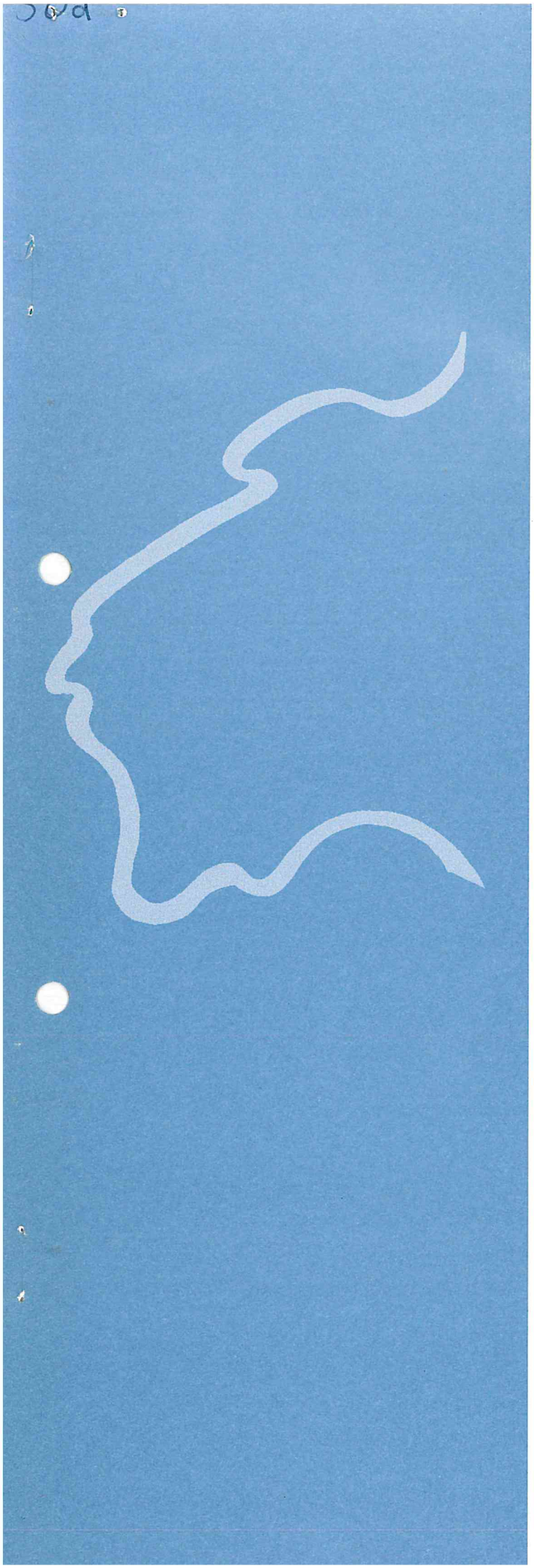

Environmental Protection Authority

Guidance for the Assessment of Environmental Factors

(in accordance with the Environmental Protection Act 1986)

Achieving EPA Risk Criteria for development in proximity to existing and proposed High Pressure Gas Transmission Pipelines

No. 50

Draft

May 2000

Western Australia

FOREWORD

The Environmental Protection Authority (EPA) is an independent statutory authority and is the key provider of independent environmental advice to Government.

The EPA's objectives are to protect the environment and to prevent, control and abate pollution. The EPA aims to achieve some of this through the development of environmental protection Guidance Statements for the environmental impact assessment (EIA) of proposals.

This document is one in a series being issued by the EPA to assist proponents, consultants and the public generally to gain additional information about the EPA's thinking in relation to aspects of the EIA process. The series provides the basis for EPA's evaluation of, and advice on, development proposals subject to EIA. The Guidance Statements are one part of assisting proponents in achieving an environmentally acceptable proposal. Consistent with the notion of continuous environmental improvement and adaptive environmental management, the EPA expects proponents to take all reasonable and practicable measures protect the environment and to view the requirements of this Guidance as representing the minimum necessary process required to achieve an appropriate level of environmental protection.

Four high pressure transmission pipelines transport natural gas from the gasfields in the North West of the State to the users in the South West, Kalgoorlie and Port Hedland. In populated areas changing landuse may result in the risk from these pipelines exceeding the EPA's individual public risk criteria.

The guidance presented in section 3 of the document will be used by the EPA in determining a level of assessment of environmental impacts with respect to public risk, and in providing advice to the Minister for the Environment for formal development applications. Where proposals meet the requirements of this guidance statement and risk criteria, the environmental impact assessment process will be assisted.

This Guidance Statement has the status "**Draft**", which means that it has been endorsed by the EPA for release for public and stakeholder review for 8 weeks.

I am pleased to release this document and encourage you to comment on it. Information on where to address your comments is given on the following page.

Bernard Bowen

Bernard Bowen
CHAIRMAN
ENVIRONMENTAL PROTECTION AUTHORITY

12 May 2000

ENVIRONMENTAL PROTECTION AUTHORITY
GUIDANCE FOR THE ASSESSMENT OF ENVIRONMENTAL FACTORS

DRAFT GUIDANCE STATEMENT No. 50:

Achieving EPA Risk Criteria for development in proximity to existing and proposed High Pressure Gas Transmission Pipelines.

How to comment on this document

This document is released for Stakeholder comment for a period of 8 weeks. Your comments are welcome.

Please send your comments by 7 July 2000 to:

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Guidance Statement No. 50

Guidance Statement for Achieving EPA Risk Criteria for development in proximity to existing and proposed High Pressure Gas Transmission Pipelines.

Key Words: **gas pipelines, high pressure gas transmission pipelines, pipelines, risk, public health and safety**

1. PURPOSE

1.1 Guidance Statements generally are developed by the EPA to provide advice to proponents, and the public generally, about the minimum requirements for environmental management which the EPA would expect to be met when the Authority considers a proposal during the assessment process.

This Guidance Statement is termed "Draft", and should be viewed as a general guide to environmental impact assessment (EIA). While the content of the guidance has not yet been signed off by the EPA at this stage, it should be regarded as the latest thinking in the mind of the EPA if it is asked to consider the issue for assessment. Users would be well advised to be mindful of the guidance at this early stage.

