2. The distance is from the centre of the cloud.

As fatalities can be expected, particularly to those in-doors, from the 14 to 21 kPa overpressure range and higher then this event has the potential for multiple serious injuries and/or fatalities. There is also the potential for significant property damage up to the 7 kPa overpressure contour, i.e. to a distance of approximately 225 m.

4.2 EXPLOSION LIKELIHOOD ESTIMATION

From Section 2.2, the probability of ignition resulting in an explosion is 0.09.

Therefore, the overall likelihood of an explosion is estimated to be:

Explosion Likelihood = 3×10^{-5} per km per year x 0.09 ignition probability

$= 2.7 \times 10^{-6}$ times/year.km

Given that the consequential impact distance of interest in this hazard analysis is up to approximately 225 metres from the point of failure, then the likelihood of an explosion impacting a particular point of interest from a failure in either direction is as follows.

Explosion Likelihood = 2.7×10^{-6} per km per year x 0.45 kms

$= 1.2 \times 10^{-6}$ times/year

Again, the estimated likelihood of an explosion can be halved (i.e.0.6×10^{-7} times/year) in the areas where the concrete casing exists.

4.3 EXPLOSION RISK ANALYSIS

Given the estimated "Safety and Health" impact of "Catastrophic" (i.e. potential for multiple off-site fatalities) with an explosion likelihood of 1.2×10^{-6} times/year to 0.6×10^{-7}/year then the corresponding level of risk as determined by the risk matrix (Figure 1) is typically II.

Given the estimated "Financial" impact of "Major" (i.e. potential for several millions of dollars damage) with the same explosion likelihood of 1.2×10^{-6} times/year to 0.6×10^{-6}/year then the corresponding level of risk as determined by the risk matrix (Figure 1) is typically II to III.

Given that the pipeline design is expected to exceed the requirements of AS 2885 then the risk from potential flash fires is considered to be not intolerable and no further safeguards are recommended.

5 REFERENCES

1 TNO, *Models for the Calculation of Physical Effects*, 2005

2 Centre for Chemical Process Safety, *Guidelines for Fire Protection in Chemical, Petrochemical and Hydrocarbon Processing Facilities*, 2003

3 Lees F.P., *Loss Prevention in the Process Industries*, 2nd Edition 1996

4 ICI Mond UK Failure Frequency Data

5 UK Health and Safety Executive, *Major Hazard Safety Performance Indicators in Great Britain's Onshore Gas and Pipelines Industry*, 2008

6 Tweeddale, M., *Managing Risk and Reliability of Process Plants*, 2003

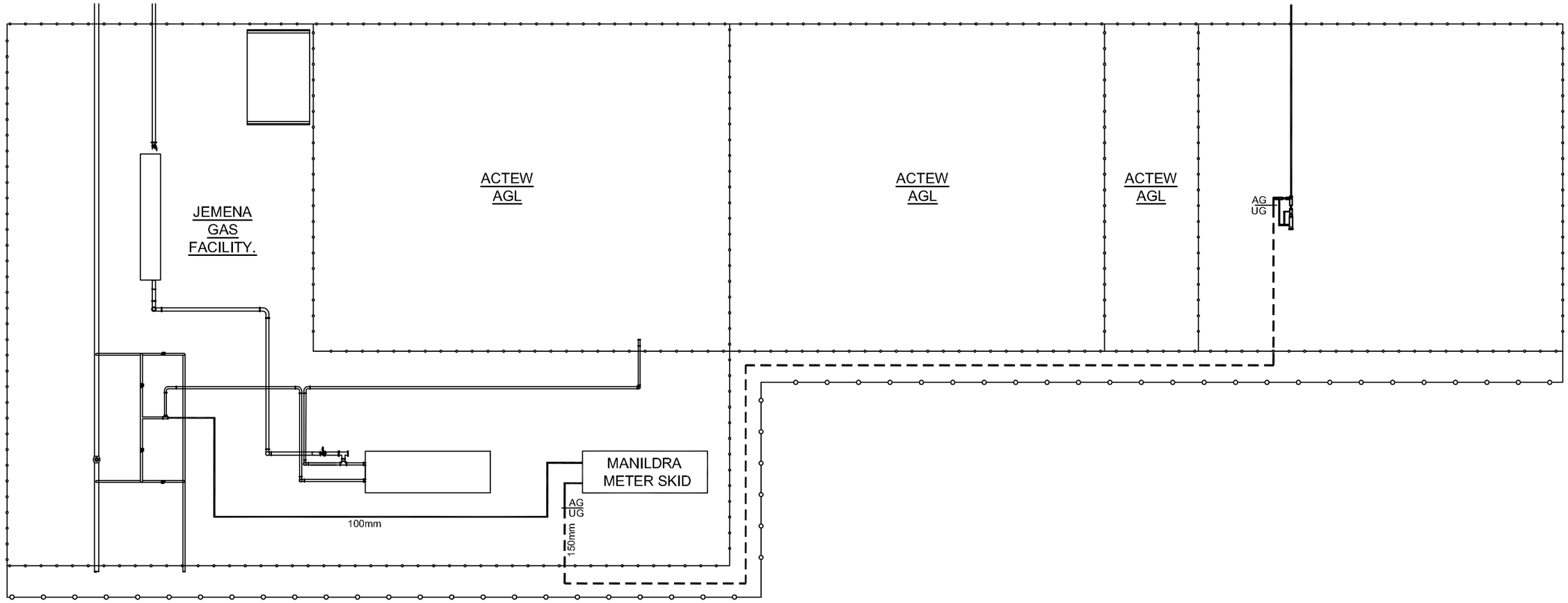
7 Cox, Lees and Ang, *Classification of Hazardous Locations*, January 2000

8 AS/NZS 4360:1999 *Risk Management*

9 AS/NZS 3931:1998 *Risk Analysis of Technological Systems – Application Guide*

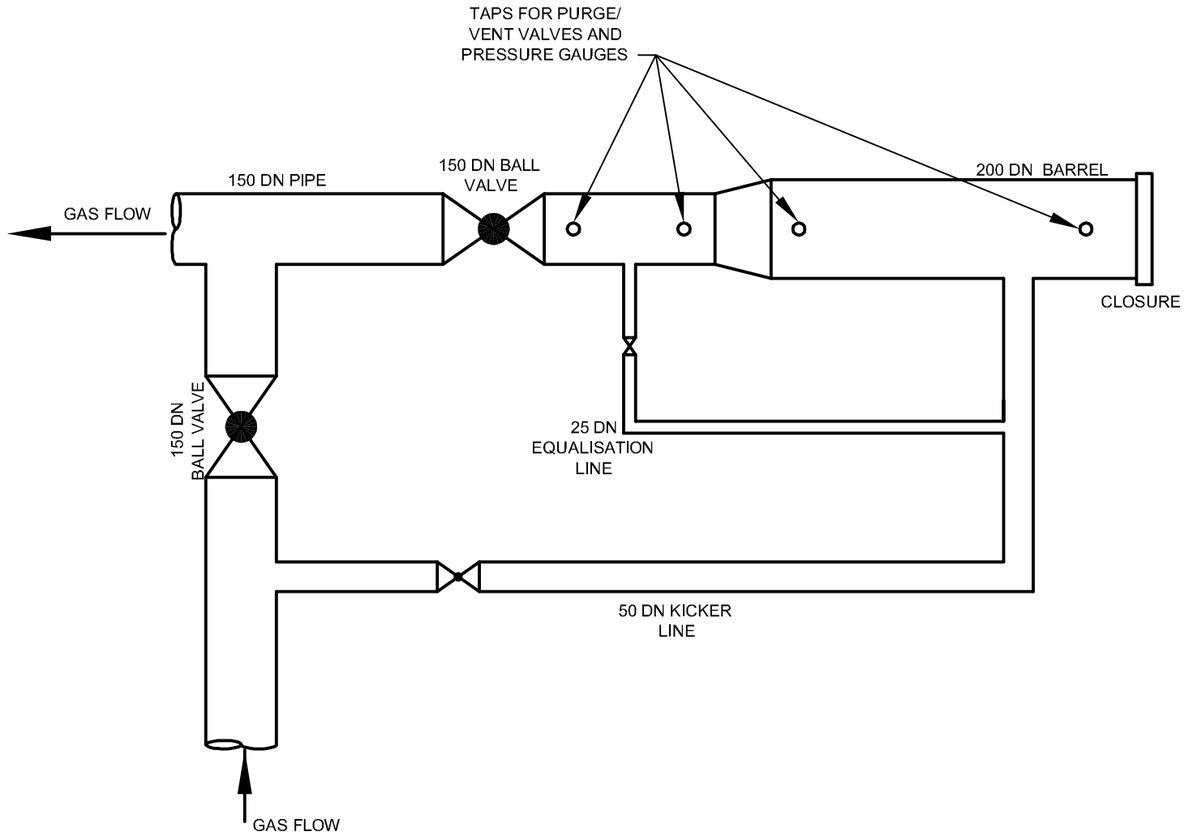
10 Centre for Chemical Process Safety, *Guidelines for Chemical Process Quantitative Risk Analysis*, 2000

11 NSW Department of Planning, *Risk Criteria for Land Use Safety Planning (HIPAP No. 4)*, 2011



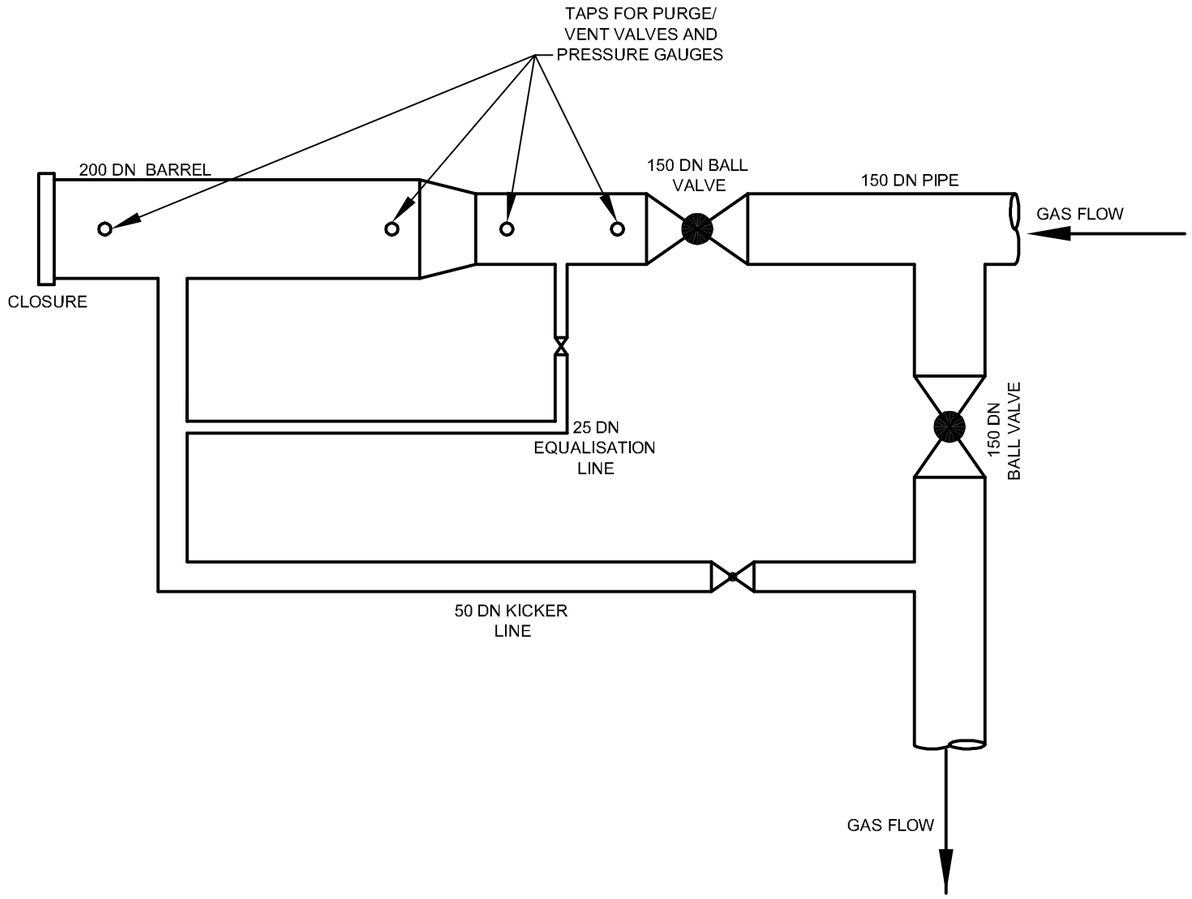
Source: XXXXX

Client: MANILDRA GROUP	Project: BOMADERRY GAS LATERAL PIPELINE		Title: SITE PLAN SCHEMATIC
URS	Drawn: AB	Approved: AH	Date: 19/01/2012
	Job No.: 43167736	File No.: 43167736.101.dwg	Figure: 101
			Rev. A
			A3



Source: XXXXX

Client: MANILDRA GROUP	Project: BOMADERRY GAS LATERAL PIPELINE		Title: TYPICAL 150 DN LAUNCHER LAYOUT (PLAN)
URS	Drawn: AB	Approved: AH	Date: 19/01/2012
	Job No.: 43167736	File No.: 43167736.102.dwg	Figure: 102
			Rev. A
			A3



Source: XXXXX

Client: MANILDRA GROUP	Project: BOMADERRY GAS LATERAL PIPELINE		Title: TYPICAL 150 DN RECEIVER LAYOUT (PLAN)
URS	Drawn: AB	Approved: AH	Date: 19/01/2012
	Job No.: 43167736	File No.: 43167736.103.dwg	Figure: 103
			Rev. A
			A3

ANNEXURE 15

Infrastructure Impacts Report

prepared by

Allen, Price & Associates

ANNEXURE 15

INFRASTRUCTURE IMPACTS REPORT

---

for the

SHOALHAVEN STARCHES Pty Ltd

GAS PIPELINE

at

Meroo Meadow & Bomaderry, NSW

allen, price & associates
land and development consultants

APA Ref: 24710

DATE: August 2011

TABLE OF CONTENTS

1 INTRODUCTION

This report was prepared by Allen, Price and Associates to supplement a project application to be made by Shoalhaven Starches Pty Ltd, for the construction of a privately owned and operated 5.5km long, 168.3mm diameter natural gas main.

The Shoalhaven Starches expansion project was approved in 2009, under Part 3A of the Environmental Planning and assessment Act 1979. Proposed development includes general expansion of the main factory to increase production output, and a proposed gas fired co-generation plant to supply electricity and steam to the factory.

The factory currently meets its energy requirements through a combination of coal, natural gas, diesel and electricity. The proposed development will require an increase natural gas consumption, from approximately 1,158,000 GJ per annum to 6,800,000 GJ per annum.

ActewAGL is the current supplier of natural gas to the Shoalhaven Starches factory. They own and operate an existing gas main, with gas supplied from the Eastern Gas Line. The Shoalhaven Starches gas main (SSGM) was proposed to allow the expansion of the factory, reduce overall operating costs, enable competitively priced gas supply, and contribute to the preservation of the environment by increasing the efficiency of the factory through the co-generation power plant.

Construction of the SSGM will impact the environment to varying degrees along the proposed route. A number of alternative routes for the SSGM were assessed by Shoalhaven Starches, Shoalhaven City Council, Allen, Price and Associates, Cowmann Stoddart and URS Australia Pty Ltd. The route described in this report was selected by the proponent as having the lowest possibility of impact, specifically on sensitive areas including; existing housing and urban areas, local wetlands, waterways, agricultural pasture, road and rail reserve, and council infrastructure.

The purpose of the report is to provide an assessment of impacts to infrastructure along the proposed pipeline route (including road and rail), and to determine measures to mitigate these impacts.

A site investigation was made along the proposed route by staff of Allen, Price and Associates to determine areas where the proposed gas pipeline will impact on infrastructure during construction.

Potential impacts to infrastructure were identified and photographed. Road reserves form the main areas where the proposed gas main will lay. The entire width of these reserves were assessed for impacts, which encompasses a larger area of assessment than a proposed 5-7m wide right-of-way to be constructed over the proposed route. This was done to take into consideration the effect of moving machinery.

Reference is made throughout this report to Figure 1 in Appendix A, which shows the proposed Shoalhaven Starches gas pipeline route as a continuous red line, along with the existing ActewAGL gas pipeline, shown as a dark blue dashed line. Photographs of the proposed route were taken during site inspections. These are consecutively numbered beginning at the Pestells Lane existing Eastern Gas Pipeline tie –in. They can be found in Appendix B. Detailed drawings of the proposed route have been provided and are available in Appendix C. Sheets 1-16 of APA drawing 24710-04 (Appendix C) provide detail of infrastructure along the route at 1:1000 scale.

1.1 Report aim and scope

The aim of this report is to satisfy the Director General's Requirements (DGRs) for the Shoalhaven Starches Project (MP 10_0108), under the heading of Traffic and Transportation in the associated report, dated 8th November 2010. This specifically is, to make "an assessment of the impacts on any road or rail infrastructure and proposed measures to mitigate these impacts".

The report also addresses requirements from Shoalhaven City Council (Correspondence from Mr T Fletcher, Director of Development and Environmental Services Group dated 22 October 2010), to assess the impacts of the proposed pipeline on Council infrastructure, mainly water and sewer. Impacts to infrastructure within roads owned and managed by Shoalhaven City Council are also included in this report.

This infrastructure impact assessment extends approximately to the cadastre boundary of the road reserves that will contain the proposed gas main. It includes the 5-7m wide construction right of way to be allocated along the full length of the proposed route, access (haul) roads and stabilised work and machinery sites

Impacts to the natural environment are not assessed in this report, either are impacts made by infrastructure on the proposed gas main.

1.2 Report Structure

The report structure is based around four main headings; Introduction, Background Information, Impact Assessment and Mitigation, and Conclusion. The content of these sections will now be briefly outlined;

Introduction: This section provided a brief introduction to the Shoalhaven Starches Pty Ltd gas main project. The aim of the report is given and the scope outlined. The report structure is also detailed.

Background Information: This section contains general information about the proposed gas main including;

- Relevant legislation, policies and Australian Standards.
- Proposed route details
- General Pipeline construction details such as materials and operating characteristics.

Impact assessment and Mitigation: This section addresses the possible impacts to significant infrastructure. These are used as headings and the route systematically addressed along its length beginning at Pestells Lane to the north-west and ending at Bolong Road in the south-east. Typical infrastructure found along the route are outlined and numbered in section 3 of this report, and are cross-referenced in Sheets 1-16 of APA drawing 24710-04 (Appendix C). Impact points contain a short paragraph titled 'Impact:' with the infrastructure in the vicinity of the arrow head listed, along with the appropriate identification number from section 3.

