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EIS/REFINERIES
– KURNELL

EFFLUENT IMPROVEMENT PROJECT REVIEW OF ENVIRONMENTAL FACTORS

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EFFLUENT IMPROVEMENT PROJECT

Review of Environmental Factors

Prepared for:

Ampol Refineries (NSW) Pty Ltd
Locked Bag 2000
Taren Point NSW 2229

Telephone: (02) 9668 1670; Facsimile: (02) 9668 1688

Prepared by:

Kinhill Engineers Pty Ltd
ACN 007 660 317
Level 9, 201 Kent Street, Price Waterhouse Tower,
SYDNEY NSW 2001
Telephone (02) 9911 0000, Facsimile (02) 9241 2900

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SE6058-001 Rev 6

LIMITATIONS STATEMENT

This Review of Environmental Factors (REF) has been prepared in accordance with the scope of services set out in the contract between Kinhill Engineers Pty Ltd (Kinhill) and Ampol Refineries (NSW) Pty Ltd ('the Client'). To the best of Kinhill's knowledge, the proposal presented herein represents the Client's intentions at the time of printing of the REF. However, the passage of time, manifestation of latent conditions or impacts of future events may result in the actual project and its impact differing from that described in this REF. In preparing this REF, Kinhill relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations referenced herein. Except as otherwise stated in this REF, Kinhill has not verified the accuracy or completeness of such data, surveys, analyses, designs, plans and other information.

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GLOSSARY

IAF	induced air flotation
REF	Review of Environmental Factors
API	American Petroleum Institute
DCS	Distributed Control System
FEED	front end engineering design
OMC	Oil Movement Centre
P&IDs	piping and instrumentation diagrams
Effluent	liquid waste
ALOR	Australian Lubricating Oil Refinery
ARN	Ampol Refineries (NSW) Pty Ltd
BOD	biochemical oxygen demand
NFR	non-filterable residue
EPA	Environment Protection Authority
MH	manhole

EXECUTIVE SUMMARY

An effluent improvement project is proposed to be implemented at Ampol's Kurnell refinery in response to NSW Environment Protection Authority requirements. The main features of the proposal are summarised as follows:

- it would provide biological treatment of oily water in average dry weather flow conditions plus a safety factor for additional flows;
- the proposed effluent improvement system would handle oily water flows relating to events up to the 1 in 10 year storm;
- the system would have an equalisation capability of 24 hours;
- the system would have a diversion capability of 40 ML or eighteen hours of storm flow.

The flow paths would be carefully balanced in accordance with weather conditions and status of elements in the treatment process.

The project would result in improved effluent quality that is discharged to the ocean. This may result in long term benefits for aquatic ecosystems near the discharge locations. The proposal is also expected to result in a minor decrease in noise emissions from the refinery due to the upgrade and improvement in plant equipment to be installed. Other impacts such as vehicle movements and those on soils, groundwater, visual amenity, air quality, and terrestrial flora and fauna would be negligible.

There may be some impact on odour as a result of the proposal. It is expected that the biotreater will produce a more 'organic' odour rather than 'chemical' odour typical of oil refineries. This different odour may not be offensive, but may be noticeably different to workers and local residents.

Relocation of the oily sludge holding bays in the south-east portion of the refinery would reduce odour in the vicinity of the proposed plant. However, treatment of spent process caustic at the proposed plant has the potential to generate odours. Odour monitoring would be performed and if there are significant odours related to the spent caustic, amelioration measures such as pre-treatment using hydrogen peroxide would be implemented.

Consultation with the community and other stakeholders will be ongoing.

1 PROJECT BACKGROUND

Growing environmental awareness by the community and government representatives has led to increasingly stringent regulatory requirements being placed on industry and others. The NSW Environment Protection Authority (EPA) is the principal regulatory body in NSW and is responsible for pollution control. EPA requirements typically include pollution control approvals and licences under legislation such as the *Pollution Control Act 1970, Clean Waters Act 1970* and *Clean Air Act 1961,* as well as broader environmental improvement strategies.

In May 1994, the EPA issued a legal notice under section 17D(3) of the *Pollution Control Act 1970* outlining the requirements for an effluent improvement plan to be established by Ampol Refineries (NSW) Pty Ltd at its Kurnell facility. The facility comprises two refineries which are as follows:

- Ampol Refineries (NSW) Pty Ltd (ARN), which produces fuel products;
- Australian Lubricating Oil Refinery Ltd (ALOR), which produces lubricating oil basestocks.

For the purpose of this report, ARN and ALOR are jointly referred to as 'the refinery'. The study area and site location of the Kurnell refinery are shown in Figures 1.1 and 1.2 respectively.

Since 1994, Ampol has conducted a series of studies to satisfy the EPA's requirements for effluent improvement at the Kurnell refinery. Ampol commissioned Davy John Brown Pty Ltd from August 1994 to August 1995 to:

- investigate pollution source control measures for streams entering the refinery oily water sewer;
- characterise the oily water in the sewer;
- conduct a pilot plant study to determine the treatability of the oily water;
- determine technology options for oily water treatment.

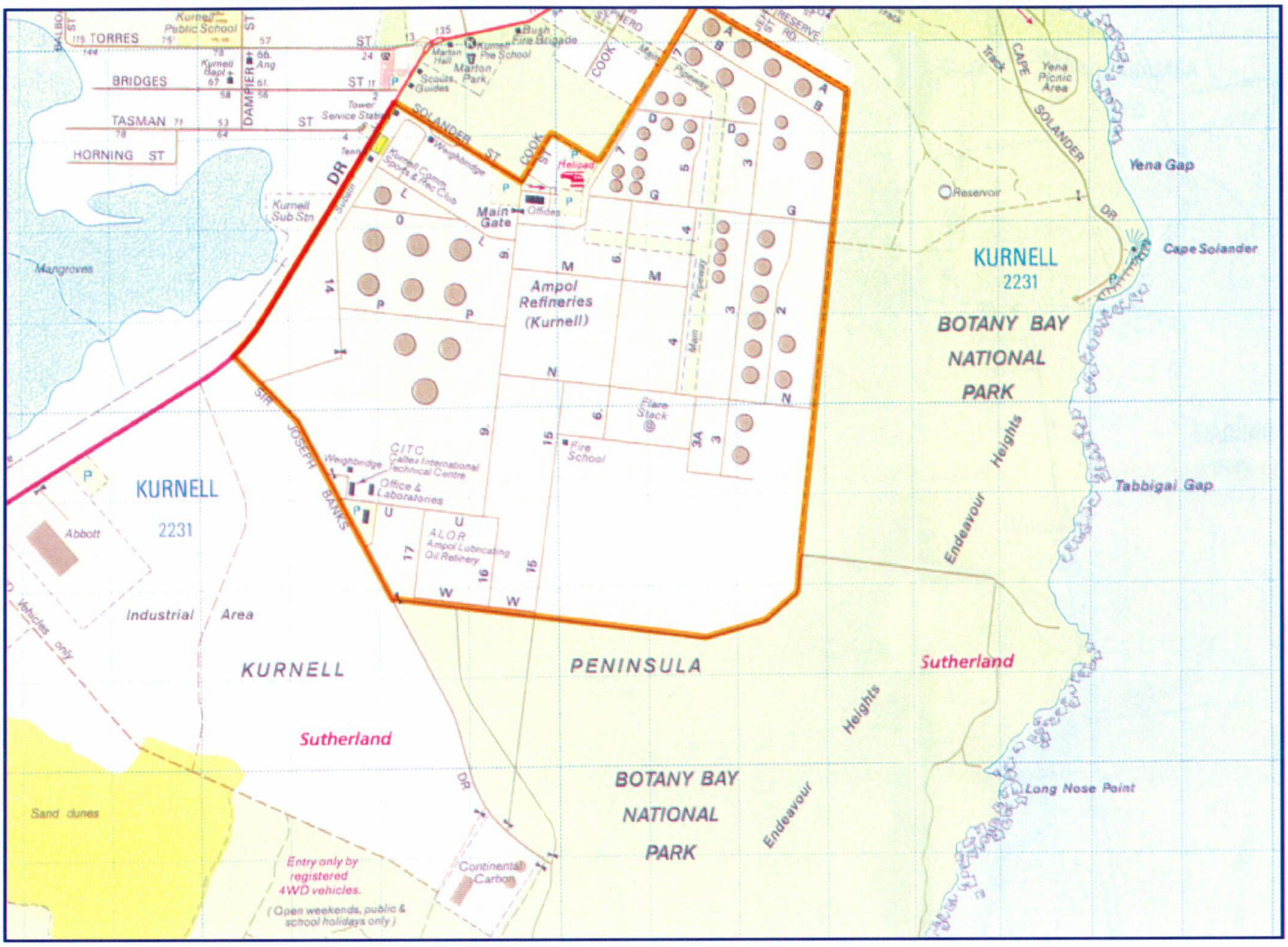


Figure 1.1

STUDY AREA

SOURCE: SYDWAYS

AMPOL EFFLUENT TREATMENT PROJECT

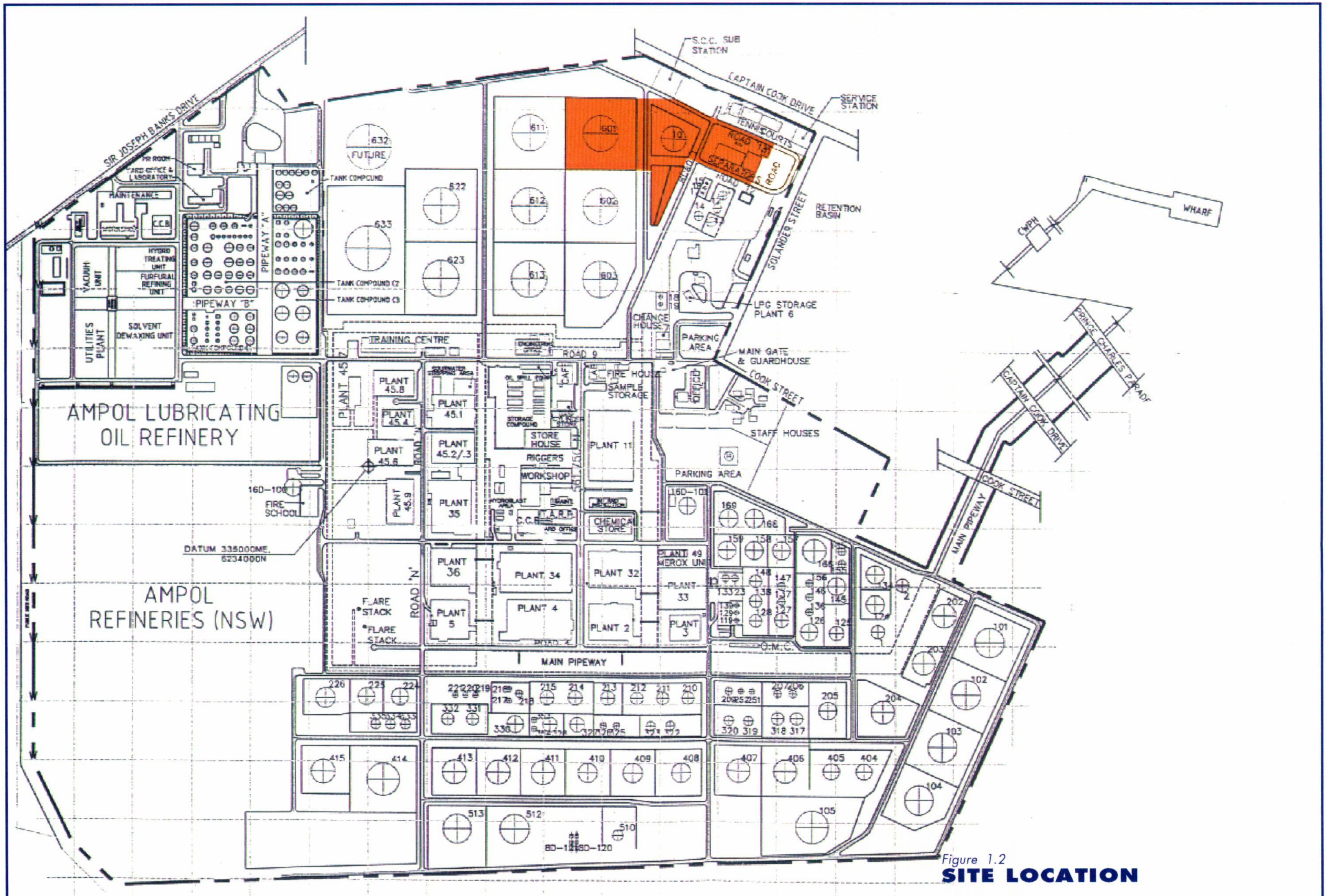


Figure 1.2
SITE LOCATION

AMPOL EFFLUENT TREATMENT PROJECT

The results of the pilot plant study and the characteristics of the oily water determined that biological processes could be used to treat the refinery oily water to prescribed compliance limits. Biological processes involve the breakdown of organic material by either aerobic or anaerobic organisms. Aerobic organisms require oxygen to break down the waste whereas anaerobic organisms do not.

Design information was also obtained from this work. Activated sludge technology was selected after evaluation and costing of seven alternative processes. Activated sludge technology involves the biological breakdown of organic material by aerobic (oxygen utilising) organisms.

ENSR Consulting and Engineering was commissioned in September 1995 to produce a front end engineering design of the proposed activated sludge plant. While this study was being performed, Ampol determined what modifications would be required to the existing effluent treatment facilities to give reliable and consistent input to the proposed activated sludge plant. The study also identified requirements for flow diversion and treatment taking into account the capacity limits of the proposed activated sludge plant.

The proposed oily water treatment system was presented to the EPA in November 1995. The submission included block flow diagrams and a process description of the proposed primary plant modifications and activated sludge plant.

A capital investment application for funding of the front end engineering of the effluent improvement project was submitted to Ampol management in April 1996. The application was based on work completed during the feasibility design. Review of the application led to a management request for the development of an option which would significantly reduce the total project cost. A design review meeting was held in May 1996, during which capital cost reduction ideas were identified.

A description of the revised design was provided to the EPA for consideration. Correspondence between Ampol and the EPA in October 1996 clarified a number of issues that resulted from the change in design. The EPA advised that it is satisfied that the conceptual design for the proposed improvements and significant upgrades to the existing oil water treatment system complies in principle with its requirements.

While ENSR proceeded with the front end engineering design, Ampol engaged Kinhill Engineers Pty Ltd (Kinhill) to prepare a review of environmental factors (REF). The REF assesses the potential environmental impacts associated with the proposed effluent improvement project. The design report and REF form the basis of an application to the EPA for Pollution Control Approval. They will also accompany a Development Application to be submitted to Sutherland Shire Council for consideration under Part 8, Section 82 of the *Environmental Planning and Assessment Act 1979*.

2 DESCRIPTION OF PROPOSAL

2.1 LIQUID WASTE SYSTEMS

The Kurnell refinery has three systems for the treatment and disposal of liquid waste:

- oily water sewer
- intermediate sewer
- stormwater.

These are collectively known as the wastewater system. The relevance of various elements of the wastewater system to this REF is examined in this section. An overview of the oily water sewer system is provided in Section 2.2.

The proposed effluent improvements only relate to the oily water sewer system. Inputs to the oily water system include oily water effluent from processes within the refinery plus rainfall that becomes contaminated when it falls on the process plant and equipment.

The intermediate sewer system is not assessed in this REF because it would not be affected by the proposed improvements. The intermediate sewer system deals with process cooling water which means that it involves extraction of water from Botany Bay which is used in heat exchangers to control the temperature of the process. The effluent is discharged to Botany Bay after passing through an open separator in case minor contamination has occurred due to leakages by plant or equipment.

The stormwater system takes rainfall runoff from relatively clean areas such as roads and building roofs. Stormwater then passes through interceptor pits and straw bales which act as final filters before being discharged to Botany Bay. This system is not examined further in this REF.

2.2 THE OILY WATER SEWER SYSTEM

This section examines the existing oily water system and the proposed changes to the treatment facilities. Oily water is currently collected, treated and discharged according to which part of the refinery it originates. Oily water from ARN currently receives treatment in API separators and induced air flotation (IAF) units prior to discharge into the ocean at Yena Gap. Oily water from ALOR is treated in API separators prior to discharge at Tabbigai Gap.

The proposed effluent treatment system would accept oily water from both ARN and ALOR. The combined effluents would be discharged to Yena Gap. Tabbigai Gap would only take oily water flows from ALOR when it rains and would take septic flows continuously.

The EPA imposed new licensing requirements on the refinery discharge as part of an effort to improve water quality in the area surrounding the outfall. These requirements were identified in the 1994 effluent improvement plan. Proposed improvements to the existing treatment facility to meet the requirements include the addition of a new biotreatment unit which would provide secondary (biological) treatment for the oily water flow from both ARN and ALOR.

Improvements to the existing oily water treatment system would include increased capacity for diversion of contaminated runoff for treatment following a storm, improvements to oil/water separation equipment, flow and composition equalisation, automatic pH control and the addition of a biotreatment system. Process flow and block diagrams of the proposed process are given in Appendix A and a list of existing and proposed equipment is given in Appendix B.

2.3 EFFLUENT LIMITATIONS

Ampol's Kurnell refinery is licensed by the EPA to discharge certain flows, and concentrations of biochemical oxygen demand (BOD), non-filterable residue (NFR) or total suspended solids, phenolics, oil and grease, pH and temperature. The total effluent discharge flowrate at Yena Gap is limited to 16,500 m^3/day, which effectively limits the potential total mass of pollutants that can be discharged. During wet weather the total effluent flowrate can exceed 16,500 m^3/day without violation of current discharge conditions.

