It will be 2.0m in diameter and 2.5m high, with a top-hung PBT mixer. This will allow for up to 2 days lime slurry storage under average conditions of waste receivals and dosage rate.

B.5.4 Oil Interception and Separation Tanks

The interception tank will be an 8m long by 1.5m wide double hopper bottomed steel tank of $25m^3$ nominal capacity. Oily waste that has been limed to pH12 will be pumped in at the rate of 20L/s from the reactor tank. When the level in the tank has risen above a low level cut-out probe, a positive displacement pump will commence pumping at 5L/s from the base of the first hopper to remove settled solids. The excess inflow will cause the tank to fill and overflow at the discharge weir with sufficient detention time to allow the bulk of the oily phase to float to the surface and pass over the weir. The flow rate into the separator tank will be controlled at the outlet from the interceptor tank launder. The second interceptor tank hopper will collect less settled sludge than the first and will be pumped out intermittently at a flow rate of 5L/s.

The oil separator will be designed to remove oil droplets down to 30 microns or less and achieve underflow residual concentrations of less than 50ppm. The underflow will be drained to the discharge line from the grit classifier tank and drain direct to the clarifier. The separated oil will be skimmed off the surface and pumped into a 2m diameter vertical steel tank, 4m high, with 10kL storage capacity. This will permit up to 3 weeks of oil storage, assuming 1% recoverable oil from the oily wastes fraction of the total wastes received.

B.5.5 Grit Removal

Grit larger than about 250 microns creates wear problems in fast moving machinery such as centrifuges and centrifugal pumps and must be removed. A hydrocyclone followed by a conventional screw type classifier was selected to remove grit in the 200 micron plus size range. The hydrocyclone will be fed from the reactor tank treating non-oily wastes and from the sludge withdrawal pumps of the oil interceptor. The classifier influent tank will be sized to allow particles of S.G. >1.5 and size >200 microns time to reach the base of the hopper, where they can be extracted by the screw conveyor. The screw speed and trough clearance is designed to optimise grit pick-up and separation of less dense materials and liquid. Reclaimed effluent will be used to spray wash the screw flight to aid in grit classification.

B.5.6 Clarification and Effluent Storage

Overflow from the hydrocyclone, grit classifier influent tank and the oil separator underflow will drain via a 200mm PVC pipe to the centre feed well of the clarifier at a combined maximum rate of approximately 40L/s. The clarifier is a 2.7m deep 13.8m diameter concrete tank with $404m^3$ capacity. At an average feed rate of 22L/s, assuming continuous discharge from either reactor tank in turn, and centrate return from both centrifuges, the detention period in the clarifier would be 5.1 hours with a surface overflow rate of approximately 0.5m/h. In fact the detention would be much higher - on average nearly 4 days at 100kL per day inflow. This will allow for very good quiescent settling conditions for fine particulate precipitates of metal hydroxides and good consolidation of the sludges.

The clarifier scraper will be modified to allow for slow peripheral speed echelon blades to move the sludge to the centre withdrawal pipe. The sludge will be drawn off intermittently and pumped to an existing $20m^3$ capacity concrete storage sump adjoining the pump basement of the Dewatering Building.

Overflow from the clarifier launder will drain to an adjacent similar sized tank which will act as a large storage basin. Effluent will be pumped to discharge at a flow rate of approximately 5L/s between two levels in the tank that will ensure sufficient storage always remains for recycling purposes. This flow rate will ensure that the Septage Plant final effluent pumps are not overloaded by the combined flow from the two plants.

B.5.7 Sludge Dewatering and Polymer Dosing

When Cleanaway purchased the Westfield Wastewater Treatment Plant equipment as part of their contract to develop the Septage Plant, two decanter solid bowl centrifuges previously used to dewater primary sludges were included. Laboratory trials as described in B.2 above indicate that the limed sludges were amenable to dewatering by centrifugation. The decision to re-use these has enabled Cleanaway to cut the capital costs associated with dewatering of the sludges, which would otherwise have been the biggest cost item of the project.

Each centrifuge has a maximum feed rate of $4.5m^3/h$. Assuming a total of 4.5 tonnes dry solids/day from all sources (average) and 8% solids concentration in the clarifier, the approximate volume of sludge to dewater daily will be $55m^3$. This will require approximately 6 hours running of both centrifuges to process. Approximately $20m^3$ of sludge cake will be produced at 20% concentration, and approximately $35m^3$ of centrate, which will be returned to the clarifier with the incoming limed waste.

Feed to the centrifuges will be by positive displacement pumps with mechanical variators for flow control. One pump will normally be dedicated to a centrifuge, but piping arrangements will allow for one pump to feed either or both centrifuges if required.

B.5.8 Disposal of Treated Effluent and Solids

Treated effluent will be pumped from the storage basin into the Septage Plant Final Effluent Pumping Sump, where it will be pumped out with the septage effluent to the Water Authority Diversion Pump Station, or to the Septage Plant Reclaimed Effluent Storage Tank for reuse in receivals washdown, lime slurry batching and filter belt washing.

Effluent from the Plant storage basin will also be pumped via a separate high pressure pump for use at the Receivals Bays as washwater, in screens spray cleaning and for polymer dilution.

The combined effluent from the Septage Plant and Plant will be pumped at 25L/s to 30L/s through an existing sampling and flow metering station. An automatic sampler collects a sample on a regular basis from the pipe flow and stores this in a series of sample bottles within the sampler casing for later removal and analysis by Water Authority. A pH probe in the line continuously records pH of the effluent on a chart recorder. An inline magnetic flow meter measures and records flow on a strip chart recorder. These recordings and samples of effluent are the basis for the Water Authority charges levied for acceptance into the sewerage system.

In addition to the above, the Plant Chemist will take grab samples of the individual plant discharges and the combined effluent at least twice per week for analysing and checking against the automatic sampler and recorded results.