1.2 This Guidance Statement specifically addresses the factor of public risk assessment and management, of off-site individual risk from high pressure gas transmission pipelines as a significant environmental determinant in the environmental impact assessment process in Western Australia. This Guidance provides information which the EPA will consider when assessing proposals in proximity to high pressure gas transmission pipelines. It takes into account:

(a) protection of the environment as defined by the *Environmental Protection Act 1986 (WA)* with a focus on people and the environment; and

(b) the need to ensure that landuses and people adjacent to high pressure gas transmission pipelines are not exposed to unacceptable levels of risk.

1.3 This is a Guidance Statement and proponents are encouraged to consider their proposals in the light of the guidance given. A proponent who wishes to deviate from the minimum level of performance set out in this Guidance Statement would be expected to put a well researched and clear justification to the EPA arguing the need for that deviation.

2. THE ISSUE

There are currently four high pressure gas transmission pipelines that extend from the northern gas fields (Dampier and Dongara) to Port Hedland, the South West, and the Goldfields of Western Australia. (Figures 1 and 2)

These pipelines are the:

(1) Dampier to Bunbury Natural Gas Pipeline (DBNGP);

(2) Goldfields Gas Pipeline (GGP);

(3) Dampier to Port Hedland Gas Pipeline (DPHGP); and

(4) Parmelia Pipeline from Dongara to the South West.

Changing landuse adjacent to the pipeline easement, or changes to activities within the easement (installation of another pipeline for example), may result in the risk posed by these pipelines exceeding the EPA criteria for individual risk of fatality and affecting the overall risk to the public. Fortunately most of the pipeline routes are located in rural areas and hence pose little risk to the public. However where the pipelines pass close to, or through built up areas, the chances of the EPA risk criteria being exceeded due to changes in landuse or modifications within the pipeline easement increases.

The purpose of this Guidance is to provide direction for proponents and regulatory authorities on how to determine the acceptable landuses adjacent to high pressure gas transmission pipelines and to ensure the individual risk of fatality meets the EPA criteria as stated in EPA Guidance No.2 (EPA, 1998).

3. THE GUIDANCE

3.1 The Environmental Protection Authority's Objectives

The EPA's objectives are to ensure that when a landuse is changed adjacent to an existing high pressure gas transmission pipeline, or when a new (or upgraded) high pressure gas transmission pipeline is proposed to be installed adjacent to existing landuses:

- the level of risk for adjacent landuses meets the EPA individual risk criteria, and
- that ALARP (As Low As Reasonably Practicable) requirements are met such that:
  - risk mitigation measures are implemented;
  - separation from the high pressure gas transmission pipeline is achieved; and
  - management of the high pressure gas transmission pipeline and easement is modified to account for the changes.

3.2 The Environmental Protection Authority's Previous Statements

Since 1986 the EPA has required proponents of industrial projects to assess the off-site individual risk associated with their proposal. In 1993 and 1995 the EPA also required proponents seeking to change landuse adjacent to existing high pressure gas transmission pipelines to ensure risk assessments were conducted to determine if their development proposals were consistent with EPA risk criteria.

The following EPA publications provide guidance on the setting of individual risk criteria and discuss aspects of societal risk for which no criteria have been set to date:

- EPA (1987), 'Risks and Hazards of industrial developments on residential areas in Western Australia', Bulletin 278. EPA, Perth.
- Guideline (1990): 'Review of guidelines for risk assessment in Western Australia', December 1990.
- EPA (1992a), 'Criteria for the assessment of risk from industry', Bulletin 611. EPA, Perth.
- EPA (1992b), 'Criteria for the assessment of risk from industry - expanded discussion', Bulletin 627. EPA, Perth.
- EPA (1994), 'Risk Criteria - on site risk generation for sensitive developments', Bulletin 730. EPA, Perth.

- EPA (1997), 'Industrial-Residential Buffer Areas (Separation Distances)', Interim Guidance No.3, July 1997.

- EPA (1998), 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant', Interim Guidance No.2, July 1998.

3.3 Application of the Guidance to Assessment

3.3.1 Operating pressure

The intention of this Guidance Statement is to focus on high pressure gas transmission pipelines with a Maximum Allowable Operating Pressure (MAOP) above 5MPa and subject to AS 2885.1 (1997), and where the landuses adjacent to these pipelines involve residences or congregations of people. At the time of writing there are four such pipelines in Western Australia (see Figures 1 and 2).
Secondary and tertiary distribution gas pipelines can still pose significant risks, but are not the primary focus of this guidance statement

3.3.2 Separation distance between high pressure gas transmission pipeline and development

Consistent with the recommendations in EPA Draft Policy No.3 'Industrial Residential Buffer Areas (Separation Distances),' proposals that achieve a minimum 300m separation distance from the high pressure gas transmission pipeline to areas where people reside or groups of people can congregate, need not be referred to the EPA.

HB105 (1998) says the operating authority should consider changes in landuses '...within a distance in metres equal to the pipeline diameter in millimetres...'. This distance can also be used as a guide by planning authorities when considering major changes in landuse for secondary and tertiary pipelines, to ensure the pipeline operator and authority is consulted.

The EPA acknowledges that certain landuses can be located closer than 300m, based on risk rather than consequence distances, provided that the risk is mitigated through the application of specific construction and management measures to the high pressure gas transmission pipeline.

Figure 1 - High pressure gas transmission pipeline locations within Western Australia (1999).