Existing and proposed EPA limits for various pollutants are listed in Table 2.1. The effluent improvement plan criteria take effect in 1998 and are provided in the table. All limits shown apply to dry weather conditions when the maximum flow is 16,500 m^3/day. The effluent improvement programme will aim to reduce the mass of organic compounds discharged in general, and the following compounds in particular:

- Naphthalene
- Phenanthrene
- Bis-(2-ethylhexyl)phthalate
- Benzene
- Toluene
- Ethyl Benzene
- 2,4-dimethylphenol.

2.4 PROPOSED TREATMENT PROCESSES

The three major elements of the proposed oily water treatment process are the biotreater, bypass routes (IAF Nos 1&2) and storage (tank 601). These are listed in Table 2.2 with their treatment capacities. There would be four different flow paths through the treatment system depending on the total inflow rate and the availability of volume for surge accumulation. Schematic diagrams of the four possible flow paths are shown in Figures 2.1(A-G) with the path number indicated as a triangular symbol. A simplified description of each of the four proposed flow paths is provided below based on ENSR (1996).

Table 2.3 depicts the different treatment paths applicable to different flowrates. The treatment paths represent a process continuum rather than separate approaches for oily water control. Characteristics of the proposed biotreatment system are listed in Table 2.4.

Table 2.1 **Existing and proposed limits for pollutants**

Parameter	50th percentile limit	Other limits
Existing		
NFR (mg/L)	35	
BOD (mg/L)	350	
Phenolics (mg/L)	2	
Oil and grease (mg/L)	5	
pH (allowable range)		6.5 - 8.5
Temperature (maximum °C)		40
Visible oil and grease		nil
Proposed (µg/L)		
Phenol	300	
polyaromatic hydrogens	30	
Ammonia	6,000	
Arsenic	70	
Nickel	30	
Lead	25	

Source: ENSR 1996

Table 2.2 **Major elements of treatment train**

Treatment train	Treatment capacity (m^3/day)
Primary oil/water separation (4 API separator bays)	40,000
Secondary oil/water separation (new IAF)	14,200
Storm flow oil/water separation (IAFs 1&2)	24,000
Biotreatment (normal operation)	11,700
Biotreatment (storm flow)	14,200

Source: ENSR 1996

Table 2.3 **Flowrates and treatment flow paths**

Flowrate (m^3/day)	Tank 601 level	Treatment flow path
0 to 11,700	low/high	0 to 1700 via flow path 1
11,700 to 22,000	low	11,700 via flow path 1 0 to 10,300 via flow path 2
11,700 to 22,000	high	11,700 via flow path 1 0 to 10,300 via flow path 3
22,000 to 40,000	low	11,700 via flow path 1 10,300 to 18,300 via flow path 2 0 to 10,000 via flow path 4
22,000 to 40,000	high	11,700 via flow path 1 10,300 via flow path 3 0 to 18,000 via flow path 2
40,000 to 60,000	low	11,700 via flow path 1 28,300 via flow path 2 0 to 10,000 via flow path 4
40,000 to 60,000	high	11,700 via flow path 1 10,300 via flow path 3 18,000 via flow path 2 0 to 20,000 via flow path 4 (Ultimately to Tank 601 bunded area)

Source ENSR 1996

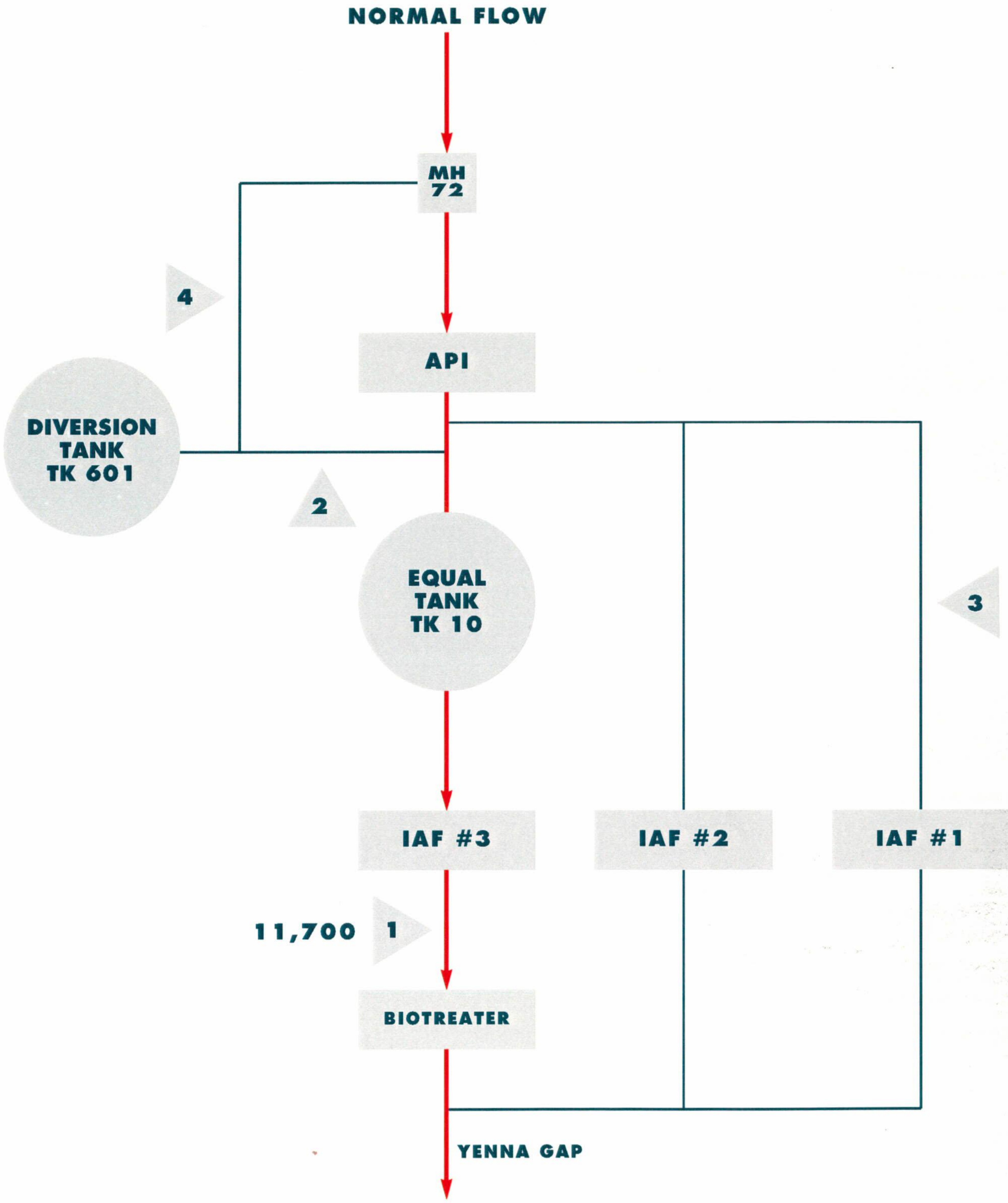


Figure 2.1(A)

NORMAL FLOW
0 TO 11,700 ML/DAY

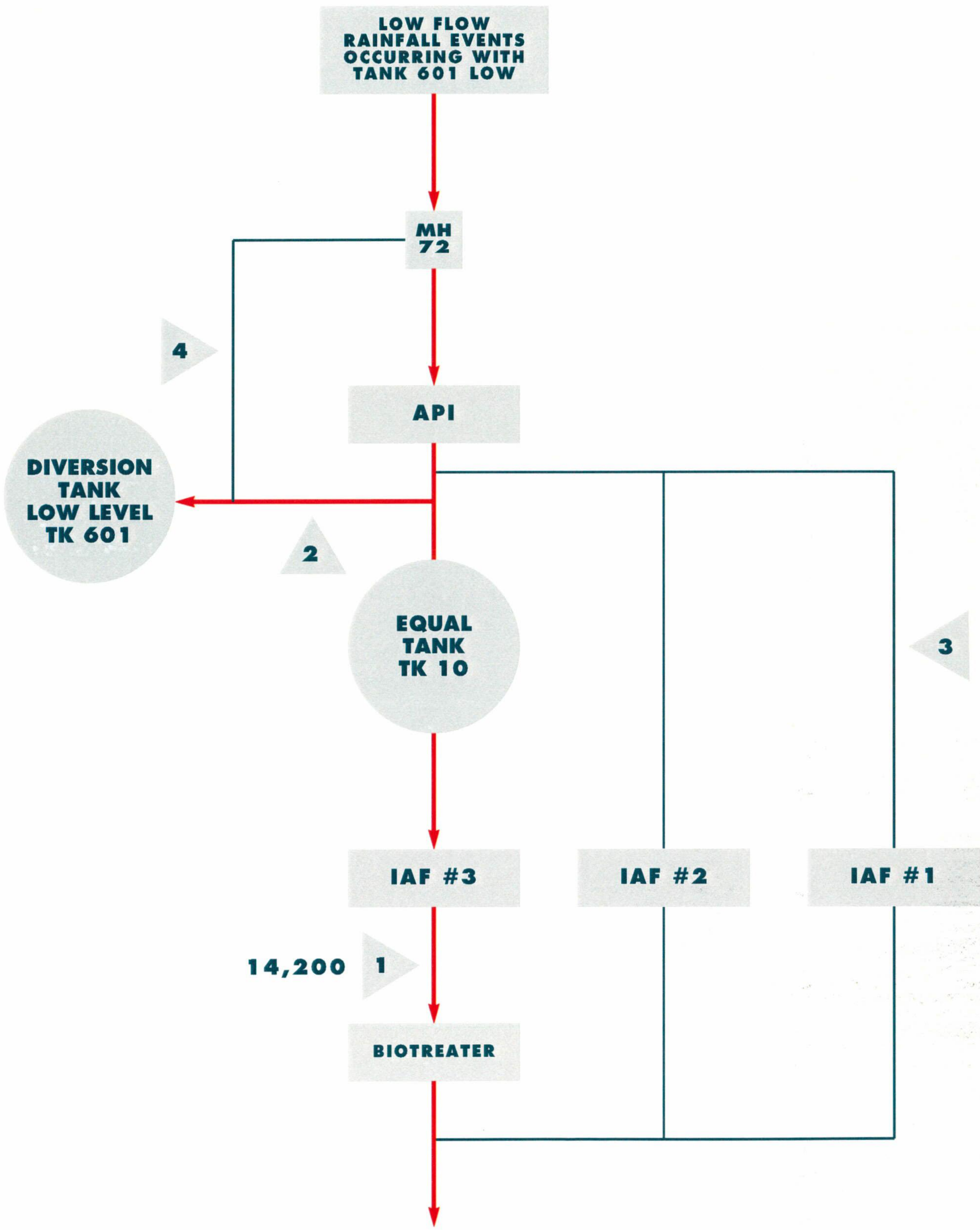


Figure 2.1(B)

11,700 TO 22,000 ML/DAY(TANK 601 LOW)

AMPOL EFFLUENT IMPROVEMENT PROJECT REF

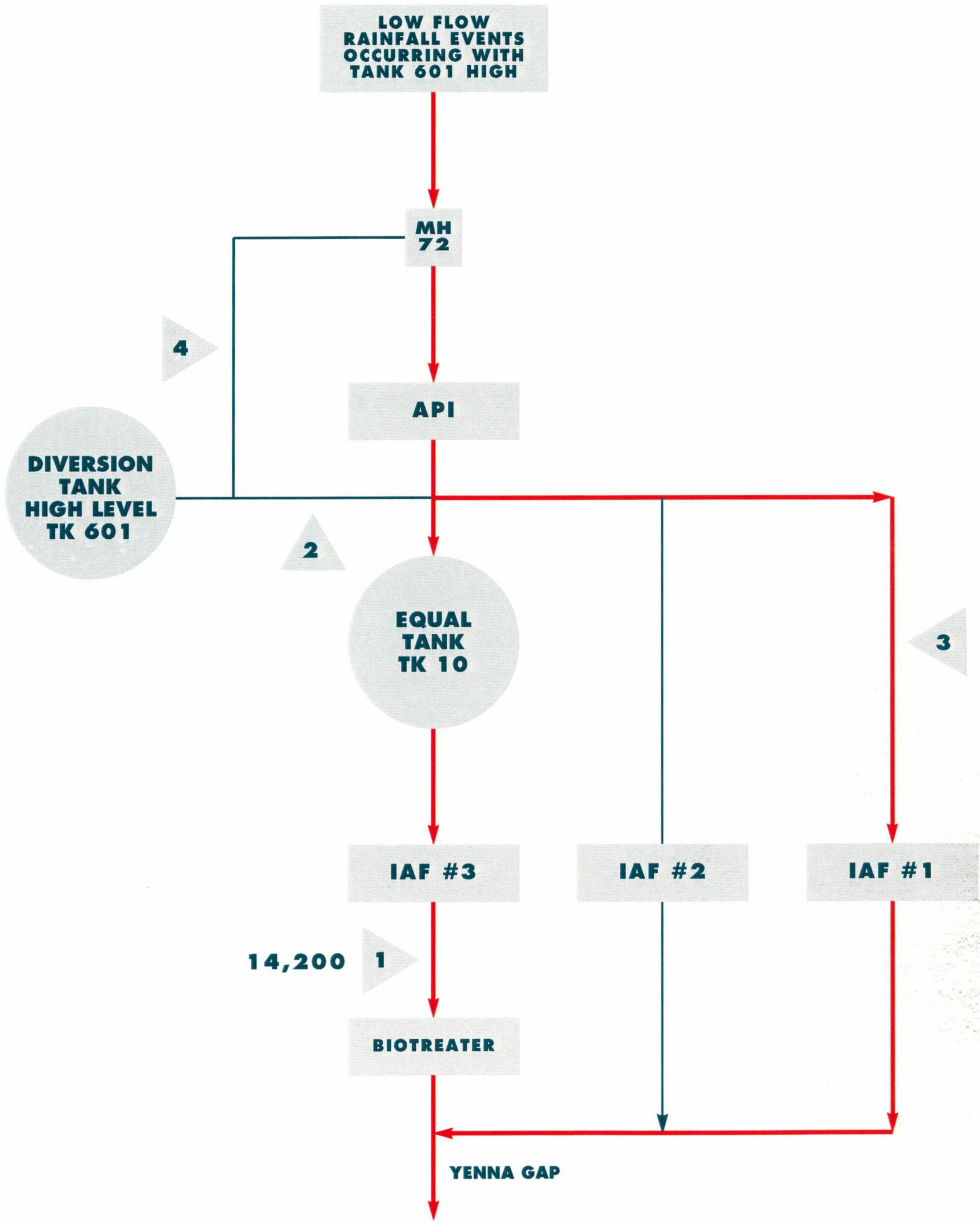


Figure 2.1(C)
11,700 TO 22,000 ML/DAY (TANK 601 HIGH)

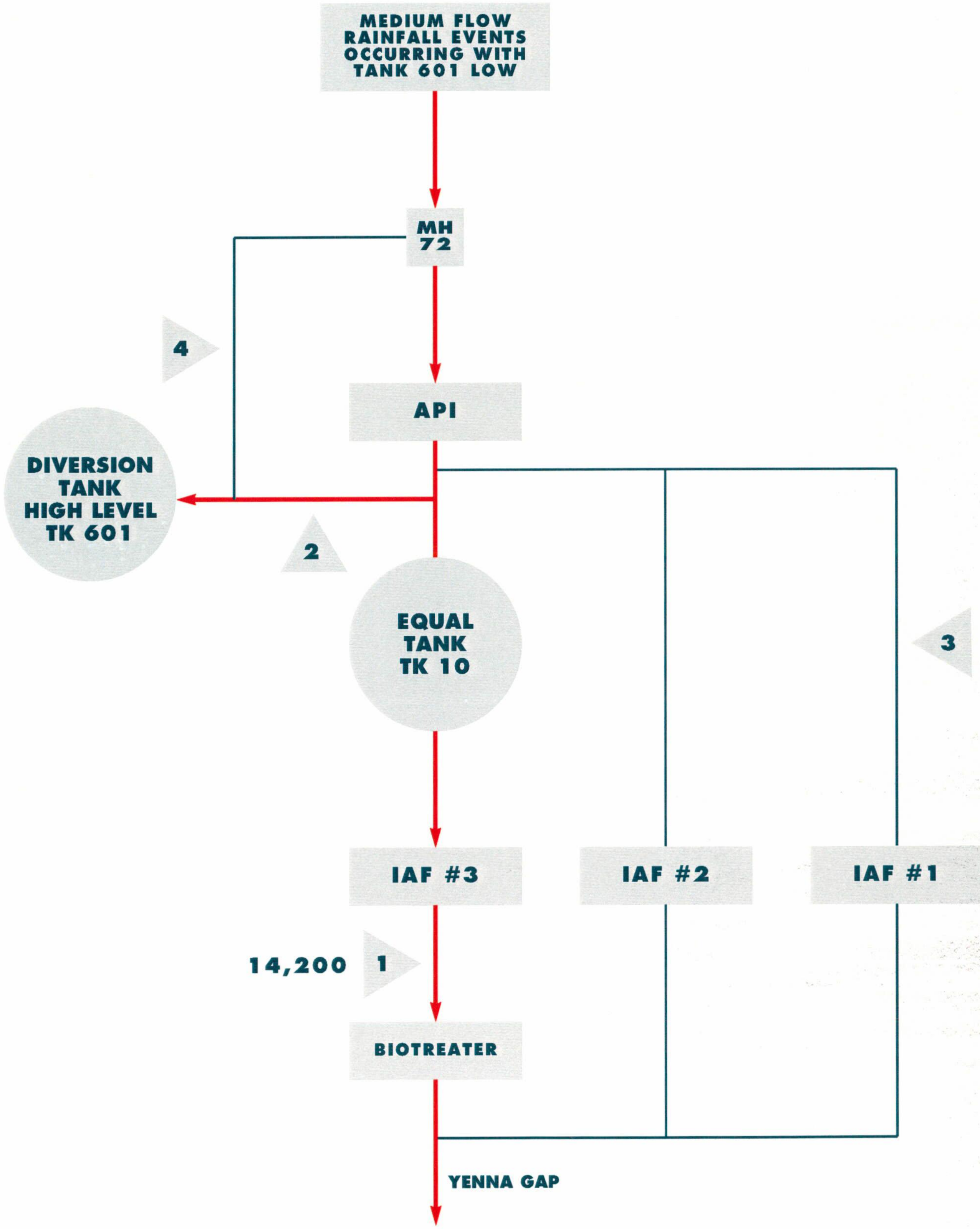


Figure 2.1(D)

