CLIENTS | PEOPLE | PERFORMANCE

Manildra

Proposed Flour Mill

Preliminary Hazard Analysis

May 2007

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. INTRODUCTION

Shoalhaven Starches Pty Ltd, a Manildra Group company, is proposing to construct a Short Flour Mill at their existing Bomaderry plant to generate wheat flour for use within the starch plant.

The proposed location for the facility is within the existing Shoalhaven Starches Bomaderry site within the city of Shoalhaven. The proposed capacity of the facility is to produce 5,000 tonnes per week of wheat flour, via a series of roller mills, sifters and bucket elevators, transported by pneumatic air conveying systems.

The flour produced within the short flourmill would be combined with an additional 5,000 tonnes per week of flour supplied by rail from Narrandera, Gunnedah and Manildra. The wheat for use in the flourmill would be supplied by rail and stored in two (2) silos of 1,600 tonne capacity each. It is anticipated that due to the rate of wheat consumption and the size of the silos, both silos would be emptied at least every four (4) days.

GHD has been engaged to prepare a Preliminary Hazard Analysis (PHA) for the proposal, for inclusion in an Environmental Assessment (EA) under Part 3a of the *Environmental Planning and Assessment Act 1979*.

This report was prepared with background information, terms of reference and assumptions supplied and agreed with Shoalhaven Starches. The report is not intended for use by any other individual or organisation and as such, GHD cannot accept liability for use of the information contained in this report, except for the purpose for which it was intended at the time of writing.

1.1 Objectives

The PHA objectives are:

- To demonstrate the risks identified during and after the proposed development are acceptable in relation to the surrounding land use;
- That any residual risk will be appropriately managed; and
- To advise risk reduction strategies where unacceptable risks are identified.

1.2 Scope

This PHA includes a description of the proposed development, SEPP 33 screening of dangerous goods, a qualitative assessment and where required, subsequent quantitative risk assessment that reviews:

- Input/output materials storage, processing and handling;
- Primary items of the process; and
- Natural disasters, bushfires and flooding, as relevant.

2. STATUTORY REQUIREMENTS

The current structure for project assessment is established by the *Environmental Planning and Assessment Act 1979* (the EP&A Act). This project is considered to be both a major project under Part 3a of the EPA&A Act, and 'designated development' and therefore an EA is required to accompany the development application.

The draft Director-General's Requirements for the EA require a PHA as per *State Environmental Planning Policy No.33 – Hazardous and Offensive Development* (SEPP 33)[1]. A PHA broadly examines the likely potential hazards that may occur as a result of a hazardous or offensive development.

SEPP 33 requires developments that are potentially hazardous to be the subject of a PHA to determine the risk to people, property and the environment at the proposed location and in the presence of controls. Should such risk exceed the criteria of acceptability, the development is classified as 'hazardous industry' and may not be permissible within most industrial zones in NSW.

For developments identified as potentially offensive the minimum criteria for such developments is meeting the requirements for licensing by the Department of Environment and Conservation (DEC) (formerly Environment Protection Authority (EPA)). If a development cannot obtain the necessary pollution control licenses, then it may be classified as 'offensive industry', and may not be permissible within most industrial zones in NSW.

This PHA was prepared applying SEPP 33, and generally in accordance with the Department of Planning (DoP) (formerly Department of Urban Affairs and Planning) publications Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis (1992) (HIPAP 6)[2] and Multi-Level Risk Assessment (1997)[3].

This PHA considers risks associated with the development in terms of accidental loss scenarios and their potential for hazardous incidents. General handling of waste materials and emissions produced during normal operations are dealt with elsewhere in the EA.

The primary objectives of a PHA are to:

» Identify potential hazards associated with the proposal;

» Analyse the consequences of significant hazards on people and the environment, and the likelihood or frequency of these hazards occurring;

» Estimate the resultant risk to the surrounding land uses and environment; and

» Analyse the safeguards to ensure they are adequate, and therefore demonstrate that the operation can operate within acceptable risk levels to its surroundings.

3. METHODOLOGY

3.1 General

A PHA is to provide sufficient information and assessment of risks to show that a project satisfies the risk management requirements of the proponent company and the relevant public authorities. Within this brief, the main objective of the PHA is to show that the residual risk levels are acceptable in relation to the surrounding land use, and that risk will be appropriately managed. This is done by systematically:

» Identifying intrinsic hazards and abnormal operating conditions that could give rise to hazards;

» Identifying the range of safeguards;

» Assessing the risks by determining the probability (likelihood) and consequence (effects) of hazardous events for people, the surrounding land uses and environment; and

» Identifying approaches to reduce the risks by elimination, minimisation and/or incorporation of additional protective measures.

With proper application, this method should demonstrate that the proposed plant can operate within acceptable risk levels in relation to its surroundings.

The PHA needs to be carefully and clearly documented with the assumptions and uncertainties of final design and operation defined.

3.2 Preliminary Risk Screening

The need for a PHA under SEPP 33 is determined by a preliminary risk screening of the proposed development. The preliminary screening methodology concentrates on the storage of specific dangerous goods classes that have the potential for significant off-site effects. Specifically the assessment involves the identification of classes and quantities of all dangerous goods to be used, stored or produced on site with an indication of storage depot locations. Details of the methodology are described in DoP's - Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (1994)[1].

3.3 Risk Classification and Prioritisation

Multi-Level Risk Assessment (1997)[3] suggests the use of preliminary analysis of the risks related to a proposed development, to enable the selection of the most appropriate level of risk analysis in the PHA. The preliminary analysis, detailed in Section 6, includes risk classification and prioritisation using a technique adapted from the Manual for Classification of Risk due to Major Accidents in Process and Related Industries (IAEA, 1993)[5].