Conclusion: The report concludes with a brief summary of the main impacts to infrastructure, and the main areas of concern along the route. Recommendations are provided detailing future steps to be taken.

Appendicies:

Appendix A contains Figure 1 which shows the proposed Shoalhaven Starches gas main route as a red continuous line. Significant areas along the route are numbered from 1-15, and are identified in Section 3 of this report.

Appendix B: contains photographs taken along the route during site inspections. These show the location and type of infrastructure discussed in section 3 of this report.

Appendix C: contains sheets 1 to 16 of APA drawing 24710 – 04, which details the route at a scale of 1:1000. Photographs in Appendix B are referenced in the drawing, corresponding to the identification number given in Appendix B. Arrow heads in the drawing indicate the position where the photograph was taken, and point to the direction shown in the photos.

2 BACKGROUND INFORMATION

2.1 Legislation and Standards

The SSGM project has been classified as a 'major project' pursuant to Part 3A of the Environmental Planning and Assessment Act. The Minister for Planning is the consenting authority.

AS 2885 *Pipelines – Gas and Liquid petroleum,* is the Australian Standard for the safe design, construction, inspection, testing, operation and maintenance of pipelines used for the transportation of gas or liquid petroleum. Specifications of the proposed gas main given in the Preliminary Environmental Assessment report indicate the design is in accordance with this standard.

Standards for the design and construction of the proposed Shoalhaven Starches gas main within the Railcorp rail reserve include:

- AS 4799-2000 *Installation of underground utility services and pipelines within railway boundaries*.
- ARTC Standards EGS00 to EGS07available from www.artc.com.au.
- Railway of Australia (ROA) – Code of installation.

2.2 Proposed Gas Pipeline Details

The proposed Shoalhaven Starches gas main is to be constructed over a period of 10 weeks, assuming good weather and geotechnical conditions. A 660mm wide open cut trench will house the SSGM for a majority of the route. The trench will be made wider at locations where welders and their equipment will join pipes together in the ground.

Mechanical under-bore method(s) will be incorporated at certain points along the route to mitigate impacts to infrastructure, service and utilities during pipeline construction. Under-bores will mainly occur at road intersections although other areas along the route may require this technique. Waterway crossings will use the under-bore technique, details of which can be found in APA's Erosion and Sediment Control Management Report.

The proposed Shoalhaven Starches gas main will sit at a depth of approximately 1200mm through the road and rail reserves it is to reside in. The minimum depth of cover stated in AS2885 is 750mm.

2.3 Route

The proposed SSGM route travels through Meroo Meadow and Bomaderry, approximately 5km north of the Nowra township in NSW. An existing 'tie-in' station exists at Pestells Lane in Meroo Meadow, containing valves and a meter which connects an existing ActewAGL gas pipeline and supplies natural gas to the Shoalhaven Starches factory. A new valve and meter (V & M) block at the Pestells Lane tie-in station will connect the proposed SSGM into the Eastern Gas Line (EGL). The proposed gas main will connect to a proposed gas pressure reducing station, to be constructed on the northern side of Bolong road, Bomaderry, on land privately owned by Shoalhaven Starches Pty Ltd.

The route is briefly explained as follows;

- Exit Pestells Lane gas pressure reduction station over the EGL tie-in, perpendicularly across Pestells Lane to the south side and change direction to the south-east.
- Continue south-east along Pestells Lane.
- Alter alignment to by-pass large trees and pass perpendicularly through an under-bore of Princes Highway intersection.
- Continue south-east along the unformed section of Pestells Lane.
- Continue through the Meroo Road intersection on the same alignment, into the east side of Meroo Road.
- Change direction to the south, continue along Meroo road and through an under-bore of Fletchers Lane intersection to the south side of Fletchers Lane.
- Change direction to the east and continue along Fletchers Lane.
- Change direction to the south, under a Railcorp gate and into the rail reserve.
- Continue south for approximately 50m along the west side of the rail reserve.
- Change direction to the east and pass through a perpendicular under-bore of the ballasted railway track, into the east side of the rail reserve.
- Continue east into the un-named road reserve adjacent to the railway track reserve
- Continue along the un-named road reserve parallel to the railway track reserve, through multiple waterway crossings, and continue into the un-sealed section of Railway Street.
- Continue along the unsealed section of Railway Street and then continue into the sealed section of Railway Street.
- Continue along the sealed section of Railway Street and change direction east into Manildra Factory Land, Lot 16 DP572583.
- Follow north boundary of Lot 16 DP572583, parallel to the open channel stormwater drain for approximately 270m.
- Change direction toward the south and continue to the location of the proposed gas pressure reduction station on Manildra land, lot 16 DP572583.
- Exit the pressure reduction station and continue south toward Bolong Road.
- Pass through an under-bore of Bolong Road into Manildra Factory Land.'
- Continue, and distribute throughout factory as required.

As mentioned in the route explanation, a small portion of Railcorp railway reserve will be utilised to route the proposed gas pipeline. This is located at the intersection of Fletchers and the un-named road reserve parallel to the rail reserve, Meroo Meadow. No significant impacts to rail infrastructure is expected in this small portion of railway reserve by the construction of the SSGM.

Road reserves form the majority of the proposed route with approximately 30% of the road reserves containing bitumen sealed roadways, 20% containing unsealed roadways, and 50% containing no formal roadway. A brief explanation of these road reserves now follows;

Pestells Lane

Pestells Lane is managed by Shoalhaven City Council, and is located at Meroo Meadow. It is divided into two by the Princes Highway and consists of a formed, unsealed section to the west, and an unformed section to the east of the Princes Highway.

The reserve width is approximately 10m. Pavement width is approximately 4m with its centerline offset to the north approximately 0.5m. Pestells Lane is shown in detail on Sheets 1 and 2 of APA drawing 24710-04 (Appendix C).

The proposed route along Pestells Lane contains no houses except for one rural property located approximately 100m north-west from the Meroo Road intersection.

The route begins at position 1 in Figure 1 (Appendix A), which shows the existing valve and meter station at Pestells Lane.

Pestells Lane continues along the same alignment, unformed, on the opposite side of the Princes Highway and intersects with Meroo Road. The gradient of the land adjacent to the road reserve is mainly flat with the only exception where the road intersects the Princes Highway, and the gradient becomes steep for approximately 15-20m down the highway embankment on the east side.

The Princes Highway

The Princes Highway is a two way, bitumen sealed, arterial road managed by the Road and Traffic Authority (RTA). The road reserve width varies considerably along its length through Meroo Meadow

and Bomaderry. At the intersection with Pestells Lane, it varies between 40 to 90m wide. The road pavement is approximately 20m wide and centered within the reserve at this point.

The proposed gas main route continues in a south easterly direction along the formed, unsealed section of Pestells Lane until it is approximately 50m from the Princes Highway. Here it will most likely be angled south for approx 10-20m, then back toward the highway to be passed through an under-bore, perpendicular to the highway.

The main infrastructure within the road reserve include road pavement, above ground power cables, Telstra service and stormwater drainage.

Pestells Lane can be seen at points 1, 2, 3 and 4 in Figure 1 (Appendix A), and corresponds to sheets 1, 2, 3, 4 and 5 of APA drawing 24710-04 (Appendix C).

Meroo Road

Meroo Road is managed by Shoalhaven City Council, is bitumen sealed and is located at Meroo Meadow. The proposed SSGM will lay within a short section of Meroo Road as it transitions from Pestells Lane, under Meroo Road and into Fletchers Lane.

The road is sparsely populated with houses within the vicinity of the proposed gas main route at this point. The closest house is approximately 100m to the north.

The road pavement is approximately 8m wide, located centrally in the 20m wide road reserve.

The road reserve is congested at the proposed Meroo Road crossing, with ActewAGL gas main, water main, Telstra service, table drains and other drainage infrastructure. The intersection of Meroo Road with Fletchers Lane contains a similar number of infrastructure.

The Meroo Road crossing point is shown at point 5 in Figure 1 (Appendix A), and sheet 5 of APA drawing 24710-04 (Appendix C).

Fletchers Lane

Fletchers Lane is a formed, unsealed road located at Meroo Meadow and managed by Shoalhaven City Council. It lays in an east-west direction. It intersects Meroo Road to the west, Railcorp's railway reserve to the east, and an unnamed road reserve running parallel to the Railcorp railway reserve.

The road is sparsely populated with three houses on the northern side and paddock to the south.
Road pavement is approximately 5m wide and located 1.5-2m offset to the north of the road reserve centerline.

The Fletchers Lane crossing point is shown at point 5 in Figure 1 (Appendix A). This corresponds with sheet 5 of APA drawing 24710-04 (Appendix C) The proposed gas line extends along Fletchers Lane to point 6 in Figure 1 (Appendix A), where it changes direction into the railway reserve. The direction changes again approximately 50m to the south and the pipe is to be passed through an under-bore of the railway tracks, into the opposite side of the railway reserve and continue through to the un-named road reserve, at point 7 in Figure 1 (Appendix A). Fletchers Lane corresponds with sheets 5, 6, 7 and 8 of APA drawing 24710-04 (Appendix C).

Un-named Road Reserve

An un-named road reserve exists adjacent to Railcorp's railway reserve, on the west side. It is un-fenced on the east boundary which gives the neighboring property access to use it as pasture land. A rural fence separates it from Railcorps railway reserve on the west boundary. There are no houses along this road reserve until its intersection with Edwards Avenue, where a single property is located adjacent to the road reserve.

Three waterway crossings will be made by the proposed gas main through this road reserve. These are discussed in the report by APA on Erosion and Sediment Control Management. Depending on minor route alterations at the detailed design stage, another waterway crossing may be made at the Fletchers Lane and un-named road reserve intersection, shown at point 7 in Figure 1 (Appendix A), and on sheet 8 of APA drawing 24710-04 (Appendix C). The proposed route is shown to by-pass this waterway and cross into the un-named road reserve further down Railcorps railway reserve, shown on sheet 8. The proposed waterway crossings can be seen in on sheets 9, 10 and 12 of APA drawing 24710-04 (Appendix C).

The un-named road reserve is intersected by Edwards Avenue and continues south, parallel to the Railcorp railway reserve until it joins with Railway Street.

Infrastructure contained within the road reserve include water main and water main, rural gates and fencing, vegetation, sewer rising main, power poles. Telegraph poles exist approximately 50m apart from each other along the boundary between the road and railway reserve.

The existing ActewAGL gas pipeline servicing the Shoalhaven Starches factory enters into this road reserve adjacent to the large railway bridge over a minor water way located approximately 380m north of the road reserve's end. It runs parallel to Railcorp's railway reserve and continues through into Railway Street Road reserve.

Edwards Avenue

Edwards Avenue road reserve is approximately 18m wide containing a 6m wide bitumen sealed pavement centrally located within the reserve. The road is located within Bomaderry and managed by Shoalhaven City Council. It lays in an east-west direction and intersects with the un-named road reserve parallel to the Railcorp railway reserve, although vehicular access to the un-named road reserve is blocked by gate and fence.

The intersection contains houses on all quadrants, although only two houses are located on the east side where the un-named road reserve is.

To minimise impacts to the pavement and seal, an under-bore is proposed for routing the Shoalhaven Starches gas main. Edwards Avenue contains a number of services at the proposed crossing point. Laying in an east-west direction are Telstra service cables, and water main. A sewer rising main and water main cross under Edwards Avenue, parallel to the un-named road reserve. Integral power poles are located approximately in the center of the un-named road reserve, located at the intersection.

Edwards Avenue can be seen at point 10 in Figure 1 (Appendix A), and corresponds to sheet 11 of APA drawing 24710-04 (Appendix C).

Railway Street

Railway Street road reserve is made up of two sections. The first section to be discussed is un-formed and connects onto the end of the un-named road reserve. It is approximately 200m in length, spanning across the west boundary of Lot 1 DP774892. It terminates at the beginning of the sealed section of Railway Street, at the driveway to Lot 1 DP774892. The sealed section begins at this point and continues in a southerly direction toward the end of Railway Street, where it intersects with Bolong Road.

The unformed section of road reserve contains existing infrastructure. The existing ActewAGL gas pipeline servicing the Shoalhaven Starches factory runs parallel to the unformed section of Railway Street. It eventually changes direction by 90 degrees and exits the sealed section of the road reserve, approximately 40m south of Lot 1 DP774892. A water main and two sewer rising mains are also located along the length of the un-formed section of Railway Street.

As the proposed gas main continues through the sealed section of Railway Street, the proposed gas main route crosses one of the most congested sections of the entire route, in relation to underground service, utilities and infrastructure, except for Bolong Road.

The road pavement along Railway Street varies from 5m to 10m wide, within a road reserve approximately 20m wide. The proposed gas main route is proposed to run along the east side of the road reserve, where many gravel and concrete driveways are situated.

Impacts to infrastructure within this road reserve include; sewer rising main, Telstra service, water main, power poles, kerb & gutter, stormwater drainage pipes, culverts and pits.

Railway Street is located between points 12 and 15 in Figure 1 (Appendix A), and corresponds to sheets 13, 14 and 15 of APA drawing 24710-04 (Appendix C).

Bolong Road

The proposed gas main is to be routed under Bolong Road reserve after exiting a proposed gas pressure reduction facility to be located on Shoalhaven Starches land.

Bolong road is an arterial road jointly managed by the RTA and Shoalhaven City Council. At the proposed crossing point, the reserve is 20m wide with a pavement width approximately 11 m. The pavement is located with its centerline approximately 0.5m offset to the north

The construction of new civil works along Bolong Road as part of Shoalhaven Starches factory upgrade project has increased the potential for impacts by the proposed gas pipeline. The crossover point for the proposed gas main contains both new road and rail infrastructure.

Although the crossing of Bolong Road is confined to a small area, the road reserve is one of the most congested along the proposed route. Many services cross perpendicularly to the proposed SSGM crossing point. Detailed survey and route design will aid in mitigating impacts at this point.

Bolong Road is located at points 15 in Figure 1 (Appendix A), and corresponds to sheet 16 of APA drawing 24710-04 (Appendix C).

3 INFRASTRUCTURE IMPACT ASSESSEMENT

This section of the report contains an assessment of the possible impacts to infrastructure associated with construction of the proposed Shoalhaven Starches gas main.

Existing infrastructure along the route provide constraints to construction. The following infrastructure was identified during sight inspections, previously conducted survey work, Dial Before You Dig reports, service operator records and local Shoalhaven City Council records. The asset owner and/or operator details are given, who should be included in the planning and design of the proposed Shoalhaven Starches gas main to limit impacts to their assets.

- **Road pavement.**
  Roads through Meroo Meadow and Bomaderry are managed mainly by Shoalhaven City Council. The Princes Highway is managed by the RTA.
- **Stormwater drainage infrastructure.**
  Stormwater drainage within road reserves are maintained by the manager of the road reserve, as mentioned above.
- **Sewer drainage infrastructure.**
  Sewer mains and associated infrastructure are owned and managed by Shoalhaven City Council.
- **Water infrastructure.**

Water mains and associated infrastructure are owned and managed by Shoalhaven City Council.

- **Telecommunications**
  Telecommunications infrastructure along the route is owned and operated mostly by Telstra. Optus own a cable located approximately halfway along the west side of Pestells Lane.

- **Power Distribution**
  All power infrastructure is owned and operated by Endeavour Energy, formally known as Integral Energy.

- **Other Gas Services.**
  Gas mains impacted along the route are owned and operated by one of two companies. The Eastern Gas Line is an asset of Jemena. ActewAGL own and operate the gas main that currently supplies the Shoalhaven Starches factory.

A brief summary of area specific impacts, and methods to mitigate these are given below. The impacts identified are indicatively shown on APA drawing 24710-04 (Appendix C) sheets1-16 by using the paragraph identification number located next to the impacts in the list given below.

3.1 Road and Rail Reserve

1. Damage to road pavement and seal.
   a. Mechanical under-bore to prevent trenching.
   b. Limit trench width to minimum.
   c. Construct under-bore pits, stabilised site access and machinery/material storage areas 3m behind edge of bitumen.
   d. Fence off as no-go area.
   e. Adhere to road tonnage limits.
   f. Construct under-bore pits, access and storage sites 3m back from edge of bitumen.

2. Disturbing table drains.
   a. Enclose table drain with fencing.
   b. Treat as no-go zone.
   c. Create temporary alternative drainage with flexible pipes.
   d. Provide adequate erosion and sediment control.

3. Damage to driveway and/or loss of access
   a. Co-ordinate works with land owner.
   b. Conduct works during low traffic periods.
   c. Under-bore driveways to prevent trenching.
   d. Stage works to ensure minimum time to complete driveway crossovers.
   e. Remove driveway for construction and replace when trenching complete.

4. Loss of vegetation and topsoil during excavation

a. Provide adequate erosion and sediment control.
b. Mark trees that are not to be removed or damaged with highly visible tape and/or fencing.
c. Remove non-native trees and shrubs during construction.
d. Replace removed trees with natives.
e. Disturb only the bare minimum surface area required for trenching.
f. Ensure machinery operators are aware of trees significance and repercussions of damage.
g. Limit number of machinery movements along haulage tracks and roads.

5. Damage to boundary fences and road signs.
    a. Mark fences with high visibility ribbon.
    b. Include as no-go zone.
    c. If damage is likely, arrange with land owner for its removal and replacement on completion of pipe works.

6. Train services interrupted.
    a. Co-ordinate work with Railcorp.
    b. Mechanical under-bore to limit damage to track and ballast.
    c. Limit work to low traffic volume periods.

7. Damage to low voltage/signalling cables (Rail infrastructure)
    a. Detailed survey to identify location and depth.
    b. Mark alignment to show position to machinery operators.
    c. Provide adequate depth of cover over proposed gas pipeline.

3.2 Shoalhaven City Council stormwater drainage infrastructure.

8. Damage to culverts and headwalls
    a. Co-ordinate works with Shoalhaven City Council.
    b. Obtain detailed survey.
    c. Provide adequate erosion and sediment control.
    d. Include as no-go zone
    e. Fence off to guide machinery away.
    f. Provide appropriate depth of cover over proposed pipeline.
    g. Remove infrastructure, provide temporary drainage, and replace on completion of proposed gas main.

9. Damage to stormwater pits, lintels and Kerb & Gutter
    a. Co-ordinate works with Shoalhaven City Council.
    b. Under-bore road containing kerb and gutter.
    c. Fence off and include as no-go zone for machinery.
    d. Remove infrastructure temporarily, provide temporary measure, and replace original after work complete.