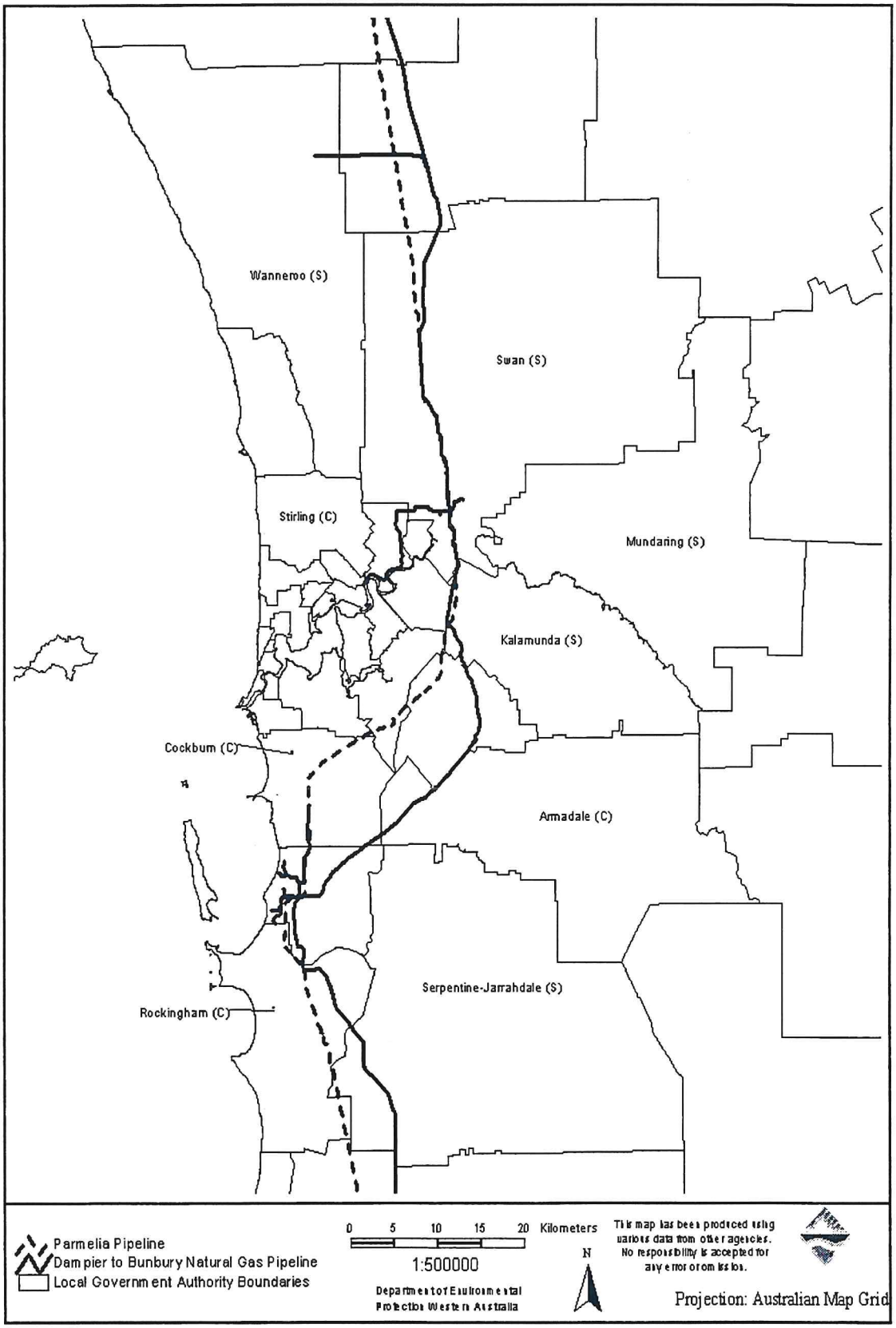


Figure 2 - High pressure gas transmission pipeline locations within the Perth metropolitan area (1999).

3.3.3 Purpose of existing pipeline easement

The existing pipeline easements for the Dampier to Bunbury Natural Gas Pipeline (DBNGP) (30m) and Parmelia pipeline (16m), were established under the *State Energy Commission Act (1979)* and *Petroleum Pipelines Act (1969)* respectively. The DBNGP was transferred to the *Dampier to Bunbury Pipeline Act (1997)* with the sale of the pipeline. The purpose of the *Dampier to Bunbury Pipeline Act (1997)*, and those that preceded it, is to create an easement which grants the pipeline operators guaranteed access for operational and maintenance activities. The easement was never intended to act as a buffer to mitigate risk and is not adequate to do so in many cases. There is, however, a general assumption that so long as development is restricted to outside the easement, risk to the public is not a concern. This assumption is incorrect, because to achieve the EPA risk criteria for individual risk of fatality, there may need to be either some restrictions placed on the type of activity that occurs adjacent to the pipeline easement or additional risk mitigation action taken for the pipeline, or both.

3.3.4 Adjacent landuses that trigger EPA involvement

The EPA has defined acceptable criteria for individual risk of fatality as it relates to five main types of landuse. These landuse types are:

- Sensitive Development (hospitals, schools, child care facilities and aged care housing developments);
- Residential Development;
- Commercial Development;
- Non-industrial Activities; and
- Industrial Facilities.

The EPA risk criterion relevant to each landuse category is presented in Appendix 2.

The location of facilities that result in the gathering of large numbers of people for relatively short periods of time (eg: Sporting Ovals) may constitute a risk to society that is not acceptable in some situations. The EPA's objective for societal risk is also stated in Appendix 2.

3.3.5 Assessment guidance

There are four development processes that may result in a change in landuse adjacent to an existing high pressure gas transmission pipeline, or a change in the operating features or

an existing high pressure gas transmission pipeline. These processes are:

- the initiation of an *Amendment* to a planning scheme (either at the Regional or Town level);
- an application for *Subdivision approval*;
- the lodging of a *Development application* for development adjacent to an existing pipeline; or
- installation of a new pipeline adjacent to an existing landuse.

A decision to finalise or approve any of these processes may lead to situations where the EPA criteria for risk may be exceeded.

Figure 3 outlines the suggested process to be followed in the event of landuse changes adjacent to an existing high pressure gas transmission pipeline, or where a new pipeline is proposed adjacent to an existing landuse, to determine if:

1. the EPA is likely to be concerned about the proposal; and
2. if the proposal meets the EPA criteria for risk.