3.4 Analysis and Assessment Levels

The hazard analysis and quantified risk assessment regime promoted in NSW relies on a systematic and analytical approach to the identification and analysis of hazards and the quantification of off-site risks to assess risk tolerability and land use safety implications. Two key objectives are emphasised in the implementation of this process:

» The systematic and analytical nature of the assessment process enables the nature of the hazards, risks, leading risk contributors and events to be identified and understood from design, operational and organisational viewpoints.

» The quantification of off-site risks, where applicable, enables judgments to be made on location safety implications with regard to people, the biophysical environment and other land uses.

Multi-Level Risk Assessment (1997)[3] prescribes three levels of risk assessment that can be undertaken. The choice of an appropriate technique is based on the results of preliminary screening, risk classification and prioritisation and the potential for significant off-site consequences arising from hazards identified for the proposed development.

Level 1 - This is a qualitative assessment using word descriptions to approximately assess and rank risks. This is used when risk screening, classification and prioritisation indicate no major off-site consequences, adequate controls exist, and surrounding land uses are not sensitive to the hazards posed.

Level 2 - A semi-quantitative assessment that utilises the hazards identified in Level 1 and provides a focused quantification of key potential off-site risk contributors to demonstrate that risk criteria will be met.

Level 3 - This involves a full quantitative risk assessment and is undertaken whenever the scale and nature of an activity creates a significant risk of a major accident. A full-scale analysis should also be carried out if partial quantification cannot sufficiently demonstrate that relevant criteria will be met.

The rationale for the multi-level risk assessment approach is that:

» Preliminary analyses that indicate minor land use safety outcomes may only require qualitative assessment (Level 1). The emphasis in such instances should be on the identification of key risk elements and optimising safety management controls, therefore fulfilling objectives of Level 1 above.

» Preliminary hazard analyses that indicate significant potential risk impacts to surrounding land uses should be subjected to a more detailed level of analysis including partial or total quantification (Levels 2 and 3). For such cases there should be increased emphasis on objectives of level 2 above, relating to land use safety and risk tolerability.

3.5 Qualitative Analysis

Qualitative analysis uses words and descriptive scales to determine the likelihood of each identified hazard and its consequences. This provides an estimate of the likely rate of occurrence of hazardous events and their severity, from which a measure of the risk may be obtained through a simple matrix format of the equation:

Risk = Likelihood x Consequence

The risk associated with a proposed development is determined by combining the likelihood of the potentially hazardous events and the magnitude of their consequences. This is illustrated in Table 3.1, which has been adapted from Australian/New Zealand Standard 4360:2004 Risk Management[6]. The process of combining consequences and frequencies gives appropriate weight to the range between small consequence events (which are relatively frequent) and events of major consequence (which are very infrequent).

Table 3.1 - Consequence and Likelihood[6]

Consequence Scale					Likelihood				
					E - Rare	D - Unlikely	C - Possible	B - Likely	A - Almost Certain
	Assets	Production	Environment	People	May occur only in exceptional circumstances (million to 1)	Could occur at some time (10,000 to 1)	Might occur at some time (100 to 1)	Will probably occur in most circumstances (even money)	Is expected to occur in most circumstances (odds-on)
1 - Insignificant	Slight Damage <$5,000	Slight Loss < 1 hour	Environmental Nuisance	Slightly Injured (FAC)	L	L	L	M	M
2 - Minor	Minor Damage <$50,000	Minor Loss < 12 hours	Material Environmental Harm	Minor Injury/Occ. Illness (MTC)	L	L	M	H	H
3 - Moderate	Localised Damage <$500,000	Localised Loss < 1 day	Serious Environmental Harm	Significant Injury/Occ. Illness (LTI-PPD)	M	M	H	H	E
4 - Major	Major Damage <$5,000,000	Major Loss < 1 week	Major Environmental Harm	Single Fatality Permanent/Total Disability	M	H	E	E	E
5 - Catastrophic	Extensive Damage >$5,000,000	Extensive Loss > 1 week	Extreme Environmental Harm	Catastrophic Multiple Fatality	H	E	E	E	E

Legend
E: extreme risk; immediate action/ control measure required
H: high risk; senior management attention required
M: moderate risk; management responsibility must be specified
L: low risk; manage by routine procedures

Adapted from AS/NZS 4360:2004 - Risk Management and Mineral Resources MDG 1010

3.6 Quantitative Analysis

Quantitative analysis is conducted using numerical data values for both likelihood and consequences. This data has been gathered from a variety of sources including mathematical risk modelling, extrapolation from experimental studies or past data. A quantitative analysis can be used to estimate:

» Thermal radiation distances;

» Explosion overpressure;

» Toxic exposure levels; and

» Fatality risk levels.

3.7 Risk Assessment

Risk assessment involves comparing the level of risk found during the qualitative and quantitative analyses to previously established risk criteria, thereby ascertaining if that level of risk can be accepted or not. Such decisions take into account the wider context of the risk and include consideration of the tolerability of the risks borne by external parties.

Low and acceptable moderate risks can be allowed with minimal further treatment; however, they should be monitored and periodically reviewed to ensure they remain at this level. Higher-level risks should be treated using safeguards (see Section 3.8).

3.8 Risk Treatment

A complete range of safeguards should be incorporated into the design and operation of the proposed development as prevention or protection measures for higher-level risks. These measures may include plant design features, organisational safety controls, emergency and counter disaster principles and approval processes. Options should be evaluated on the basis of the extent of risk reduction and the extent of benefits or opportunities they create. In general, the cost of managing risks should be commensurate with the benefits obtained.

3.9 Monitoring and Review

Risks and the effectiveness of control measures need to be continually monitored to ensure changing circumstances do not alter risk priorities. Factors that may affect the likelihood and consequences of an outcome may change, as may the factors that affect suitability or cost of various treatment options. Ongoing review is, therefore, essential to ensure that risk management activities remain relevant.