22,000 TO 40,000 ML/DAY (TANK 601 LOW)

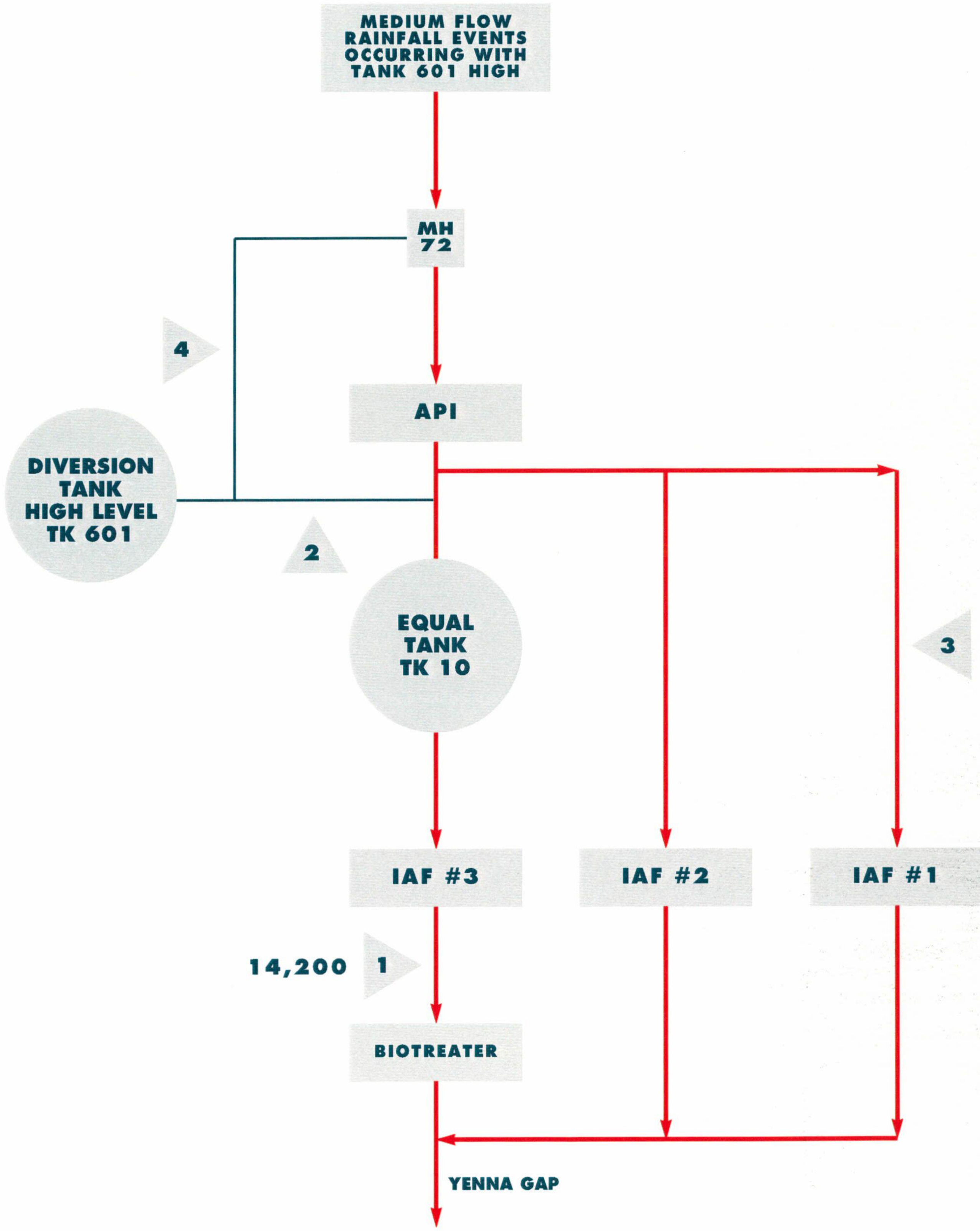


Figure 2.1(E)

22,000 TO 40,000 ML/DAY (TANK 601 HIGH)

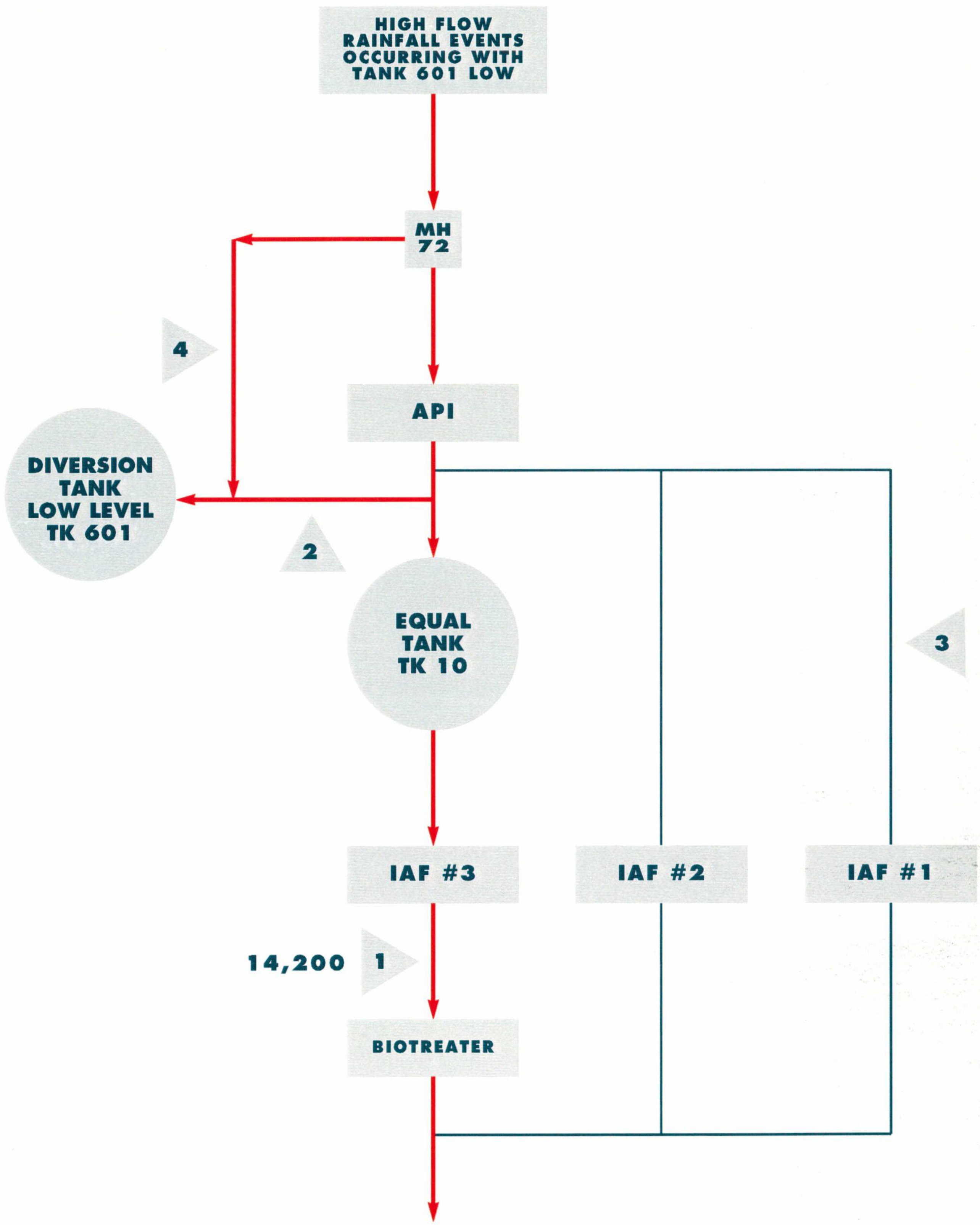


Figure 2.1(F)
40,000 TO 60,000 ML/DAY (TANK 601 LOW)

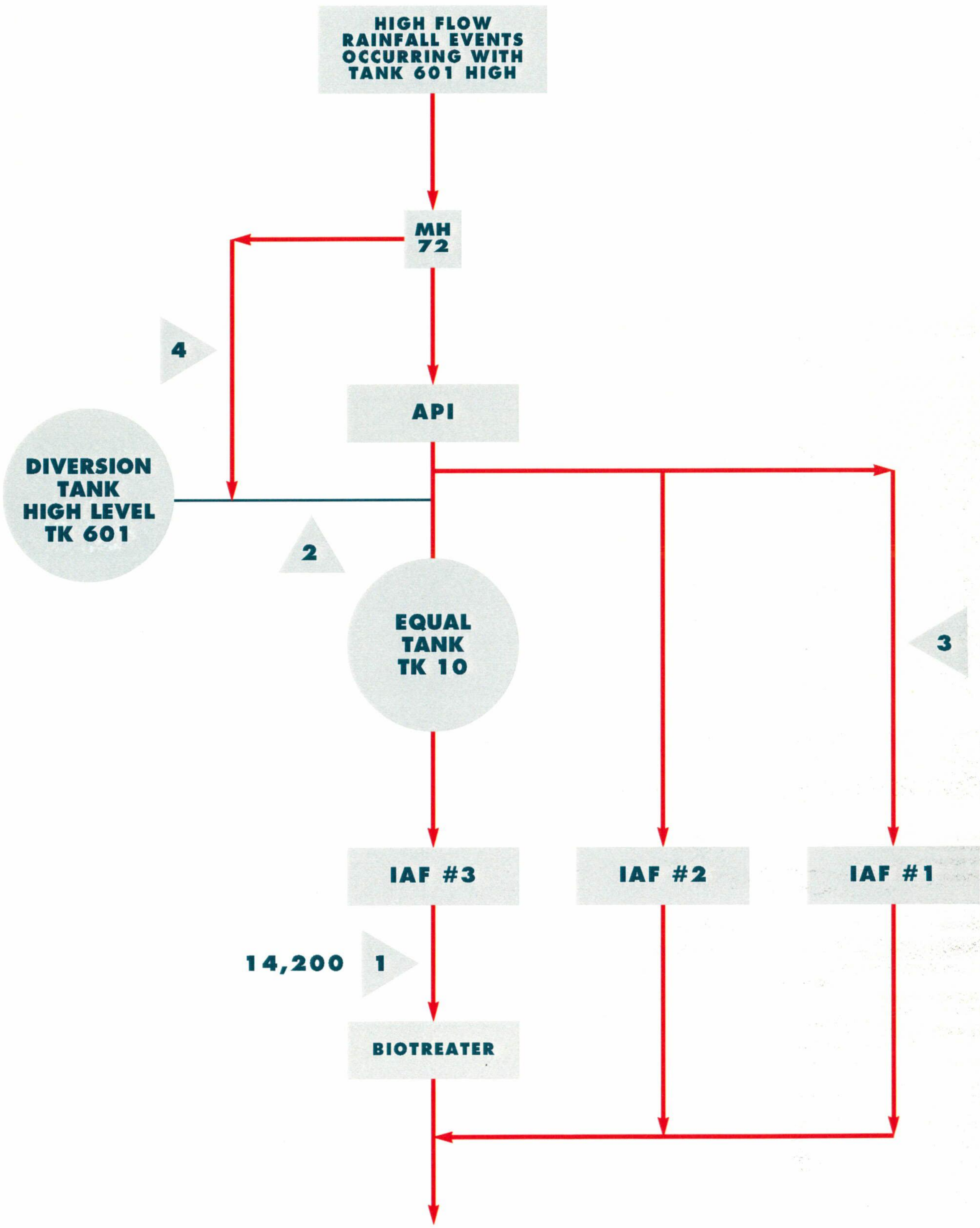


Figure 2.1(G)
40,000 TO 60,000 ML/DAY (TANK 601 HIGH)

Table 2.4 **Characteristics of the proposed biotreatment system**

Influent characterisation	
Flow	11,700 m^3/day
Chemical oxygen demand	436 mg/L
Total suspended solids	16 mg/L
TKN-nitrogen	25 mg/L - assume all TKN reacts to form Ammonia
Effluent Characterisation	
Eff. COD_S	30 mg/L
Eff. COD_T	70 g/L
Eff. TSS	15 mg/L
Eff. TVSS	10 mg/L
Eff. Ammonia-N	1 mg/L
COD mass loading	5,100 kg/day
Equipment Design	
Aeration basin	
F/M or U	0.311 kg COD removed/kg MLVSS under aeration
MLVSS	2,100 mg/L - RAS = 4,173 m^3/day
MLVSS/MLSS	0.75
Aeration volume	7,819 m^3
Hydraulic retention	16.0 hrs
Y	0.3 lb cells/lb COD removed
Kd	0.07 day^{-1}
MRT	59 days
Liquid depth	8.54 m+freeboard
Diameter (1 tank)	34.2 m
Aeration system	
AOR	5,867 kg oxygen/day
SOR	11,722 kg oxygen/day
Adsorption	18.9%
Air flowrate - aeration	8,779 NM^3/hr air - 0 C
Air flowrate - digester	1,273 NM^3/hr air - 0 C
Total blower power	373 brake kw
Number of blowers	2 (ore operating, one full space)
Gravity clarification	
Suction type, rapid sludge return	
Diameter (1 clarifier)	31.1 m
Diameter (2 clarifiers)	22.0 m each
SWD	3.7 m

Table 2.4 **Characteristics of the proposed biotreatment system (cont'd)**

Equipment Design (cont'd)	
VSS in bottom sludge	8,000 mg/L
TSS in bottom sludge	10,667 mg/L
Net sludge make	21 m^3/day
Sludge return	4,173 m^3/day
Aerobic digestion	
Volume	1,121 m^3
Diameter	12.9 m
Liquid depth	8,54 m+freeboard
Residence time	40 days
VSS reduction	20%
Sludge concentration	
Gravity decant	
Solids concentration	2 wt%
TSS in decant	15 mg/L
Expected sludge at design loading	8.41 m^3/day

Source ENSR 1996

Oily water from ARN and ALOR would flow into the proposed treatment system and be directed to the API separators where gross oil and suspended solids would be removed by primary treatment. The oily water would not include ballast water or desalter water. Ballast water is discharged from vessels during unloading in order to stabilise the vessel. Desalter water is highly contaminated salty water that results from the crude treatment process.

Ballast water would enter the proposed system via the retention/surge tank (tank 601) to allow for flow equalisation. Desalter water would enter the proposed system at the equalisation tank (tank 10) to ensure it passes through biotreatment, even during high flow periods.

The combined effluent would then flow from the equalisation tank, after the addition of acid or caustic to neutralise the pH, to the proposed IAF No. 3. At this point, further oil and suspended solids would be removed. Effluent from the IAF would then flow to the proposed activated sludge system (biotreater) where ammonia, soluble organics and residual oil and grease would be removed. Treated effluent would then be discharged to the ocean at Yena Gap.

The proposed treatment plant would also treat spent process caustic. This is produced by a range of processes which include stripping unwanted sulphur compounds from the various crude oil fractions that are separated during refining. The spent process caustic would be injected directly into the biotreater feed just before the aeration tank by two pumps with a maximum flow rate of 10 m^3/day per pump. Normally one pump would operate continuously and one would be spare. The pumping rate would be varied depending on the spent caustic's organic loading, the organic loading of the treatment plant, and the pH of the spent caustic.

Control of oily water under wet weather conditions depends on the quantity of oily water passing through the system and the available storage capacity. The amount of oily water inflow, storage capacity, treatment method, and volume of treated effluent being discharged will constantly change during a storm event.

The proposed biotreatment system is designed to handle normal, dry weather flowrates of up to 11,700 m^3/day. When inflow rates exceed the capacity of the biotreatment train, additional flow would be directed from the API separator outlet either to storage or, if the retention/surge tank (tank 601) is full, to Yena Gap via the first and second IAF units bypassing the biotreater. During extreme high flow periods, oily water flow in excess of the API separator design capacity of 40,000 m^3/day would be diverted from manhole 72 directly to the retention/surge tank. Oily water collected at the retention/surge tank would then be fed back into the treatment system at a controlled rate.

Desalter effluent would be routed directly to the equalisation tank (tank 10). By limiting the flow through the equalisation tank to the capacity of the proposed biotreatment plant (11,700 m^3/day), the highly contaminated streams would pass through biotreatment at all times, even when part of the flow is bypassing the biotreater. The proposed pH control system would only monitor and control the pH of the stream exiting the equalisation tank. As a result, the pH of the stream from the flotation cell feed pumps to IAF Nos 1 and 2 would be monitored so that when the pH exceeds the acceptable range, flow in excess of biotreatment capacity is diverted to the retention/surge tank until the effluent pH is back within range.