3.3.6 EPA area of interest

Part 1 of Figure 3 establishes the EPA's area of concern as situations where the Maximum Allowable Operating Pressure (MAOP) of a gas pipeline is greater than 5MPa and the separation distance from the centre line of the pipeline to the adjacent landuse is less than 300m.
The proponent, or planning officer considering the proposal, can easily obtain the necessary information from the pipeline operator. The two pieces of information required are:

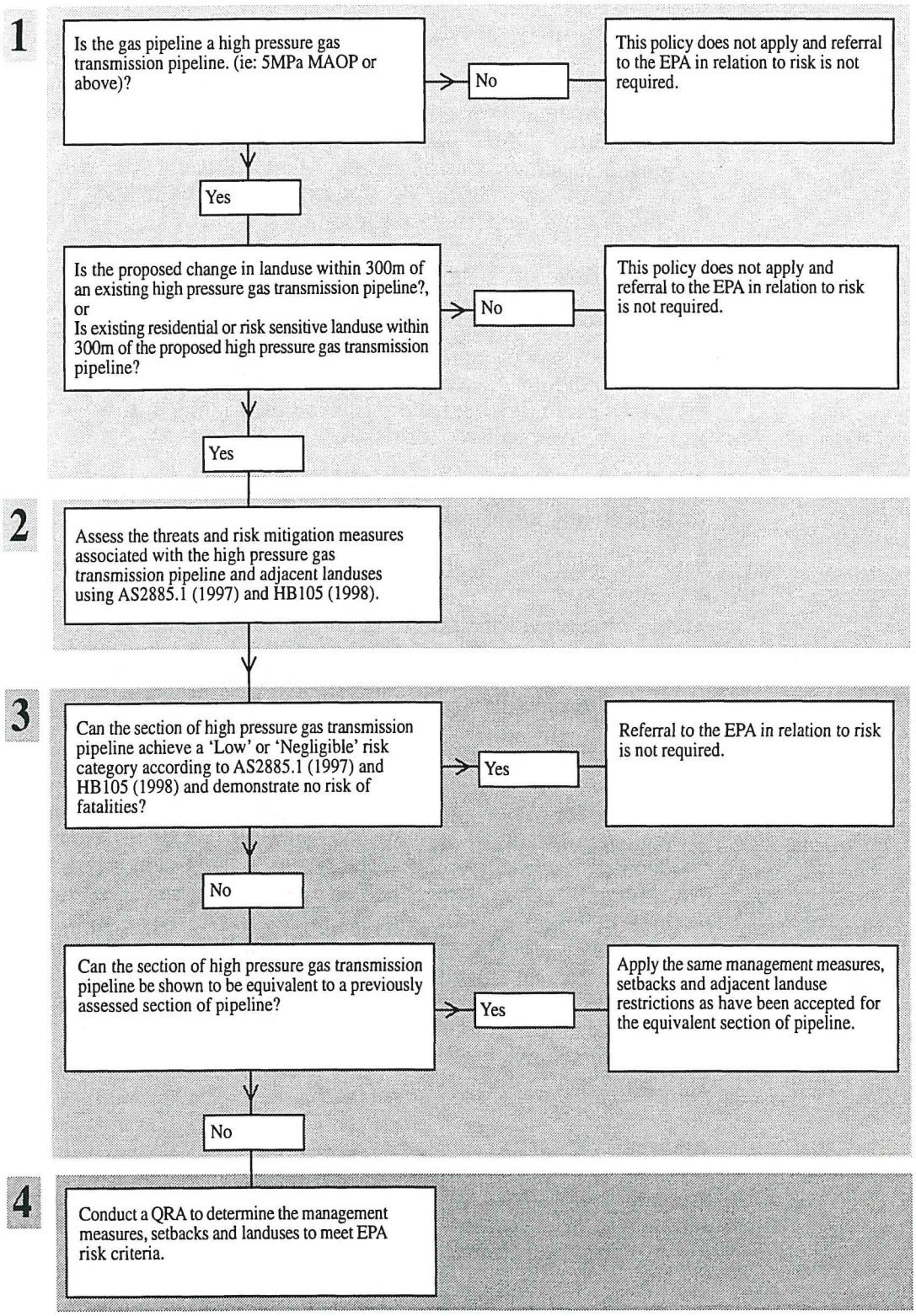
- the maximum allowable operating pressure for the pipeline, and
- the point of closest separation between the adjacent landuse (existing and proposed) and the centreline of the pipeline (existing or proposed).

If risk is the only issue and the MAOP is less than 5MPa or the separation distance between the pipeline and adjacent landuse is greater than 300m, the proposal need not be referred to the EPA in relation to risk.

3.3.7 Assessing threats and risk mitigation features

Part 2 of Figure 3 shows that it is the responsibility of the operator(s) of a high pressure gas transmission pipeline to conduct studies to assess the threats and risk mitigation features of the pipeline according to AS2885.1 (see Appendix 4). The

Figure 3. Decision flowchart to determine actions necessary to achieve the EPA risk criteria for Individual Risk of Fatality and Societal Risk.



proponent of a change in landuse adjacent to an existing pipeline will need to liaise with the pipeline operator(s) to have this assessment carried out for the proposed change in landuse.

3.3.8 Acceptability of risks

To complete Part 3 of Figure 3, the Department of Environmental Protection (DEP) and Department of Minerals and Energy (DME) should be involved in consideration of the pipeline operator's assessment. The DEP and DME will need to discuss the details of the assessment with the pipeline operator and proponent to determine if:

- 'Low' or 'Negligible' risk can be achieved, or
- the risk arising from the proposed section of pipeline can be made equivalent to the risk associated with a previously assessed section (see Appendix 3), so similar risk mitigation features can be incorporated to achieve the EPA objectives for risk.

If risk is the only issue the proposal need not be referred to the EPA in relation to risk if:

- 'Low' or 'Negligible' risk can be achieved, or
- features which result in an equivalent status to previously assessed sections of pipeline can be incorporated in the current development to the satisfaction of DEP, DME and the pipeline operator (see Appendices 3 and 5).