4. FACILITY DESCRIPTION

4.1 Location and Surrounding Land Uses

The subject site is located at Bomaderry, approximately 3 kilometres north east of Nowra, on the northern bank of the Shoalhaven River in southern NSW (refer Figure 4.1). Access to the site is via Bolong Road. The existing site processes 10,000 tonnes per week of flour supplied by rail from Narrandera, Gunnedah and Manildra to produce starch, gluten, glucose and ethanol. Wastes produced within the process are processed through Dried Distiller Grain (DDG) dryers and sold as stock food. The whole site covers approximately 9 hectares, of which the proposed flour mill facility would occupy approximately 250m^3 near the Shoalhaven River boundary.

The area surrounding the proposed flour mill includes existing Manildra plant (refer Figure 4.2). To the east are silos, grain processing plant, a dust collector and a flour unloading facility. To the west is the boiler house and ash hopper, and to the north are the glucose and starch plants. To the south is the Shoalhaven River, which is approximately 500m wide.

The greater Bomaderry site is bounded by the Shoalhaven River to the south, Bomaderry Creek to the west and Bolong Road to the north. The area west of the railway crossing on Bolong Road and the area to the east is zoned industrial/light industrial and the area to the north is rural, except for the CO_2 plant, which forms part of the Bomaderry site.

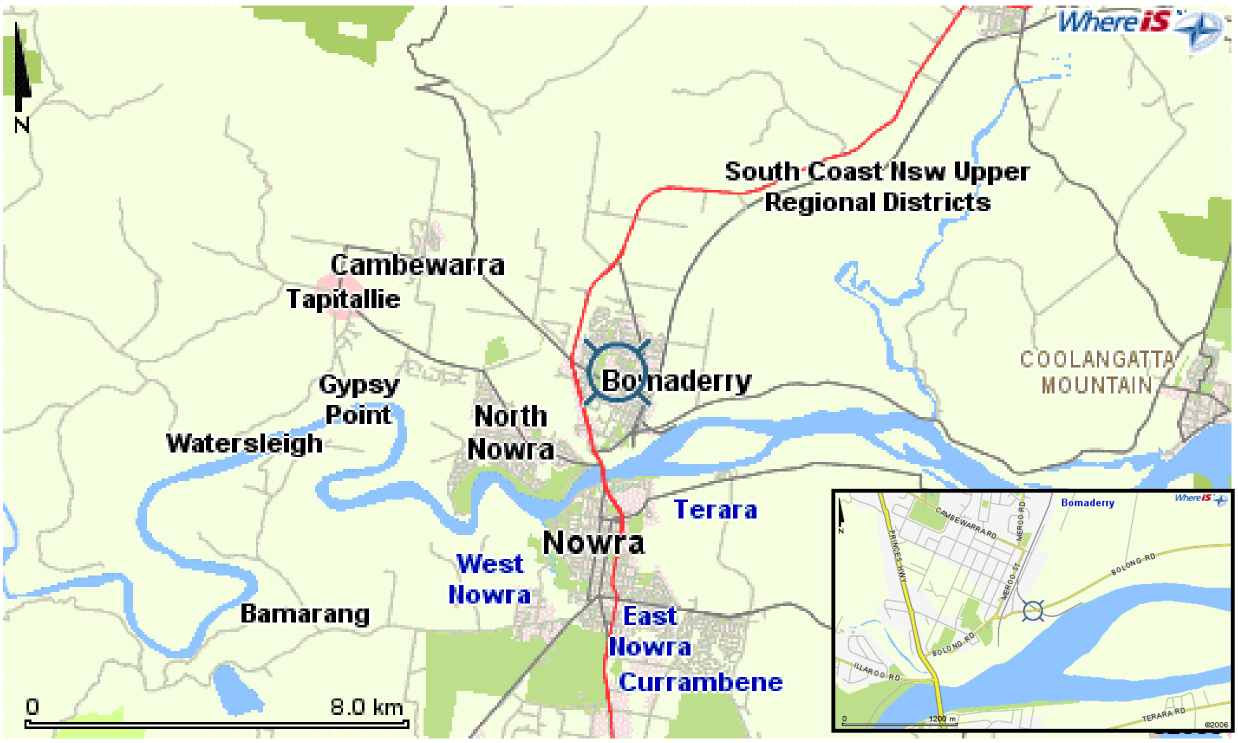

Figure 4.1: Site Location (Inset Bolong Rd)

4.2 Site Process Description and Layout

The proposed facility would produce 5,000 tonnes per week of industrial grade wheat flour. The flour produced by the proposed plant would be combined with an additional 5,000 tonnes per week of flour supplied by rail from Manildra's flour mills at Narrandera, Gunnedah and Manildra. The flour would then be used in the existing Shoalhaven Starch plant to produce starch, gluten, glucose and ethanol. All remaining mill feed/offal would be processed through the Dried Distiller's Grain (DDG) dryers for sale as stock feed.

The new plant would be located at the existing Shoalhaven Starches premises at Bomaderry, within an existing storage area located between the grain processing, flour unloading and boiler house structures, on the banks of the Shoalhaven River, as detailed in Figure 1. The short flour mill would require the construction of an additional silo and flour processing building.

Wheat would be delivered to the site twice per week in rail hopper cars nominally of 60 tonne capacity. Each train would deliver approximately 3000 tonnes of wheat. The proposal would not alter the current number or frequency of train movements at the site.

Wheat delivered to the site by train would discharge through a grid below the hopper outlet, and would be transported via drag chains and a bucket elevator system into two silos, each of 1,600 tonne capacity.