10. Blocked culvert or pipe

a. Adequate erosion and sediment control to prevent erosion of excavated material entering into stormwater system.
b. Maintain erosion and sediment controls

3.3 Shoalhaven City Council sewerage drainage infrastructure.

11. Damage to sewer pipe pit lids and vent pipes
    a. Co-ordinate works with Shoalhaven City Council.
    b. Obtain detailed survey of water pipes.
    c. Fence off aboveground infrastructure and mark with highly visible tape
    d. Ensure minimum construction clearances as per Shoalhaven Councils requirements.
    e. Provide adequate depth of cover over proposed gas pipeline.
    f. Remove infrastructure, provide temporary sewer pipe, and reinstall original section on completion of proposed gas main.

3.4 Shoalhaven City Council water infrastructure.

12. Damage to water main
    a. Co-ordinate works with Shoalhaven City Council.
    b. Obtain detailed survey of water pipes.
    c. Ensure minimum construction clearances as per Shoalhaven Councils requirements.
    d. Provide adequate depth of cover over proposed gas pipeline.
    e. Remove infrastructure, provide temporary water pipe, and replace on completion of proposed gas main.

3.5 Telecommunications

13. Damage to optic fibre cable
    a. Co-ordinate works with appropriate telecommunication provider.
    b. Dial before you dig to locate position of cable.
    c. Detailed survey of cable to find exact location.
    d. Mark alignment to show position to machinery operators.
    e. Adequate depth of cover over proposed gas pipeline.
    f. Relocate existing infrastructure.

14. Damage to telecommunication cable.
    a. Co-ordinate works with appropriate telecommunication provider.
    b. Dial before you dig to locate position of cable.
    c. Detailed survey of cable to find exact location.
    d. Mark alignment to show position to machinery operators.
    e. Adequate depth of cover over proposed gas pipeline.
    f. Relocate existing infrastructure.

15. Damage to regular copper telecommunication infrastructure
    a. Co-ordinate works with appropriate telecommunication provider.
    b. Dial before you dig to locate position of cable.
    c. Detailed survey of cable to find exact location.
    d. Mark alignment to show position to machinery operators.
    e. Adequate depth of cover over proposed gas pipeline.

3.6 Power Distribution

16. Damage to power poles and wires by machinery.
    a. Mark power poles with high visibility tape at eye level of machinery drivers.
    b. Create no-go zone barrier fencing around power pole.
    c. Cover wires with highly visible non-conductive covers

3.7 Other Gas Services

3.7.1 Jemena Eastern Gas Line

17. Rupture or crushing of Eastern Gas Pipeline
    a. Communicate with owner (Jemena) as to requirements for digging and working adjacent to EGL.
    b. Detailed survey to locate exact position of gas pipeline.
    c. Position the proposed pipeline as far as possible away from EGL.
    d. Do not exceed recommended tonnage to be driven over top of gas pipeline.
    e. Hand dig trench of proposed gas main to prevent machinery hitting the EGL.

3.7.2 ActewAGL

18. Rupture or crushing of ActewAGL gas pipeline
    a. Communicate with owner (Jemena) as to requirements for digging and working adjacent to pipeline.
    b. Detailed survey to locate exact position of gas pipeline.
    c. Position the proposed gas pipeline as far as possible away from the existing gas pipeline.
    d. Do not exceed recommended tonnage to be driven over top of gas pipeline.
    e. Hand dig trench of proposed gas main to prevent machinery hitting gas pipeline.

4 Conclusion

The aim of this report was to assess impacts to infrastructure along the length of the proposed Shoalhaven Starches Pty Ltd gas pipeline, and to address the associated requirement outlined under the heading of Traffic and Transportation in the Director General's Requirements for the Shoalhaven Starches Project (MP 10_0108), dated 8th November 2010. This report is to be included as part of a development application to Shoalhaven City Council.

Section 1 of this report provides an introduction to the Shoalhaven Starches Pty Ltd expansion project, specifically the construction of a 5.5km long, 168.3mm diameter , coated mild steel gas pipeline to increase supply of natural gas for the proposed gas co-generation plant and expansion of Shoalhaven Starches Bolong Road Factory in Bomaderry NSW.

A site investigation was made by staff of Allen, Price and Associates to become familiar with the proposed gas main route, to determine areas where the proposed gas pipeline will impact on public and private infrastructure during construction.

Appendicies are attached to this report which contain figures, photographs and drawings of the proposed route in relation to this report.

Section 2 contains background information on the proposed gas pipeline. The proposed route is identified and general details of the gas main given. Road reserves form the main areas where the proposed gas main will lay. To take into consideration the effect of moving machinery, the entire width of the reserves were assessed for impacts, which encompass the 5-7m wide right-of-way to be constructed over the proposed route. Widths of reserves vary from 10 to 20 meters.

The proposed gas main will lay in the following road reserves;

- Pestells Lane
- The Princes Highway
- Meroo Road
- Fletchers Lane
- An un-named road reserve located to the east of and parallel to Railcorp's railway reserve.
- Railway Street
- Bolong Road
-

A brief discussion of the road reserves is available in section 2 of this report.

Section 3 of this report contains details of the infrastructure that will be impacted and methods to mitigate the impacts. Existing infrastructure along the route may constrain construction of the gas pipeline and so an assessment of the possible impacts to infrastructure was made. The infrastructure found along the route includes;

- Road seal and pavement.
- Stormwater drainage
- Sewer drainage
- Water mains
- Telecommunications
- Power distribution
- Other gas services

Potential impacts to existing infrastructure are found along the entire length of the route, although certain areas contained significantly more impacts. These areas include;

- The proposed gas main tie-in point to the existing valve and meter station on Pestells Lane.
- Crossing of the Princes Highway back into Pestells Lane.
- Crossing of Meroo Road.
- Crossing of Fletchers Lane
- Crossing of Railcorp's railway reserve, and the un-named road reserve to the east.
- Crossing of Edwards Avenue intersection
- Along entire length of route on Railway Street
- Bolong Road crossing

5 Recommendations

Recommendations for moving forward with the proposed Shoalhaven Starches gas main project, in relation to infrastructure impacts caused by the gas pipeline, include;

- Contact infrastructure owners and operators to determine their requirements, eg, minimum clearances, emergency procedures, obtaining exact location details of underground infrastructure.
- Re-examine proposed route and alter to minimise impacts to above ground infrastructure.
- Obtain a detailed survey of the entire route to accurately locate infrastructure above and below ground the proposed route.
- Obtain detailed erosion and sediment control plan.
- Re-examine proposed route to minimise infrastructure impacts further, based on detailed survey and information obtained from infrastructure owner and operators.
- Develop detailed construction timetable.
- Organise de-commissioning and/or removal of any infrastructure with owners and managers, including the provision of temporary measures to allow continued functioning of essential services.
- Make contact with Shoalhaven city council regarding traffic control during construction. Develop traffic control plan.

Allen, Price & Associates

18 August 2011

6 Appendices

Appendix A – Figure 1

Appendix B - Photographs

Appendix C- APA drawing 24710-04 sheets 1-16

APPENDIX A–PROPOSED GAS MAIN ROUTE

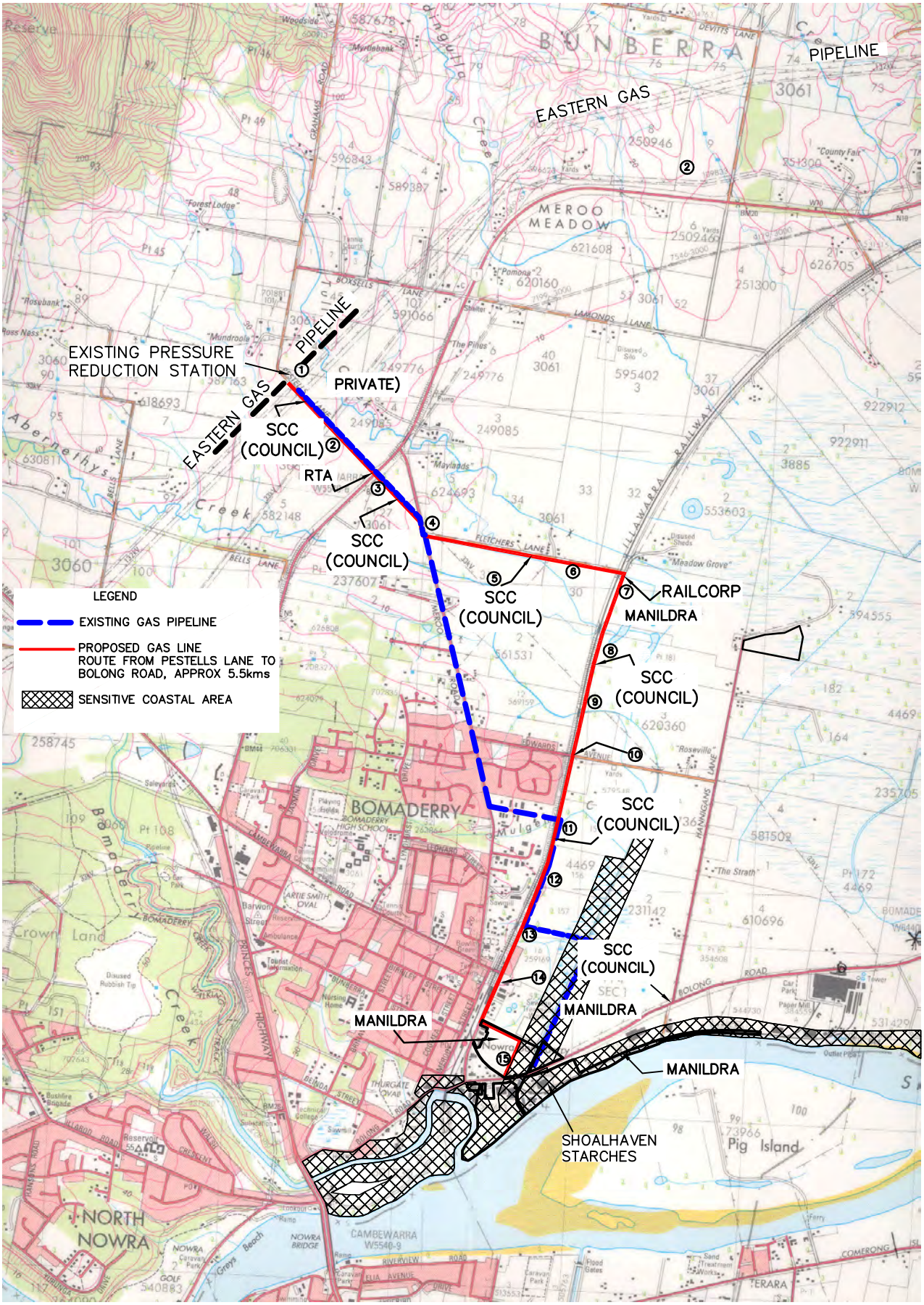


FIGURE 1

0 250 500 750 1000

scale: – 1:22000

SKETCH PLAN SHOWING EXISTING GAS LINE AND PREFERRED OPTION FOR PROPOSED GAS LINE ROUTE FROM EXISTING GAS MAIN TO THE BOLONG ROAD FACTORY FOR THE MANILDRA GROUP

CAD FILE: 24710-04a

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821 DX 5310 nowra
consultants@allenprice.com.au www.allenprice.com.au

A3 SIZE
RATIO 1:22,000 DATE 04-8-11 REF: 24710-04a

Appendix B

Photo 1-Pestells Lane Eastern Gas Pipeline tie-in point, with valve and meter station

Photo 2 Pestells Lane Eastern Gas Pipeline tie-in point for existing ActewAGL gas pipeline

Photo 3-Pestells Lane

Photo 4-Cattle Loading Station on Pestells Lane

Photo 5- Existing ActewAGL gas main marker adjacent rural fence at Princes Highway Intersection

Photo 6- Proposed gas main route across Princes Highway

Photo 7- Table drain and culvert on Princes Highway intersection with Pestells Lane

Photo 8- Unformed section of Pestells Lane

Photo 9- Looking down embankment of Princess Highway, along existing gas pipe route

Photo 10- Un-formed Pestells Lane

Photo 11-Intersection of Pestells Lane with Meroo Road

Photo 12-Table drain along Meroo Road

Photo 13- Culvert headwall (bottom right) on Meroo Road and Fletchers lane intersection

Photo 14-Fletchers Lane intersection with Meroo Road

Photo 15-Possible stabilised machinery access and storage area on Fletchers lane intersection

Photo 16- Culvert Headwall and drain leading in Paddock

Photo 17-Open channel drain through paddock on south side of Fletchers Lane

Photo 18- Example of tail-out drains on south side of Fletchers Lane, leading into Open channel drain

Photo 19- Middle of Fletchers Lane

Photo 20-End of Fletchers Lane toward Railcorp railway reserve

Photo 21- Ramp crossing over train tracks at intersection of Fletchers lane and un-named road reserve

Photo 22-Large culvert in Railcorp railway reserve

Photo 23- Gates to Railcorp railway reserve and un-named road reserve

Photo 24- First waterway crossing, approximately 50m south of ramp over train tracks at end of Fletchers Lane

Photo 25-Scour valve in un-named road reserve adjacent to second proposed waterway crossing, south of Edwards Avenue

Photo 26-Second proposed waterway crossing

Photo 27- Large railway bridge at second proposed waterway crossing

Photo 28- Looking north along proposed gas main route in un-named road reserve

Photo 29- Water main marker at steep approach to Edwards Avenue, in un-named road reserve

Photo 30- Looking north along proposed gas main route in un-named road reserve, toward water main marker

Photo 31- Edwards Avenue crossing point on north side

Photo 32- South side Edwards Avenue crossing in un-named road reserve

Photo 33- Water main infrastructure in un-named road reserve

Photo 34- At gate on crest in un-named road reserve, looking south down into gully and third waterway crossing point

Photo 35- Third water way crossing, looking back toward gate and crest, along proposed gas main route

Photo 36- ActewAGL existing gas main marker on boundary of un-named road reserve

Photo 37- Rural fence and gate at end of un-named road reserve and beginning of Railway Street

Photo 38- un-formed section of Railway Street, looking at ActewAGL existing gas main testing station

Photo 39- Railway Street

Photo 40- Water main infrastructure in Railway Street road reserve

Photo 41-Sewer rising main manhole and vent pipe

Photo 42- Water main infrastructure in Railway Street road reserve

Photo 43-Water main, power pole and existing gas main infrastructure in Railway Street

Photo 44- Beginning of sealed section of Railway Street

Photo 45- Stormwater headwall and culvert in Railway Street

Photo 46- Scour valve in Railway Street

Photo 47- East side Railway Street road reserve-

Photo 48- West side Railway Street road reserve showing water main marker

Photo 49- Railway Street

Photo 50- Looking at Cambewarra Road intersection with Railway Street

Photo 51- Infrastructure at intersection between Cambewarra Road and Railway Street, on west side road reserve

Photo 52- Example of Railway Street Infrastructure in west side of road reserve

Photo 53- Road reserve infrastructure along Railway Street

Photo 54- Open channel drain through lot 1 DP825808 at proposed gas main direction change in Railway Street

Photo 55- Headwall and culvert under Railway Street, at direction change of proposed gas main

Photo 56- Sewer pipe through open channel drain in lot 1 DP825808

Photo 57- Culvert and support for sewer pipe accross open channel drain in lot 1 DP825808

Photo 58-Open channel drain in Lot 1 DP 825808

Photo 59- Sewer man hole in open drain along north boundary of Lot1 DP 825808

Photo 60- North boundary of Lot1 DP825808

Photo 61-Proposed gas main route in Shoalhaven Starches property lot 1 DP 825808

Photo 62- Looking toward Shoalhaven Starches Factory (Manildra), along existing sewer rising main alignment

Photo 63- Proposed gas main route through Shoalhaven Starches paddock, looking toward interim packing plant

Photo 64- Sewer pump station on Shoalhaven Starches land, with location of proposed gas main route and pressure reduction station in background

Photo 65- Civil works at most likely position of proposed gas main crossing of Bolong Road

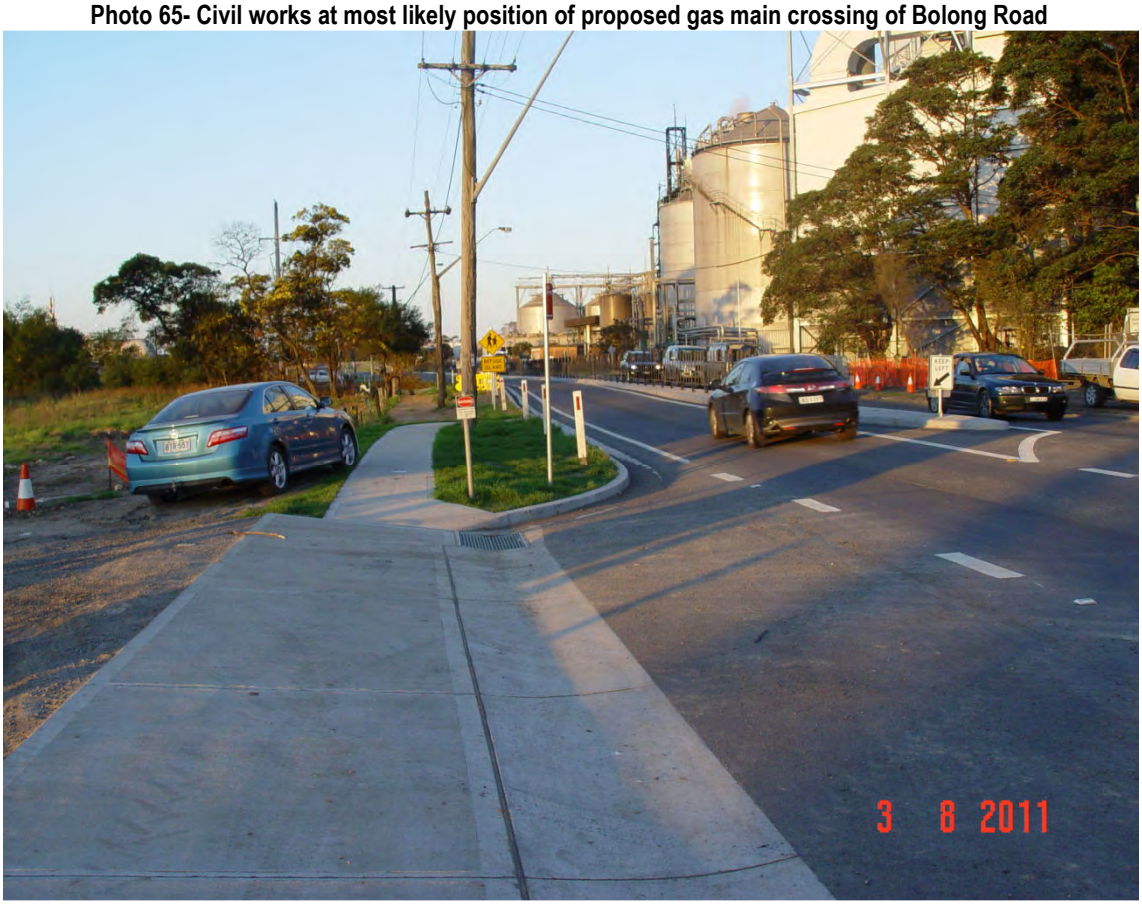


Photo 66 - Bolong Road showing infrastructure in vicinity of proposed gas main crossing