3.3.9 Detailed quantitative risk assessment

If, after the above issues have been considered and the case for equivalent status to previous assessments cannot be satisfied, a detailed quantitative risk assessment (QRA) will need to be conducted. (Part 4 of Figure 3) The proponent will need to engage the services of a professional risk assessment consultant. This consultant will need to liaise closely with the DEP, DME and pipeline operators to conduct the detailed QRA. The QRA will establish appropriate separation distances for various landuses to ensure the EPA objectives and criteria for risk are achieved, consistent with previous assessments.

3.4 Management System

An Environmental Management System (EMS) is an essential requirement for the successful management of risk levels in proximity to existing and proposed High Pressure Gas Transmission Pipelines.

Where appropriate, the proponent should demonstrate that there is in place an environmental management system which includes the following elements:

1. an environmental policy and corporate commitment to it;

2. mechanisms and processes to ensure:

   2.1 planning to meet environmental requirements;

   2.2 implementation and operation of actions to meet environmental requirements;

   2.3 measurement and evaluation of environmental performance; and

3. review and improvement of environmental outcomes.

4. APPLICATION

4.1 Area

This Guidance Statement applies to all applications that will result in a change in landuse adjacent to an existing high pressure gas transmission pipeline, and to all applications to construct new (or upgrade existing) high pressure gas transmission pipelines adjacent to existing risk sensitive landuses as defined in Appendix 2 throughout the State of Western Australia.

4.2 Duration and Review

(To be inserted when the final Guidance is released)

5. RESPONSIBILITIES

5.1 Environmental Protection Authority Responsibilities

The EPA will apply this Guidance Statement during the assessment of proposals under Part IV of the *Environmental Protection Act 1986* where proposals may result in unacceptable levels of risk on existing or proposed landuses adjacent to existing or proposed high pressure gas transmission pipelines.

The EPA will recommend to the Minister the imposition of these requirements following its assessment of the proposals for which it is a relevant factor.

5.2 Department of Environmental Protection Responsibilities

The DEP will assist the EPA in applying this Guidance Statement in environmental impact assessment and in conducting its functions under Part V of the *Environmental Protection Act 1986.*

5.3 Proponent Responsibilities

Where proponents demonstrate to the EPA that the requirements of this Guidance Statement are accountably and enforceably incorporated into proposals, the assessment of such proposals is likely to be assisted.

6. DEFINITIONS AND ABBREVIATIONS

ALARP	As Low As Reasonably Practicable	Standards Australia (1998), 'Guide to Pipeline risk assessment in accordance with AS 2885.1', HB105, Standards Australia, Homebush NSW, p4.
Amendment	Any change to a Regional, Metropolitan, or Town Planning Scheme as defined by the Town Planning and Development Act 1928 or Western Australian Planning Commission Act 1985.	
AS	Australian Standard	
Commercial development	Includes offices, retail centres and showrooms located in buffer zones between industrial facilities and residential zones. Generally located in areas zoned for 'general industry' or 'commercial use' where large numbers employees are present and there is no coordinated emergency response.	EPA (1998), 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant', Interim Policy No.2, July 1998
DBNGP	Dampier to Bunbury Natural Gas Pipeline	
Decision making authority	Public authority empowered by or under a written law, or any agreement to which the State is a party, and which is ratified or approved by an Act.	Environmental Protection Act 1986.
DEP	Department of Environmental Protection	

Development application	An application to a local authority or regulatory authority to develop zoned and subdivided land.	Town Planning and Development Act 1928
DME	Department of Minerals and Energy	
DPHGP	Dampier to Port Hedland Gas Pipeline	
EIA	Environmental impact assessment	
EMS	Environmental Management System	
EPA	Environmental Protection Authority	
GGP	Goldfields Gas Pipeline	
High pressure gas transmission pipeline	A steel pipeline and associated piping and components that are used to transmit single phase and multiphase hydrocarbon fluids, such as natural and manufactured gas, liquefied petroleum gas, natural gasoline, crude oil, natural gas liquids and liquid petroleum products where the temperatures of the fluid are not more than 200°C nor less than -30°C, and either the maximum allowable operating pressure (MAOP) of the pipeline is more than 1050kPa, or at one or more positions in the pipeline the hoop stress exceeds 20% of the specified minimum yield stress (SMYS).	Standards Australia (1997), 'Pipelines - Gas and liquid petroleum, Part 1: Design and construction', AS 2885.1, Standards Australia, Homebush NSW , p5.
IAEA	International Atomic Energy Authority	
Individual Risk of Fatality	The chance (likelihood or probability) per year that any one member of the general public will be killed as a result of the exposure to an activity.	International Atomic Energy Agency 'Manual for the classification and prioritisation of risks due to major accidents in process and related industries' - 1996 - IAEA - TECDOC - 727.
Industrial facilities	Heavy industry areas such as Kwinana where workers have a high level of preparedness and training to respond in the event of an incident. Does not generally include areas zoned for 'general industry' or commercial use where larger numbers of less prepared employees are present.	EPA (1998), 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant', Interim Policy No.2, July 1998

Maximum Allowable Operating Pressure (MAOP)	The maximum pressure at which a pipeline may be operated.	Standards Australia (1997), 'Pipelines - Gas and liquid petroleum, Part 1: Design and construction', AS 2885.1, Standards Australia, Homebush NSW , p9.
MPa	pressure in megapascals	
Non-industrial activity	Public open space, car park areas located in buffer zones between industrial facilities and residential zones.	EPA (1998), 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant', Interim Policy No.2, July 1998
Operating authority	The organisation responsible for the design, construction, testing, inspection, operation and maintenance of pipelines and facilities within the scope of AS 2885.1	Standards Australia (1997), 'Pipelines - Gas and liquid petroleum, Part 1: Design and construction', AS 2885.1, Standards Australia, Homebush NSW , p10.
Proponent	A person who or which is nominated under section 38 of the Environmental Protection Act 1986 as being responsible for the proposal, or public authority on which the responsibility for the proposal is imposed under another written law.	Environmental Protection Act 1986.
QRA	Quantified Risk Assessment	
Regulatory authority	An authority with legislative powers relating to petroleum pipelines.	Standards Australia (1997), 'Pipelines - Gas and liquid petroleum, Part 1: Design and construction', AS 2885.1, Standards Australia, Homebush NSW , p10.
Residential development	Residential zone consisting of houses or units used as primary residences.	EPA (1992), Criteria for the Assessment of Risk from Industry, Bulletin 611.