Wheat would be taken from the raw wheat silos, weighed and then passed through various cleaning operations as follows:

- Sieves for the removal of impurities larger or smaller than wheat;
- Gravity separators for the removal of heavy impurities such as stone;
- Magnetic separators for the removal of ferrous metal impurities; and
- Aspirators, using air currents, for the removal of lighter impurities.

The moisture content of wheat received at the site would typically be in the range of 8% - 10%, which is too dry for milling. Water would therefore be added to the wheat in a carefully controlled manner to increase the moisture content of the grain to around 15%. The damped wheat would then be stored in a conditioning or tempering bin where it would be allowed to remain for a period of time to allow the added moisture to be fully absorbed into the grain. Conditioning of grain would be necessary to:

- Assist in the separation of the component parts of the grain by toughening the bran to ensure a clean separation of the endosperm from the bran and germ; and
- Allow the reduction rollers to grind the endosperm into flour with the minimum power consumption, and ensure accurate and easy sifting on the following sieving machines.

When the grain is at the optimum milling condition it would be taken from the conditioning bins and passed through final scouring, weighing and separation stages before being passed to the mill. Milling would be carried out on roller mills which would mill the grain into progressively finer fractions.

Each milling process would be followed by coarse sieving to separate large flakes of bran and chunks of endosperm, which would then be passed to the next milling cycle. The finer starchy material would be passed over a series of progressively finer sieves to remove any flour, and to grade the remaining particles into various sizes for further grinding.

Flours from the various grinding operations would be collected and blended together before passing through final treatment and weighing operations to bulk storage bins. Flour would be taken from these bins for use in existing site production processes.

The coarse particles left at the end of the reduction system, known as pollard, and the bran from the end of the break system, would be combined into a single by-product (DDG) for sale as animal feed. All air extracted from the mill would be passed through Buhler Airjet bag houses prior to being discharged to the atmosphere.

The proposal would be powered by electrical energy, would not require any additional gas supply, and would use compressed air only for instrument use.

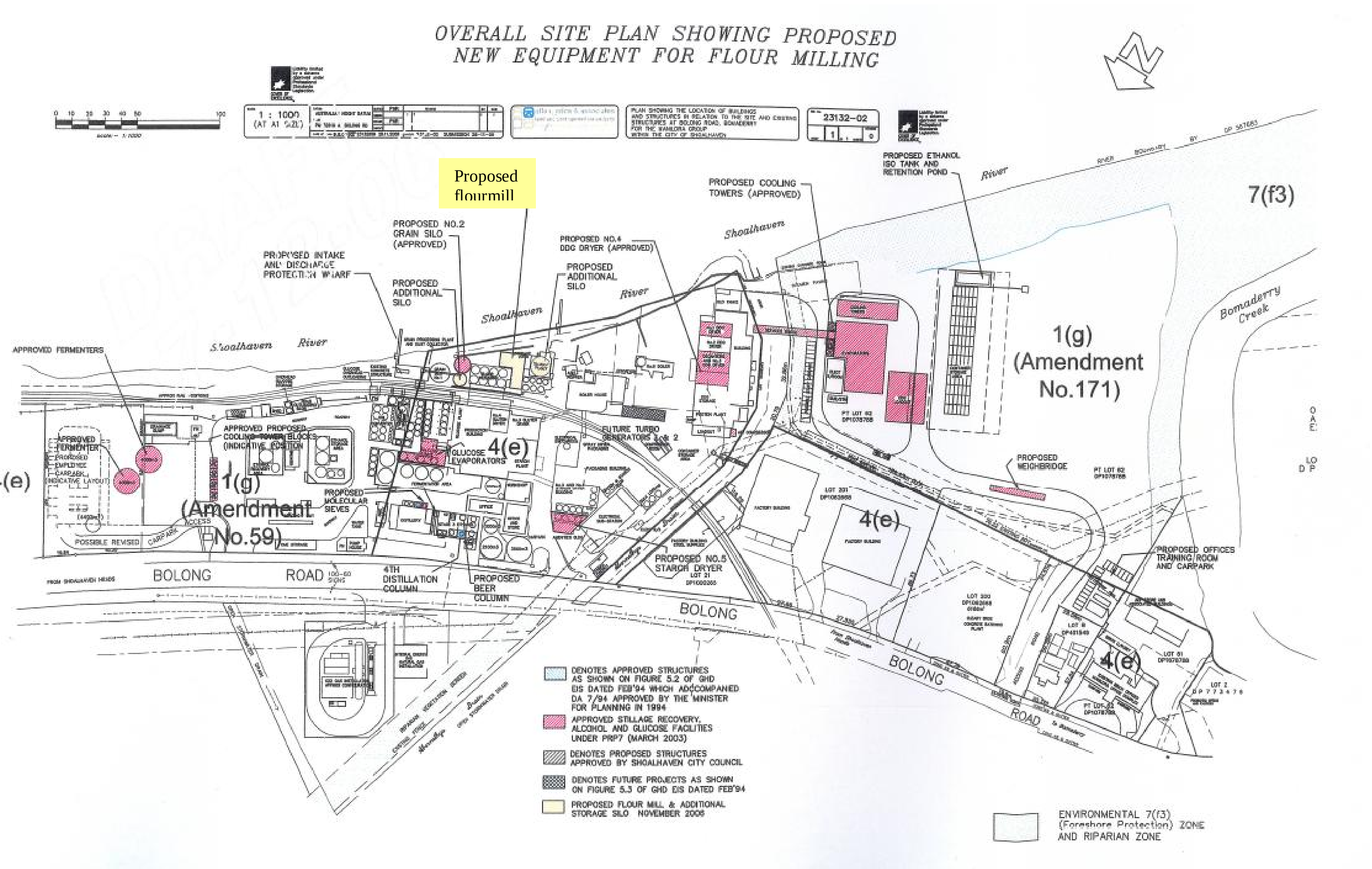

Figure 4.2: Proposed Site Layout (Including Existing Facilities)