2.4.1 FLOW PATH ONE

Flow path one would involve the oily water entering the system via the API separators to remove gross oil and suspended solids. The oily water would then pass via the flow equalisation tank (tank 10) to the proposed IAF (No. 3) for oil and suspended solids removal and on to biotreatment.

2.4.2 FLOW PATH TWO

The second flow path would allow oily water to flow into the API separators for primary treatment. The effluent would then be pumped to the retention/surge tank (tank 601) for storage before further treatment.

2.4.3 FLOW PATH THREE

Flow path three would involve oily water flowing into the API separators for primary treatment. It would then be pumped to the No. 1 and No. 2 IAFs for secondary treatment. (One of these IAFs will be upgraded to ensure that the effluent consistently meets the wet weather limits for oil and total suspended solids). Effluent which is essentially devoid of oil and suspended solids would then be discharged from Yena Gap to the ocean.

2.4.4 FLOW PATH FOUR

The fourth flow path is a storage option, in which oily water would flow directly to the retention/surge tank (tank 601).

2.4.5 SUMMARY OF PROPOSAL

The main features of the proposal are summarised as follows:

- it would provide biological treatment of oily water in average dry weather flow conditions plus a safety factor for additional flows;
- the proposed effluent improvement system would handle oily water flows relating to events up to the 1 in 10 year storm;
- the system would have an equalisation capability of 24 hours;
- the system would have a diversion capability of 40 ML or eighteen hours of storm flow.

The four flow paths would be carefully balanced in accordance with weather conditions and status of the treatment process elements.

Because the refinery operates continuously and produces oily water, the proposed plant would operate 24 hours a day, seven days per week. No additional staff would be employed specifically for the proposed plant.

2.5 INCIDENT MANAGEMENT

A serious incident in the refinery may cause highly contaminated flows to enter the oily water sewer thereby exceeding the capacity or overloading the activated sludge plant. This would occur because certain contaminants are biological toxins and can inactivate the sludge. Also, if the flows exceed the biological degradation capacity of the activated sludge the oily water would not be treated.

While the equalisation tank and the pH control system would usually even out variations in contaminant loading, as an added precaution, highly contaminated effluent would be detected via pH monitors located at the inlet of the API separators. pH meters would also be located upstream in the sewers for early warning.

Alarms on the distributed control system console in the control room would alert the operator to divert the flow to the retention/surge tank via the effluent diversion pumps. These pumps would be started/stopped from the control room console. The offspec effluent would be held in the retention/surge tank then gravity fed back to the inlet of the API separators by a manually operated flow control valve. This would be done at a rate to allow dilution and full secondary treatment.

2.6 CONSTRUCTION

The proposed facilities would be constructed over a nine month period. There would be no substantial demolition of existing facilities, with the exception of decommissioning the existing oily sludge holding bays. The main construction activity proposed would involve tank fabrication, which has occurred previously at the refinery. There would be little concrete works and earthworks. There would be no over-sized loads on trucks required for the purposes of construction.

There will be an overall reduction in capital investment at the refinery compared to previous years, so no additional staff would be employed to construct or operate the proposed plant. The workforce during peak construction of the proposed effluent treatment facility would be approximately thirty to forty people.

During construction, staff would be required to use the existing carpark which is capable of catering for up to 1,000 vehicles.

2.7 COST ESTIMATE

The estimate of total installed capital cost for the effluent improvement project is $14,500,000. The estimate includes direct costs for detailed design, engineering, equipment, materials, labour, construction equipment, engineering, project and construction management, procurement, commissioning, and contingencies. The base date for the estimate is 1 May 1996 and potential future escalation was not considered.

3 EXISTING CONDITIONS

3.1 STUDY LOCATION AND ZONING

3.1.1 REGIONAL CONTEXT

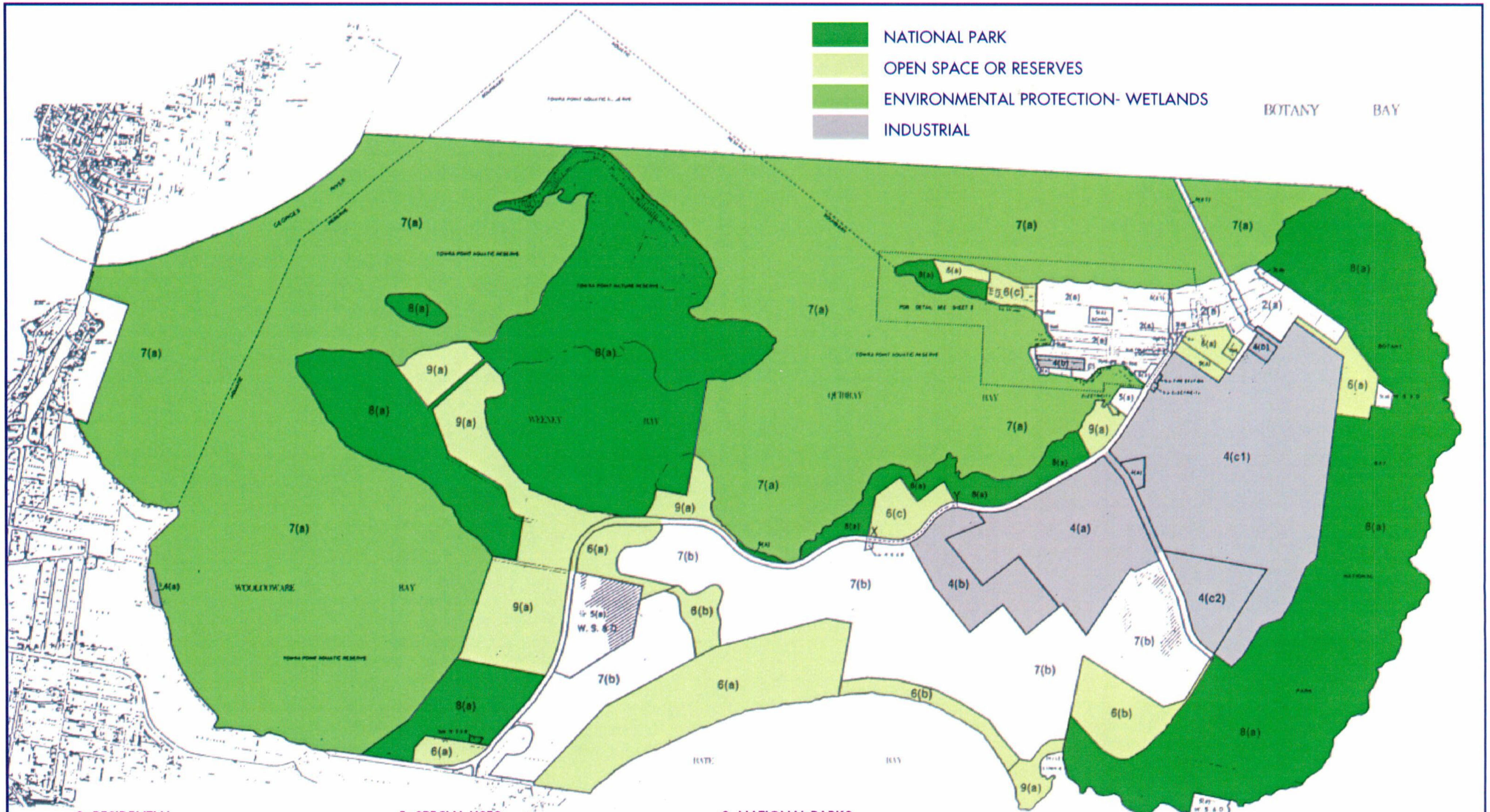
The Ampol refinery is located on the Kurnell Peninsula, in the eastern sector of the Sutherland Shire local government area. Sutherland Shire is situated on the southern fringe of the Sydney metropolitan area. Botany Bay is located to the north of the Kurnell Peninsula, the Tasman Sea to the east and Bate Bay to the south. Cronulla and Woolooware are the closest residential suburbs on the south western side of the peninsula.

The peninsula itself is characterised by a variety of land uses and zones as shown in Figure 3.1. These include the Kurnell residential area, Botany Bay National Park, recreation reserves, Cronulla sewage treatment plant, Kurnell landfill, Towra Point Nature Reserve and a number of industries.

The Kurnell refinery was established under State Environmental Planning Policy 33 defining Hazardous and Offensive Development in the *Environmental Planning and Assessment Act 1979*. Sydney Regional Environmental Plan No. 17—Kurnell Peninsula (REP 17) defines the zoning conditions that apply within the study area and these are shown in Figure 3.1. This environmental planning instrument was prepared in 1989 by the (former) Department of Planning to protect the natural heritage of the peninsula while at the same time facilitating compatible development.

3.1.2 THE STUDY AREA

The study area is within the 4(c1) Industrial Special (Oil Refining) land use zone under REP 17. The site of the proposed effluent improvement project is positioned near the junction of Captain Cook Drive and Solander Street (Figure 3.2). The site is separated from Captain Cook Drive by a service station, tennis courts, licensed recreation club and an electricity substation. Residential properties and local shops (zone 2(a) under REP 17) are located on the western side of Captain Cook Drive near the study area. A small area of Regional Open Space (zone 9(a) under REP 17) exists on the northern side of Solander Street near the study area.



	2. RESIDENTIAL	
2(a)	(a) RESIDENTIAL	
	3. BUSINESS	
3(a)	(a) BUSINESS (NEIGHBOURHOOD)	
	4. INDUSTRIAL	
4(a)	(a) GENERAL INDUSTRIAL	
4(b)	(b) INDUSTRIAL (LIGHT)	
4(c1)	(c1) INDUSTRIAL SPECIAL	
4(c2)	(c2) INDUSTRIAL SPECIAL	
	5. SPECIAL USES	
5(a)	(a) SPECIAL USES (SCHOOLS ETC.)	
	6. OPEN SPACE	
6(a)	(a) RECREATION EXISTING	
6(b)	(b) RECREATION PROPOSED	
6(c)	(c) RECREATION PRIVATE	
	7. ENVIRONMENTAL PROTECTION	
7(a)	(a) WATERWAYS	
7(b)	(b) SPECIAL DEVELOPMENT	
	8. NATIONAL PARKS	
8(a)	(a) NATIONAL PARKS AND NATURE RESERVES - EXISTING	
	9. RESERVATIONS	
9(a)	OPEN SPACE (REGIONAL)	
	LAND REFERRED TO IN CLAUSE 14	X
	PART OF CAPTAIN COOK DRIVE REFERRED TO IN CLAUSE 13.5.	
	WS & D WATER BOARD PURPOSES	

Figure 3.1

LAND ZONING ON KURNELL PENINSULA

SOURCE: SYDNEY REGIONAL ENVIRONMENTAL PLAN No.17 (1989)

AMPOL EFFLUENT TREATMENT PROJECT

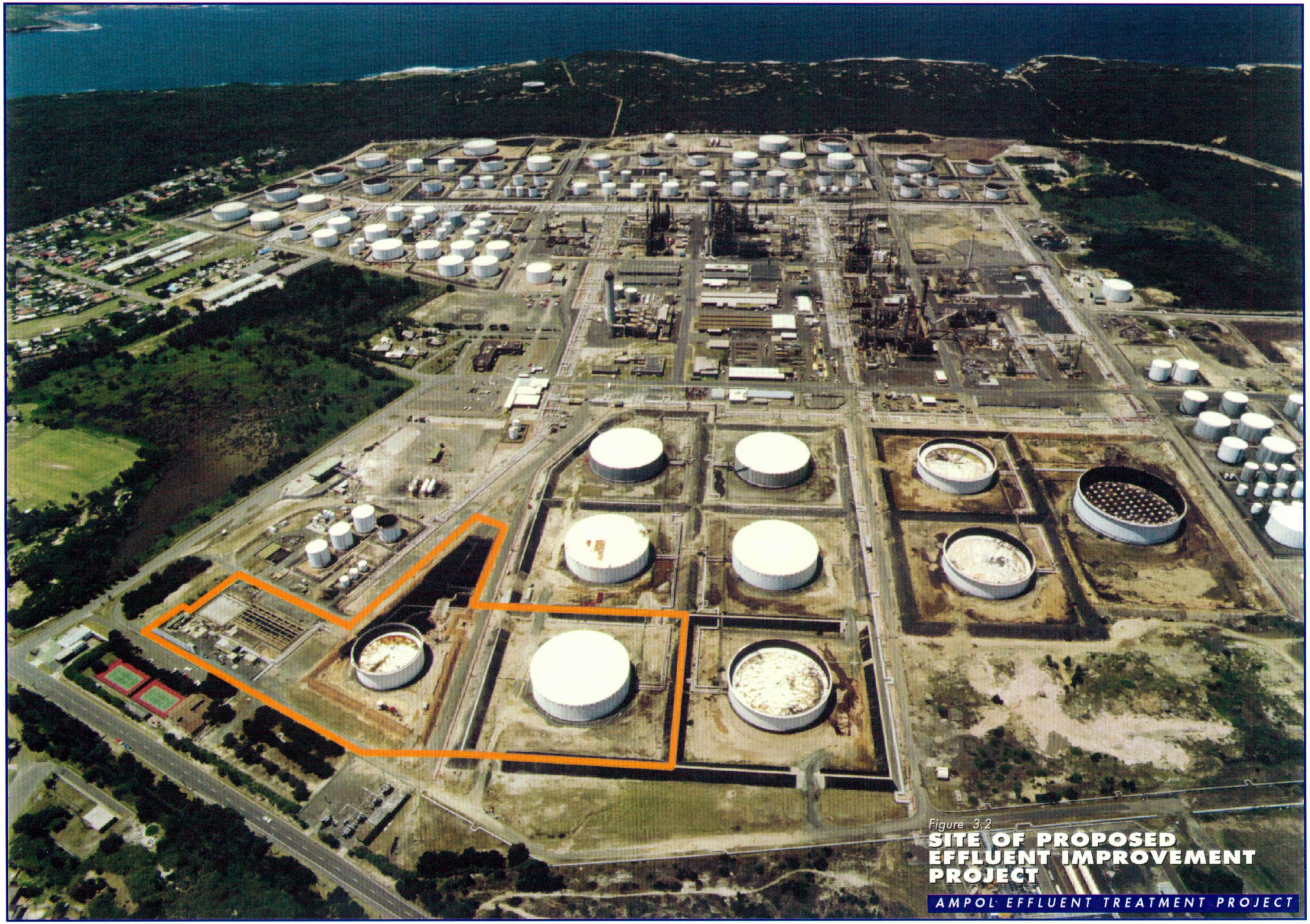


Figure 3.2
SITE OF PROPOSED
EFFLUENT IMPROVEMENT
PROJECT
AMPOL EFFLUENT TREATMENT PROJECT

3.2 TRANSPORTATION AND ACCESS

3.2.1 MAJOR ACCESS ROADS

Captain Cook Drive provides the only road access to the study area and the Kurnell peninsula. West of Taren Point Road in Caringbah, Captain Cook Drive becomes The Boulevard (MR 277) which continues westerly across Port Hacking Road (MR 227) to its junction with the Princes Highway (SH1). Captain Cook Drive runs east from Taren Point Road in Caringbah to Polo Street in the Kurnell residential area. Captain Cook Drive is a State Road between Taren Point Road (MR 199) and Gannons Road in Caringbah, constructed as a six lane divided urban arterial road. For the remainder of its length, east of Gannons Road, it is a two lane regional road with limited access.

At the Elouera Road junction, Captain Cook Drive turns north towards Kurnell. The portion of Captain Cook Drive west of Elouera Road (which runs south to Cronulla) was recently reconstructed and is in good condition. Right turn bays and acceleration and deceleration lanes have been constructed at all major access points to developments along this portion of Captain Cook Drive. The road has white centre lines and edge lines and wide sealed shoulders.

3.2.2 ACCESS AT THE REFINERY

Access to the refinery is via Solander Street near where it becomes Cook Street. To control movements in and out of the refinery there is only one access point. The number and type of vehicle movements by staff and visitors is strictly controlled. The study area can be reached via well marked, two-way internal roads. Security and traffic movements are tightly controlled for safety reasons.

3.2.3 ANNUAL AVERAGE TRAFFIC VOLUMES

Information in this section of the REF has been adopted from AGC Woodward-Clyde (1996).

Traffic volumes on the Kurnell Peninsula fluctuate significantly due to the variety of land uses, which generate differences in traffic volumes on weekends and weekdays, and between summer and winter months. A regular public bus service travels along Captain Cook Drive, providing access to the Kurnell township, the Ampol oil refinery and the Botany Bay National Park.

The most recently published annual average daily traffic (AADT) volumes in Captain Cook Drive were based on 1987 data (RTA 1991). These data indicate that, east of Elouera Road, Captain Cook Drive carried 9,986 vehicles per day, and west of Elouera Road carried 13,481 vehicles per day. The capacity of the two lane section of Captain Cook Drive east of Gannons Road is about 20,000 vehicles per day, indicating there was ample capacity to cater for growth in traffic in the short and medium term. The traffic volumes on the road network described above are presented in Table 3.1.

Table 3.1 **Annual average daily traffic (AADT) on Captain Cook Drive**

Location of traffic count site along Captain Cook Drive	Year		
	1983	1985	1987
Site no. 36.087, Caringbah, east of Taren Point Road	32,060	28,700	30,970
Site no. 37.077, North Cronulla, west of Elouera Road	13,090	13,684	13,481
Site no. 36.001, North Cronulla, north of Elouera Road	9,010	9,702	9,986
Site no. 35.002, south of Polo Street, Kurnell	2,530	1,537	1,171

Source: AGC Woodward-Clyde 1996

Table 3.2 lists 1987 AADT movements throughout the local area in proximity to the Ampol refinery. No further traffic studies have been undertaken in this area by Sutherland Shire Council.