Solid wastes will be in the form of screenings and grit collected in a single bin and sludge cake dewatered in the centrifuges and deposited into two bins. The dewatered sludge will be in the form of an easily handleable crumbly cake which will fill two bins per day on average with approximately 20m^3 total volume at 80% moisture content. If the moisture content can be reduced to around 70% which is possible for part of the time, the volume of cake will reduce by up to 50%.

It is difficult to estimate the volume of screenings and grit that will be removed. However a preliminary assumption based on other industrial waste processing plants and the Septage Plant, is that 2 to 4m^3 of grit and 3 to 5m^3 of screenings will be collected per day.

Both the grit and screenings bin and the dewatered sludge bins will be loaded and carted to a landfill site as directed by the Proponent, for tipping and burial daily.

B.5.9 Off-Specification Wastes

Wastes that are suspected of being outside the permissible quality for discharge into the Plant will be examined by the Plant Chemist who will require the tanker driver either to wait while more conclusive testing is carried out to determine the nature of the waste, or to pump the contents from the drive-through bay to one of the two 25kL volume off-specification tanks for holding. If it is determined that the waste can be safely treated without compromising effluent quality, the superintendent, by arrangement with the Proponent shall authorise the chemist to supervise the necessary treatment of the waste in the off-specification tank.

The off-specification tanks will be 3m diameter by 4.0m high epoxy coated steel tanks with domed bottoms and top covers. Each tank will have a top hung PBT mixer installed and facilities for sampling the contents via a valved take-off pipe. Each tank will be provided with two dosing points - one for lime and one with a valved quick-release coupling pipe connection, for metering in other reagents such as acid, sodium meta-bisulphite or hypochlorite solutions. Once the treatment has been carried out to the satisfaction of the Chemist, the waste will be pumped or drained back to the Receivals Bay trench for processing through the Plant in the normal manner.

In some cases where mixed septage and industrial waste loads are delivered the decision may be taken to process the load through either the Septage Plant or the Plant, provided the Chemist has established that personnel safety, treatment process, plant function or effluent quality is not compromised in any way.

Typical off-specification but treatable situations might be the delivery of strongly acidic solutions or solvent solutions that can be satisfactorily treated by excess lime or sufficiently diluted in the process. Facilities will also be available to treat cyanide or hexavalent chromium residues at marginally higher than acceptable concentrations in the waste. All such cases of non-compliance shall be reported with full details to the Proponent by Cleanaway. The Proponent will take suitable disciplinary action after investigating the generator and transporter and recover from the party in breach any additional costs of handling and treating the waste at the Plant.

Should any wastes arriving at the site prove untreatable within the resources of the Plant, the wastes shall be removed under the direction of the Proponent to a suitable place of treatment or disposal, or returned to the generator.

B.5.10 Backup and Storage Facilities

Should there be a major breakdown in any part of the process such as the centrifugation system or the effluent disposal system, which cannot be rectified within a short period and available storage in the Receivals trenches and reactor tanks and feed sumps is fully taken up, then additional storage facilities exist. These consist of two extra clarifiers with a combined volume of $800m^3$ storage, as well as at least two spare aeration tanks with an extra volume of $1300m^3$ storage for use in an emergency.

All major components will be duplicated with switchover facilities in the event of a single item breakdown. Should a centrifuge break down or be taken out of commission for any reason then overtime will be worked to process any build-up of sludge. In the event of a major control system failure such as a PLC malfunction it will be possible to operate the plant in manual mode from local pushbutton stations, at full capacity if necessary. In such cases additional operations staff will be brought across from the Septage Plant to assist.

SEC blackout or main transformer failure will be covered by the site standby diesel fired alternator set which is large enough to supply power to both plants.

APPENDIX C

LIST OF DRAWINGS

The Environmental Assessment (EIA) Process
(Under the Environmental Protection Act, 1986)