Photo 67-Bolong Road showing infrastructure in vicinity of proposed gas main crossing

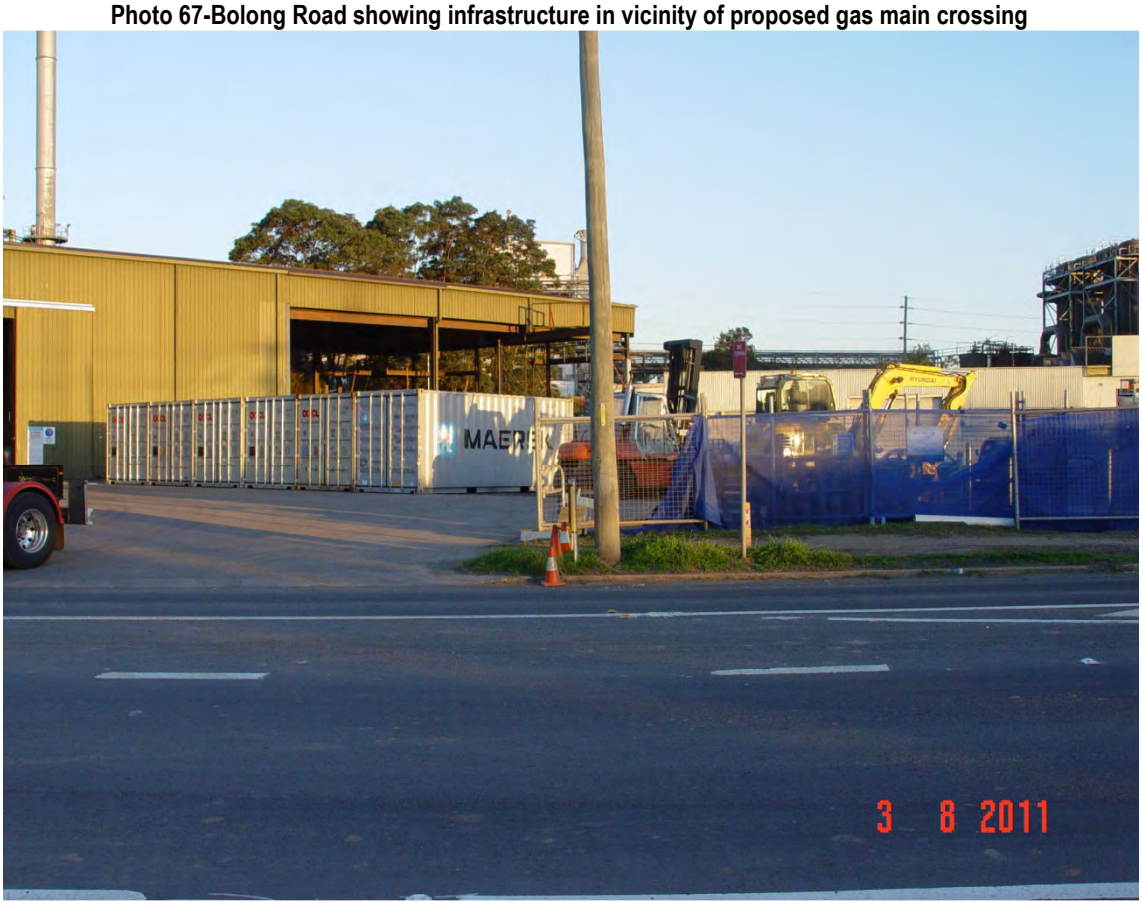
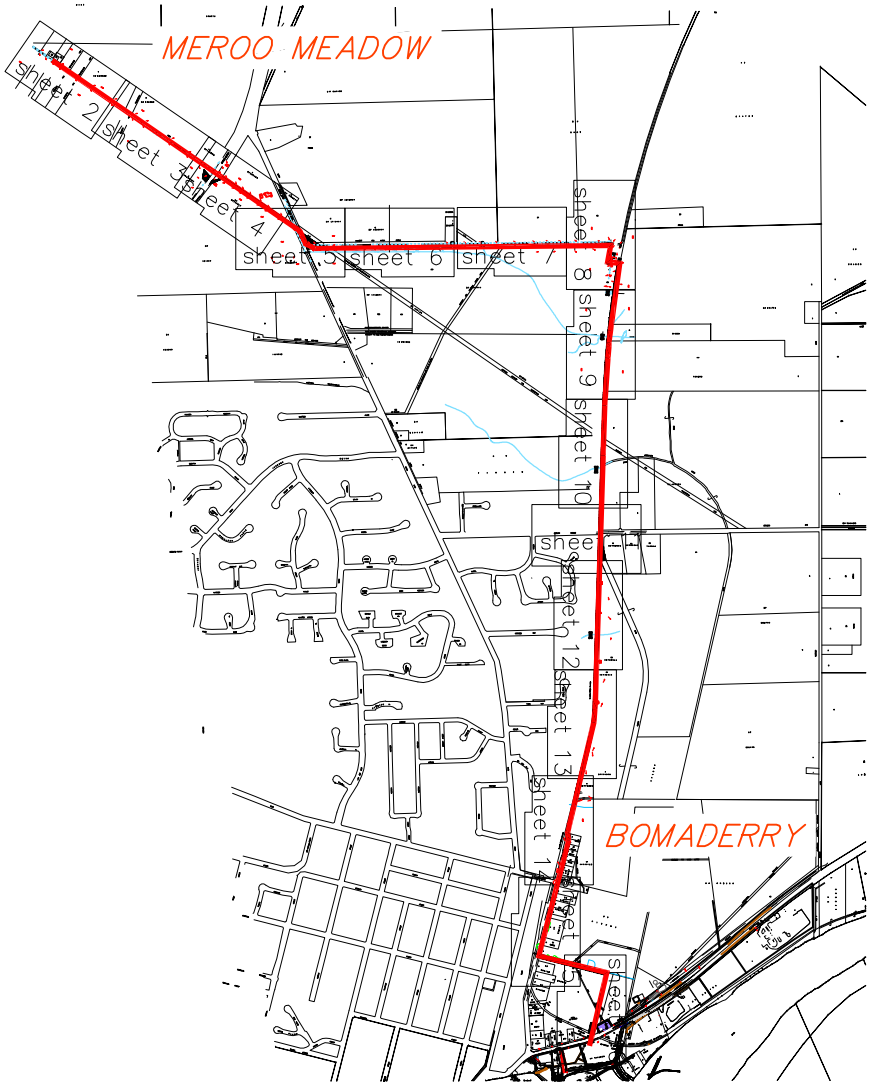


Photo 68- Shoalhaven Starches interim packing plant on south side of Bolong Road

SHOALHAVEN STARCHES PROPOSED GAS PIPELINE

AT MEROO MEADOW AND BOMADERRY, NSW

APPENDIX C



This drawing complements two reports written by Allen, Price and Associates for the proposed Shoalhaven Starches gas pipeline project. To better understand the content of this drawing, the reports titled, 'Impacts on Infrastructure Report' and 'Erosion and Sediment Control Management Plan' should be read prior. This drawing is located in Appendix C of both reports.

LEGEND

- 1 2 DP 595402 — EXISTING BOUNDARY FENCE (SCC CADASTRE)
- EXISTING RURAL FENCE
- EXISTING GAS MAIN
- PROPOSED GAS MAIN
- GAS — EASTERN GAS LINE
- E E — EXISTING OVERHEAD ELECTRICAL POWER SERVICE
- W W — EXISTING WATER MAIN
- S S — EXISTING SEWER MAIN
- SRM — EXISTING SEWER RISING MAIN
- T T — EXISTING UNDERGROUND TELSTRA LINE
- EXISTING TAIL-OUT OR TABLE DRAIN
- EXISTING CREEK OR SWALE DRAIN LESS THAN 5m WIDE
- EXISTING TREE SHOWING APPROX. DRIP LINE
- PP — POWER POLE (SCC INFRASTRUCTURE)
- TP — TELEGRAPH POLE (RAIL INFRASTRUCTURE)
- EXISTING BRIDGE
- EXISTING CULVERT
- AV — EXISTING AIR VALVE FOR WATER MAIN
- SV — EXISTING STOP VALVE FOR WATER MAIN
- SCV — SCOUR VALVE
- RAILWAY TRACK
- LAND SLOPE
- TEMPORARY STABILISED SITE AND ACCESS FOR MACHINERY STORAGE AND UNDERBORE OPERATIONS

REVISION	BY	DATE

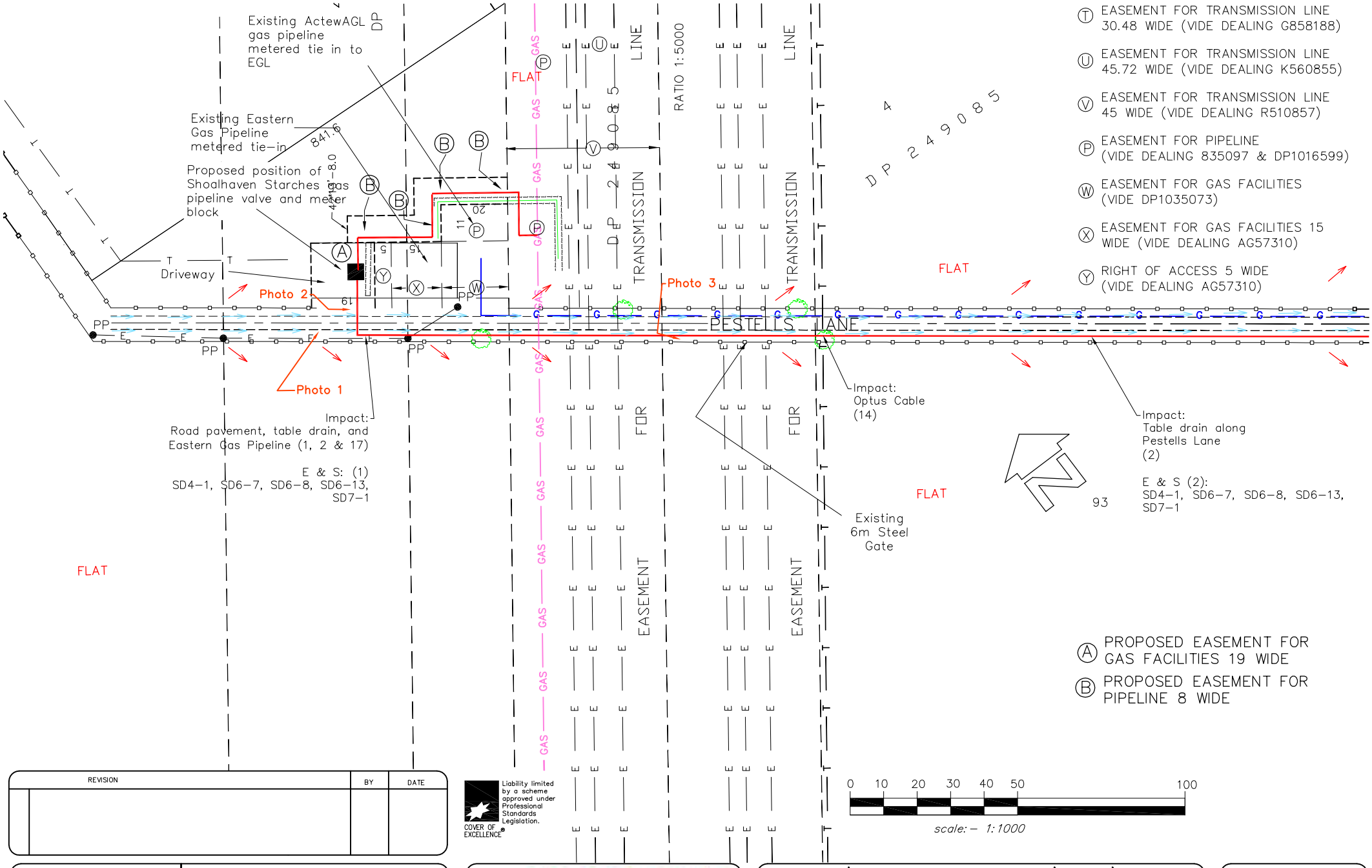
Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE®

RATIO: 1:20000 on A3	DATUM:
	ORIGIN:
	DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 1 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE

RATIO: 1:1000 @ A3

DATUM:

ORIGIN:

DATE OF PLAN: AUGUST 2011

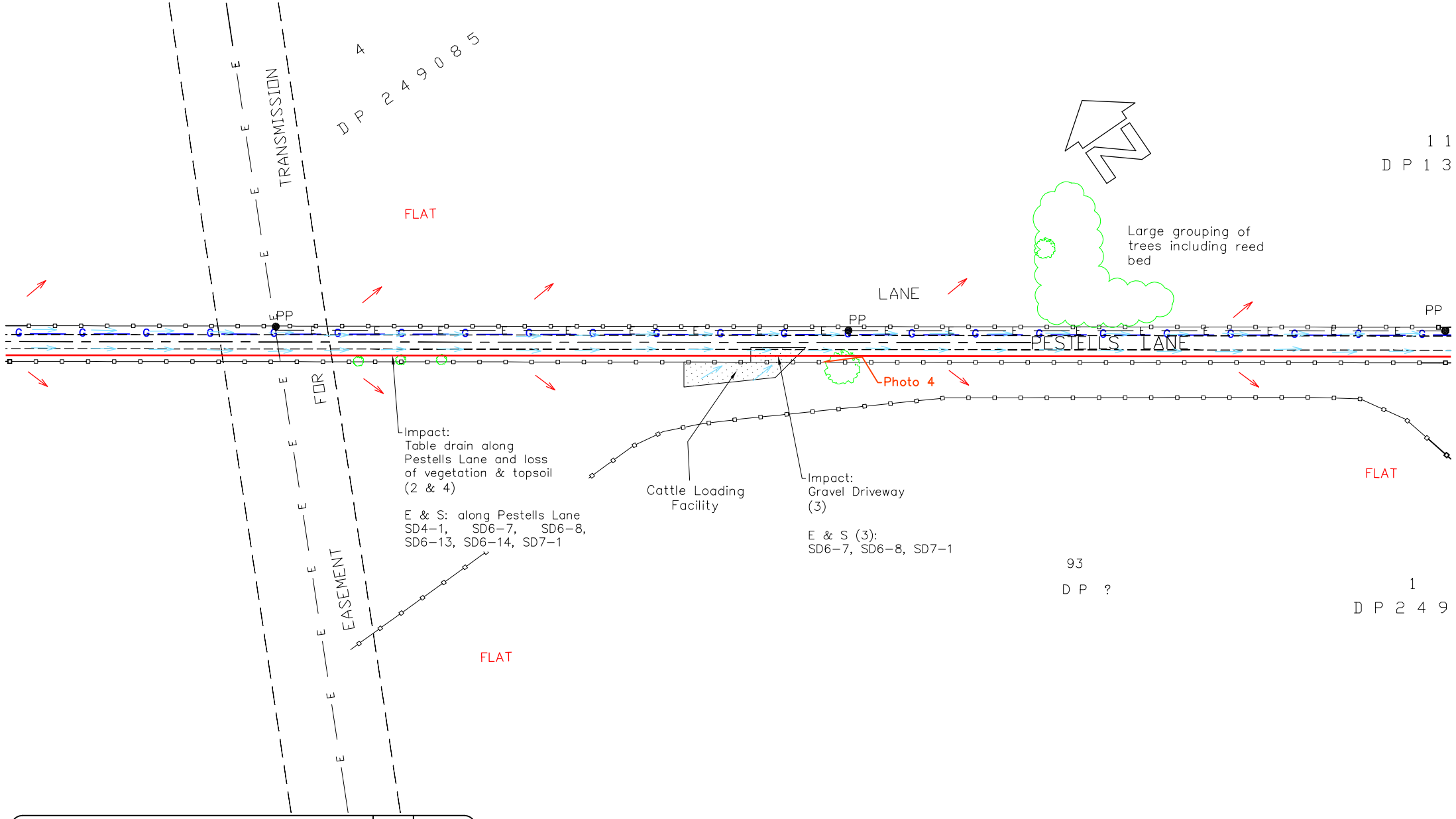
allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04

sheet 2 of 16

REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE®

0 10 20 30 40 50 100

scale:– 1:1000

RATIO: 1:1000 @ A3

DATUM:

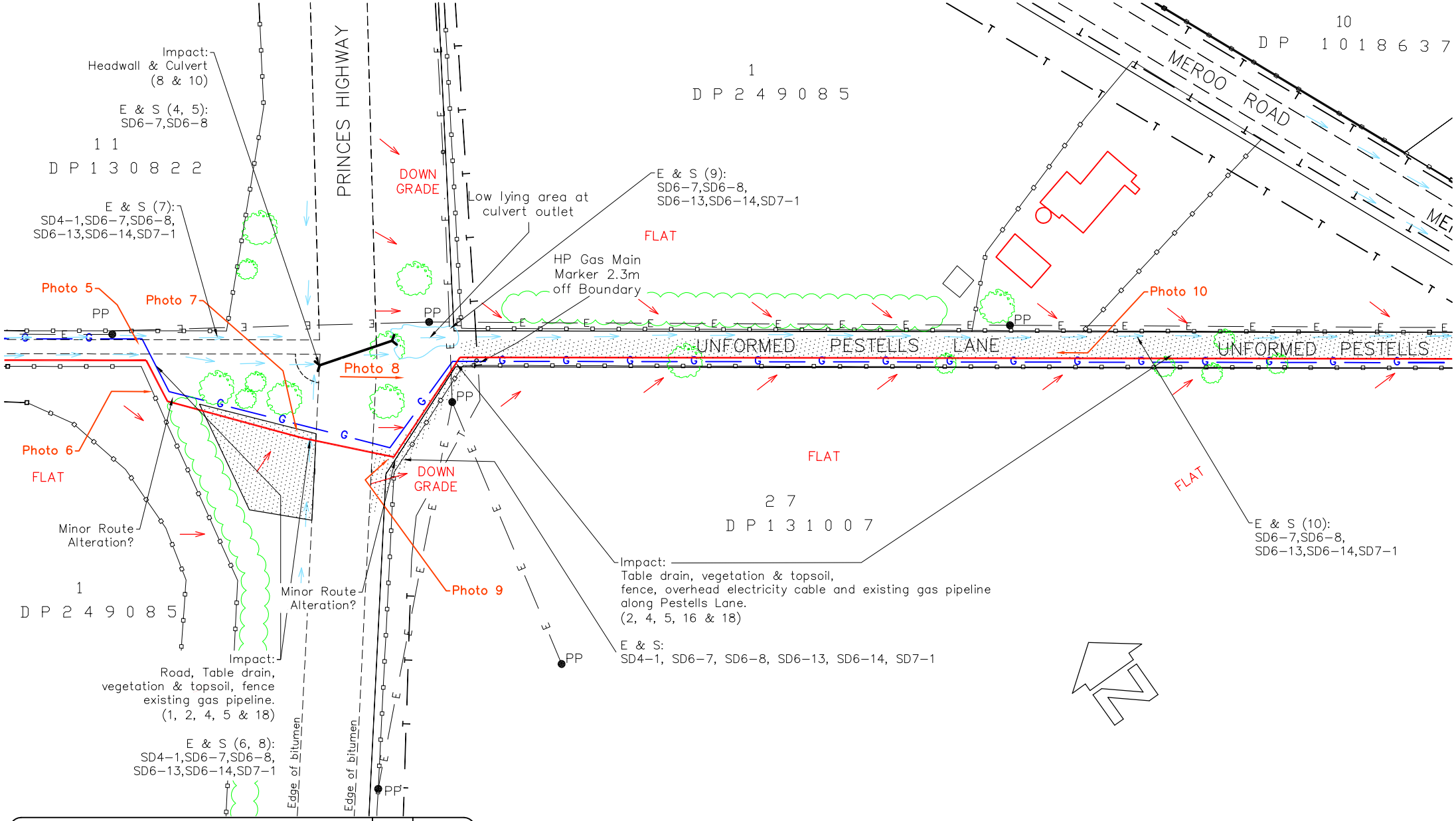
ORIGIN:

DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 3 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE®

0 10 20 30 40 50 100

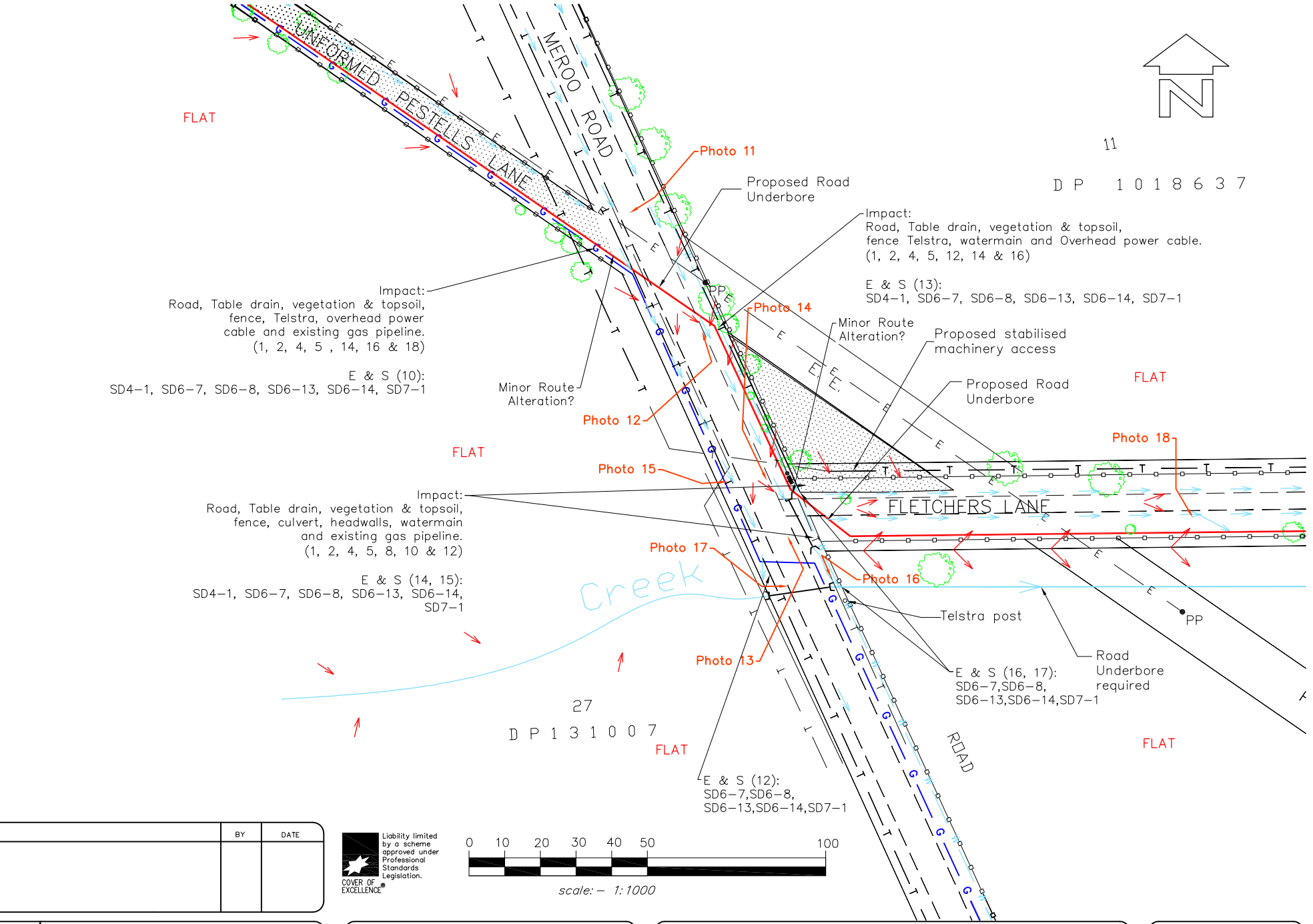
scale: – 1:1000

RATIO:	DATUM:
1:1000 @ A3	ORIGIN:
	DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 4 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE®

RATIO: 1:1000 @ A3

DATUM:

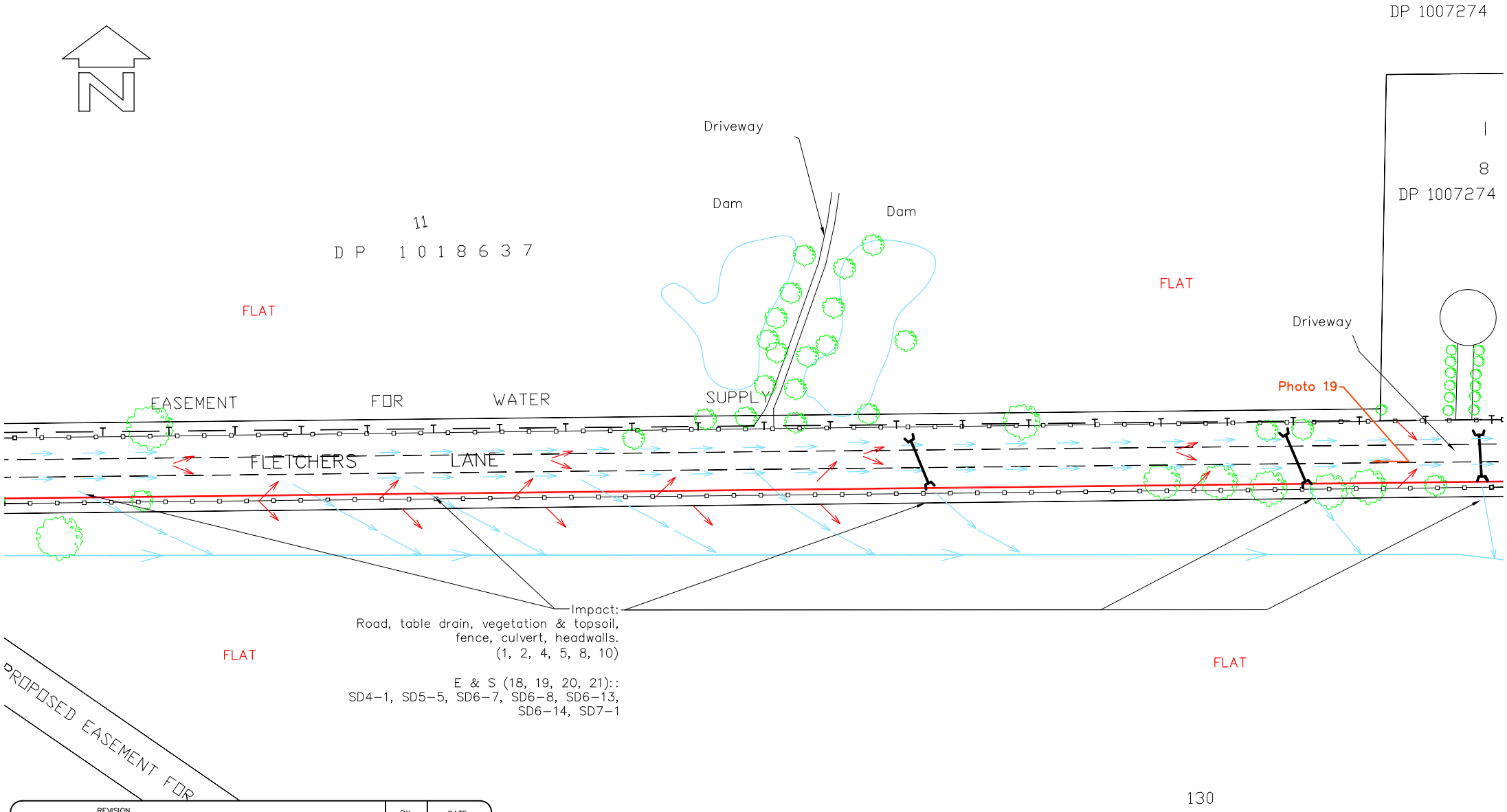
ORIGIN:

DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 5 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE®

0 10 20 30 40 50 100

scale: – 1:1000

RATIO: 1:1000 @ A3

DATUM:

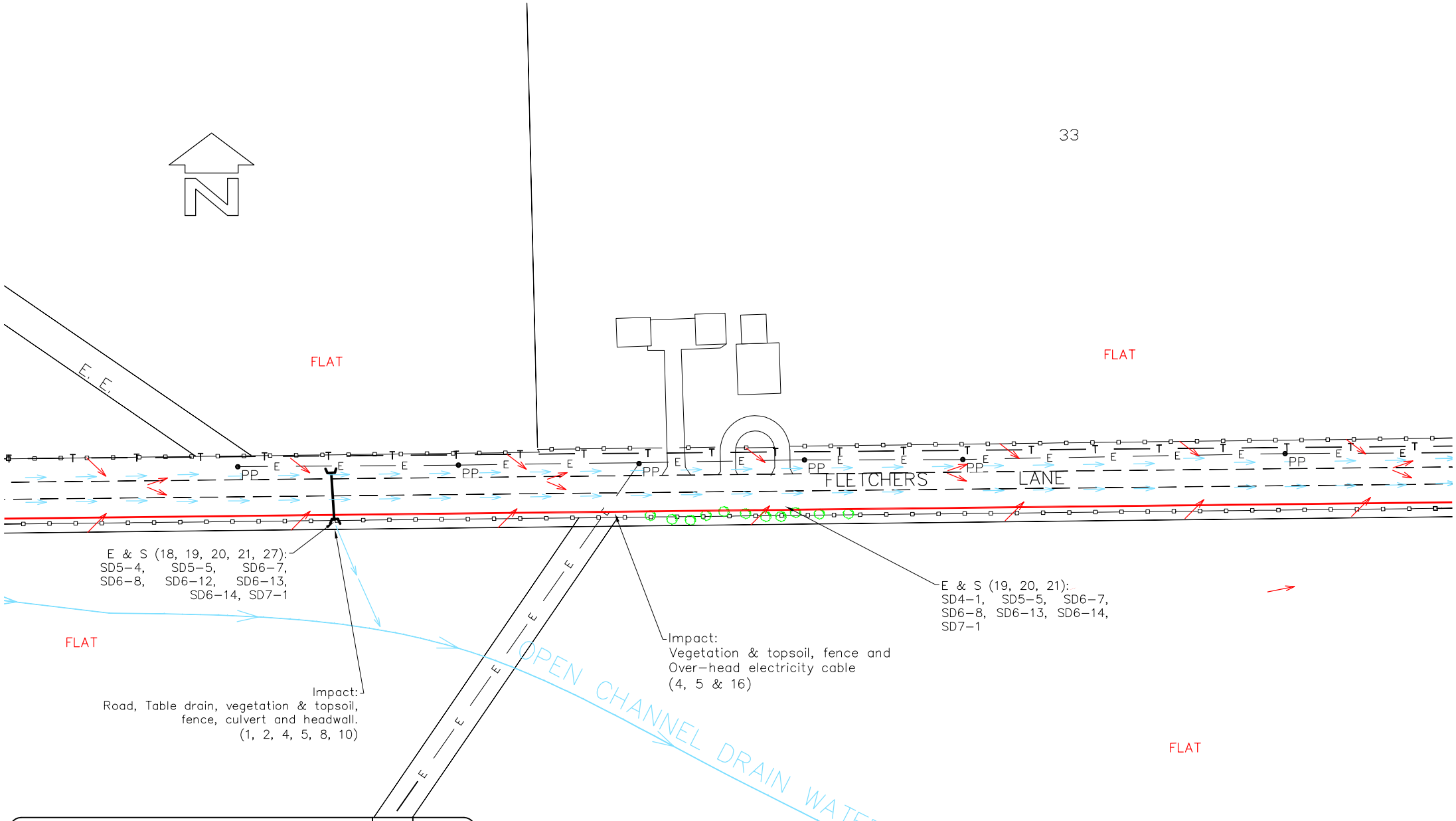
ORIGIN:

DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 6 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE®

0 10 20 30 40 50 100

scale: – 1:1000

RATIO: 1:1000 @ A3

DATUM:

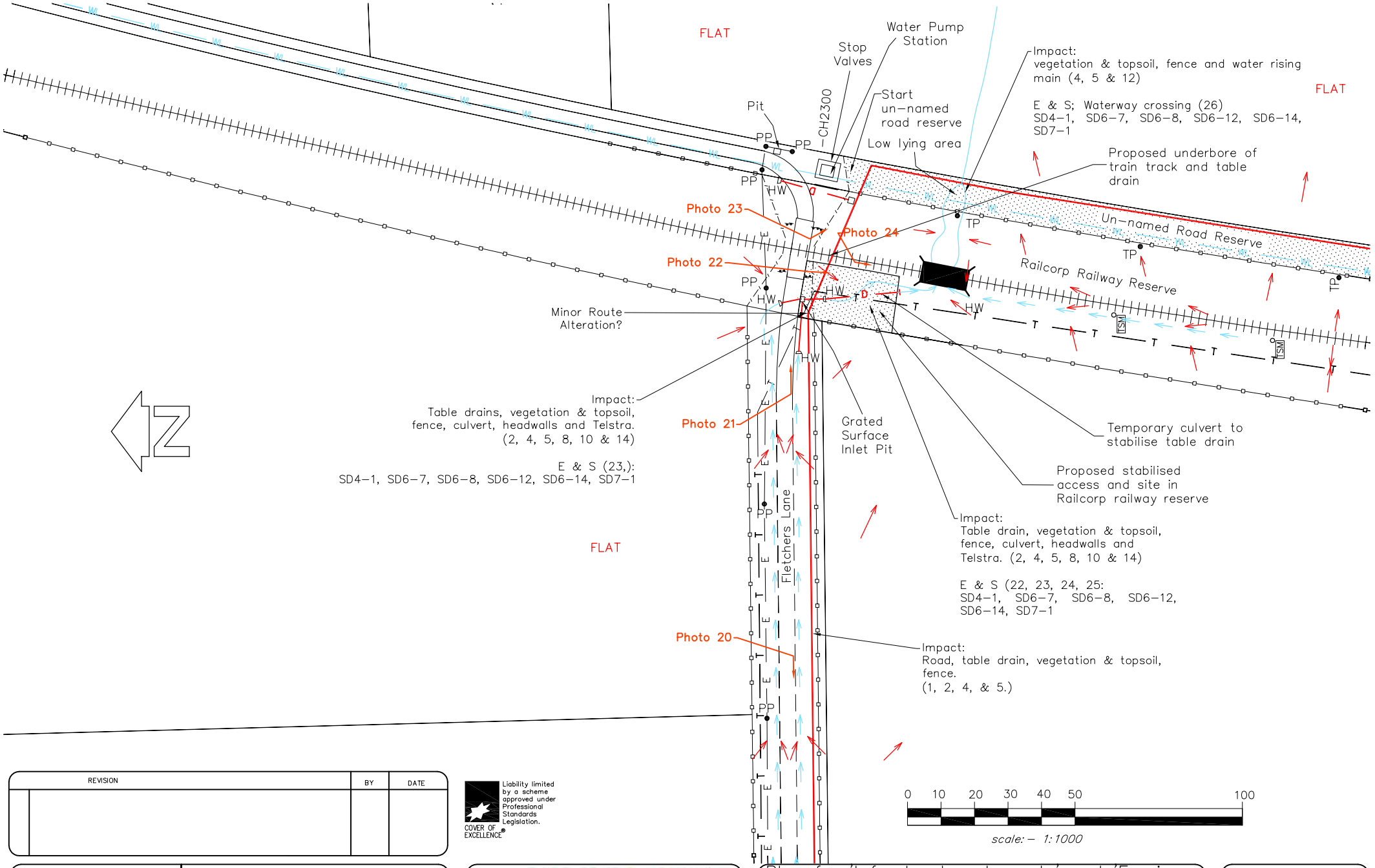
ORIGIN:

DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 7 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE

RATIO: 1:1000 @ A3

DATUM:

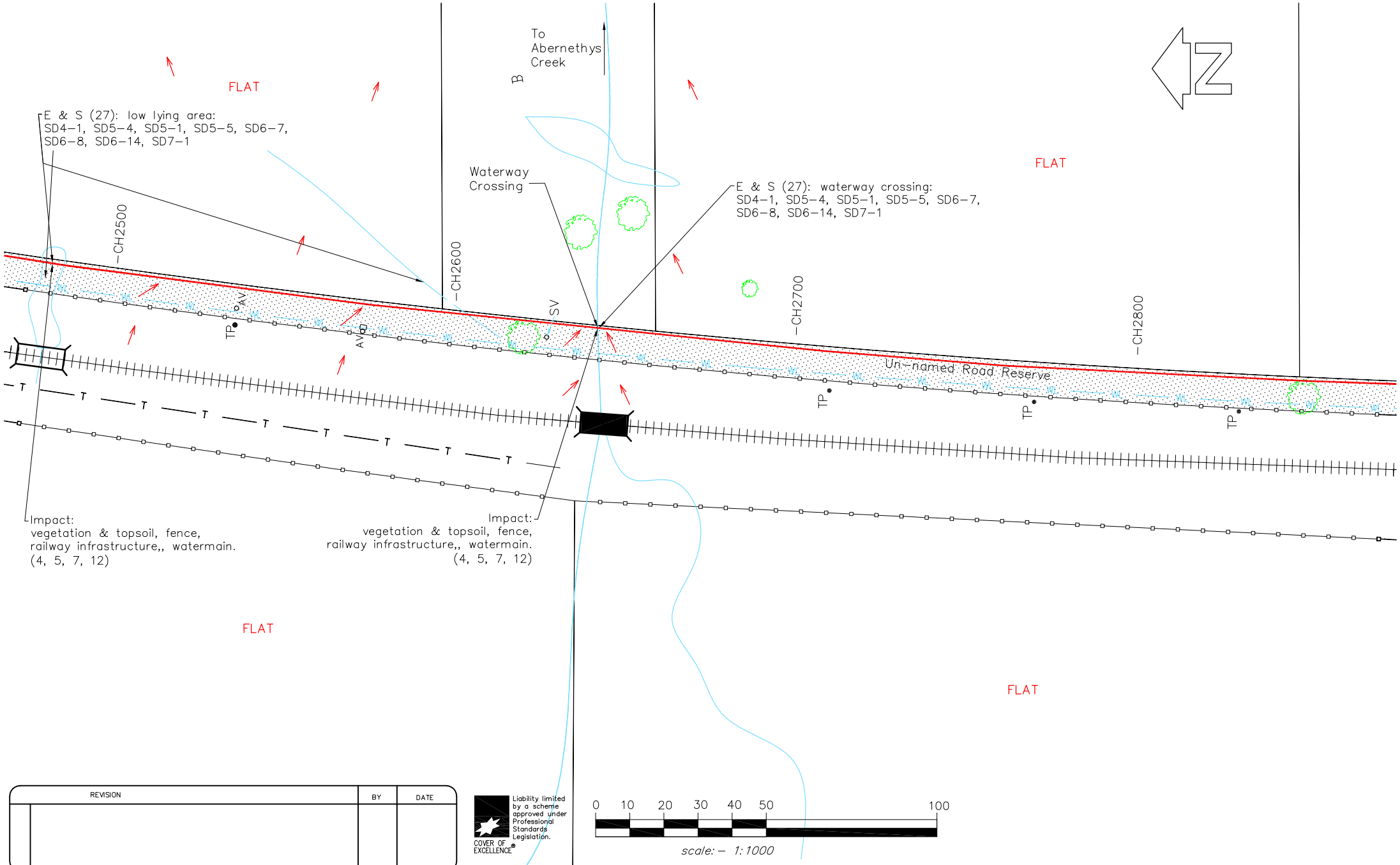
ORIGIN:

DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 8 of 16
REVISION 00



REVISION	BY	DATE

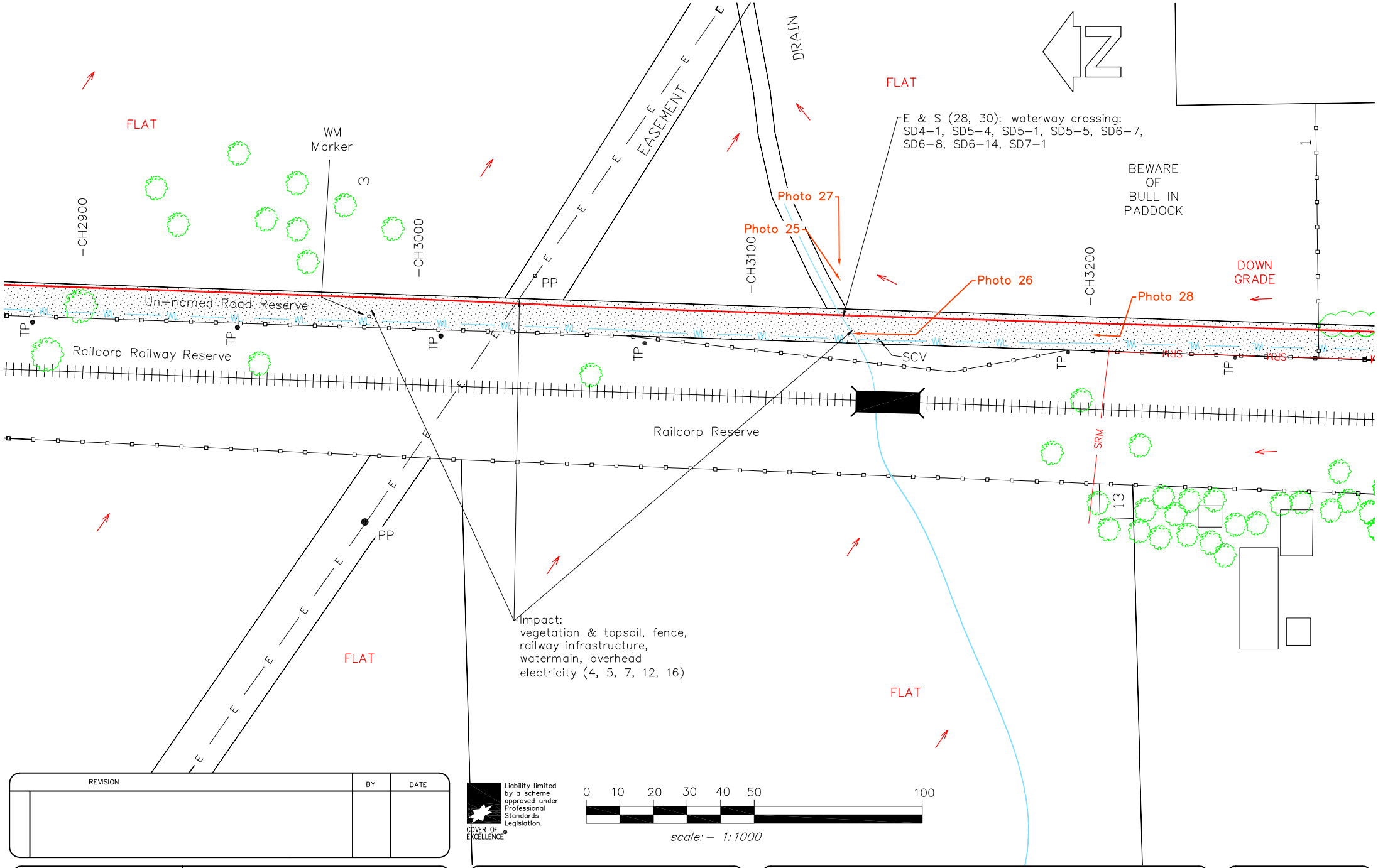
Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE®

RATIO:	DATUM:
1:1000 @ A3	ORIGIN:
	DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 9 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

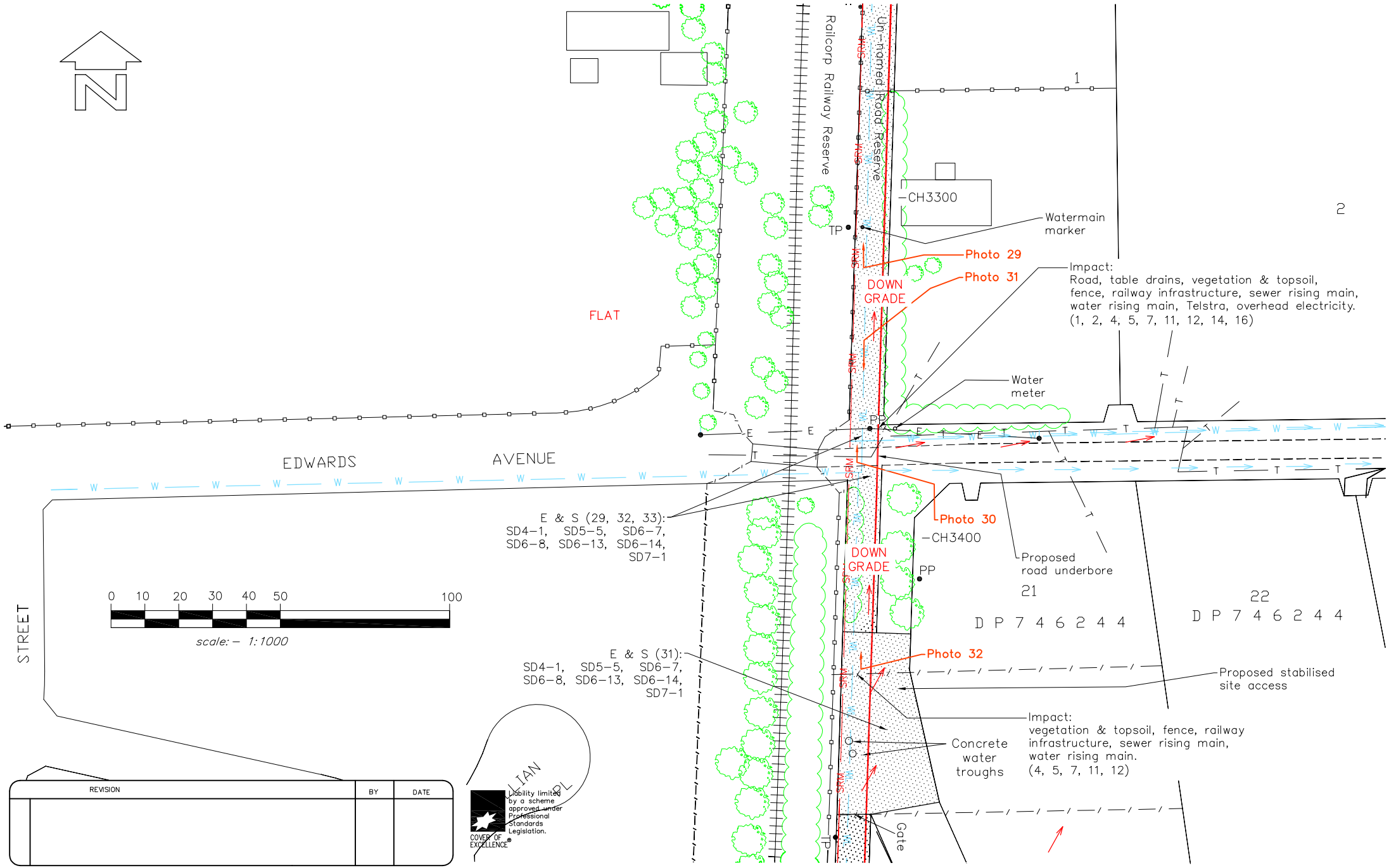
COVER OF EXCELLENCE®

RATIO: 1:1000 @ A3	DATUM:
	ORIGIN:
	DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710-04
sheet 10 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

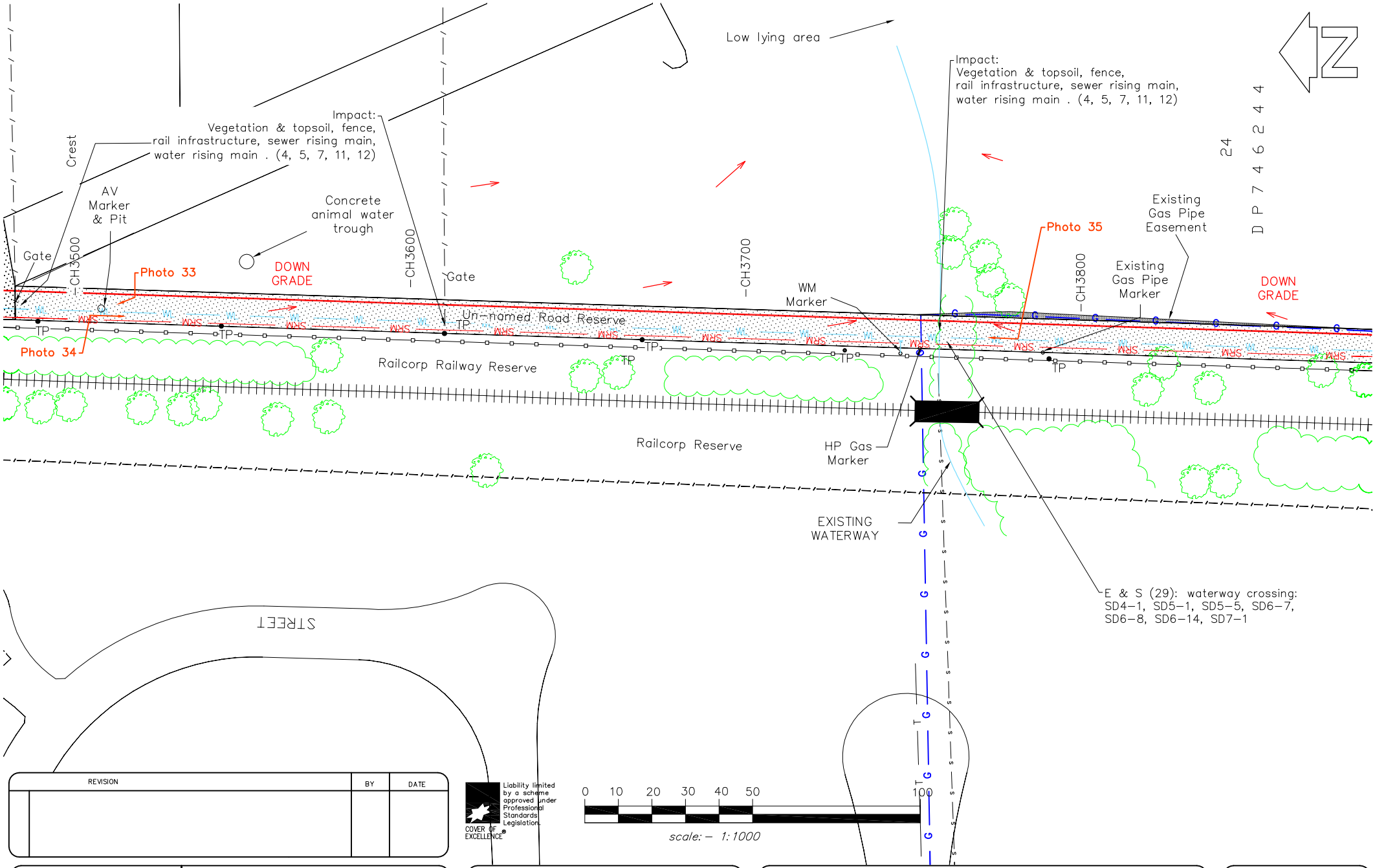
COVER OF EXCELLENCE

RATIO: 1:1000 @ A3	DATUM:
	ORIGIN:
	DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

Plan for 'Infrastructure Impacts' and 'Erosion and Sediment Control Management' Reports for the proposed Shoalhaven Starches Gas Pipeline project at Meroo Meadow and Bomaderry, NSW

REF. No. 24710–04
sheet 11 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE

RATIO: 1:1000 @ A3

DATUM:

ORIGIN:

DATE OF PLAN: AUGUST 2011

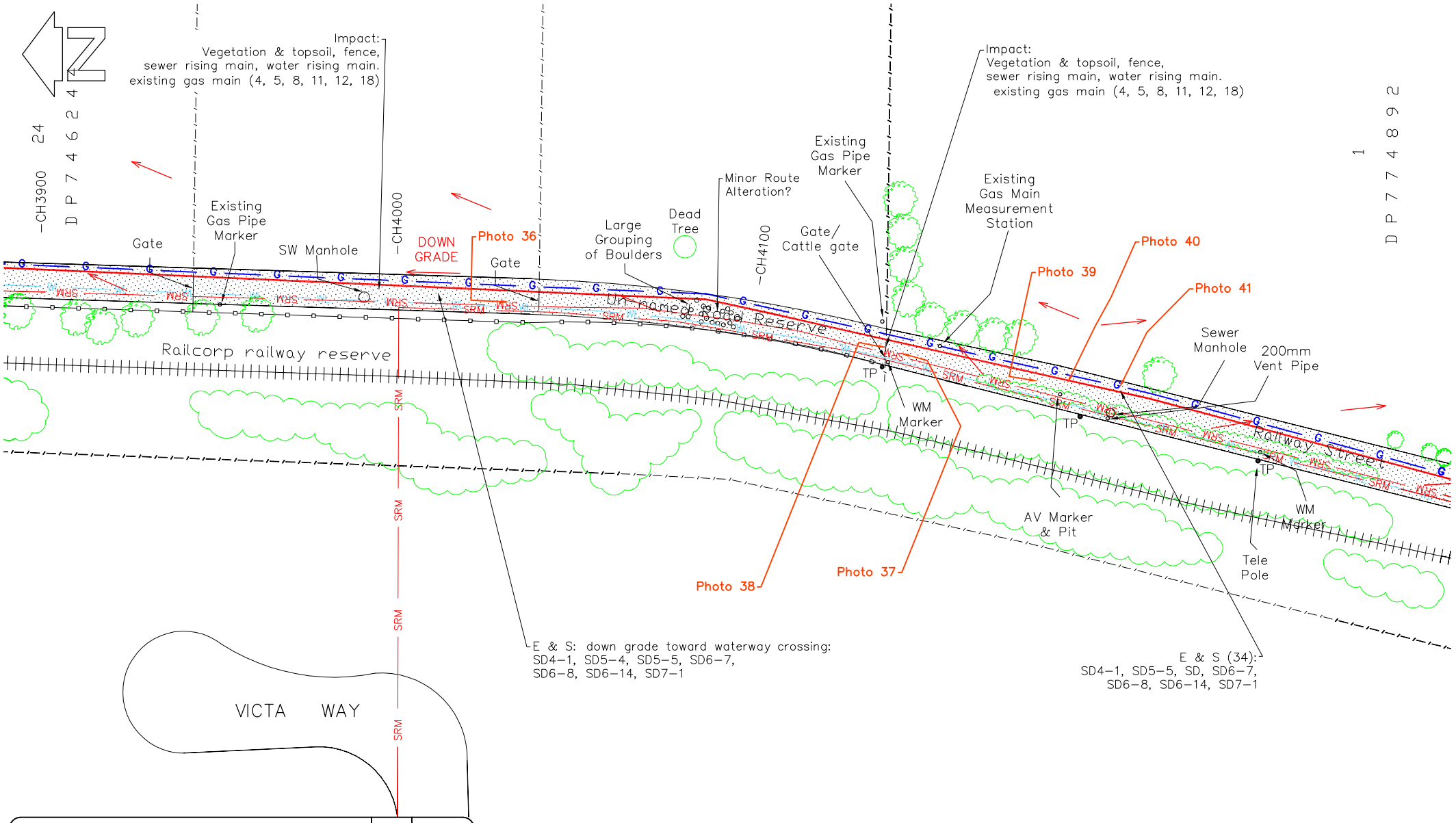
allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