Table 3.2 **1987 Annual average daily traffic (AADT) on local roads**

Road	AADT	Road status
Captain Cook Drive	13,841	Sub arterial
Elouera Road	11,848	Collector
Hume Road	2,097	Collector
Sturt Road	3,994	Collector
Kurnell Road	2,164	Local
Mitchell Road	2,796	Local
Bate Bay Road	2,841	Local

Source: Sutherland Shire Council (1991)

3.2.4 PROPOSED ROAD IMPROVEMENTS

Short term

Relatively few road accidents have been recorded on the eastern seaboard roads of the Sutherland Shire. However, areas of concern to Council include Captain Cook Drive at the intersection of Elouera Road. The Council commenced reconstruction of the roundabout at this intersection in late 1995 and have completed the work. The Council also plans to construct a roundabout at the Woolooware Road junction with Captain Cook Drive, but the timing of this work has not yet been finalized.

Long term

In 1991, the Eastern Seaboard Tourism Traffic and Parking Study was carried out by the Council to address existing and future traffic and parking issues. The study estimated that the maximum industrial floor space in the Kurnell precinct is 500,000 m^2 and that this could result in up to 25,000 AADT or 4,900 trips during the peak hour period. This industrial traffic would be limited to Captain Cook Drive and it would most likely have a 90% outbound, 10% inbound during the evenings (and vice versa in the morning). The study further estimated that full development of all 7(b) Environmental Protection Special Development zoned land could amount to as much as 2,500 trips per hour in the evening peak with a 65% inbound, 35% outbound directional split.

Also in 1991, Council approved a major resort development (Sydney Destination Resort Bate Bay) and forecast that upgrading Captain Cook Drive to four lanes from Gannons Road to Sir Joseph Banks Drive would be necessary to cater for the projected growth in traffic. Captain Cook Drive has subsequently been reconstructed between Elouera Road and Sir Joseph Banks Drive. Major pavement upgrading to Captain Cook Drive between Gannons Road and Elouera Road was also recommended in the study, but has not yet been undertaken.

3.3 GEOLOGY AND GEOMORPHOLOGY

The following description of geology and geomorphology in the study area is taken from AGC Woodward-Clyde (1996).

Kurnell Peninsula is located within the Botany Basin, which comprises part of the Sydney Basin geological unit. The Sydney Basin is a broad structural basin of Triassic sedimentary rocks, comprising the Botany Basin, the Kurnell Peninsula and Bate Bay.

Kurnell Peninsula is an elevated plateau of Hawkesbury Sandstone, approximately 18 km in length. The Hawkesbury Sandstone is a massive, medium to coarse-grained sandstone composed of predominantly quartz, with very minor lithic fragments, feldspar, mica and clay pellets. It contains occasional lenses of shale, conglometric horizons and significant cross bedding. The sandstone generally has a low primary porosity owing to the high clay content of the matrix.

The dominant geological units of the Kurnell Peninsula include the intertidal flat and swamp deposits of the north shore and the transgressive dune deposits which are gradually over-riding them from the south. The units are predominantly composed of aeolian sand underlaid by estuarine and river sands, with occasional thin silty-clay impregnated layers and peat lenses. The estuarine sands overlying the marine sands are composed of fine to medium grained, well sorted quartz with less than 5% lithic fragments.

3.3.1 SOILS AND LANDFORM STABILITY

The soils of the study area have been described by the Soil Conservation Service NSW (1990) and their features are outlined below as provided by AGC Woodward-Clyde (1996). The study area is situated on Quaternary sands deposited over the last 25,000 years. Soils developed on these deposits are podzols, which are non-cohesive, highly permeable and of very low fertility and high erodibility. Areas underlain by Hawkesbury Sandstone are prone to gully and sheet erosion.

Much of the western portion of the modern day Kurnell Peninsula headland consists of a coastal sand barrier complex with large sand dunes of 30 to 40 m in elevation. The present dune deposits form a series of transverse dune ridges intersected by longitudinal dunes and occasional parabolic dunes on the southern side of the isthmus. The transgressive dune deposits in the north are stabilised by vegetation and have developed a parabolic morphology, but where exposed are believed to be migrating northwards at approximately 2 m/yr.

The Kurnell sand dunes were Sydney's main source of building sand, and much of the mobile sand layer has been removed by commercial sand mining operations, exposing lower Holocene aeolian and upper Pleistocene estuarine sands, some of which have been overlain by fill material, resulting in relatively flat pit floors.

3.4 GROUNDWATER HYDROLOGY

3.4.1 REGIONAL GROUNDWATER

This section on groundwater hydrology of the Kurnell Peninsula is taken from AGC Woodward-Clyde (1996).

The original dune sands (Botany Bay Sands) of the Kurnell Peninsula are well sorted and form a highly permeable, high yielding aquifer system referred to as the Botany Aquifer. It is a system of unconfined and semi-confined aquifers of variable yield, depending on their degree of tightness, consolidation and/or cementing, and their peat and clay content. The variation in yield is believed to reflect the presence of discrete high yielding layers within the sequence, which are interconnected vertically via a leakage through the confining peat and clay layers, and laterally by the discontinuous geometry of most of the confining units. Discharge points in the area include Bate Bay to the south-east, Woolooware Bay to the north-west and Quibray Bay to the north, as well as local discharge points in the numerous natural and artificial ponds located within the isthmus. The surrounding dune system in the area acts as a recharge zone.

The Botany Aquifer is an important source of bore water for local residents and industry, and irrigation of parks and golf courses. Approximately eighteen bores in the immediate vicinity of the project area are registered with the Department of Land and Water Conservation. These bores have been installed over a period of time spanning from 1954 to 1992. All of the bores are shallow (total depths ranging from 3 to 21 m) and bore logs indicate that groundwater was found at depths ranging from 1.2 to 11 m below the surface. Where available, salinity records indicate that water quality is very good (0 to 500 ppm) or good (501 to 1,000 ppm). The use of these bores is understood to be for private use, and most appear to be associated with residential properties and community facilities on or near Captain Cook Drive.

3.4.2 GROUNDWATER AT THE REFINERY

Ampol has initiated a number of measures to achieve short and long term targets identified in its Soil and Groundwater Management Plan for the Kurnell refinery. These measures are aimed at achieving a continuing improvement cycle for the protection of the soil and groundwater.

The areas of concern have been identified and prioritised in the Soil and Groundwater Management Plan. The list has been developed on the basis of internal environmental audits, visual observations, historical research of past spills, review of records and interviews with long term staff. The nature and extent of these areas of concern have been defined by geophysical techniques, monitoring wells, soil vapour surveys and pumps tests. They include the following:

- the pipeline corridor groundwater
- ALOR
- the MEK/Toluene plume, soil and groundwater
- the main pipeline, soil and groundwater
- the condition of oily water sewer lines, soil and groundwater
- the groundwater around the limestone pits
- the soil at the old landfill site
- the soil around tanks 15, 16/17
- the soil around the water treatment area
- the soil around tanks 622 and 623.

The risks associated with the areas of concern are either currently being addressed or have been addressed as part of the Soil and Groundwater Management Plan. The requirements of the plan are currently being met through an implementation plan. The plan provides for an organisational structure to reflect reporting relationships and department functions, the responsibilities of monitoring, investigation and reporting and the importance of resource utilisation, training and documentation control.

The Soil and Groundwater Management Plan also incorporates a Corrective Action Plan which is concerned with the methodology of soil and groundwater protection, emergency preparedness and response, soil and groundwater treatment and recovery, remediation of hydrocarbon in soils and remediation of groundwater.

Ampol has also initiated a number of measures to achieve the short term targets and longer term objectives of the Soil and Groundwater Management Plan. These measures include regular soil and groundwater site evaluations, a boundary groundwater monitoring system, regular environmental audits and a biannual internal environmental risk assessment.

The Soil and Groundwater Management Plan is reviewed on an annual basis. The following aspects are independently reviewed:

- plan, policy, objectives, targets and performance
- monitoring and treatment technology

- effectiveness of incident reporting and feedback.

3.5 SURFACE WATER HYDROLOGY

There are two drainage systems within the refinery, namely:

- an oily water sewer system, which services the plant areas, and also conveys process water;
- a stormwater system, which conveys stormwater runoff from relatively clean areas of the refinery (eg. roads).

As outlined in Section 2.1, this REF assesses impacts relating to proposed changes to the oily water sewer system. However, the stormwater system needs to be considered because it comprises part of the existing environment.

3.5.1 STORMWATER SYSTEM

In 1992, Gutteridge Haskins and Davey conducted a stormwater management study for the ARN and ALOR sites. The ARN and ALOR sites were broken down into discrete catchments and analysed using an ILSAX computer model to estimate a range of flows up to the 100 year flood. The model was then used to evaluate alternative drainage improvement options.

The study demonstrated it was possible to reduce flooding of the pipeways by diversion of flows and provision of storage areas within the sites, without the need to increase flows off site. Reduction of flooding within the pipeways was found to increase the efficiency of minor drainage systems although the capacity of these systems is limited and significant overland flows would still occur.

In order to prevent excessive contamination of stormwater, low-level mountable bunds were required for process areas.

3.5.2 OILY WATER SYSTEM

The oily water drainage system at the Kurnell refinery was investigated by Gutteridge Haskins and Davey in 1995. The study determined the capacity of the piped drainage system and the volume of runoff to be temporarily stored prior to treatment. This information has been used in discussions between Ampol and the NSW EPA.

The oily water system at the Kurnell refinery drains concrete and asphalt surfaces over an area of approximately 3.45 ha. This comprises approximately half of the total area of the refinery. These surfaces grade to a series of pits with flame traps, which can be covered with sand bags as required. The surfaces are graded to collect oily water, with stormwater from the surrounding roads being conveyed to the separate stormwater system.

Tanks that are grouped together and surrounded by clay-lined bunds (tank farms) also discharge rainwater to the oily water system, although the valves on the connection pipes are normally closed in case of spillage. These valves are opened following rainfall events, enabling potentially contaminated surface water to be conveyed to the oily water system. The total length of the drainage system is 3820 m, with pipe diameters ranging from 165 to 1150 mm. There are a total of 73 pits in the system, of which eighteen have contributing catchment areas.

Effluent in the oily water system flows to an oil separator and IAF before being discharged through an API designed diffuser outfall at Yena Gap to the Tasman Sea. Diversion storage is provided adjacent to the separator to store runoff in excess of the capacity of the oil separators.

Gutteridge Haskins and Davey (1995) found that peak flows in the oily water system would occur during sixty minute storm events. For storm durations less or more than this time, the catchment would not contribute as much to the flow at the catchment outlet. The critical duration storm will not result in the highest runoff volume from the catchment as the rainfall depth, and hence runoff volume, increases with storm duration.

Flood levels within the oily water system were determined using hydraulic grade line analysis techniques. The results of the modelling indicated that limited surcharging occurs during a one year average recurrence interval event, with more substantial surcharging occurring during a two year average recurrence interval event. The ultimate capacity of the system is approximately 1,200 ML/d.

3.6 WINDS

A description of prevailing wind conditions in the study area is provided from AGC Woodward-Clyde (1996). Winds affect the carriage of noise, and the movement and dispersion of odours from the refinery and other land uses in the area.

Wind rose data were recorded in 1992 at the Cronulla sewage treatment plant site. Samples were taken for each month (excluding January) for daytime hours (10 am to 10 pm) and night hours (10 pm to 10 am). The results indicate two distinct seasons:

- May to September, when westerly winds are most frequent
- October to April, when northeast and southeast winds are most common.

During the winter months, particularly June to August, the dominant wind directions are generally the same by day and night with west, northwest and southwest winds. During the summer months, there is a higher proportion of winds from the northeast and southeast, reflecting the effect of seabreezes. There are more offshore westerly winds at night which reflects the land drainage air flow.

Strong winds, which are greater than 36 km/hr (10 m/s), usually come from the west during winter and from the south during summer. The long term wind record from Sydney (Kingsford-Smith) Airport shows that strong winds are more common in summer months, exceeding 36 km/hr for about 10% of the time from November to February.

Weak winds (less than 2 m/s) occur for about 10% of most months at night. The most common direction for weak night winds are southwest to northwest.

3.7 UTILITIES AND COMMUNICATIONS

The Kurnell Peninsula is serviced with sufficient power, sewer, water and telecommunications links to support existing industry, with some spare capacity. The refinery has adequate supplies for current levels of activity. The refinery is not connected to Sydney Water's sewerage system.

3.8 NOISE

There have been two studies undertaken to assess the noise levels in the refinery complex. The first was prepared by Camets Services Pty Ltd (1994) and the second by Ampol (1996). Information relevant to the proposal from these reports is presented below.

3.8.1 1994 NOISE ASSESSMENT

Camets Services Pty Ltd (1994) investigated a number of sites within the refinery complex so that appropriate noise reduction technology could be implemented to enable EPA requirements to be met. Sites assessed included the fluid catalytic cracking units (Plants No. 4 and No. 34) and plants No. 11 and No. 45 (as shown in Figure 3.3), as well as miscellaneous smaller items or secondary sources of noise. Plants No. 4 and No. 34 were found to be the main sources likely to affect the nearby residential areas.

During the study, close proximity sound pressure measurements were taken at the effluent discharge pumps and the induced air flotation units (IAFs No. 1 and No. 2). These are located at the site of the proposed effluent treatment facility. Additional noise measurements were taken in the vicinity of the acoustic wall at Tasman Street as well as two locations at an 'equivalent acoustic distance' to that of Tasman Street. These additional sample sites were within sight of the effluent pumps and IAF units.

Measurements showed that IAF No. 1 contributes significantly to the noise in Tasman Street. An analysis of the measurements confirmed that the effluent discharge pumps and one of the IAFs are clearly audible in the nearby residential area and contributed significantly to the overall noise emissions from the refinery.

Table 3.3 presents the calculated sound power levels for equipment around the existing effluent treatment plant.

Table 3.3 **Calculated sound power levels**

Equipment	Sound power level (dB(A))
Effluent Discharge Pumps	
• Start-up	121
• Continuous running	126
IAF No. 1	91

Source: Camets Services Pty Ltd (1994)

Sound pressure measurements were taken at three locations outside the refinery. These locations were chosen as reference points within the residential areas to assess the existing environmental noise levels and for use as future reference points to assess noise reductions. Existing noise levels measured at these locations are provided in Table 3.4.

Table 3.4 **Existing noise levels outside the refinery**

Location	Noise level dB(A)
Reserve Road to the east of the refinery	54 dB(A) to 58 dB(A) with a minimum of 50 dB(A) relative to increased wind speed
near the Fire Station on Captain Cook Drive to the north of the refinery	45 dB(A) to 52 dB(A)
No. 5 and No. 40 Tasman Street to the north west of the refinery	39 dB(A) to 51 dB(A) and 39 dB(A) to 48 dB(A), respectively

Source: Camets Services Pty Ltd (1994)

The study found that sources of intermediate noise within the refinery were the effluent discharge pumps near the north-west boundary, the IAF units near the north-west boundary, the fuel transfer pumps near the main pipeway, and power plant (plant No. 11). Major sources of noise audible in the residential area were the fluid catalytic cracking units (plants No. 4 and No. 34), which are well removed from the proposed study site.

3.8.2 1996 NOISE ASSESSMENT

A noise monitoring system was established by Ampol in 1996 to provide an estimate of noise emission levels at various locations around the refinery. The majority of locations sampled are within proximity of the proposed effluent improvement facilities as shown in Figure 3.3. The emissions are checked for compliance with EPA license conditions.