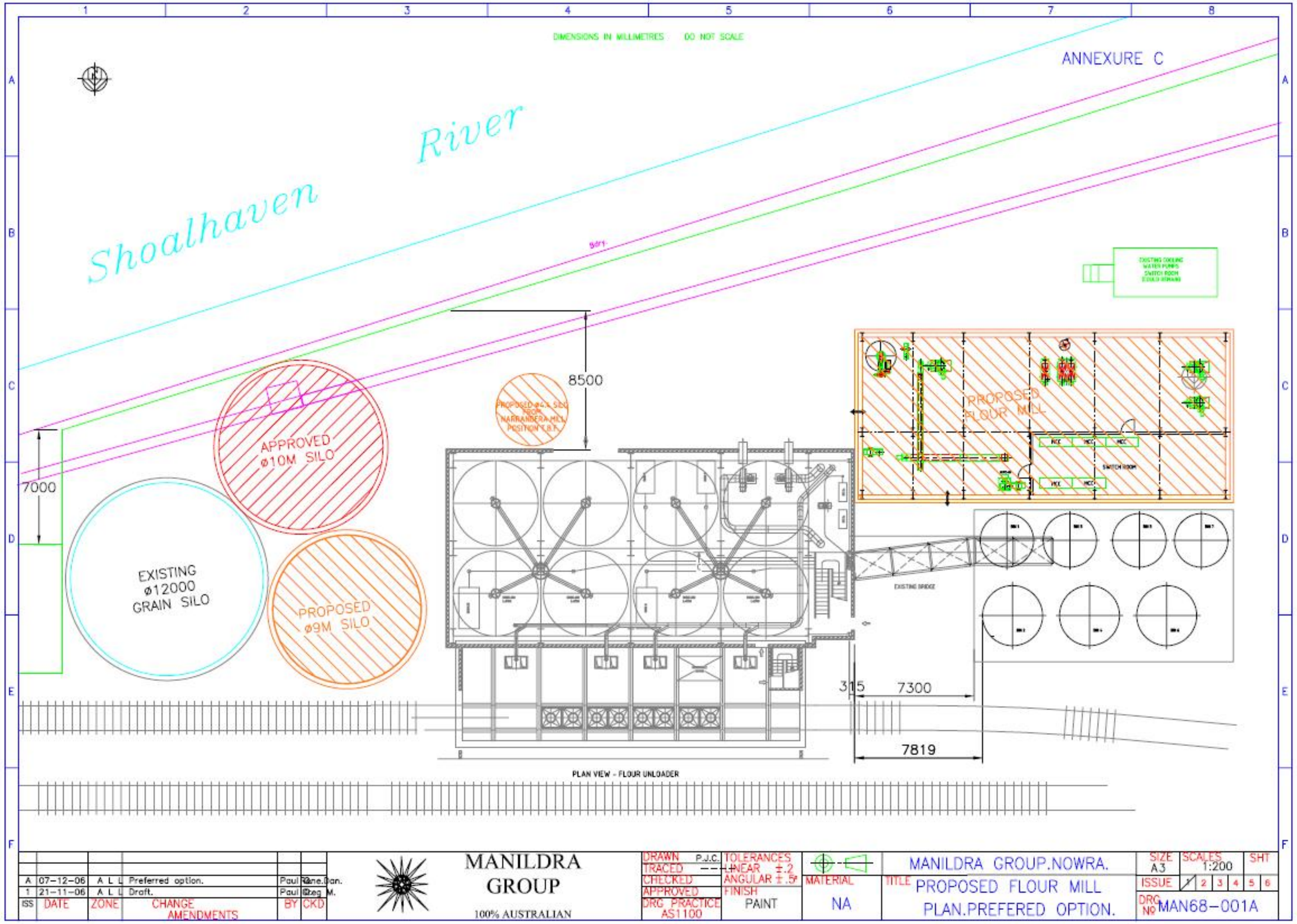

Figure 4.3: Proposed Flour Mill Layout

5. PRELIMINARY RISK SCREENING

5.1 Dangerous Goods Storage Screening

A preliminary screening of the proposed development is required by SEPP 33, to determine if there is a need for a PHA. The methodology is described in DoP's Applying SEPP 33 – Hazardous and Offensive Development Application Guidelines (1994)[1].

The proposed inventories of hazardous substances and dangerous goods to be stored and utilised on site are listed below in Table 5.1. Some of these are defined as Dangerous Goods (DG) in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).

Note that no new chemicals would be used within the proposed short flour mill and that all chemicals listed below exist under previous site approval. As all chemicals currently on site are approved, a dangerous goods storage screening is not required.

Table 5.1 - Dangerous Goods Storage Screening

Chemical	UN	Class	Packaging code	Hazchem code	Quantity on site (kL)
Dimethyl ether	1033	2.1		2WE	100
Butanol's	1120	3	PGII or III	3[Y]E	6.8
n-Propanol	1274	3	PGII	2[Y]E	8.6
n-Propyl Acetate	1276	3	PGII	3[Y]E	8.6
Methyl Isobutyl Ketone	1245	3	PGII	3[Y]E	6.8
Ethanol	1170	3	PGII or III	2[Y]E	2,600
Petrol	1203	3	PGII	2[Y]E	5
Methanol	1230	3	PGII	2WE	5
Hydrogen peroxide solution 20-60%	2014	5.1	PGII	2P	1
Sulphuric Acid <51%	2796	8	PGII	2R	17.7
Acetic Anhydride	1715	8	PGII	2W	3
Hypochlorite Solution	1791	8	PGII or III	2X	30
Hydrochloric acid	1789	8	PGII or III	2R	50
Sodium Hydroxide Solution	1824	8	PGII or III	2R	72
Ammonia Solution 10-35%	2672	8	PGIII	2R	35
Phosphoric Acid	1805	8	PGIII	2R	36

There would be no change in transportation of the above-mentioned dangerous goods on site and the proposed flourmill would not require the transport of any dangerous goods. All dangerous goods transported on site have been previously approved for the existing site and therefore there is no requirement to conduct a dangerous goods transportation screening.