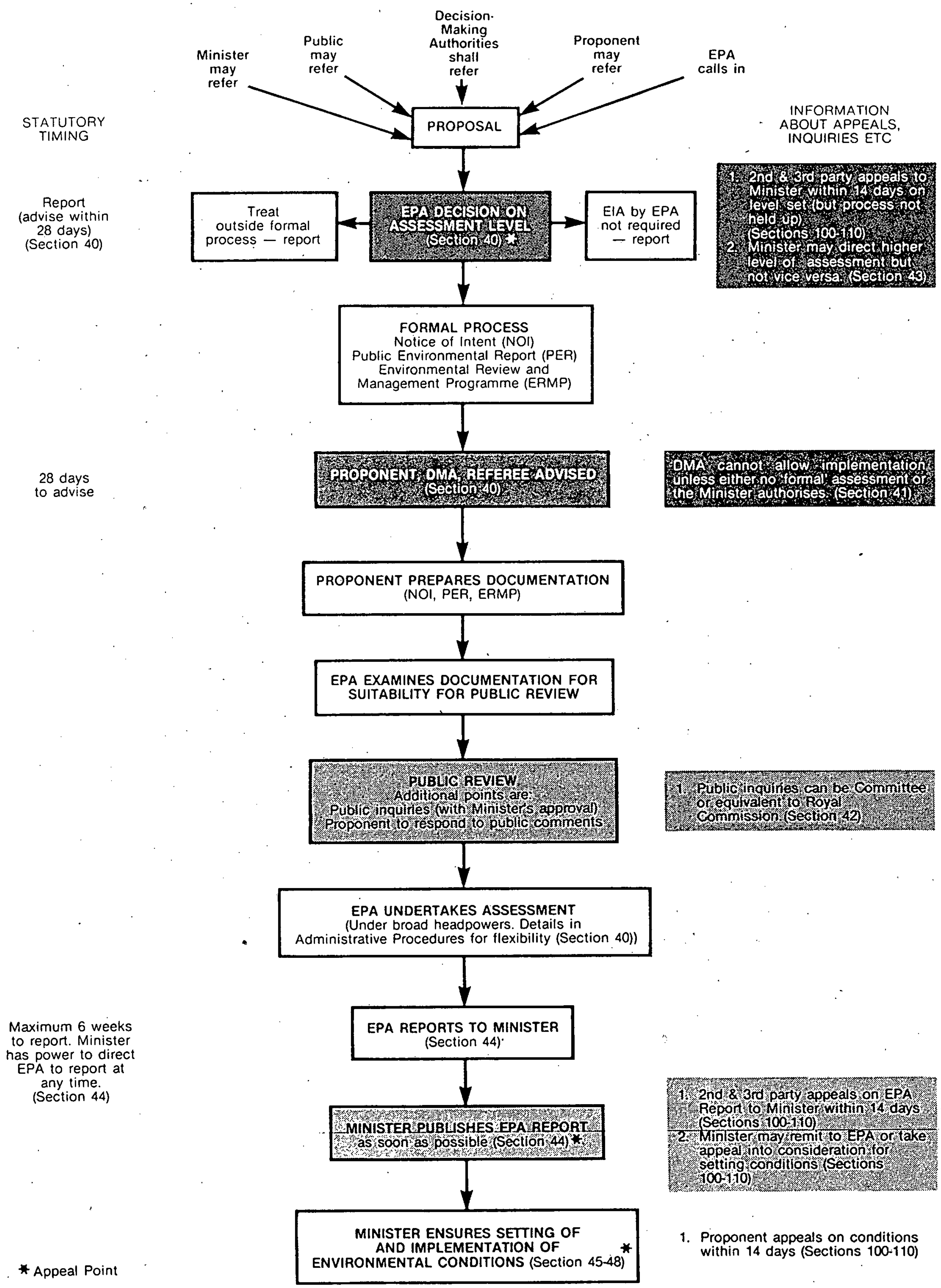
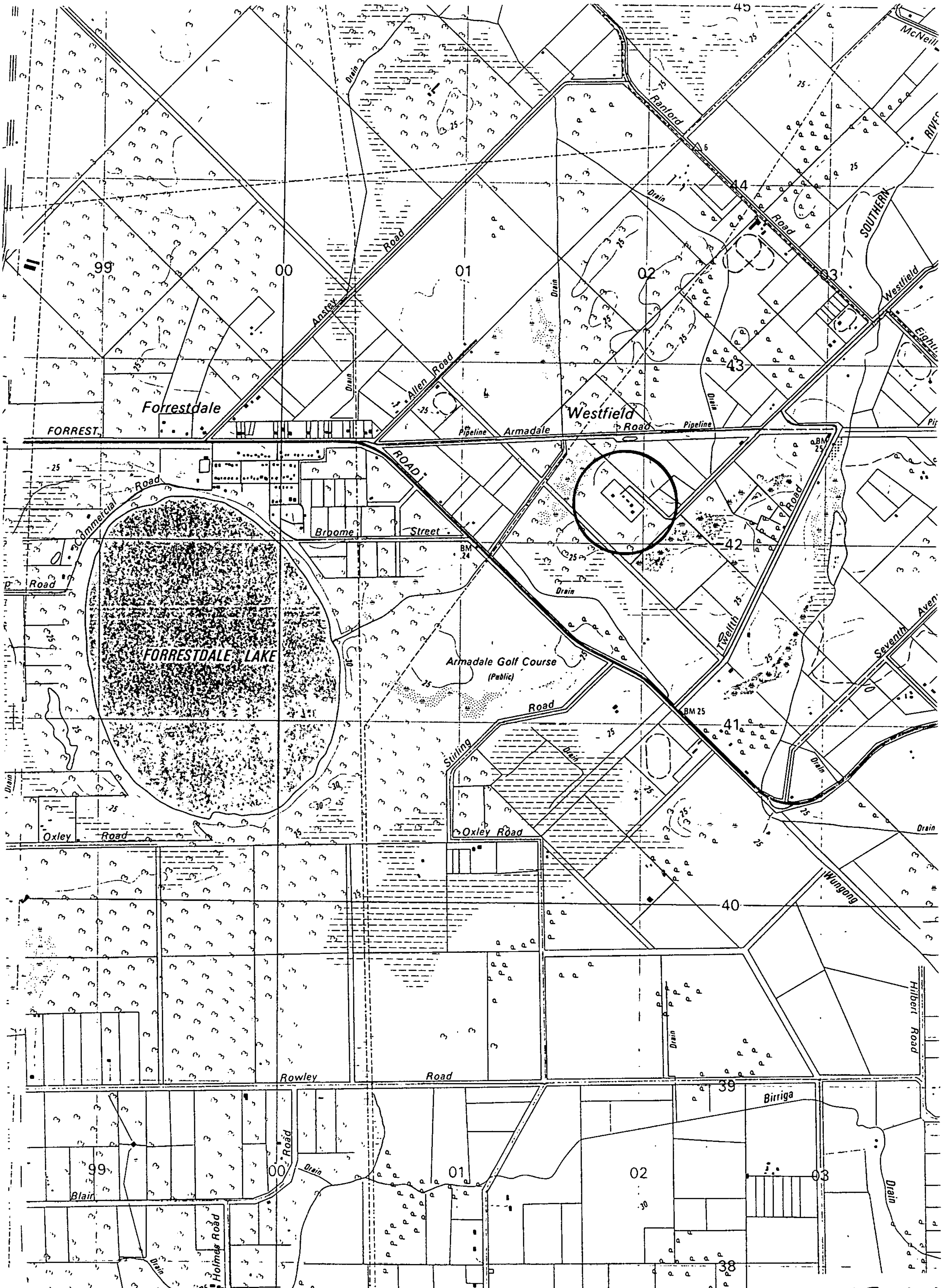