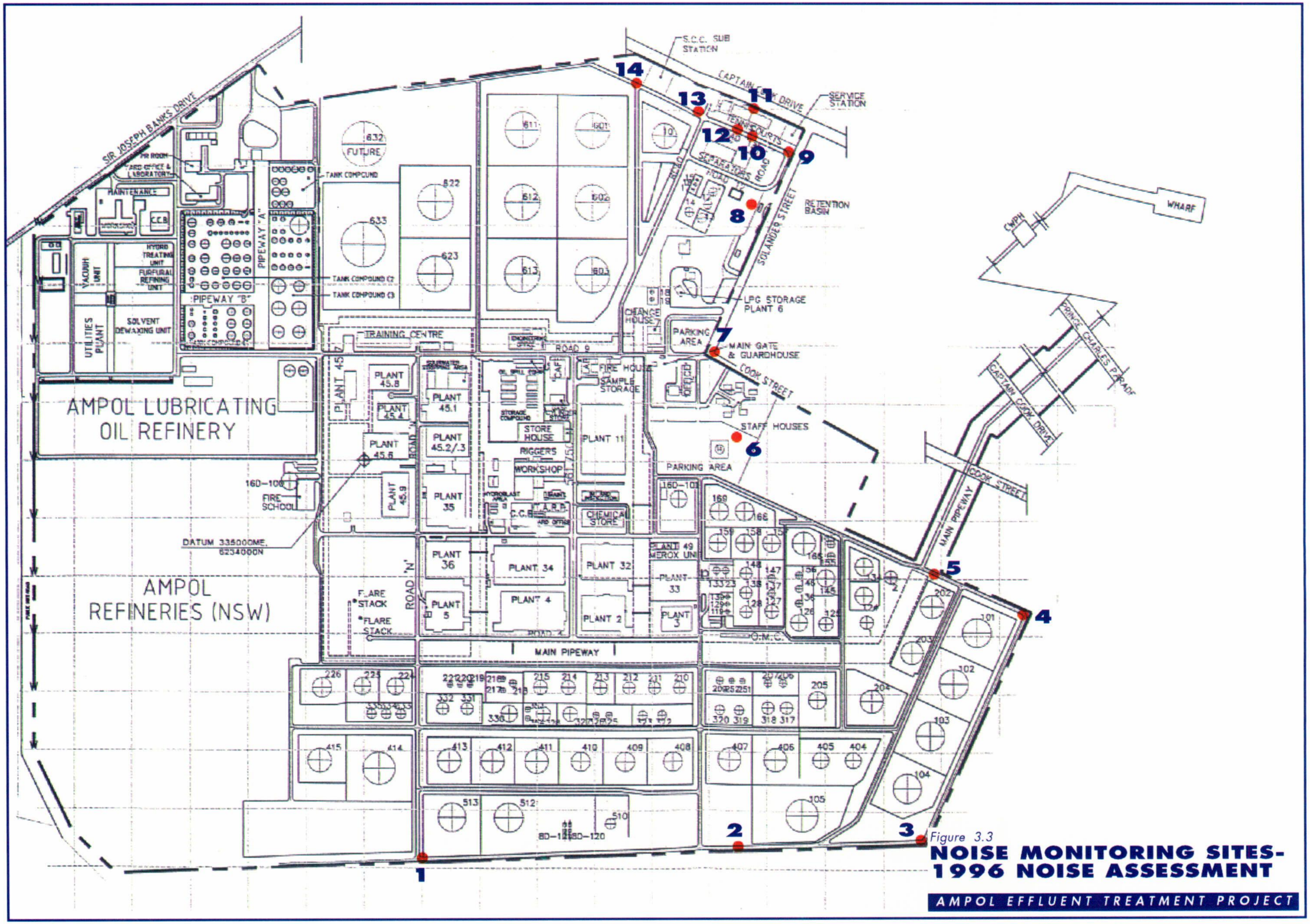


Figure 3.3

NOISE MONITORING SITES-1996 NOISE ASSESSMENT

AMPOL EFFLUENT TREATMENT PROJECT

The current ARN noise emission license condition states that noise emanating from operation of the oil refinery shall not exceed an $L_{A10,\,T}$ sound pressure level of :

- 70 dB(A) - between 7:00 am and 10:00 pm
- 65 dB(A) - between 10:00 pm and 7:00 am

when measured at any point within 1 m of the plant boundary. The condition states that the $L_{A10,\,T}$ sound pressure levels be measured over a period of ten to fifteen minutes. It is also stated that 5 dB(A) shall be added to the measured level if the noise is substantially tonal or impulsive in character.

Noise conditions were surveyed in early 1996 as part of this monitoring system. Sound pressure levels were measured on four days between 12 to 20 March 1996 at thirteen locations within the refinery boundary and one within 1 m of the boundary outside of the Kurnell Community Recreation Club. Initial measurements were attempted during daylight hours but except for a few locations it was found that there was too much external noise, including background noise from passing cars and trucks. Most readings were taken between 4:00 am and 7:00 am.

Peak readings during the ten and fifteen minutes time intervals that were measured were noted. Extraneous noise levels from aircraft and nearby road traffic were ignored. The average for each set of readings at each location was calculated to estimate a $L_{A10,T}$.

Figure 3.3 shows the locations of the noise measurements and Table 3.5 provides the measurement results.

The noise measurements were taken during a period when the plant was fully operational when all production units were on-line. Measurements were not taken at the southern end of the western boundary because of the noise emitted by extractors located near this boundary. Similarly, no measurements were taken at the southern boundary because of noise emitted by ALOR.

All calculated $LA_{10,T}$ sound pressure levels were less than or equal to 65 dB(A) except for those measured at location 12, approximately 60 m from the refinery boundary on the refinery side of the acoustic wall. To gauge the effectiveness of the wall, measurements were also taken near the Kurnell Community Recreation Club. Due to the shielding and sound absorption qualities of the trees and buildings between these two locations, the noise was significantly reduced from 68.2 to 48.7 dB(A). Using a standard sound attenuation equation, the level of 68.2 dB(A) would reduce to approximately 61 dB(A) at the refinery boundary.

One other area measured was at the 'night time' limit on the eastern boundary of the refinery adjacent to the National Park. This is at the highest point of the refinery with direct visual contact of the fluid catalytic cracking unit (plants No. 4 & 34). This area does not receive the shielding that the other boundaries and community have from the tanks and building.

Table 3.5 **Results of noise monitoring (dB(A))**

Measurement location (Fig. 3.3)	Noise level dB(A)			
	12/3/96	13/3/96	19/3/96	20/3/96
	7 am to 10 pm	10 pm to 7 am	10 pm to 7 am	7 am to 10 pm
1	54.6			
2			65.0	
3			60.8	
4		49.0		
5		53.8	580	
6	60.7	58.2	59.9	
7		57.0		
8		58.8	59.7	
9		54.		
10		56.2		
11			48.7	
12			68.2	68.3
13		54.4		
14		51.7		

Source: Ampol 1996

The study reported that the $LA_{10,T}$ noise levels emanating from the refinery between the hours of 7:00 am and 10:00 pm were less than 70 dB(A) within 1 m of the plant boundary. The $LA_{10,T}$ noise levels emanating from the refinery between the hours of 10:00 pm and 7:00 am were less than 65 dB(A) within 1 m of the plant boundary with the exception of a few locations on the eastern boundary adjoining the National Park. This area may occasionally be at the limit of 65 dB(A).

3.9 AIR QUALITY AND ODOUR

3.9.1 AIR EMISSIONS

Ampol regularly monitors emissions to air from the stacks and outlets at the Kurnell refinery in accordance with the license conditions determined by the NSW EPA. Under the recent license (ARN License No. 00837) dealing with air emissions from the refinery, the following conditions have been outlined:

- sulphur dioxide: a maximum limit of 1600 kg/h maximum from all ARN sources under normal conditions;
- power house boilers: Ringlemann 1 maximum;

- sulphur recovery unit incinerator operating temperature: 650°C minimum except when on standby;
- sulphur recovery unit incinerator flue gas oxygen concentration: 1.0% minimum;
- bitumen storage temperature: 220°C maximum;
- bitumen loading temperature: 220°C maximum.

3.9.2 ODOUR ASSESSMENT

Even though Ampol regularly measures air emissions, there have been no recent odour assessments conducted at the Kurnell refinery. Odour emissions are dealt with under the air quality criterion for scheduled premises in the *NSW Clean Air Act 1961*. Section 15A of the Act states that an odour shall not traverse the boundary of the site from which it was generated. Section 15A, however, is currently being reviewed by the EPA.

Generally air quality goals or criteria are set so that odour does not cause a nuisance beyond the boundary of the property on which the odour is generated. Because of the very large range in the sensitivity of individuals to odours this is often difficult to achieve. An attempt to overcome these individual differences can be found in the way odour measurements are made.

The two main types of odour thresholds that can be determined by dynamic olfactometry are:

- the odour detection threshold - defined as the lowest concentration that will elicit a response without reference to odour quality (reproducible and the most widely reported threshold);
- the odour recognition threshold—defined as the minimum concentration that is recognised as having a characteristic odour quality.

A discussion about the acceptability of odours is presented in a report by Warren Springs Laboratory (1980). The public's reaction to an odour will depend on social and regional conditions as well as the frequency, intensity, duration and offensiveness of the odour. Although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable.

All of these factors need to be taken into account when determining acceptable odour levels. For example, an objectionable odour may be tolerated if it occurs at a high intensity for only one or two days a year, while the same odour may not be acceptable at a much lower level if it exists persistently. In recognition that it is impractical to set a goal which must be achieved 100% of the time, the EPA has set design criteria for scheduled premises of one odour recognition unit not to be exceeded for more than 1% of the time.

The potential for odours to become a 'nuisance' is dependant on the concentration of odour, the nature or character of the odour and the frequency of odour occurrence. Odour detection units (ODU) are commonly used to represent the concentration of odour by indicating the number of dilutions required to reduce the odour to its detection threshold which is determined using the method of dynamic olfactometry.

3.9.3 EXISTING ODOURS

A site investigation was conducted on 6 February 1997 to qualitatively assess odour conditions at the existing Kurnell refinery effluent treatment plant. The following factors were considered during the site investigation to determine the impact of existing odour on the surrounding environment:

- odour sources
- odour nuisance and odour intensity
- the frequency of odour incidents within the community
- the location of the odour source(s) from the nearest residence
- the changing nature and character of odours from the effluent stream
- local weather conditions.

The main odour sources were identified to be:

- IAF units No. 1 and No. 2
- the covered effluent skimming bays (API separators)
- the two oily sludge holding bays located to the east of tank No. 10.

Odours near the effluent treatment plant were considered to be 'organic', 'hydrogen sulfide', 'ammonia', 'methane' and 'oily residue'. However, these descriptions are subjective and may not accurately represent the odour composition. The variable quality of effluent recorded at the plant suggests that associated odours would be variable.

An assessment of odour nuisance was conducted at the boundary of the nearest residence located west of the effluent treatment plant and at the main odour sources of the plant. On the day of the investigation, weather conditions were fine, calm, and moderately humid. The intensity of odour around the existing plant and at the boundary of the nearest residence was considered to be low and therefore not at a 'nuisance' level.

The Kurnell Community Recreation Club is the nearest building outside the refinery and is located approximately 60 m west of the effluent treatment plant. On the day of investigation, odour was considered to have a low intensity at the club.

A letter was issued to all members of the local community in 1994 inviting comments on environmental matters. The number of odour complaints from residences surrounding the plant has been recorded and is presented in Table 3.6. For the period 1994 to 1996, the peak incidence of complaints about odour occurred in 1995.

Odour type and intensity will be influenced by the variable nature of the effluent being treated at the plant, local topography, other sources of odour and weather conditions. The relatively flat topography of the site coupled with the pattern of local coastal meteorology and wind conditions assist in the dispersion of both fugitive sources of odour from other sections of the oil refinery as well as odours emitted from the existing effluent treatment plant. When the potential for odour dispersion is low and the nature of the effluent being treated changes, odour is likely to be detected at the nearest boundary to the existing effluent treatment plant.

Table 3.6 **Community responses concerning odour**

Year	Odour incidents
1994	48
1995	122
1996	56

3.10 FLORA AND FAUNA

3.10.1 TERRESTRIAL CONDITIONS

The site where the work is proposed to occur has been modified by industrial development, and does not have flora or fauna. However, areas of bushland are situated near the refinery site. These include the picnic area on the northern side of Solander Street and the Botany Bay National Park to the east of the refinery. Because these areas would not be affected by the proposal, their ecological qualities are not described in this document.

3.10.2 AQUATIC CONDITIONS

There are three studies of aquatic conditions for the Tabbigai Gap and Yena Gap discharge locations that are available. Stormwater runoff, effluent discharges and oil spills have been identified as potential impacts from the refinery. However, all available studies indicate that there is no significant impact from refinery effluent discharge and emissions comply with EPA license conditions. The current EPA license conditions for discharges to water are presented in Appendix C.

McGuiness (1988) and Illert and Reverberi (1996) found that the marine environment near Tabbigai Gap and Yena Gap constitutes broad areas of sand and mud, with beds of seagrasses (in particular, *Posidonia australis* and *Zostera capriconi*), and artificial and natural rocky reefs. Also, 230 fish species and another 225 animal species inhabit these waters.

In 1989, W.S. Rooney and Associates conducted a marine ecological resurvey of Yena Gap two years after commissioning of the Malabar deep ocean sewage outfall. This indirectly assessed the ecological impacts from the ALOR effluent outfall at Yena Gap and at Tabbigai Gap. The following conclusions were drawn:

- effluents discharged at Yena Gap and Tabbigai Gap were not having a deleterious effect on the ecology of the marine environment;
- the possibility exists that effluent from Yena Gap was causing some stress to certain algae (*Ecklonia radiata*) at a distance of 30 m north of the diffuser, but this required verification by repeated observation over at least one year;
- effluent from Tabbigai Gap was clearly affecting an area of intertidal rock surfaces by inhibiting sessile animal attachment, thereby encouraging tolerant encrusting red and brown algae to cover the rocks. However, the volume of effluent appeared to be readily diluted by wave action and no observable impact on the plant and animal community was detectable below low water;
- an examination of bioaccumulation of organic residues in the flesh of fish or invertebrates of the nearshore rocky reefs was not conducted;
- effluent quality should continue to be improved.

The EPA's Estuarine Unit has recently investigated biological assemblages and bioaccumulation in the vicinity of Yena Gap industrial outfall. However, this report was not available for reference at the time of preparing this REF.

3.11 VISUAL AMENITY

The Ampol refinery is a distinct part of the visual environment on the Kurnell Peninsula. Tanks and other facilities can be seen from all directions, including across Bate Bay and across Botany Bay. The refinery is visible from many residences of the Kurnell township. The proposed works area currently comprises a number of tanks, separators and other infrastructure.

To an extent these facilities are shielded from view by a small acoustic barrier between the refinery site and the tennis courts. Landscaping also provides some 'softening' of the current visual impact of the refinery to adjacent land users.

4 ENVIRONMENTAL IMPACT ASSESSMENT

A number of government agencies were consulted during preparation of the REF to identify any issues of interest regarding construction and operation of the proposed plant. Agencies contacted included:

- Environment Protection Authority
- Sutherland Shire Council
- National Parks and Wildlife Service
- NSW Fisheries.

This section examines potential environmental impacts of the proposal. It addresses all of the relevant issues raised by government agencies regarding the proposal. It is anticipated that discussions between Ampol and these agencies, as well as community consultation, will be ongoing.

4.1 WATER QUALITY

The proposed plant would result in improved effluent quality discharged by the refinery and would be designed for a 1 in 10 year storm. This would allow the EPA's requirements under the Effluent Improvement Plan to be achieved. Careful balancing of the four flow paths would be performed in accordance with weather conditions and status of the treatment process elements.

It is expected that there would be no disruption to wastewater treatment during construction because the proposed effluent improvement project involves a would be introduced while the existing system continues to operate.

4.2 ODOUR

The following factors were considered when assessing the potential impact of odour from the proposed facilities on existing conditions:

- capacity for equalisation is included in the engineering design and both effluent streams (ARN and ALOR) would be combined resulting in a more consistent biological load to the proposed biotreatment plant. This would allow the activated sludge to stabilise and provide maximum biodegradation, thus minimise odour emissions;

- current levels of emissions would be maintained because production rates would not significantly increase from current levels;
- the type of feedstocks currently used by ARN and ALOR would remain relatively constant. If the type of feedstock used is changed, resulting in a higher waste fraction being generated from the process stream, the biotreatment plant could be overloaded and emission of odours increase. Similarly, the potential exists for a feedstock of high toxicity to pass through the refinery process causing a reduction to biotreatment efficiency;
- the biotreater would produce a more 'organic' odour rather than the 'chemical' odour typical of oil refineries;
- spent process caustic would be added to the treatment system which has a potential to generate odour.

Spent process caustic is produced by a range of refinery processes which include the removal of sulphur compounds from the various crude oil fractions separated during refining. While the caustic itself has no odour and is not volatile, virtually all sulphur compounds are highly volatile and odorous. In addition, some hydrocarbon fractions will be extracted from the crude by the caustic and combined with the extracted sulphur compounds. The resultant spent process caustic contains a mixture of hydrocarbons and sulphur compounds, and can create a significant odour problem.

Odour levels would be minimised by controlling the rate that the spent process caustic is added to the oily water stream. The rate of addition would depend on the total biological load on the treatment plant and the prevailing weather conditions.

Continuous monitoring of hydrogen sulphide levels would be performed using fixed point monitors and all personnel working in the vicinity would wear personal monitoring units designed to measure their occupational exposure to sulphur compounds.

4.2.1 AERATION TANKS IN ACTIVATED SLUDGE UNIT AND AERATED DIGESTERS

The activated sludge unit and digester are both aerobic process units and are expected to produce the earthy odours typical of this type of plant. The odours are usually not offensive and do not travel far. The activated sludge unit has the potential to produce hydrogen sulfide odours due to the treatment of spent caustic which has a high sulphide concentration. The potential for hydrogen sulfide release would be minimised by introducing the spent caustic into the activated sludge unit via a closed system.

It would be first introduced into the activated sludge unit feed pipe where it would mixes and gets diluted with the bulk of the effluent. This mixture would then be fed to the unit through a distribution manifold at the bottom of the tank, which would also aid the dispersion and dilution of sulphides throughout the tank. The pH of the tank would remain in the range 7.0 to 9.0 thereby minimising the evolution of hydrogen sulphide emissions. These measures would lead to preferential biological oxidation of the sulphides to non odorous sulphates in the unit.

If short term odours are apparent the spent caustic rate can be reduced, if long term odours are apparent there is provision for incorporating hydrogen peroxide pretreatment of the spent caustic.

4.2.2 STORAGE AND TRANSPORT OF SLUDGE

Sludge would be stored in the proposed digester. The digester is an aerobic unit which is not expected to produce offensive odours. The sludge would be transported only within the refinery from the digester to the bioremediation landfarm in sealed tankers.

4.2.3 BIOMASS IN THE EVENT OF TOTAL FAILURE OF THE ACTIVATED SLUDGE OR DIGESTER UNITS

It is expected that the biomass would not cause offensive odours providing the proposed aeration system does not fail. The likelihood of aeration system failure is low because there would be a complete and independent blower on standby in case of failure of the duty unit. If both blowers fail there would be sufficient time to remove the biomasss from both the activated sludge tank and digester before offensive odours are produced by anaerobic biological activity.