From a Major Hazard Facility (MHF) perspective the quantity of materials detailed in Table 5.1 are approximately 53% of threshold, which may require submission and review under new NSW MHF legislation that is to be implemented within the next six months. Additional assessment work may be required at that time, but is not required to be considered in this risk screening exercise.

5.2 Level of Risk Assessment

According to SEPP 33, if any of the screening thresholds are exceeded then the proposed development should be considered potentially hazardous and a PHA is required to be submitted with the development application. Also, if the quantities are close to the screening threshold values and the development site is near a sensitive receiver then the proposed development is also considered to be potentially hazardous and a PHA is required.

Based on the above assessment the proposed development does not exceed the storage threshold or transport threshold for any substances and hence is not considered as potentially hazardous. Therefore a PHA is not required for these substances.

6. HAZARD IDENTIFICATION

6.1 General

Hazard identification represents a Level 1 or qualitative risk assessment and involves documenting all possible events that could lead to a hazardous incident. It is a systematic process listing potential causes and consequences (in qualitative terms). Reference is also made to proposed operational and organisational safeguards (and their basis) that would prevent such hazardous events from occurring, or should they occur, that would mitigate the impact on the plant, its equipment, people and the surrounding environment. This process enables the establishment, at least in principle, of the adequacy and relevancy of proposed safeguards.

The aim of the hazard identification study process is to highlight any residual risks associated with the interaction of the facility (as a whole) with the surrounding environment. A range of possible hazard scenarios were developed and ranked in terms of consequence and likelihood in consultation with the relevant stakeholders.

6.2 Hazard Identification Tables

The hazard scenarios identified are presented in Table 6.1. Each hazard scenario was evaluated in terms of consequence and likelihood using the scoring methodology from Table 3.1. A qualitative assessment of the resultant risk was then made, again using Table 3.1. The hazards identified are a result of deviation from normal operations and the qualitative risk assigned to each scenario takes into account the inherent and proposed physical, operational and organisational safeguards designed to reduce the consequence and likelihood of these hazards.

It is important to understand that the selection of the qualitative consequence score (Table 3.1) for each hazard identified is based on the most likely consequence given the existing physical safeguards only. It does not consider the soft barriers such as control systems, training or standard operating procedures.

The likelihood score (Table 3.1) is an estimation of the likelihood of the nominated consequence occurring. Alternatively, the likelihood score may be considered as an estimation of the effectiveness of the inherent and proposed physical, operational and organisational safeguards.

6.3 Assumptions

In undertaking the Hazard Identification Study a number of assumptions were made. These include:

- Wheat flour has a Kst value of 139 bar.m/sec and wheat grain has a Kst value of 112 bar.m/sec consequently rated as an St-1 dust hazard class (weak explosion);
- All electrical equipment within the plant is dust protected – zoned according to appropriate Australian Standards (Zone 20, 21 & 22 as required);
- All plant and equipment is installed and operated in accordance with appropriate Australian Standards, codes and guidelines;
- Dangerous goods quantities and locations are as notified to GHD Pty Ltd;
- Dangerous goods are stored in accordance with the ADG Code, relevant standards and guidelines even if not a licensable quantity; and
- All equipment and systems are designed to be inherently safe.

Table 6.1 - Hazard Identification

Plant Unit	Hazard	Scenario	Consequence	Current Controls	C	L	R	Action
Wheat storage silo	Deflagration	Ignition of wheat dust	Possible deflagration of wheat dust & consequently ignition of wheat	Electrically earthed silo Regular maintenance program to limit ingress of water into silos Explosion venting to VDI standard 3673	3	C	H	Potential off-site risk identified (incl damage, fatality or injury), depending on probability of passing vessel on river.
Tempering bins	Deflagration	Ignition of wheat dust	Possible deflagration of wheat dust & consequently ignition of wheat	Add water to wheat via water dosing unit	3	C	H	Potential off-site risk identified (incl damage, fatality or injury), depending on probability of passing vessel on river.
Bag houses / Filter system	Deflagration	Ignition of wheat/flour dust.	Possible deflagration of dust	Explosion venting to VDI standard 3673 Antistatic bags in bag houses Regular system maintenance Sock monitoring procedure and maintenance program	3	C	H	Potential off-site risk identified (incl damage, fatality or injury), depending on probability of passing vessel on river.
Elevators	Ignition source	Belt slip, generate friction etc	Potential ignition source	Monitoring program for belt, speed, and friction. Automatic switch off mechanism	2	C	M	No off-site risk identified (incl damage, fatality or injury)
Screenings bin	Deflagration	Ignition of screenings	Possible deflagration of wheat screenings	Aspiration of screenings	3	C	H	Potential off-site risk identified (incl damage, fatality or injury), depending

Plant Unit	Hazard	Scenario	Consequence	Current Controls	C	L	R	Action
								on probability of passing vessel on river.
Plant Control system	Loss of power	Plant shut down	Plant shutdown	Plant electrical controls housed in switch room and electrical cabinets rated to AS	1	D	L	No off-site risk identified (incl damage, fatality or injury)
Natural Hazards	Storm	Water contacting wheat in silo to develop scenario possible for spontaneous combustion	Spontaneous combustion of wheat (over time)	Regular maintenance program Silos designed for high wind rating High turnover rate of wheat	3	E	M	No off-site risk identified (incl damage, fatality or injury) Evaluate potential for temperature monitoring
	Lightning	Ignition of wheat and / or flour	Possible fire	Building and silos earthed	3	D	M	Potential off-site risk identified (incl damage, fatality or injury), depending on probability of passing vessel on river.
	Fire	Emergency response / External fire source	Possible ignition of wheat dust / flour layers on surface of floor / equipment	Fire sprinkler system on each floor designed in accordance with NFPA 15 & 16 and AS211B Trained fire crew on site (regular weekly training) Housekeeping Pneumatic vacuum lift to minimise spills	3	D	M	Potential off-site risk identified (incl damage, fatality or injury), depending on probability of passing vessel on river.