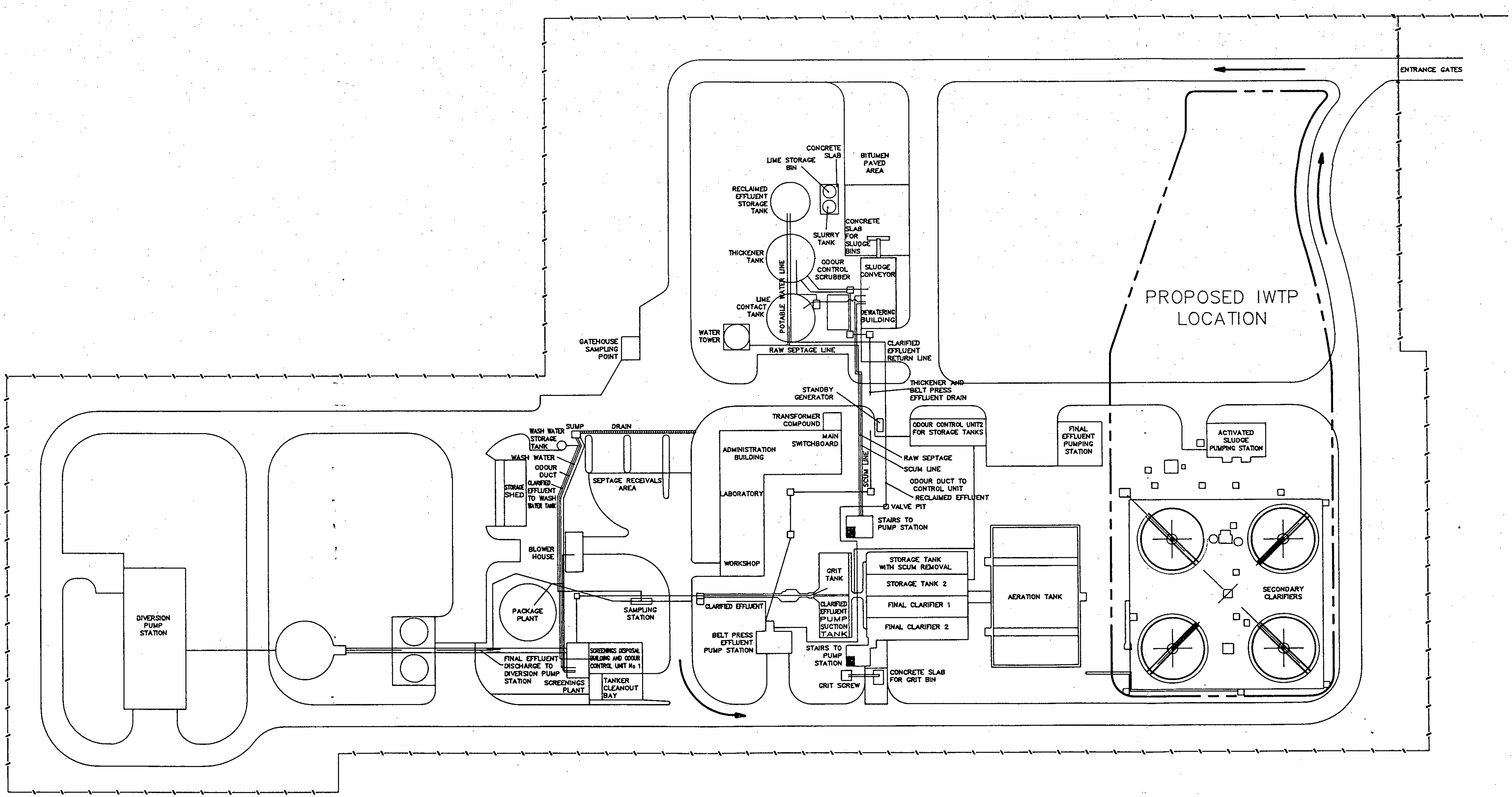