Air quality will continue to be monitored at source locations within the proposed plant and refinery.

4.3 NOISE

4.3.1 TRAFFIC NOISE

Given that there is not expected to be any increase in the number of traffic movements or types of vehicles accessing the site as a result of the proposal, there would not be an increase in traffic noise.

4.3.2 DURING CONSTRUCTION

The EPA sets out requirements for the control of construction noise in its Environmental Noise Control Manual.

For a cumulative period of exposure to noise from construction activity of up to four weeks duration, the $L_{A10(15\ minute)}$ *noise level emitted by the works when measured at a residential receiver should not exceed the* L_{A90} *background noise level by more than 20 dBA.*

For a cumulative period of exposure to noise from construction activity of between four and 26 weeks duration, the $L_{A10(15\ minute)}$ *noise level emitted by the works when measured at a residential receiver should not exceed the* L_{A90} *background noise level by more than 10 dBA.*

For a cumulative period of exposure to noise from construction activity in excess of 26 weeks duration, the $L_{A10(15\ minute)}$ noise level emitted by the works when measured at a residential receiver should not exceed the L_{A90} background noise level by more than 5 dBA.

It is generally considered acceptable for received noise levels within commercial or industrial zones to be up to 10 dBA or more higher than those received at residential areas as the activities carried out in such an environment tend to be less prone to disruption or interference by noise.

Time restrictions that typically apply to construction are as follows:

- Monday to Friday 7.00 am to 6.00 pm
- Saturday 7.00 am to 1.00 pm (inaudible at residential premises)
  8.00 am to 1.00 pm (audible at residential premises)
- no work on Sundays or public holidays.

All practical measures should be used to silence construction equipment, particularly where extended hours of operation are required.

The proposal would involve construction techniques and equipment which are typically proven throughout the refinery. The proposed site is relatively close to residential areas, tennis courts, the recreation club and shops which means that it may be slightly more sensitive than other parts of the refinery. Even taking this into account, it is expected that construction activities would be temporary and the associated noise would not be significant compared to existing background levels.

Construction noise would be monitored and any complaints by residents or others would be immediately addressed by Ampol. Construction equipment would be used in accordance with EPA requirements.

4.3.3 DURING OPERATION

The equipment to be installed for the proposed effluent treatment facility would comply to less than 85 dBA approximately 1 m from the source.

The existing acoustic wall that is approximately 40 m long provides a barrier between the nearest neighbours and the noise from the G-14 pumps. Parts of the pumps would be enclosed by the proposed cowlings to reduce the noise level. The IAFs No.1 and No.2 would not be in continuous use because they are only used in rainfall events, which is expected to further reduce the impact of noise. IAF No.1 would have low noise aerators installed. Aeration blowers are located well away from the boundary and would be placed within an acoustic enclosure if necessary.

It is therefore expected that noise associated with the proposed effluent treatment facility would be less than levels for the existing plant. The impact of noise would continue to be monitored at specific locations around the proposed plant and reported in reference to compliance with EPA license conditions.

4.4 SOLID WASTE

4.4.1 ESTIMATES OF THE QUANTITY AND QUALITY OF SLUDGE PRODUCED

It is estimated that an average of 10 m^3/day of aerated waste activated sludge at 2% solids concentration would be produced.

4.4.2 PROPOSED METHOD OF SLUDGE DISPOSAL

It is proposed that the sludge be removed from the digester periodically by vacuum truck and transported to the on site bioremediation landfarm (which was approved by the EPA under the *Waste Minimisation and Management Act 1995* as a controlled waste facility) where it would be biodegraded.

The new landfarm facility is located at the southern portion of the refinery and supersedes the old landfarm. The new landfarm bed comprises a high density propyl ethylene surface with double sealed joints sitting over a secondary liner of approximately 15 cm thick compacted clay. The landfarm has a leachate collection and reticulation system which feeds back into the refinery's water treatment system. The landfarm will have the net effect of significantly reducing the potential for impact on groundwater and soils.

4.4.3 SUPERNATANT DISPOSAL OR TREATMENT

Supernatant from the digester would be fed to the start of the primary treatment plant via the oily water sewer.

4.4.4 DISPOSAL OF BIOMASS IN THE EVENT OF FAILURE OF ACTIVATED SLUDGE OR DIGESTION PROCESS

In the event of failure of the activated sludge or digestion process the biomass would be removed and dewatered with a hired dewatering unit. The supernatant would be fed to the start of the proposed primary treatment plant via the oily water sewer. The dewatered sludge would be transported in covered skips to the on site bioremediation landfarm where it will be biodegraded before offensive odours can be produced by anaerobic biological activity.

An emergency plan would be developed and include a section covering the possible failure of the activated sludge or digestion processes. The emergency plan would include procedures for sludge removal, dewatering and treatment and provide for the availability of appropriate equipment and staff.

4.5 SOILS AND GROUNDWATER

There is potential for surface runoff and sedimentation to result from construction activities, especially at the time when the tanks are built. Spoil and other waste associated with construction would be managed using best environmental practice techniques as identified by the EPA in their draft publication *Managing Urban*

Stormwater—Construction Activities. Examples of site work practices to be adopted, where appropriate, include:

- sediment filters
- stockpile management
- waste recycling and disposal.

A soil and water management plan for the proposal would be prepared in consultation with the appropriate authorities prior to commencing construction. Attention would be given to proper maintenance of environmental controls during the construction period and to their removal once construction is complete.

The operation of the proposed effluent treatment facility is not expected to impact on the quality of existing soils and groundwater because the facility would be constructed above ground on a developed site. Stormwater runoff would be managed by the existing stormwater management system. Ampol's Soil and Groundwater Management Plan provides for ongoing monitoring and management of potential areas of concern at the refinery.

4.6 TRAFFIC

There would be no change to current site access arrangements for vehicles travelling to and from the refinery along Captain Cook Drive.

Ampol has spent up to $50 million per annum in previous years on capital investment. The current year's approved amount is $25 million which means that the total amount of construction activity at the refinery will be less than in previous years. The biotreater proposal is included in this investment budget.

The level of construction activity is directly linked to the number of staff employed and the amount of traffic experienced. Because there will be an overall reduction in capital investment compared to previous years, no additional staff would be employed to operate the proposed plant and there would be no increase in the traffic volumes as a result of the proposed construction work.

During operation, trucks would be required for the delivery of caustic and acid and also for transfer of biosludge to oily sludge holding bays. However, the delivery of materials for pH control to the plant would be very infrequent and total truck movements to and from the refinery is expected to decrease significantly from previous years. The operation of the proposed effluent treatment facility would not result in an increase in vehicle movements.

The risk of a spill or accident affecting humans or ecosystems along routes to and from the refinery would not differ to current levels of risk. This applies to both construction and operational stages of the proposal.

4.7 FLORA AND FAUNA

The study area does not contain any terrestrial flora or fauna that would be directly affected by the construction of the proposed facilities. Terrestrial ecosystems in the areas surrounding the refinery are not expected to be affected by the proposal.

Effluent discharges during the construction period would be tightly controlled in accordance with EPA requirements and license conditions. Improved quality of effluent discharged to the ocean would be expected to benefit aquatic and benthic ecosystems, especially near the discharge locations.

It is expected that the EPA and others will continue to monitor aquatic ecosystems in the vicinity of the outfalls. Over time, the monitoring may reveal greater diversity and species abundance as a result of the improved effluent being discharged.

4.8 UTILITIES

There would be no change to current water supply to the refinery as a result of the proposal. There is no gas supplied to the refinery at present and this arrangement would not change.

Internal electricity supply to the effluent improvement facilities would need to be substantially upgraded, although this would not result in much change to overall power demand by the refinery complex.

The recreational club and service station located on the boundary between the refinery and Captain Cook Drive currently utilise the refineries' sewer line to Yena Gap. Sewage along this line receives no treatment prior to discharge. It is proposed that the recreation club and service station be connected to the main sewer which flows to the Cronulla sewage treatment works. The control room toilets in the study area currently use a pump-out system and it is proposed to connect this to the refineries' internal sewage disposal system.

It is proposed to convert from the current safety management system of alarms, emergency lights and pagers to a system utilising two-way radios and a centralised remote control room system manned with an operator. Improved communications would provide a safer environment in which to work and enable greater control to be placed on management of the effluent system. This approach has been demonstrated to be highly effective for other areas within the refinery.

4.9 VISUAL

It is considered that both the construction of the proposed effluent treatment facility and the proposed relocation of the oily sludge holding bays to the back of the refinery would not significantly impact the visual amenity. It is expected that the proposal would:

- maintain current visual amenity at the study site and ensure no significant increase in building height;
- increase the distance between the sludge treatment facility and the existing residential boundary.

4.10 LOCAL COMMUNITY

Ampol will continue to consult the local community on environmental and developmental issues associated with the refinery. To date, Ampol has conducted a number of consultation meetings and has communicated relevant information by letter drops to the majority of residents at Kurnell. A letter and refrigerator magnet were given to members of the local community to encourage inquiries about the plant's operations. Ampol is committed to further developing relationships with residents through its community consultation program in an effort to broaden awareness about refinery operations and company initiatives. It is intended the same standard of consultation be maintained during the approval process of the proposed effluent improvement project.

5 CONCLUSIONS

The proposed effluent improvement project would result in improved effluent quality that is discharged to the ocean as required by the EPA under the effluent improvement plan. This may result in long term benefits for aquatic ecosystems near the discharge locations. The proposal is also expected to result in a minor decrease in noise emissions from the refinery due to the upgrade and improvement in plant equipment to be installed. Other impacts such as vehicle movements and those on soils, groundwater, visual amenity, air quality, and terrestrial flora and fauna would be negligible.

Odour from the proposed biotreater would have a different character to odours currently associated with the refinery. It is expected that the biotreater would produce a more 'organic' odour rather than 'chemical' odour typical of oil refineries. Because odour assessment is largely a subjective exercise, its impacts are difficult to predict. Residents and refinery workers are likely to have become familiar with the existing odours from the refinery and although the biotreater may not generate offensive odour, it may be noticeable because it is different.

As a result of the proposed change to the oily water treatment process and the relocation of the oily sludge holding bays to the south-east portion of the refinery, it is expected that there would be a reduction in odour from the study site. However, treatment of spent process caustic at the proposed plant has the potential to generate hydrogen sulphide odours. Rigorous monitoring would be performed and if there are significant odours related to the spent caustic, amelioration measures would be implemented.

The effluent improvement project is proposed in response to EPA requirements. Key stakeholders have been involved throughout the concept design formulation and environmental impact assessment process. Consultation with residents, the broader community and government agencies will be ongoing.

6 REFERENCES

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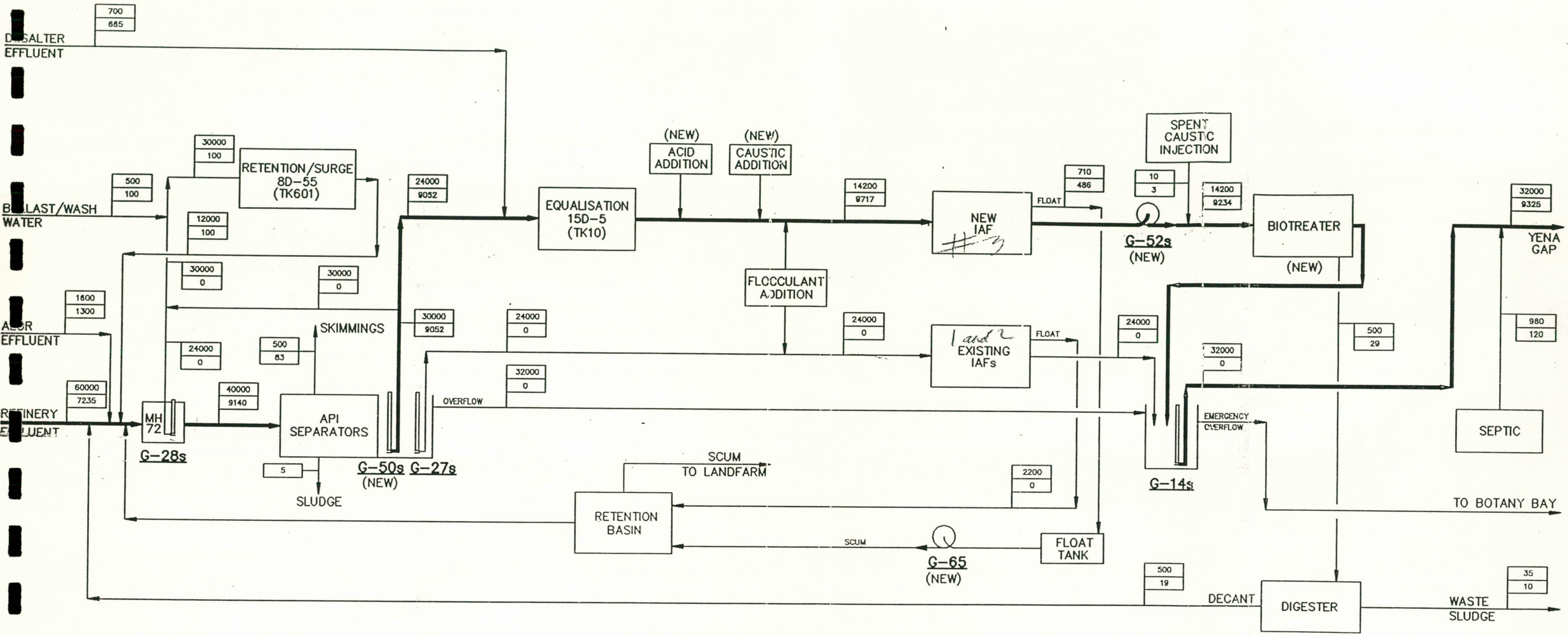
Appendix A

PROCESS FLOW AND BLOCK DIAGRAMS



NOTES:

1. MAXIMUM FLOWS SHOWN REFLECT CAPACITIES OF EXISTING PUMPS.

LEGEND

MAXIMUM FLOWRATE, M^3/DAY
NORMAL FLOWRATE, M^3/DAY

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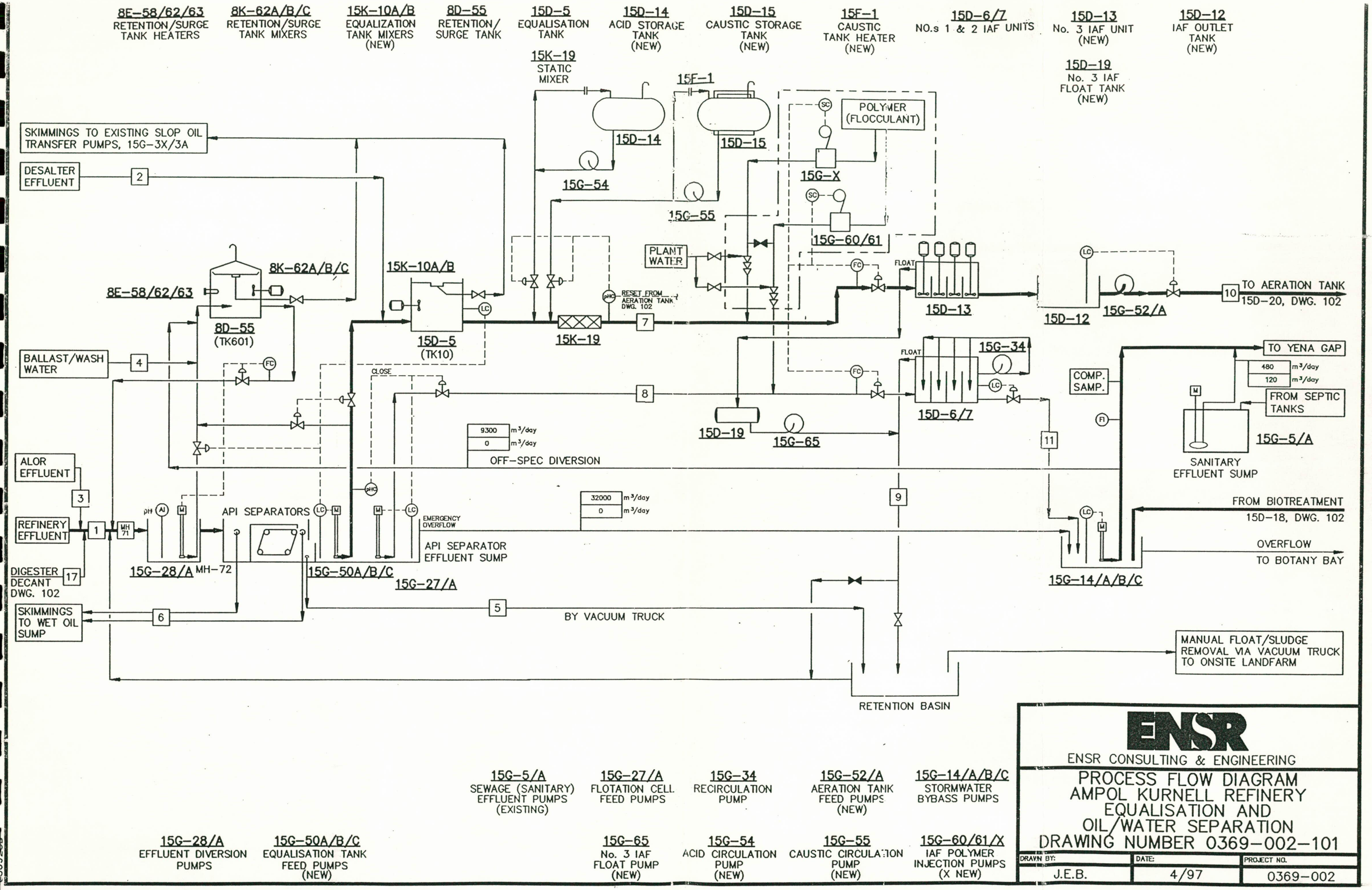
BLOCK FLOW DIAGRAM
AMPOL KURNELL REFINERY
EFFLUENT TREATMENT
DRAWING NUMBER 0369-002-100