Sensitive development	Schools, hospitals, child care facilities and aged care housing developments.	EPA (1992), Criteria for the Assessment of Risk from Industry, Bulletin 611.
SMYS	Specified minimum yield stress	
Societal Risk	The relation between the number of people killed in a single accident and the chance or likelihood that this number will be exceeded.	International Atomic Energy Agency 'Manual for the classification and prioritisation of risks due to major accidents in process and related industries' - 1996 - IAEA - TECDOC - 727.
Subdivision approval	Approval granted by the Minister for Planning under the Town Planning and Development Act 1928 to subdivide zoned land according to the documentation supplied by the proponent at application with or without modification or conditions.	

7. LIMITATIONS

This Guidance Statement has been prepared by the Environmental Protection Authority to assist proponents and the public. While it represents the contemporary views of the Environmental Protection Authority, each proposal which comes before the Environmental Protection Authority for environmental impact assessment will be judged on its merits. Proponents who wish to deviate from the Guidance provided in this document should provide robust justification for the proposed departure.

8. REFERENCES/BIBLIOGRAPHY

AS 2885.1 (1997), 'Pipelines - Gas and liquid petroleum, Part 1: Design and construction', Standards Australia, Homebush NSW.

EPA (1998), 'Risk Assessment and Management: Offsite Individual Risk from Hazardous Industrial Plant', Interim Guidance No.2, July 1998. EPA, Perth.

EPA (1997), 'Industrial Residential Buffer Areas (Separation Distances)', Draft Policy No.3. EPA, Perth.

EPA (1994), 'Risk Criteria - on site risk generation for sensitive developments', Bulletin 730. EPA, Perth.

EPA (1992), Criteria for the assessment of risk from industry - expanded discussion, Bulletin 627. EPA, Perth.

EPA (1992), Criteria for the Assessment of Risk from Industry, Bulletin 611. EPA, Perth.

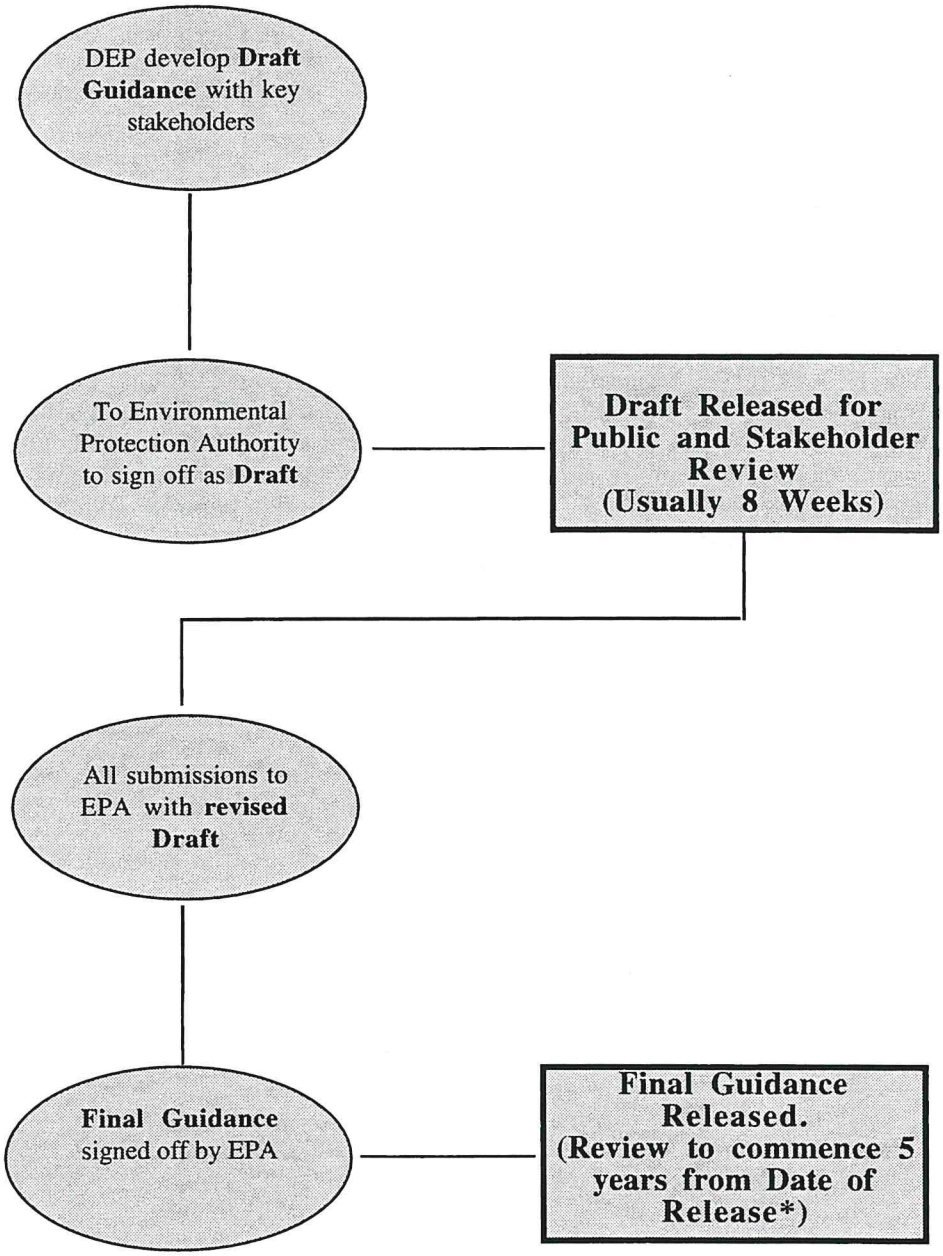
EPA (1987), 'Risks and Hazards of industrial developments on residential areas in Western Australia', Bulletin 278. EPA, Perth.

HB105 (1998), 'Guide to Pipeline risk assessment in accordance with AS 2885.1', Standards Australia, Homebush NSW.