Note: Hazard identification was conducted by information provided to GHD by the Manildra Short Flour Mill design team during a teleconference on 27 February 2007.

7. Detailed Analysis

Many of the scenarios identified in the hazard identification do not have a risk of off-site, or even on-site damage, fatality or injury. The following scenarios may have the potential for off-site impacts:

- Deflagration of wheat dust in storage silo;
- Deflagration of wheat dust in tempering bins;
- Deflagration of wheat dust / flour in bag houses; and
- Deflagration of screening in screenings bin.

There were no plausible scenarios found for off-site events having potential on-site impacts.

7.1.1 Qualitative Risk Analysis

The scenario of a deflagration of the wheat dust and / or flour present within the wheat storage silos, tempering bins, bag houses or screenings bin could conceivably occur if the correct air to dust ratio were present in combination with an ignition source.

Due to the location of the Short Flour Mill being in close proximity (approximately 10m) to the site boundary, in the unlikely event of a major deflagration, it is unlikely to result in off site effects. It is more likely to peel open the bin and provide pressure relief.

Given that there are considerable physical preventative controls designed into the Short Flour Mill, this scenario is considered not likely to occur. Examples of the preventative controls, as outline in Table 6.1, include:

- Plant is enclosed so as to prevent escape and accumulation of dust in the building
- Silos and dust collection system is fitted with explosion relief;
- Silos and flour mill are electrically earthed;
- Antistatic bags are used in the bag houses;
- All electricity supply is dust protected;
- Areas are zoned appropriately to limit ignition sources associated with electricity supply (zone 20, 21 and 22 according to Australian Standards);
- Plant is designed of sufficient quality in a way so as to prevent dust explosions;
- After construction there will be a detailed monitoring and maintenance program;
- Detailed housekeeping plan and;
- A suitable fire protection system installed.

Furthermore the wheat and flour have a dust hazard rating of St-1 (Kst <200), which, according to the Health Safety Executive (HSE), implies there is limited explosion capacity. Deflagration of the wheat dust or flour will only occur with the correct dust to air ratio, which is approximately 56g of dust per cubic metre of air, in conjunction with an ignition source.

Incorporating all these factors suggests there is limited potential for offsite impact (damage, injury, fatality) caused by wheat dust / flour deflagration. However, due to the extent of engineering controls in place, the likely occurrence of such a scenario is considered to be very low.

7.2 Quantitative Risk Analysis

Based on the results of the Qualitative Risk Assessment, the deflagration of wheat dust and / or flour scenario has been identified as having limited potential for an offsite effect. Due to the degree of engineering controls incorporated into the design of the Short Flour Mill, in conjunction with the relatively weak explosion capacity of wheat and flour, the occurrence of a deflagration is not considered likely.

Despite the proximity of the flourmill to the site boundary increasing the potential for offsite effects, it has not been considered necessary to conduct a Quantitative Risk Assessment due to the limited likelihood of deflagration occurring and the ability of the storage vessel to provide pressure relief.

8. RISK ASSESSMENT

The relative significance of quantified risk estimates can be assessed by comparison with other risks that people experience in everyday life. In setting risk criteria, the underlying principle is that people should not involuntarily be subject to risk from a development that is significant in relation to the background risk associated with the surrounding land use area classification.

8.1 Risk Evaluation – Qualitative Criteria

The methodology used to review the risks associated with the proposed Short Flour Mill addressed the following qualitative criteria:

A All identified risks have been avoided and remaining risks have been reduced to as low as practicable.

The qualitative risk analysis has sought to identify all avoidable risks. Table 6.1 summarises how the design and installation of the proposed facility mitigates the risks through appropriate safeguards and barriers.

B Consequences of the more likely hazardous events are, wherever possible, contained within site boundaries.

C Where there is an existing high risk, then the additional hazardous development does not add significantly to the risk.

The risk assessment process demonstrates that the proposed Short Flour Mill has the potential to increase the risk off-site, however the scenario identified to increase the risk off site is considered not likely to occur.

8.2 Risk Evaluation – Quantitative Criteria

Due to the extent of engineering controls incorporated into the design of the Short Flour Mill, a quantitative risk analysis was not considered to be necessary.

For future reference, the assessment criteria for individual fatality risk recommended by DoP are summarised in Table 8.1. The criteria have been set on the basis that they represent very low risks compared to other everyday risks associated with the various land uses. The criteria for the proposed flour mill is not to increase the risk associated to surrounding land users, as defined by HIPAP 4 and reproduced in Table 8.1 and Table 8.2. It is assumed that the nearest land users to the proposed flour mill would be vessels on the Shoalhaven River, which has been categorised as 'sporting complexes and active open space'.