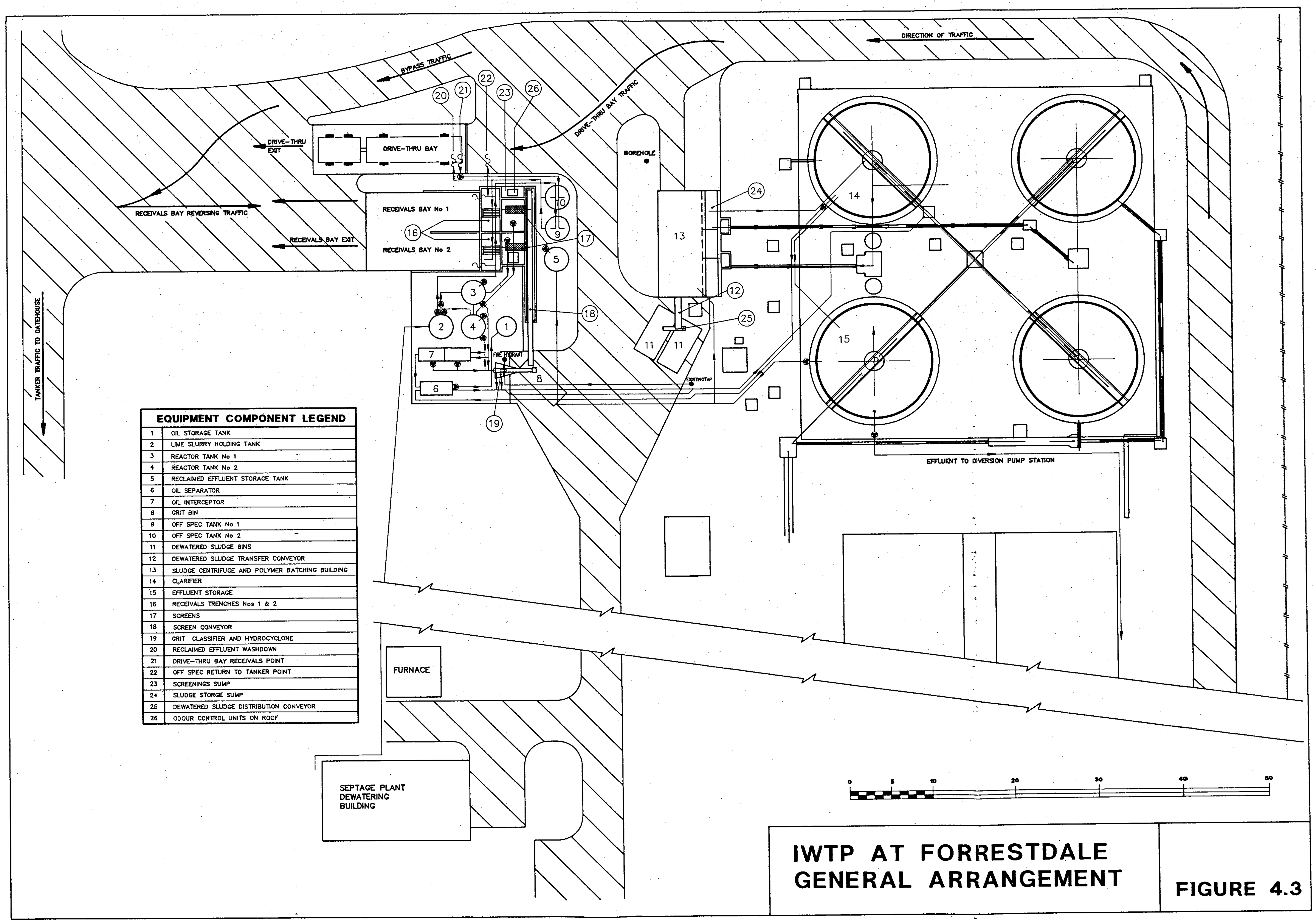
FIG. 1.1


Forrestdale
FORREST
ROAD
Westfield
Armadale
Road
Pipeline
Allen Road
Anstey Road
Ranford
Road
SOUTHERN
RIVER
McNeill
Westfield
Eighth
Commercial Road
Broome Street
FORRESTDALE LAKE
Armadale Golf Course
(Public)
Stirling Road
Twelfth Road
Seventh Avenue
Oxley Road
Wungong
Hilbert Road
Rowley Road
Birriga
Blair
Holmes Road
Drain
BM 24
BM 25
99
00
01
02
03
38
39
40
41
42
43
44
45
FIG 4·1



METROPOLITAN SEPTAGE TREATMENT PLANT AT FORRESTDALE - SITE LAYOUT

FIGURE 4.2



EQUIPMENT COMPONENT LEGEND

1	OIL STORAGE TANK
2	LIME SLURRY HOLDING TANK
3	REACTOR TANK No 1
4	REACTOR TANK No 2
5	RECLAIMED EFFLUENT STORAGE TANK
6	OIL SEPARATOR
7	OIL INTERCEPTOR
8	GRIT BIN
9	OFF SPEC TANK No 1
10	OFF SPEC TANK No 2
11	DEWATERED SLUDGE BINS
12	DEWATERED SLUDGE TRANSFER CONVEYOR
13	SLUDGE CENTRIFUGE AND POLYMER BATCHING BUILDING
14	CLARIFIER
15	EFFLUENT STORAGE
16	RECEIVALS TRENCHES Nos 1 & 2
17	SCREENS
18	SCREEN CONVEYOR
19	GRIT CLASSIFIER AND HYDROCYCLONE
20	RECLAIMED EFFLUENT WASHDOWN
21	DRIVE-THRU BAY RECEIVALS POINT
22	OFF SPEC RETURN TO TANKER POINT
23	SCREENINGS SUMP
24	SLUDGE STORGE SUMP
25	DEWATERED SLUDGE DISTRIBUTION CONVEYOR
26	ODOUR CONTROL UNITS ON ROOF