DRAWN BY:	DATE:	PROJECT NO.
J.E.B.	4/97	0369-002


8E-58/62/63
RETENTION/SURGE TANK HEATERS
8K-62A/B/C
RETENTION/SURGE TANK MIXERS
15K-10A/B
EQUALIZATION TANK MIXERS (NEW)
8D-55
RETENTION/ SURGE TANK
15D-5
EQUALISATION TANK
15K-19
STATIC MIXER
15D-14
ACID STORAGE TANK (NEW)
15D-15
CAUSTIC STORAGE TANK (NEW)
15F-1
CAUSTIC TANK HEATER (NEW)
15D-6/7
NO.s 1 & 2 IAF UNITS
15D-13
No. 3 IAF UNIT (NEW)
15D-19
No. 3 IAF FLOAT TANK (NEW)
15D-12
IAF OUTLET TANK (NEW)
SKIMMINGS TO EXISTING SLOP OIL TRANSFER PUMPS, 15G-3X/3A
DESALTER EFFLUENT
2
15F-1
15D-14
15D-15
POLYMER (FLOCCULANT)
SC
15G-X
15G-54
15G-55
SC
15G-60/61
PLANT WATER
8K-62A/B/C
15K-10A/B
8E-58/62/63
8D-55
(TK601)
15D-5
(TK10)
LC
pHC
RESET FROM AERATION TANK DWG. 102
15K-19
7
FC
FLOAT
15D-13
LC
15D-12
15G-52/A
10
TO AERATION TANK 15D-20, DWG. 102
BALLAST/WASH WATER
4
FC
CLOSE
8
FLOAT
15G-34
FC
LC
15D-6/7
15D-19
15G-65
TO YENA GAP
480 m³/day
120 m³/day
COMP. SAMP.
M
FROM SEPTIC TANKS
FI
15G-5/A
SANITARY EFFLUENT SUMP
11
9300 m³/day
0 m³/day
OFF-SPEC DIVERSION
ALOR EFFLUENT
3
pHC
9
REFINERY EFFLUENT
1
MH 71
pH
AI
M
API SEPARATORS
LC
M
M
LC
EMERGENCY OVERFLOW
API SEPARATOR EFFLUENT SUMP
32000 m³/day
0 m³/day
FROM BIOTREATMENT 15D-18, DWG. 102
LC
M
OVERFLOW TO BOTANY BAY
DIGESTER DECANT DWG. 102
17
15G-28/A
MH-72
15G-50A/B/C
15G-27/A
15G-14/A/B/C
SKIMMINGS TO WET OIL SUMP
6
5
BY VACUUM TRUCK
MANUAL FLOAT/SLUDGE REMOVAL VIA VACUUM TRUCK TO ONSITE LANDFARM
RETENTION BASIN
15G-5/A
SEWAGE (SANITARY) EFFLUENT PUMPS (EXISTING)
15G-27/A
FLOTATION CELL FEED PUMPS
15G-34
RECIRCULATION PUMP
15G-52/A
AERATION TANK FEED PUMPS (NEW)
15G-14/A/B/C
STORMWATER BYBASS PUMPS
15G-28/A
EFFLUENT DIVERSION PUMPS
15G-50A/B/C
EQUALISATION TANK FEED PUMPS (NEW)
15G-65
No. 3 IAF FLOAT PUMP (NEW)
15G-54
ACID CIRCULATION PUMP (NEW)
15G-55
CAUSTIC CIRCULATION PUMP (NEW)
15G-60/61/X
IAF POLYMER INJECTION PUMPS (X NEW)
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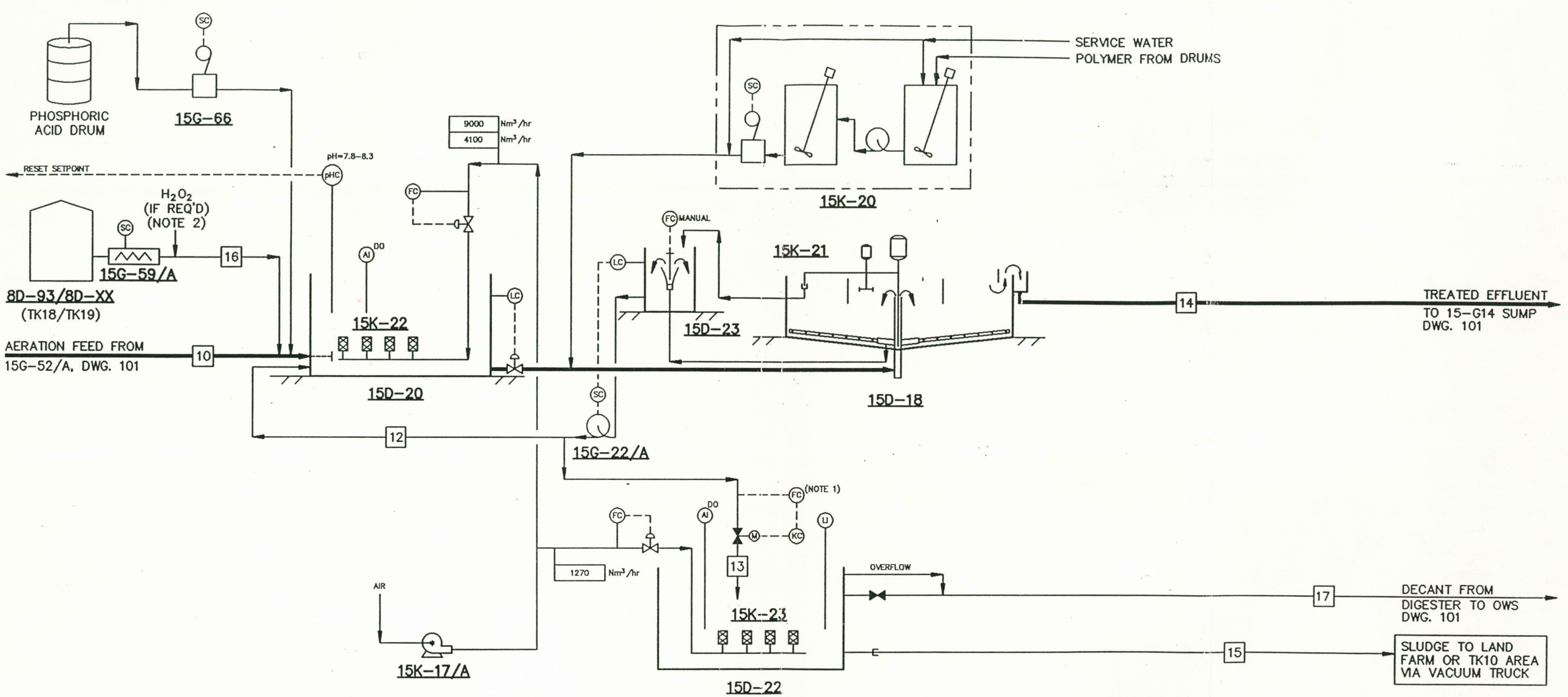
PROCESS FLOW DIAGRAM
AMPOL KURNELL REFINERY
EQUALISATION AND
OIL/WATER SEPARATION
DRAWING NUMBER 0369-002-101
DRAWN BY: J.E.B.
DATE: 4/97
PROJECT NO. 0369-002

8D-93/8D-XX	15D-20	15K-22	15D-18	15D-22	15K-23	15D-23	15K-20	15K-21
SPENT CAUSTIC TANKS (EXISTING)	AERATION TANK	BIOTREATMENT AERATION SYSTEM	CLARIFIER TANK	AEROBIC DIGESTER	DIGESTER AERATION SYSTEM	SLUDGE RETURN TANK	CLARIFIER POLYMER ADDITION PACKAGE	FLOCCULATOR/ CLARIFIER



NOTES:

1. INTERMITTENT SLUDGE WASTING ON TIMER/TOTALIZER.
2. PEROXIDE ADDITION SYSTEM TO BE ADDED IN FUTURE IF REQUIRED.

15G-66	15G-59/A	15K-17/A	15G-22/A
PHOSPHORIC ACID DOSING PUMP	SPENT CAUSTIC INJECTION PUMPS	AERATION BLOWERS	RETURN SLUDGE PUMPS

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PROCESS FLOW DIAGRAM
AMPOL KURNELL REFINERY
ACTIVATED SLUDGE SYSTEM
DRAWING NUMBER 0369-002-102

DRAWN BY:	DATE:	PROJECT NO.
J.E.B.	4/97	0369-002

Appendix B

EXISTING AND PROPOSED EQUIPMENT

Appendix B
EXISTING AND PROPOSED EQUIPMENT

Table B.1 **Required process equipment—tanks and sumps**

Equipment	Diameter (mm)	Height (mm)	Nominal capacity (m^3)	Remarks
Retention/surge tank (effluent surge/ballast tank)	61,000	14,600	42,600	Existing; cone roof w/floating pan roof; 3 heaters; 3 mixers
Spent caustic tank (heptene/bitusol storage tank)	7,600	9,100	408	Existing; floating roof
Spent caustic tank (heptene storage tank)	7,600	9,100	408	Existing; floating roof
Equalisation tank (retention/ballast tank)	43,000	14,600	18,000	Existing; floating roof with 2 new mixers
IAF No.1	3,050 (W) 12,600 (L)	3,050(D)	-	Existing; includes dispersers
IAF No.2	3,050(W) 12,050 (L)	3,660(D)	-	Existing; revamped unit & includes pump
IAF Outlet Tank	6,180	2,624	65	Open top; coal tar epoxy lined steel
IAF No.3	2,300(W) 7,000(L)	2,800(D)		
Acid storage tank	1,300	3,250	4.5	Horizontal drum w/desiccant vent dryer
Caustic storage tank	1,300	3,250	4.5	Horizontal drum w/ external heater
Clarifier tank	32,000	5,200	-	Open top; coal tar epoxy lined steel
IAF No.3 Float Tank	2,845	9,020	57	
Aeration tank	35,100	9,756	9,440	Open top; coal tar epoxy lined steel
Aerobic digester	13,700	9,756	1,438	Open top; coal tar epoxy lined steel
Sludge return tank	8,530	4,878	279	Open top; coal tar epoxy lined steel
Manhole No. 72 pump pit	1,830 L x 915 W x 2,070D			Existing
Oily water separator outlet chamber	1,400(W) 2,500 (L)	3,500(D)		Existing
API separator effluent sump	2,500 L x 1,400w x 3,500D			Existing; modified sump
Effluent sump				Existing
Sanitary effluent sump				Existing
Retention basin				Existing

Table B.2 **Required process equipment—general**

Equipment	Remarks
Tank 601 heaters	Existing (to be removed)
Retention/surge tank mixers (Tank 601 mixers)	Existing; tank side entering agitators
Caustic tank heater	External tank heater to maintain tank 15D-15 at 20°C; heating duty = 2 kW
IAF No.1 dispersers	Existing; IAF dispersers
Equalisation tank mixers	Two identical tank side entering agitators
Static mixer	
Clarifier polymer addition package	
Flocculator/clarifier	
Biotreatment aeration system	Coarse bubble diffusers to deliver 8,900 Nm^3/hr air flow
Digester aeration system	Coarse bubble diffusers to deliver 1,300 Nm^3/hr air flow
IAF No.3 dispersers	Included with No. 3 IAF unit
API separators	Existing; fixed roof API separators with scrapers; four separator bays each includes oil skimmer, separator rakes, hydraulic power unit

Table B.3 **Required process equipment—pumps and blowers**

Equipment	Capacity (m^3/day)	Delta P (kPa)	Motor (kW)	Remarks
Aeration blowers	10,150 Nm3/hr	94	450	Single stage centrifugal blowers with inlet guide vane control
Sewage (sanitary) effluent pumps	980	500	26	Existing; vertical centrifugal
Stormwater bypass pumps (oily water effluent pumps)	8,200	770	112	Existing; vertical centrifugal
Return sludge pumps	12,000	236	56	Variable speed centrifugal
Flotation cell feed pumps	12,600	140	30	Existing vertical centrifugal
Effluent diversion pumps (rain water pumps)	16,000	270	75	Existing vertical centrifugal
Booster pump (ballast booster pumps)	19,600	130	45	Existing; centrifugal pump curve
Recirculation pump (N0.2 IAF Recycle Pump)	14,400		37	Existing; centrifugal pump curve
Equalisation tank feed pumps	10,000	430	75	Low speed vertical centrifugal (replaces existing pumps)
Aeration tank feed pumps	11,700	234	56	Centrifugal Pump
Acid circulation pump	273	181	2.2	Centrifugal Pump
Caustic circulation pump	273	179	2.2	Centrifugal Pump
Spent caustic injection pumps	10	117	0.37	Progressive cavity
IAF polymer injection pumps	20-60 L/hr			Existing
No. 3 IAF float pump	1420	316	11	Centrifugal Pump
Phosphoric acid dosing pumps	6.5 l/hr	178	0.37	Metering pump
No. 3 IAF polymer injection pumps	20-60 L/hr	256	0.37	Metering pump

Appendix C

ARN LICENSE CONDITIONS

PRP3: EFFLUENT IMPROVEMENT PLAN

1. OBJECTIVE

The effluent improvement plan must have as its objective, minimisation of pollutant discharges to the Yena Gap outfall through pollution source control and/or effluent treatment. Following completion of the improvement plan, the EPA expects the effluent discharge to at least comply with the following tabulated effluent quality criteria.

2. EFFLUENT QUALITY CRITERIA

Substance	Maximum concentration in 50% of samples (micrograms per litre)
Arsenic	70
Nickel	30
Ammonia	6000
Phenols	300
Lead	25
PAHs	30

It is intended that these criteria shall become effluent quality limits in any licence issued after commissioning of the effluent treatment plant.

The effluent improvement plan should aim to significantly reduce the mass of organic compounds discharged in general and the following organic compounds in particular:

- Naphthalene
- Phenanthrene
- Bis-(2- ethylhexyl)phthalate
- Benzene
- Toluene
- Ethyl Benzene
- 2,4 - dimethylphenol

The discharge may be amenable to future mass-based limits.

3. REQUIREMENTS

The effluent improvement plan consists of pollutant source control measures and additional effluent treatment. To achieve this end, the licensee has carried out investigations, concept and functional design to facilitate effluent improvement plan for the Yena Gap discharge. Current requirements is for the submission of the detailed design to facilitate Pollution Control Approval for the works, followed by construction and commissioning. The aim of the plan must be to eliminate pollutants, or where this is not possible, to achieve the above effluent quality criteri within the timetable specified below.

The effluent improvement plan is also to provide for complete decommissioning of the seawater/cooling water dilution of the Yena Gap discharge. Effluent treatment solutions that were required to be examined included, biological treatment for removal of phenol, ammonia and organic compounds, and treatment processes for heavy metal reduction.

4. PROJECT AND REPORTING TIMETABLE

It is envisaged: that the works will be constructed prior to 31 December 1998 followed by 6 months of commissioning; and that the following major equipment order placement dates are met and reported to the EPA:-

Equalisation Tank Feed Pumps	September 1997
Clarifier	September 1997
Induced Air Flotation Unit #3	September 1997
Aeration Tank	December 1997

Note: An application for pollution control approval with supporting information containing complete engineering and operational details is to be submitted to the EPA prior to the commencement of works.

5. EFFLUENT IMPROVEMENT ENVIRONMENTAL MONITORING

The licensee must conduct monitoring of the environment immediately surrounding the Yena Gap outfall for at least six months after completion of the effluent improvement plan pollution reduction programme.

The environmental monitoring must include investigation of biological assemblages and bioaccumulation in the vicinity of the Yena Gap outfall. The monitoring must be undertaken by an independent expert organisation an in accordance with a methodology approved by the EPA.

The monitoring shall be used to assess the performance of the effluent improvement plan, to detect any further environmental impacts occurring an

Appendix D

EPA REQUIREMENTS

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Table D.1 **EPA Requirements for the Proposed Effluent Improvement Project REF**

EPA Requirements/Issues	Section of Reference in REF
Water management/Background	
• background and benefits	1
• wastewater discharge quality	2.4
• brief treatment process description	2.4
Noise	
• identify major noise sources in new plant such as pumps and compressors	3.8, 4.3
• estimation of any increase in the current level of noise from the refinery as a result of the upgrade and comparison with the refinery's noise boundary limit	4.3.3
Construction and other	
• expected construction noise impacts	4.3.2
• minimisation of disruption to wastewater treatment during construction	4.1
• minor sediment controls required during construction	4.4
• consent authorities requirements for the project to date	4.9
Air	
• potential odour emissions and odour controls	4.2
• aeration tanks in activated sludge unit and aerated digesters	4.2.1
• storage and transport of sludge	4.2.2
• biomass in the event of total failure of the activated sludge or digester units	4.2.3
Solid Waste	
• estimates of the quantity and quality of sludge produced	4.4.1
• proposed method of sludge disposal	4.4.2
• supernatant disposal or treatment	4.4.3
• disposal of biomass in the event of failure of activated sludge or digestion processes	4.4.4
Review of monitoring regime for discharge to Yena Gap	Independent review to be conducted

KINHILL