EROSION & SEDIMENT CONTROL MANAGEMENT PLAN FOR PROPOSED SHOALHAVEN STARCHES GAS PIPELINE, FROM PESTELLS LANE TO THE BOLONG ROAD FACTORY

REF. No. 24710–04

sheet 12 of 16

REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE

0 10 20 30 40 50 100

scale: – 1:1000

RATIO: 1:1000 @ A3

DATUM:

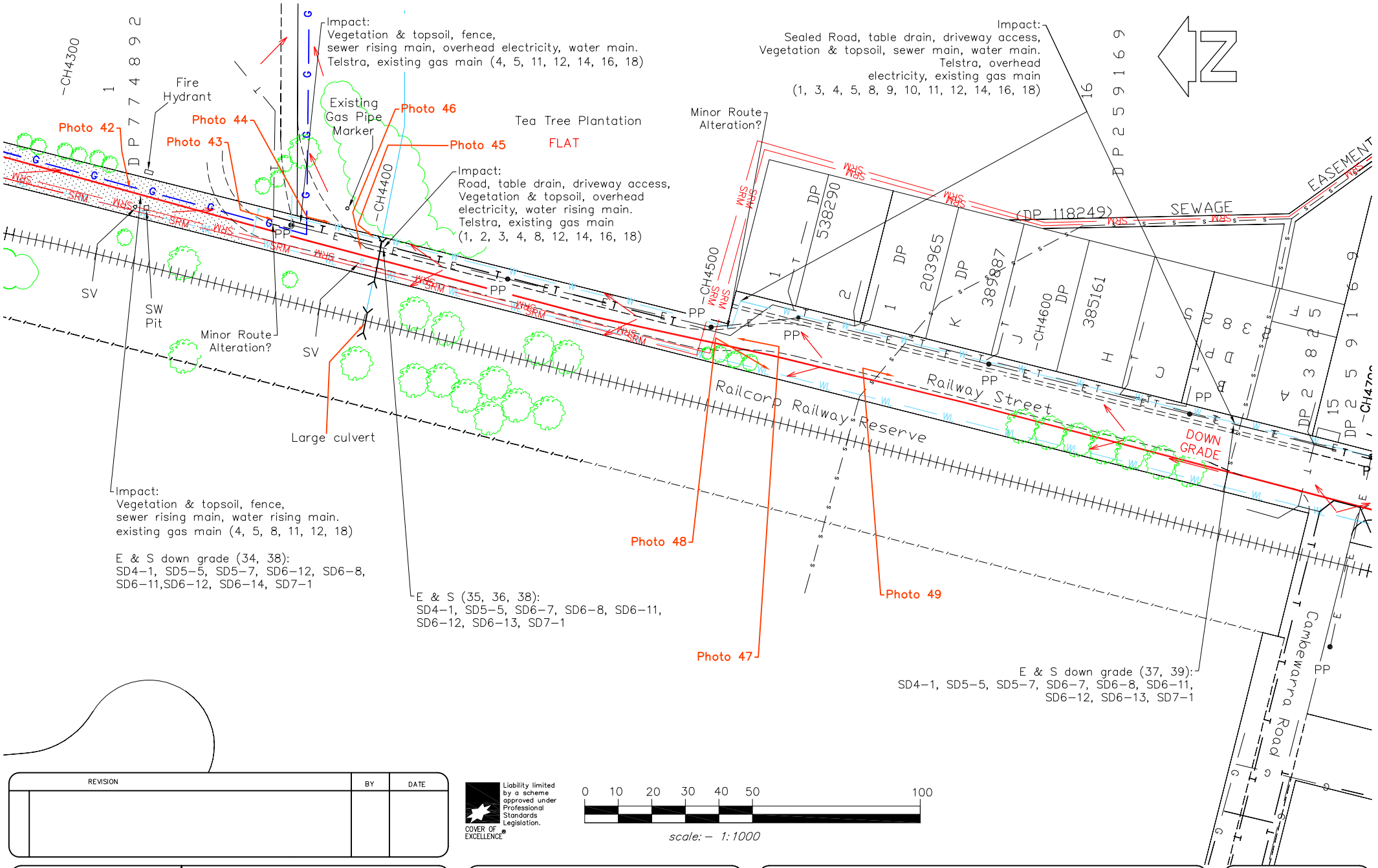
ORIGIN:

DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

EROSION & SEDIMENT CONTROL MANAGEMENT PLAN FOR PROPOSED SHOALHAVEN STARCHES GAS PIPELINE, FROM PESTELLS LANE TO THE BOLONG ROAD FACTORY

REF. No. 24710–04
sheet 13 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE

0 10 20 30 40 50 100

scale: – 1:1000

RATIO: 1:1000 @ A3

DATUM:

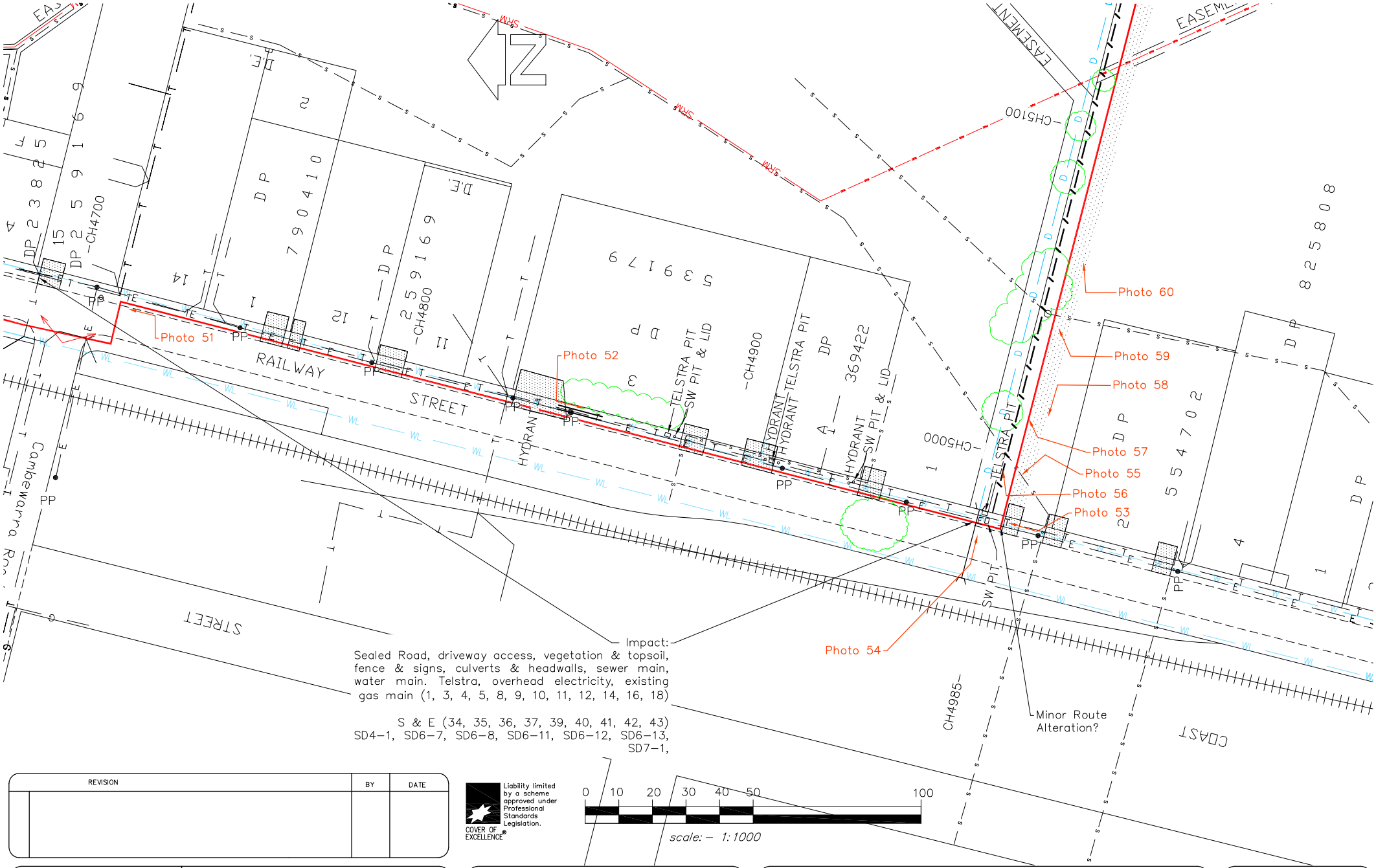
ORIGIN:

DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

EROSION & SEDIMENT CONTROL MANAGEMENT PLAN FOR PROPOSED SHOALHAVEN STARCHES GAS PIPELINE, FROM PESTELLS LANE TO THE BOLONG ROAD FACTORY

REF. No. 24710–04
sheet 14 of 16
REVISION 00



Impact:
Sealed Road, driveway access, vegetation & topsoil, fence & signs, culverts & headwalls, sewer main, water main. Telstra, overhead electricity, existing gas main (1, 3, 4, 5, 8, 9, 10, 11, 12, 14, 16, 18)

S & E (34, 35, 36, 37, 39, 40, 41, 42, 43)
SD4-1, SD6-7, SD6-8, SD6-11, SD6-12, SD6-13, SD7-1,

REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE

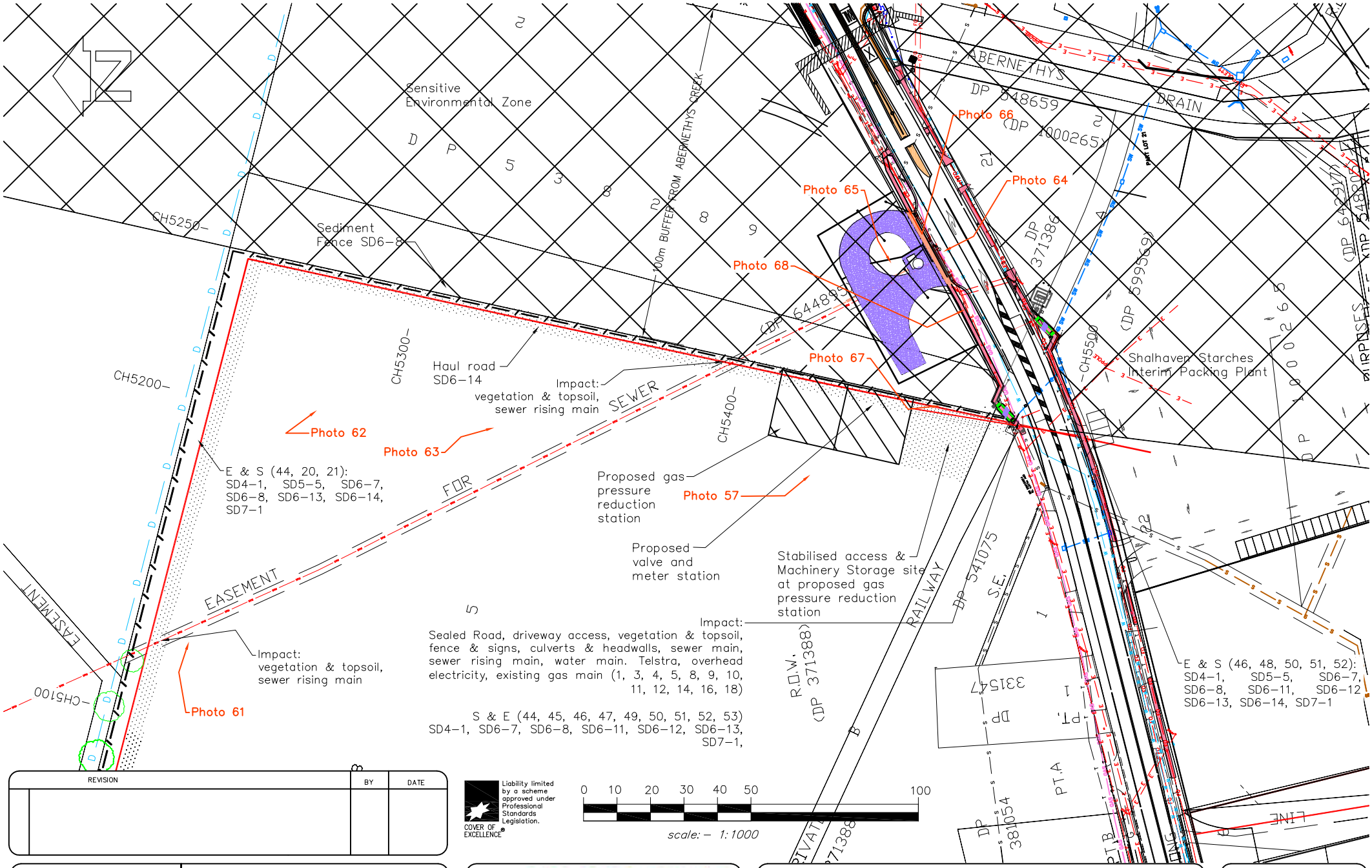
0 10 20 30 40 50 100
scale: – 1:1000

RATIO: 1:1000 @ A3
DATUM:
ORIGIN:
DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

EROSION & SEDIMENT CONTROL MANAGEMENT PLAN FOR PROPOSED SHOALHAVEN STARCHES GAS PIPELINE, FROM PESTELLS LANE TO THE BOLONG ROAD FACTORY

REF. No. 24710–04
sheet 15 of 16
REVISION 00



REVISION	BY	DATE

Liability limited by a scheme approved under Professional Standards Legislation.

COVER OF EXCELLENCE

RATIO:	DATUM:
1:1000 @ A3	ORIGIN:
	DATE OF PLAN: AUGUST 2011

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

EROSION & SEDIMENT CONTROL MANAGEMENT PLAN FOR PROPOSED SHOALHAVEN STARCHES GAS PIPELINE, FROM PESTELLS LANE TO THE BOLONG ROAD FACTORY

REF. No. 24710–04
sheet 16 of 16
REVISION 00

ANNEXURE 16

Construction Noise
and Vibration Management Plan

prepared by

Day Design Pty Ltd

ANNEXURE 16

DAY DESIGN PTY LTD

A.B.N. 73 107 291 494

CONSULTING ACOUSTICAL ENGINEERS

Suite 17, 808 Forest Road
Peakhurst Sydney NSW 2210
Phone: (02) 9584 2639 Fax: (02) 9584 2619
Email: acoustics@daydesign.com.au
www.daydesign.com.au

CONSTRUCTION NOISE AND VIBRATION MANAGEMENT PLAN

PROPOSED GAS PIPELINE

SHOALHAVEN STARCHES, BOMADERRY, NSW

REPORT NUMBER: **4522 REV B**

PREPARED FOR: Shoalhaven Starches Pty Ltd
C/- Cowman Stoddart Pty Ltd
PO Box 738
Nowra NSW 2541

Attention: Mr Stephen Richardson
Telephone: 02 4421 6198

DATE ISSUED: 29 March 2012

Report Status	**Prepared by:** Matthew Harwood	**Approved by:** Stephen Gauld
Rev B		

Document R\4522-r1 rev b,30 pages plus attachments

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Shoalhaven Starches Pty Ltd proposes to construct a new gas pipeline from the Eastern Gas Pipeline to their ethanol plant, 'Manildra', on Bolong Road, Bomaderry, NSW. The pipeline will extend approximately 5.5 kilometres from Meroo Meadow, east toward the south coast railway line then south to the Manildra factory.

The pipeline route passes various isolated residences and a residential area. The construction phase will last for approximately 10 weeks and involve site preparation, installation of the pipeline, restoration and demobilisation.

The major noise sources associated with the project are the directional drill rig and other mobile plant and equipment used in the installation process. There is also potential for rock hammering to be required at isolated locations along the southern part of the route.

This construction noise and vibration management plan has been prepared in accordance with the Australian Standard AS2436 – 2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"*. Construction noise management levels have been derived from the Office of Environment and Heritage's *Interim Construction Noise Guideline* and are used for a quantitative assessment at each of the residential receiver locations.

There is potential, at least on some occasions, for noise emission from construction works to exceed the noise management level at some residences during various stages of the works.

All feasible and reasonable methods to reduce noise emissions and minimise the noise impact on neighbouring properties have been provided in Section 7 of this report. These include, limiting construction activity to within the prescribed hours, selecting quiet equipment, incorporating periods of respite, maintaining community consultation relations, managing noise complaints and conducting ground-borne vibration monitoring.

Provided the recommendations in Section 7 of this report are implemented and adhered to, the level of noise and vibration from the construction works will be minimised in accordance with the NSW Office of Environment and Heritage's *Interim Construction Noise Guideline 2009* and Australian Standard AS2436 – 2010.

2.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Shoalhaven Starches Pty Ltd to prepare a noise assessment and management plan for the construction of a new 5.5 kilometre gas pipeline to supply their facility on Bolong Road, Bomaderry, NSW.

This commission involves the following:

Scope of Work:

- Inspect the site and environs.
- Measure the background noise levels at critical locations and times
- Establish acceptable noise and vibration level criteria.
- Quantify noise emissions from the proposed construction works.
- Calculate the level of noise emission at potentially affected receiver locations.
- Prepare a site plan identifying the development and nearby noise sensitive locations.
- Provide recommendations for noise control, if necessary.
- Prepare a Noise & Vibration Management Plan.

3.0 SITE AND PROJECT DESCRIPTION

Shoalhaven Starches proposes to construct a new gas pipeline to supply gas directly to their ethanol plant located on Bolong Road, Bomaderry. The pipeline shall tie-in to the Eastern Gas Pipeline at the existing Meter Station on Pestells Lane, Meroo Meadow and follow a pre-determined route to Manildra. The proposed route of the pipeline is shown on the attached Figure 1 and is approximately 5.5 kilometres long.