Index	**Draft Guidance May 2000** Final Guidance
Status	Signed-off by the EPA at this stage for public and stakeholder review
Citation	This document cannot be cited at this time but may be used by the EPA for the purposes of environmental impact assessment (EIA) with respect to this factor.
Acknowledgments	The EPA acknowledges the assistance Mr W Horwood, Mr K Collins in preparing this Guidance Statement.
Contact officer	Mr J Güld Ph: (08) 9222 7144 email: john_guld@environ.wa.gov.au

Appendix 1

Generic Flow Diagram for the Guidance Statement Process



* Guidance may be reviewed earlier if circumstances require it.
Note: Shaded areas denotes those parts of the process completed

Appendix 2 - EPA risk criteria

Individual Risk of Fatality (EPA, 1998.)

Type of Development	EPA criteria (fatalities per year)	Examples
Sensitive	0.5 in 1 000 000	hospitals, schools, aged care centres etc
Residential	1 in 1 000 000	residential housing
Commercial	5 in 1 000 000	shopping centres, showrooms, etc
Non-industrial Activity	10 in 1 000 000	public open space
Industrial Facilities	50 in 1 000 000	heavy industry

Societal Risk

The EPA will take cognisance of societal risk in its assessments and may require that a societal risk study be undertaken as part of the risk assessment of new proposals. Societal risk is an issue where groups of people may congregate such as at a shopping centre or sporting venue. A qualitative approach may be used in the assessment of societal risk levels based on the benefits of each proposal, rather than on specifically set numerical values.

Appendix 3 - Previous risk assessments

The DEP/DME need certain basic information to allow it to make a decision on the significance of the proposal. This information may be available in previously conducted risk assessments or it may be necessary to obtain this information by conducting a new risk assessment.

Existing risk assessments that may be applicable to the current proposal should be examined for their applicability to the current proposal prior to embarking on a new risk assessment. It should be verified whether there are any new threats applicable to the proposed section of pipeline that have not been identified in previous studies.

If a new risk assessment is determined to be necessary, it should be conducted according to AS 2885.1 (1997) and HB105 (1998). If the risk class is determined as 'intermediate' or 'high', then a further detailed Quantified Risk Assessment (QRA) should be conducted in accordance with EPA Guidance No.2 (July 1998).

At the time of writing, two detailed Quantitative Risk Assessments (QRA) have been conducted to evaluate risk and determine the risk mitigation features necessary for specific proposals to meet the EPA objectives for risk. It is expected that in time, detailed QRAs will be conducted for the other gas pipelines to the Goldfields and Port Hedland.

Kogolup

The first major conflict in land use came to the attention of planning authorities in WA in 1993 with a major residential development planned for land which was otherwise bushland, adjacent to a high pressure Parmelia gas pipeline at Kogolup, south of Perth. The original local structure plan showed the pipeline running under the proposed front driveways of 50 residential lots. The pipeline was a 350mm diameter pipe with a maximum operating pressure of 5.6MPa. A quantitative risk assessment was requested by the DEP.

Discussions with the risk consultant, developer, DEP, DME and Department of Planning and Urban Development resulted on a distance of 32m being set as meeting the EPA risk criteria of 1 in a million for residential areas and 96m to sensitive uses to meet the EPA risk criteria of 0.5 in a million.

Once these distances were set as guidelines, the developer was able to rearrange his development plan to provide public open space on one side of the pipeline and a service road on the other. In addition, pipeline protection measures were provided to meet the ALARP requirements:

(a) concrete footpath cover over the pipeline;

(b) added sign posting;

(c) reduced utility service (water etc.) crossings;

(d) continual pipeline surveillance by the pipeline operator every week; and

(e) planned procedures for adjacent construction subdivision work.

Table 1. Summary of the features of the high pressure gas transmission Parmelia pipeline at Kogolup.

Feature	Description
Operating Characteristics	
Pipe Outside Diameter	356mm
Pipe Wall Thickness	5.56mm
Pipe Maximum Operation Pressure	5.61 MPa
Pipe Depth of Cover, minimum	750mm
Typical Gas Composition	93% Methane
Pipe Steel Classification	X52
Pipeline Design Factor (safety)	0.72
Pipeline Coating Materials	yellow jacket
Protective Measures	
Sign Posting	100m
Marker Tape Installed	no
Pipe Cathodic Protection	yes
Pressure monitoring	yes
Inspection	weekly
Fencing	no
Digging protection	'One call' system and permit to work required within easement
Concrete Barrier	1m wide and 75mm thick (min) for non traffic areas
Minimum separation distance from the centre line of the Parmelia gas pipeline to adjacent landuse	
1×10^{-6} Individual risk of Fatality	32m
0.5×10^{-6} Individual risk of Fatality	96m

Ellenbrook

A second major residential development along high pressure gas pipeline commenced in 1995 at the Ellenbrook subdivision, north of Perth. This time there were two high pressure gas pipelines running in adjacent easements. One was the Parmelia pipeline previously assessed at Kogolup, but operating at a higher pressure, and the other was the larger Dampier to Bunbury Natural Gas Pipeline. This larger pipeline was 660mm in diameter and operated at a higher pressure of 8.5MPa. There was also the possibility of a third pipeline being constructed in the same easement in future.

A QRA was again requested and after extensive discussions between the land developer, pipeline operators, risk consultant and planning agency as to what would be an acceptable public standard for separation distances from the pipeline and the mitigation factors necessary, separation distances of 60m to residential uses and 200m to sensitive uses were agreed for the combined risk from both pipelines.

Again the protection measures of concrete footpaths, pipe tape, signs, pine bollards etc were incorporated for the pipelines similar to the Kogolup development.
In the development plan of the buffer area, functional areas and mounding were created to provide walk trails, bicycle paths, BMX tracks and public open space.

Table 2. Summary of the features of the high pressure gas transmission pipelines at Ellenbrook.