IWTP AT FORRESTDALE GENERAL ARRANGEMENT

FIGURE 4.3

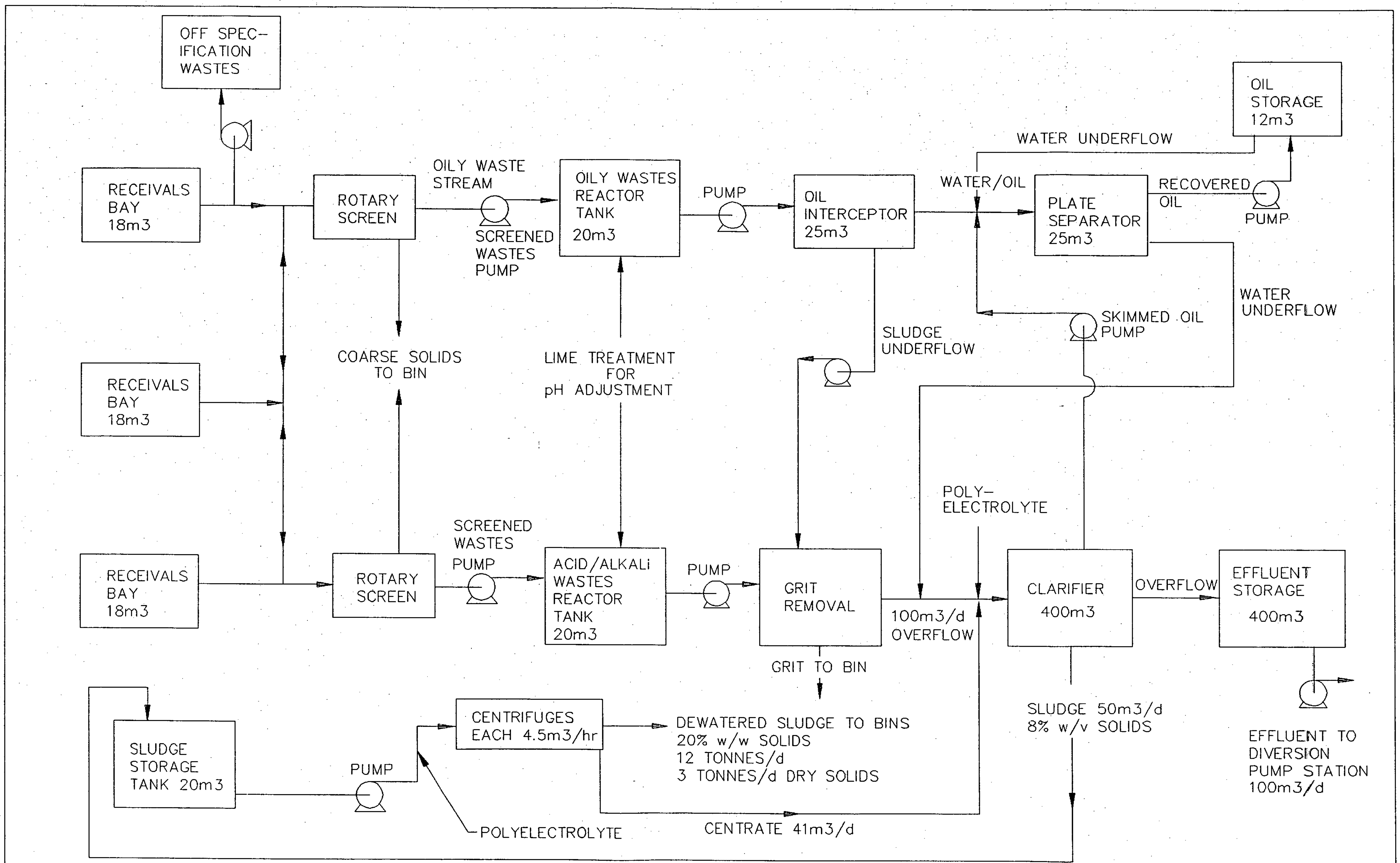


FIGURE A.1

SCALE	N.T.S.
DATE	4.5.89
DRAWN	EWC
CHECKED	RG
DESIGNED	RG

SINCLAIR KNIGHT & PARTNERS
CONSULTING ENGINEERS K0093

CLEANAWAY

INDUSTRIAL WASTE TREATMENT PLANT AT FORRESTDALE – BLOCK DIAGRAM

DRG. No. 90288-P-004 REV. A

A1 REFERENCE DRAWING TITLE | DRG. No. | REV | DATE | REVISIONS | MADE | CKD | APP | REV | DATE | REVISIONS | MADE | CKD | APP | NORTH

APPENDIX D

ENVIRONMENTAL PROTECTION AUTHORITY GUIDELINES FOR THE PER

DRAFT GUIDELINES FOR THE PUBLIC ENVIRONMENTAL REPORT ON THE PROPOSED INDUSTRIAL LIQUID WASTE DISPOSAL PLANT

The guidelines identify issues that should be addressed within the Public Environmental Report (PER). They are not intended to be exhaustive and the proponent may consider that other issues should also be included in the document.

The PER is intended to be a brief document; its purpose should be explained, and the contents should be concise and accurate as well as being readily understood by interested members of the public. Specialist information and technical description should be included where it assists in the understanding of the proposal. It may be appropriate to include ancillary or lengthy information in technical appendices.

Where specific information has been requested by a Government Department or the Local Authority, this should be included in the document.

1. SUMMARY

The PER should contain a brief summary of:

- salient features of the proposal;
- alternatives considered;
- environmental aspects of transport of liquid waste to the proposed site;
- description of receiving environment, if any, and analysis of potential impacts and their significance;
- environmental monitoring and management programme, safeguards and commitments; and
- conclusions.

2. INTRODUCTION

The PER should include an explanation of the following:

- identification of proponent and responsible authorities;
- background and objectives of the proposal;
- brief details of and timing of the proposal;
- relevant statutory requirements and approvals; and
- scope, purpose and structure of the PER.

3. NEED FOR THE PROPOSAL AND RELEVANCE TO UPGRADING REGIONAL WASTE DISPOSAL

The PER should examine the justification for the proposal, especially in its relationship to the development on the existing site. Broad costs and benefits of the proposal at local and regional levels could also be discussed.

The PER should include the relevance of the proposal to upgrading and managing regional waste disposal including Coogee liquid waste/effluent.

4. EVALUATION OF ALTERNATIVES

A discussion of alternative sites and scales (sizes) of the proposal should be provided and should be presented to justify the proposed site and size selection.

5. PROPOSED LOCATION

The preferred location is to be described, including:

- cadastral information;
- adjacent land uses, including urban;
- location of structures, etc. on the site;
- location of structures to be built on the site; and
- provision of services, including drainage.

6. TRANSPORT OF LIQUID WASTE TO PROPOSED SITE

The issue of transport w.r.t. environmental impacts in the event of spillage should be outlined as follows:

- nature of liquid waste;
- integrity of the transport containers w.r.t. spillage;
- any pretreatment of liquid waste before transport;
- emergency plans proposed to cope with spillages; and
- use of road versus rail transport for toxic waste disposal; eg. cyanide waste.