Table 8.1 - NSW Individual Fatality Risk Criteria[4]

Land Use	Acceptable Criteria (risk in millions per year)
Hospitals, schools, childcare facilities, old age housing	0.5
Residential, hotel, motels, tourist resorts	1
Commercial developments	5
Sporting complexes and active open space	10
Industrial	50

Table 8.2 - Effects of Heat Radiation[4]

Heat Flux (kW/m^2)	Effect
1.2	Received from the sun at noon in summer
2.1	Minimum to cause pain after 1 minute
4.7	Will cause pain in 15-20 seconds and injury after 30 seconds exposure (at least 2nd degree burns will occur)
12.6	Significant chance of fatality for extended exposure (10%, Technica, 1988) High chance of injury Thin steel may reach a thermal stress level high enough to cause structural failure
23	Likely fatality for extended exposure and chance of fatality for instantaneous exposure Unprotected steel will reach thermal stress temperatures that can cause failure.
35	Significant chance of fatality for people exposed instantaneously

It must be noted that if future quantitative analysis is carried out on the proposed Short Flour Mill, the above HIPAP 4 criteria must be taken into consideration and complied with as appropriate.

8.3 Management of Residual Risk

The qualitative risk assessment identified control measures, safeguards and procedures that will be put in place, as well as recommending additional actions to reduce the level of risk associated with the installation of the proposed Manildra Short Flour Mill facility. These actions are summarised in the Hazard Identification in Table 6.1.

In addition a Hazard and Operability Study (HAZOP) should be conducted on the proposed Short Flour Mill prior to construction so as to review the hazards, controls and associated risks in greater detail. The quantitative risk assessment has identified residual risk associated with the Short Flour Mill. One of the most effective means of ensuring the ongoing safe operation of a facility is through implementing a comprehensive Safety Management System. Such a system will ensure that hazards associated with the site are identified and managed, so that all activities are undertaken in a safe manner.

9. CONCLUSIONS AND RECOMMENDATIONS

The proposed Manildra Short Flour Mill will generate up to 5,000 tonnes of wheat flour weekly.

The SEPP 33 threshold screening value for dangerous goods is not exceeded by the proposed flour mill, as no new chemicals would be introduced to the site, other than those already approved. Additionally, as the proposed flour mill would not require new chemicals to be introduced to the site, the transportation screening thresholds are not exceeded. As a result, the proposed development is not potentially hazardous with respect to dangerous goods, and these aspects do not require a PHA.

The qualitative risk assessment/hazard identification study identified a number of possible hazard scenarios of high risk due to unacceptable potential consequences and/or possible likelihoods that may result in impacts to surrounding land users. These included:

» Deflagration of wheat dust in storage silo;

» Deflagration of wheat dust in tempering bins;

» Deflagration of wheat dust / flour in bag houses; and

» Deflagration of screening in screenings bin.

The likelihood of the above hazards causing harm to adjacent land users is also dependant on the probability of the presence of a passing vessel on the river.

None of the other hazard scenarios identified had the potential to present an unacceptable risk to the surrounding land users. Adequate safeguards are required to ensure the high and medium risk scenarios that were identified with potential off site impact are contained or at least controlled to an acceptable level.

Based on the results of the qualitative risk assessment, particularly the limited potential for the deflagration scenario to occur, it was found that all objectives of Level 1 of the Multi-Level Risk Assessment (1997)[3] were met and that conducting a quantitative analysis (Levels 2 and 3) would not be necessary.

It is concluded that although there exists a potential for deflagration to cause offsite effects, the scenario of wheat or flour deflagration is considered to be unlikely due to the design incorporating sufficient engineering controls to adequately minimise it's low probability of occurrence. Additionally, the occurrence of such a scenario would have to coincide with the presence of a passing vessel on the Shoalhaven River for it to have an impact on adjacent land users.

It is recommended that all possible safeguards be employed to ensure that the potential for deflagration of wheat and / or flour is minimised. There are three strategies for reducing risk:

» Elimination;

» Management; and

» Mitigation.

The complete elimination of the potential scenario is not an option considered for this development, as wheat and flour are the key inputs and outputs respectively for the process. Therefore risk management and mitigation procedures need to be employed.

It is recommended that management procedures and design considerations be implemented to incorporate practices that would prevent risk scenarios occurring through:

- Minimising build-up of combustible materials on-site;
- Minimising dust cloud formation;
- Ensuring all silos and the flour mill are electrically earthed;
- Enclosing plant to prevent the escape and accumulation of dust in the building;
- Fitting silos and dust collection systems with explosion relief;
- Using antistatic bags in the bag houses;
- Providing dust protection to all electricity supply;
- Zoning areas appropriately to limit ignition sources associated with electricity supply (zone 20, 21 and 22 according to Australian Standards);
- Designing the plant to prevent dust explosions;
- Implementing a monitoring and maintenance program; and
- Installing a suitable fire protection system.

Mitigation measures are practices that control the impact after a risk scenario has occurred. It is recommended that emergency management procedures be developed for response to fire and explosion that may be initiated from either on-site or off-site sources.

The risks posed by the deflagration of wheat dust or flour poses an on-site risk. It should therefore be examined in more detail during the design and construction phase of the project.

10. GLOSSARY

ALARP	As Low As Reasonably Practicable
DDG	Dried Distiller Grain
DEC	Department of Environment and Conservation
DoP	Department of Planning
EA	Environmental Assessment
EPA	Environment Protection Authority
FAQ	Frequently Asked Questions
HAZOP	Hazard and Operability Study
HIPAP	Hazardous Industry Planning Advisory Paper
HSE	Health Safety Executive
HV	High Voltage
KPI	Key Performance Indicators
PHA	Preliminary Hazard Assessment
PLL	Potential for Loss of Life (p.a.) expressed as fatalities per annum
PPE	Personal Protective Equipment
PRRC	Potential Risk Reduction Controls
QRA	Quantitative Risk Assessment
RRA	Risk Reduction Action
SEPP 33	State Environmental Planning Policy No.33
SQRA™	Semi-Quantitative Risk Assessment

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