Feature	Description	
Operating Characteristics	Parmelia	DBNGP
Pipe Outside Diameter	356mm	660mm
Pipe Wall Thickness	5.2mm	12.7mm
Pipe Maximum Operation Pressure	7.48MPa	8.48MPa
Pipe Depth of Cover, minimum	760mm	900mm
Typical Gas Composition	93% Methane	93% Methane
Steel Classification	X52	X65
Pipeline Design Factor (safety)	0.72	0.5
Pipeline Coating Materials	yellow jacket	yellow jacket
Protective measures	Parmelia	DBNGP
Sign Posting	100m	150m
Marker Tapes Installed	no	yes
Pipe Cathodic Protection	yes	yes
Pressure scanning	yes	yes
Inspection	weekly	weekly
Fencing	pine bollards	pine bollards
Digging protection	'One call' system and permit to work required within easement	'One call' system and permit to work required within easement
Concrete Barrier	yes	yes
Minimum separation distance from the centre line of the closest gas pipeline to adjacent landuse		
1 x 10^{-6} Individual Risk of Fatality from both pipelines	60m	
0.5 x 10^{-6} Individual Risk of Fatality from both pipelines	200m	

Minimum separation distance from the centre line of the DBNGP pipeline to adjacent landuse	
1 x 10^{-6} Individual Risk of Fatality from both pipelines	45m
0.5 x 10^{-6} Individual Risk of Fatality from both pipelines	160m

Appendix 4 - Australian Standard 2885.1 and HB105

AS 2885.1 (1997) is an Australian Standard developed by the regulators and operators of high pressure gas transmission pipelines for states and territories in Australia and New Zealand. HB 105 (1998) is a companion document to AS 2885.1 (1997) and states its purpose as '...to ensure a consistent and informed approach to risk assessment of pipelines...in accordance with the requirements of AS 2885.1 - 1997, Section 2.'

'AS 2885.1 applies to '...new pipelines and to pipelines for which there are significant changes in fundamental design parameters; however, it is not intended to be applied retrospectively. When risk assessment to AS 2885.1 is applied to pipelines designed and constructed under earlier Standards, the methodology of AS 2885.1 is expected to provide a sound basis for risk identification and risk evaluation of such pipelines. However, it may not be possible to achieve either the same number of protective measures or reduction of all risks in the same manner as for a new pipeline, and this would need to be resolved with the operating authority and the regulatory authority, if appropriate.'

What do AS 2885.1 and HB105 mean?

The AS2885.1 and HB105 standards;

- are tools to help assess the risk from an existing High Pressure Gas Transmission Pipeline for a proposed change in landuse.
- are tools to help assess the risk from a proposed High Pressure Gas Transmission Pipeline near an existing landuse.
- can be used to help determine if a proposed landuse meets acceptable risk criteria.
- can be used to help determine risk mitigation features that must be implemented to achieve acceptable risk criteria for a proposed change in landuse.
- can be used to identify areas of existing landuse that do not meet the current risk criteria.
- can be used to identify risk mitigation features that could be implemented in areas to meet current risk criteria for existing landuses.
- should not generally be used retrospectively to require additional risk mitigation measures where previous Standards have been used as a basis for approval in the past, unless there is a specific need to do otherwise.

Section 2 of AS 2885.1 is '...designed to ensure that each threat to a pipeline and each risk from loss of integrity of a pipeline are systematically identified and evaluated, while action to reduce threats and risks from loss if integrity is implemented so that risks are reduced to As Low As Reasonably Practical (ALARP). Further, the procedures are designed to ensure that identification of threats and risks from loss of integrity and their evaluation is an ongoing process over the life of the pipeline.'

In complying with AS 2885.1 the operating authority is the custodian of the information necessary to determine the existing level of risk an existing or proposed high pressure gas transmission pipeline poses to existing or proposed adjacent landuses.

Appendix 5 - Achieving the EPA objectives for risk

New Proposals

Change in landuse adjacent to an existing High Pressure Gas Transmission Pipeline.

If a change in landuse is proposed adjacent to an existing high pressure gas transmission pipeline, it is the responsibility of the proponent to ensure a risk assessment is carried out using AS 2885.1 to determine what additional risk mitigation features are necessary for the proposal to comply with the EPA criteria. This must be done in conjunction with the pipeline operator. Additional risk mitigation features to those proposed in AS 2885.1 may include:

- incorporation of risk mitigation features outside the High Pressure Gas Transmission Pipeline easement such as redesign of a proposed subdivision layout;
- incorporation of risk mitigation features within the pipeline easement that would need to be negotiated and agreed by the high pressure gas transmission pipeline operator (eg: footpaths, bollard protection); or
- incorporation of risk mitigation features with the operation of the pipeline (eg: increased monitoring); and
- a combination of the above options.

Changes in operating conditions for an existing High Pressure Gas Transmission Pipeline or installation of a new High Pressure Gas Transmission Pipeline adjacent to existing landuses

If a pipeline operator proposes to change the operating conditions of an existing high pressure gas transmission pipeline, or install a new pipeline, it is the responsibility of the pipeline operator to conduct a risk assessment using AS 2885.1 to determine what additional risk mitigation features are necessary for the proposal to comply with the EPA criteria for adjacent landuses. Additional risk mitigation features may include:

- incorporation of risk mitigation features within the pipeline easement;
- incorporation of risk mitigation features in the design and operation of the pipeline;
- incorporation of risk mitigation features outside the High Pressure Gas Transmission Pipeline easement that would need to be negotiated and agreed by the adjacent landowners and regulatory authorities; or
- a combination of the above three options.

Previous approvals that do not meet the current EPA criteria

There are some areas where the EPA criteria are exceeded as a result of previous planning decisions using previous standards. Notwithstanding this the EPA does expect that when decision making authorities (DMA) and operating authorities become aware of situations where the EPA criteria is not achieved, the DMA will ensure the risks are reduced to ALARP.

In situations where the risk from a high pressure gas transmission pipeline on adjacent landuses achieves ALARP but fails to meet the EPA criteria this should be brought to the EPA's attention. The EPA will then make a recommendation to Government on the most appropriate course of action having taken into account the standards that were applicable when the previous approvals were granted and the degree to which the current EPA criteria are not met.