7. PROCESS DESCRIPTION

There should be a clear description of each stage of the waste water treatment process using diagrams where appropriate. An indication of the ultimate capacity of the plant should be provided. Operational times should also be outlined.

8. EFFLUENT TREATMENT AND DISPOSAL

The PER should discuss the treatment and disposal of effluent from the plant and include:

- a description of the nature of the waste and effluent, including volume and composition;
- a description of the treatment of the waste and effluent, including the design basis used to determine the size of each component of the treatment process and the rationale for selection of the particular treatment process;
- a review of alternative effluent disposal methods and strategies considered, leading to the rationale for the selected option;
- a description of the method of disposal of the treated waste and effluent, including the frequency of disposal, location of disposal and composition of effluent after final treatment;
- an indication of the ultimate volume of waste and effluent to be treated and disposed;
- a description of the quality control employed to ensure compliance with decision-making authorities;
- an outline of any backup treatment, storage and disposal systems if necessary; and
- disposal of solid waste off-site.

9. SITE AND EFFLUENT IMPACTS AND MANAGEMENT

Having described the proposed treatment and disposal of effluent, it is important to identify likely impacts on the environment, including implications to surrounding land users, and to indicate approaches that will be adopted to ameliorate and manage the identified impacts. Issues that should be addressed include:

- procedures to be adopted in the event of plant or effluent disposal system breakdown;
- procedures used to ensure that the effluent disposal system operates efficiently and effectively;
- methods of ensuring that other potential environmental problems such as noise and odour factors, are minimised and managed; and
- consideration of related site management, such as stormwater disposal, security, safety, etc.

10. MONITORING

The effluent treatment and disposal system may require monitoring to ensure that contaminated water does not leave the site to either adjacent properties or groundwater.

11. CONCLUSION

12. GUIDELINES

A copy of these guidelines should be included in the document.

13. REFERENCES

All references should be listed.

14. APPENDICES

Where detailed technical or supporting documentation is required, this should be placed in appendices.

15. COMMITMENTS

Where an environmental problem has the potential to occur, the proponent should cover this potential problem with a commitment to rectify it. Where appropriate, the commitment should include (a) who will do the work, (b) what is the work, (c) when the work will be carried out and (d) to whose satisfaction the work will be carried out.

16. HOW TO MAKE A SUBMISSION

As this document will be a PER, a brief note regarding 'how to make a submission to the Environmental Protection Authority' should be presented at the front of the document.

APPENDIX E

GLOSSARY OF TECHNICAL TERMS USED IN THIS REPORT

APPENDIX E - GLOSSARY OF TECHNICAL TERMS USED IN THIS REPORT

acids/alkalis: compounds that produce hydrogen or hydroxide ions respectively in water. They can be highly reactive and corrosive depending on the strength of the acid or alkali in solution.

activated sludge: biological solids (biomass) composed of microorganisms (bugs) which are encouraged to grow in high concentrations in an aerated basin to feed on organic pollutants in sewage.

aerosols: vapours or mists of solutions that are emitted from zones of turbulence or splashing and can spread through wind transportation over considerable distances if not adequately contained.

air changes/hour: a measure of the number of times a given volume of air such as in a building, is exchanged through extraction and replacement in one hour (used to size ventilation systems).

batch treatment: a process in which a fixed volume of waste is treated and then discharged before accepting the next volume or batch for treatment.

biological wastes: wastes that are capable of conversion to stable end products by the action of living microorganisms feeding on organic matter in the waste.

BOD, BOD_5: biological oxygen demand - a measure of the oxygen required by microorganisms to biologically convert organic pollutants present in a waste to stable end products. The BOD_5 test is a standard laboratory method to determine the oxygen demand over a 5 day period.

buffer capacity: the capacity of a plant to store influent waste prior to treatment and discharge or after treatment and prior to discharge.

bund: a wall surrounding a tank or other liquid holding structure to contain and prevent escape of liquid spilled from the structure.

cake: sludge that has been dewatered to a state of dryness that enables it to be easily handleable for transportation and disposal.

cake solids concentration: a measure of the dryness of the cake; the higher the concentration of solids, the lower the moisture content of the cake.

centrate: liquid that has been separated from sludge in a centrifuge in a dewatering process.

clarifier: a tank in which solids in suspension are encouraged to settle out under gravity and leave a clear or clarified solution in the upper layer of the solution.

COD: chemical oxygen demand - a measure of the oxygen required to chemically oxidise compounds in a solution. It is a standard laboratory test that is quicker and easier to perform than the BOD_5 test.

cracking of emulsions: a means of treatment causing minute particles of oil and grease in a solution to come together and form larger globules that can be removed, usually by floating to the surface of the solution.

decant: to pour off, usually the clarified portion of a settled liquid from a vessel.

decanter solid bowl centrifuge: an enclosed high speed spinning device for separating solids suspended in a liquid by centrifugal force. The separated solids are removed as a cake from one end of the machine and the excess liquid as centrate the other end.

dedicated process line: a pipeline which is used exclusively for conveying fluids to or from a particular process.

degritting: removing of hard, coarse particles such as sand grains which could cause abrasion and wear on machinery and pipes.

dewatered sludge: a solids/liquid mixture that has had excess moisture removed to a point where it can be stockpiled and handled without flowing.

DSM screens: curved screens made of wedgewire down which a liquid flows causing solids to be rejected while the liquid passes through for collection.

duty/standby: a control facility that allows for automatic or manual changeover from the selected drive to a spare or standby drive in the event of failure of the selected drive.

emergency lock-off-stop: a push button stop switch that will stop the drive in circuit immediately; located near to the drive motor; can be padlocked in the off position for safety during maintenance.

equilibrium: a state of balance of energy; in chemical terms this means that a reaction and its reverse are proceeding at the same rate in a given process.

floc formation: the process whereby particles in suspension are encouraged to or naturally come together and form aggregations or clumps of solids that will separate from the suspension normally by settlement.

grit: hard solid particles such as sand grains, normally bigger than 100 microns, that can abrade or otherwise damage mechanical equipment when present in liquid waste.

grit screw classifier: a device which removes grit above a certain size from liquid wastes with a cleansing action.

hazardous: dangerous to health or the environment; classified in various categories in the Australian Dangerous Goods Code.

heavy metals: a general term describing metals of high atomic weight, such as mercury, cadmium, lead, etc., generally damaging to the environment if present in solution in more than trace concentrations in receiving waters.

hydrocyclone: a device which separates materials of different specific gravity in a solution; used to separate grit from a liquid by centrifugal action.

hydroxides: compounds of metals (mainly basic) formed in alkaline solutions; generally insoluble, they settle under quiescent conditions in clarifiers.

intractable: not easily treated to a safe, stable condition. Requires very special methods to destroy or dispose of. Intractable materials include PCB's, organochlorine pesticides and some radioactive substances.

intrinsically safe equipment: equipment that is designed and built to be safe under any potentially hazardous operational conditions, normally used to describe electrical equipment that will not spark or cause a flammable or explosive substance to ignite.

kL: kilolitre or 1000 litres.

lanyard switch: an emergency pull wire or rope near to a machine that stops the drive when pulled; normally required along side conveyors.

lime putty: a form of lime solution formed by slaking quicklime; highly alkaline.

lime slurry: lime in solution, generally formed by dissolving hydrated lime powder in water; highly alkaline.

lime stabilisation: a process of stopping all biological activity in a liquid waste by the addition of lime slurry.

ML: megalitre or one million litres.

neutralisation of acids, alkalis: treating acids with alkalis and alkalis with acids to produce non-reactive salts.

particulate: solid particles; eg. particulate hydroxides of metals are fine particles which slowly settle from solution to form sludge sediments in a clarifier.

PBT mixer: pitch blade turbine mixer - usually suspended from the top of a tank with a long hanging shaft and a 3 or 4 blade impeller at the end to produce an axial flow mixing action in the tank.

pH: a measurement of the concentration of positively charged hydrogen ions in a solution; used to indicate the extent to which the solution is acid or alkaline; the logarithmic scale ranges from 0 to 14 with strong acids at the low end and strong alkalis at the high end. Neutral pH is 7.

physical-chemical process: a process in which chemical agents are utilised to enhance a physical reaction, such as the use of polyelectrolyte in a solution to cause agglomeration and settlement of suspended solids from the solution.

polluting plume: an advancing front of a polluting substance through a medium, such as wastewater seeping into the ground and spreading away from the point of entry by gravity flow or transported by prevailing groundwater movement.

polyelectrolyte flocculant: chemicals (usually inert) that form long chain polymers in solution in water which attract suspended solids, to form flocs that are heavy enough to settle.

polymer batching: the process of making up a solution of polyelectrolyte in water for dosing into the waste liquid in the treatment process.

positive displacement pump: a pump that forces liquid along a pipeline at a constant rate irrespective of pressure variations - commonly used in dosing applications.

potable water make-up: a standby supply of potable water to fill a vessel in the event of the regular feed (usually reclaimed effluent) not being available.

ppm: parts per million; describes the concentration of a substance in a solution, usually water; equivalent to milligrams per litre (mg/L).

precipitate: solid particles of an insoluble salt formed in a reaction which can be removed from solution by physical treatment methods, such as settlement.

primary treatment area: the area of the Plant where the waste is dosed with lime and treated to remove oils and grit.

programmable logic controller (PLC): an electronic microprocessor which is programmed with the necessary sequences and functions to control and monitor the Plant machinery and process operation.

quick release coupling: a coupling in a pressure pipeline which can be rapidly made or broken by an operator; normally used for connecting a hose to a pipeline or a pump.

reaction vessel: a tank in which a liquid is dosed and mixed with a chemical reagent to produce a reaction such as precipitation, neutralisation, oxidation.

reclaimed effluent: liquid waste that has been treated to a standard suitable for reuse in the process; usually taken from the final clarifier prior to discharge.

roll-on/roll-off bin: a transportable bin with rear rollers that is winched onto a truck and can be tipped to discharge its contents. It is normally left in position beneath the discharge point of a conveyor and loaded and carted away when full.

rotary drum screen: a rotating cylindrical screen which is fed at one end with liquid waste and traps coarse solids inside the mesh cage while allowing fine solids and the liquid to pass through. The coarse solids are moved to the opposite end and rejected.

screenings: coarse solids removed on a screen. Typically liquid waste contains rags, fibre, cans, stones and other solids that cause problems of clogging in pipes and equipment if not removed on a screen early on in a treatment plant.

secondary (final) clarifier: a large volume long retention vessel which holds a liquid containing settleable solids for long enough to allow the solids to settle to the base from which the sludge can be removed by scrapers; clarified effluent overflows at the surface.

septage: contents of septic tanks, leach drains, sullage tanks.

sludge: a layer of solids and liquid that settles from a solution or mixture to form a more concentrated solids-liquid medium at the bottom of a tank.

supernatant: the layer of liquid that lies above settled sludge in a vessel.

suspended solids: solid particles in a liquid that do not readily settle to the bottom, or float to the top of a vessel.

trash rack: a bar screen or grid with large openings (50 to 75mm), to intercept gross solids at the point of discharge from tankers and prevent damage to downstream equipment.

variators: manually adjusted speed control devices, often installed on pumps to allow the operator to vary the flow rate of the pumped fluid.

wedgewire: a special slotted screen fabricated from wedge shaped wire which is superior in its non-clogging properties than normal mesh or perforated plate screens.

w/w: weight for weight; used to define the form in which solids concentration in a liquid is to be expressed.