An overview of the route is as follows:-

- Follow Pestells Lane in a south easterly direction (from the Meter Station);
- Cross the Princes Highway and follow the transmission line easement to Meroo Road;
- Cross Meroo Road and travel south to Fletchers Lane;
- Follow Fletchers Lane east to the South Coast Railway Line;
- Cross the railway tracks and follow the rail easement in a generally southerly direction to Edwards Avenue;
- Cross Edwards Avenue and continue in a southerly direction;
- Turn east past the sewage treatment works and south to Manildra;

Details of the proposed route, construction methods and equipment to be used have been supplied by URS Australia Pty Ltd, Level 3, 116 Miller Street, North Sydney. Information supplied in their draft *"Front End Engineering Design, Bomaderry – Manildra Pipeline Lateral"* report number 43167736/R001/A dated 4 May 2009 and discussions with principal engineer, Mr Alex Horn, have been used in this assessment.

There are residential premises at various locations along the route as shown on the attached Figures 1 to 4 inclusive. These include isolated residences on Pestells Lane and Fletchers Lane with a higher concentration of residential and commercial premises south of Edwards Avenue.

The project duration is approximately 10 weeks and the proposed hours of construction are as follows:-

- 7 am to 5 pm Monday to Friday; and
- 8 am to 2 pm on Saturdays.

The installation of the pipeline is likely to involve directional drilling under roadways and the railway tracks, excavation / mobile trenching, removal of materials, welding pipe, lowering in pipe, backfilling, hydro testing, dewatering and site restoration. A preliminary construction schedule is as follows:-

- Mobilisation, site inductions, third party line locates – Weeks 1 to 2;
- Pipeline installation (stringing, excavating, welding, lowering in, tie-ins, backfill, hydro testing) – Weeks 3 to 7;
- Right-of-way restoration, begin demobilising – Weeks 8 to 9;
- Demobilisation complete – Week 10

The main sources of noise during construction will be the plant and equipment used during the pipeline installation. It is expected that the pipeline installation process will move approximately 500 to 800 metres per day.

There is potential for rock hammering to occur in and to the south of Receptor Area 4, as identified in Coffey Environments Australia Pty Ltd's *"Acid Sulfate Soil, Contamination and Geotechnical Investigation"* report prepared for the Manildra Group in July 2011. The report states that where highly weathered sandstone, Class V, is encountered along the route, rock hammering may be required, however the extent to which this may occur is not yet known.

4.0 MEASURED AMBIENT NOISE LEVELS

4.1 Noise Survey Instrumentation

Noise level measurements and analysis were made with instrumentation as follows in Table 4.1.

Table 4.1 Noise Instrumentation

Description	Model No.	Serial No.
Modular Precision Sound Analyser Condenser Microphone 0.5" diameter Acoustical Calibrator Microphone Windscreen	B&K 2260 B&K 4189 B&K 4231 Acoustically transparent foam	244 3406 244 0653 243 9033
Infobyte Noise Logger Condenser Microphone 0.5" diameter Microphone Windscreen	iM3 MK 250 Acoustically transparent foam	38 3156
Infobyte Noise Logger Condenser Microphone 0.5" diameter Microphone Windscreen	iM4 MK 250 Acoustically transparent foam	105 3357

The **B&K 2260 Sound Analyser** is a real-time precision integrating sound level meter with octave and third octave filters that samples noise at a rate of 10 samples per second. The B&K 2260 provides L_{eq}, L_1, L_{10}, L_{50} and L_{90} statistical data at 15 minute intervals (longer or shorter intervals optional) over the desired monitoring period.

An environmental noise logger is used to continuously monitor ambient noise levels and provide information on the statistical distribution of noise during an extended period of time. The Infobyte Noise Monitors iM3 and 1M4 are Type 1 precision environmental noise monitors meeting all the applicable requirements of AS1259 for integrating-averaging sound level meters.

The instrument systems had been laboratory calibrated and certified within the last two years as required, using instrumentation traceable to National Standards. The measurement system was field calibrated prior to and after noise surveys. Calibration drift was found to be less than 0.3 dB during attended measurements and within 1 dB for long-term measurements. No adjustments for instrument drift during the measurement period were warranted.

4.2 Measured Ambient Noise Levels

In order to assess the severity of a possible environmental noise problem in a residential area it is necessary to measure the ambient background noise level at the times and locations of worst possible annoyance. The lower the background noise level, the more perceptible the intrusive noise becomes and the more potentially annoying.

The ambient L_{90} background noise level is a statistical measure of the sound pressure level that is exceeded for 90% of the measuring period (typically 15 minutes).

The Rating Background Level (RBL) is defined by the NSW Office of Environment and Heritage as the median value of the (lower) tenth percentile of L_{90} ambient background noise levels for day, evening or night periods, measured over a number of days during the proposed days and times of operation.

The places of worst possible annoyance are the residences located along the route of the proposed pipeline, particularly those near Edwards Avenue where ambient noise levels are lower than those at other residential areas.

Noise monitors were placed at the following locations between the following dates:-

- Location A – 100 Pestells Lane, Meroo Meadow (06/01 – 13/01/2011);
- Location B – 55 Fletchers Lane, Meroo Meadow (06/01 – 13/01/2011); and
- Location C – 65A Edwards Avenue, Bomaderry (21/01 – 28/01/2011)

Background noise levels were measured at each location over a minimum period of 7 days and are presented in the attached Figures 2, 3 and 4 and also in Table 4.2 below.

The measured background noise is representative of the background noise at the nearest residences in the absence of noise from the subject development, as required by the NSW Office of Environment and Heritage in Section 3.1 of the NSW *Industrial Noise Policy*.

Table 4.2 Rating Background Level

Noise Measurement Location	Time Period	Rating Background Level
Location 'A' – 100 Pestells Lane, Meroo Meadow	Day (7 am to 6 pm)	**37 dBA**
Location 'B' – 55 Fletchers Lane, Meroo Meadow	Day (7 am to 6 pm)	**32 dBA**
Location 'C' – 65A Edwards Avenue, Bomaderry	Day (7 am to 6 pm)	**30 dBA**

Meteorological conditions during the testing typically consisted of clear skies and temperatures between approximately 13 to 28 ^{O}C at Locations A & B and 16 to 29 ^{O}C at Location C. Atmospheric conditions at each monitoring location were ideal for noise monitoring.

5.0 ACCEPTABLE NOISE LEVELS

5.1 Department of Planning Director-General's Requirements

The Department of Planning provide Director General's requirements for Shoalhaven Starches Pipeline Project (MP 10_0108) dated 8 November 2010.

'Key Issues', states:-

"Noise and Vibration – including:

- *A noise impact assessment, including an assessment of noise impacts and road traffic noise during both construction and maintenance;*
- *Consideration of potential vibration impacts from excavation works; and*
- *Details of the proposed noise mitigation, monitoring and management measures."*

5.2 Australian Standard AS2436

The Australian Standard AS2436–2010 *"Guide to noise and vibration control on construction, demolition and maintenance sites"* provides guidance on noise control in respect to construction, demolition and maintenance sites. The Standard also provides guidance for the preparation of noise and vibration management plans.

Section 1.5 'Regulatory Requirements' of the Standard states:-

"Legislation associated with the control of noise and vibration on and from construction, demolition and maintenance sites in Australia is generally the responsibility of the relevant State or Territory government, local council or a designated statutory authority."

Consequently the Standard does not provide specific noise criterion rather sets out practical methods for determining the potential for noise and vibration impact on the community from construction, demolition and maintenance sites.

A qualitative method is described in Section 3.3 of the standard, which is designed to avoid the need for complex noise predictions by following a series of questions relating to, for example, whether the noise is likely to be loud, have annoying characteristics or affect sleep.

In the event that any of these outcomes are likely, a more detailed and quantitative approach should be adopted.

In relation to carrying out detailed noise impact assessments, Section 4 'General' of the standard states:-

"Regulatory authorities may have relevant polices and/or guidelines for the control of noise and vibration on construction sites. These should also be referred to when developing noise and vibration management plans for such projects."

In NSW this is the NSW Office of Environment and Heritage's *Interim Construction Noise Guideline 2009* as outlined in Section 5.3 below.

The Standard further states, in Section 4.6.1, that if noisy processes cannot be avoided, then the amount of noise reaching the receiver should be minimised and goes on to provide advice and recommendations to reduce noise and vibration impacts as far as reasonably practicable.

This report has been prepared in accordance with the guidance provided in AS2436-2010.

5.3 OEH Construction Noise Guideline

The NSW Office of Environment and Heritage published the *Interim Construction Noise Guideline* in July 2009. While some noise from construction sites is inevitable, the aim of the Guideline is to protect the majority of residences and other sensitive land uses from noise pollution most of the time.

The Guideline presents two ways of assessing construction noise impacts; the quantitative method and the qualitative method.

The quantitative method is generally suited to longer term construction projects and involves predicting noise levels from the construction phase and comparing them with noise management levels given in the guideline.

The qualitative method for assessing construction noise is a simplified way to identify the cause of potential noise impacts and may be used for short-term works, such as repair and maintenance projects of short duration.

In this instance, the quantitative method is the most appropriate and has been used in this assessment. Details of the quantitative method are given in Section 4 of the Guideline.

Normal construction hours are defined by the OEH as follows:

- 7.00 am to 6.00 pm Monday to Friday;
- 8.00 am to 1.00 pm Saturday; and
- No work on Sunday or Public Holiday.

Table 2 in Section 4 of the Guideline sets out noise management levels at affected residences and how they are to be applied during normal construction hours. The noise management level is derived from the rating background level (RBL) plus 10 dB in accordance with the Guideline. This level is considered to be the 'noise affected level' which represents the point above which there may be some community reaction to noise.

The 'highly noise affected' level of 75 dBA represents the point above which there may be strong community reaction to noise. This level is provided in the Guideline and is not based on the RBL. Restrictions to the hours of construction may apply to activities that generate noise at residences above the 'highly noise affected' noise management level.

Based on the varying RBL levels at residential receiver locations, the recommended noise management levels during all aspects of the construction phase are summarised in Table 5.1 below.

Table 5.1 L_{eq} Noise Management Levels from Construction Activities

Receptor Location	Noise Management Level	How to Apply
Residential (Location A) (Location B) (Location C)	**47 (= 37 + 10) dBA** **42 (= 32 + 10) dBA** **40 (= 30 + 10) dBA**	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured $L_{Aeq\ (15\ min)}$ noise level is greater than the noise affected level, the proponent should apply all feasible and reasonable* work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

* Section 6, "work practices" of The *Interim Construction Noise Guideline*, states:- *"there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts.*

This approach gives construction site managers and construction workers the greatest flexibility to manage noise". Definitions of the terms feasible and reasonable are given in Section 1.4 of the Guideline.

5.4 OEH Vibration Guideline

The NSW Office of Environment and Heritage published the *Assessing Vibration: a technical guideline* in February 2006. This guideline is based on the British Standard BS 6472:1992 *"Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)."*

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. The guideline considers vibration from construction activities as Intermittent Vibration. Table 2.4 of the guideline sets out limits for Vibration Dose Values to assess intermittent vibration and is replicated in Table 5.2 below for residential receptor locations.

Table 5.2 Vibration Dose Values (VDV) from Construction Activities

Receptor Location	Daytime	
	Preferred value ($m/s^{1.75}$)	Maximum value ($m/s^{1.75}$)
All Residences	0.20	0.40

The British Standard BS 7385-2:1993 *"Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration"* provides guide values for transient vibration relating to cosmetic damage, replicated in Table 5.3 below for residential buildings.

Table 5.3 Transient vibration guide values for cosmetic damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Residential	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

In our opinion, an overall peak particle velocity of **15 mm/s** at the boundaries will comply with the recommended values in Table 5.3 and is an acceptable criterion for intermittent vibration to prevent cosmetic damage to the adjacent residential buildings.

6.0 CONSTRUCTION NOISE EMISSION

The main sources of noise on the site during construction will be during the directional drilling works lasting up to approximately 3 weeks, potential rock hammering where required for short periods and the pipe installation works lasting approximately 5 weeks.

The noise emission has been calculated to the following residential areas and uses the relevant measured background noise levels from Section 4.2 to establish noise management levels in those areas (see Figure 2):

- Receptor Area 1 – Pestells Lane residences (background noise - Location A;)
- Receptor Area 2 – Flecthers Lane residences and Meroo Road residences north of Fletchers Lane (background noise – Location B);
- Receptor Area 3 – Residences located on Meroo Road to the south of Fletchers lane (background noise – Location B);
- Receptor Area 4 – Residences located on Edwards Avenue and to the south in Alfred Street and Lillian Place (background noise - Location C)

6.1 Construction Plant Noise Emission

The installation of the pipeline will be continuous during the hours of construction with various items of plant operating in different locations along the route. For example, the trenchers will be operating ahead of the welders, pipe laying and backhoes, over a distance of up to 800 metres, depending on the section of the route being worked on at the time. The drilling rig will be located at various locations temporarily, i.e. the Princes Highway, Meroo Road, the railway line crossing and Edwards Avenue, for approximately 3 or 4 days at each location.

Rock hammering may potentially occur on the southern side of Edwards Avenue and further to the south along Railway Street where there are isolated sections of heavily weathered sandstone.

Table 6.1 below shows examples of the type of plant and equipment to be used during the construction phase with indicative overall sound power levels (L_w) in decibels re: 1 pW.

Schedules of the sound power levels for the main construction equipment were extracted from the Day Design database of Sound Power Levels and the Australian Standard AS2436–2010 *"Guide to Noise Control on Construction, Maintenance and Demolition Sites"*.

Table 6.1 Pipeline Installation - Plant and Equipment - Sound Power Levels

Description	Sound Power Level (dBA)
Directional Drilling Rig	106
Backhoe	94
Trencher	110
Loader	105
Welding Rig (Diesel)	95
Dewatering Pump	90
Truck	107
Staff Car / 4WD	70
Hydraulic Rock Breaker	118

6.2 Predicted Construction Noise Emission

Knowing the sound power level of a noise source (see Table 6.1 above), the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for distance losses, atmospheric effects, etc.

The level of noise from the construction activities is calculated (using computer modelling) to be as shown in Tables 6.2, 6.3, 6.4 and 6.5 below.

Table 6.2 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 1
(Without Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 1 (Pestells Lane)	Drilling (Princes Highway crossing)	**49**	**47**	**No** + 2dB
	Backhoe	37	**47**	Yes
	Trencher	**53**	**47**	**No** + 6 dB
	Loader	**49**	**47**	**No** + 2 dB
	Welding Rig (Diesel)	38	**47**	Yes
	Dewatering Pump	34	**47**	Yes
	Truck	**51**	**47**	**No** + 4 dB
	Combined	**57**	**47**	**No** **+** 10 dB *****

* See Section 8

Table 6.3 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 2
(Without Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 2 (Fletchers Lane)	Drilling (Meroo Road crossing)	**55**	**42**	**No** + 13 dB
	Drilling (at Railway Line)	**59**	**42**	**No** + 17 dB
	Backhoe	**60**	**42**	**No** + 18 dB
	Trencher	**75**	**42**	**No** + 33 dB
	Loader	**71**	**42**	**No** + 29 dB
	Welding Rig (Diesel)	**61**	**42**	**No** + 19 dB
	Dewatering Pump	**56**	**42**	**No** + 14 dB
	Truck	**73**	**42**	**No** + 31 dB
	Combined	**78**	**42**	**No** + 36 dB *

* See Section 8

Table 6.4 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 3
(Without Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 3 (residences on the eastern side of Meroo Road, south of Fletchers Lane)	Drilling (Meroo Road crossing)	**45**	**42**	**No** + 3 dB
	Drilling (at Railway Line)	**46**	**42**	**No** + 4 dB
	Backhoe	38	**42**	Yes
	Trencher	**55**	**42**	**No** + 13 dB
	Loader	**49**	**42**	**No** + 7 dB
	Welding Rig (Diesel)	39	**42**	Yes
	Dewatering Pump	34	**42**	Yes
	Truck	**51**	**42**	**No** + 9 dB
	Combined	**58**	**42**	**No** + 16 dB *

* See Section 8

Table 6.5 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 4
(Without Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 4 (residences in Edwards Avenue and south e.g. Alfred Street and Lillian Place)	Drilling (Edwards Avenue Crossing)	**61 to 72**	**40**	**No** + 21 to 32 dB
	Backhoe	**60**	**40**	**No** + 20 dB
	Trencher	**75**	**40**	**No** + 35 dB
	Loader	**71**	**40**	**No** + 31 dB
	Welding Rig (Diesel)	**61**	**40**	**No** + 21 dB
	Dewatering Pump	**56**	**40**	**No** + 16 dB
	Truck	**73**	**40**	**No** + 33 dB
	Rock Hammering (if required)	**75**	**40**	**No** + 35 dB
	Combined	**80**	**40**	**No** + 40 dB *

* See Section 8

All calculations and predictions consider attenuation from geometric divergence (distance attenuation) only and are based on the nearest potentially affected residences in the vicinity of the work at any given location.

For instance, directional drilling at the railway line will affect the residence at 130 Fletchers Lane more so than those at 55 and 79 Flecthers Lane (see Figure 3). Similarly trenching and backfilling operations, for example, will affect the residences at 55 and 79 Fletchers Lane more so than at 130 Fletchers Lane.

Further south, drilling at the Edwards Avenue intersection will affect the residence at 65A Edwards Avenue more so than those to the west of the railway line in Alfred Street (see Figure 4). However as works progress south, Alfred Street and Lillian Place residences will be exposed to noise emission from excavation works. Similarly if rock hammering is required in this area the residents in Alfred Street and Lillian Place will be the most potentially affected.

In every case Tables 6.2 to 6.5 inclusive show the highest predicted noise level at the most affected residence in each residential area, for each individual construction activity, at any given time. Residential areas are shown in the attached Figures 2, 3 and 4.

The predicted levels of noise from the construction activities are generally in excess of the noise management levels in Section 5.3 of this report.

To minimise the noise impact from the construction activities we recommend that the noise controls and management plan detailed in Section 7 of this report be implemented.

6.3 Vibration Emission

It is difficult to accurately predict levels of ground borne vibration at remote locations as there are many variables to consider including the surrounding terrain, strata, rock density, etc.

Previous measurements of ground borne vibration from rock hammering show that levels can vary significantly at different distances and locations. Given the distances from neighbouring residences to any potential rock hammering on site, vibration levels are likely to be well under the required maximum levels established in Section 5 of this report. However, we recommend that compliance monitoring of ground borne vibration is carried out along the route, wherever rock hammering is required.

6.4 On Road Traffic Noise

The Director-General's Requirements require an assessment of on road traffic noise generated by the proposal. Motor vehicle movements, for example trucks and staff vehicles, are considered part of the construction works and assessed under the OEH's *Interim Construction Noise Guideline*.

Consideration is given to heavy vehicles as part of the overall construction activities and predicted noise levels for 'trucks' are given in Tables 6.2 to 6.5 inclusive.

With regard to staff vehicles, details have been supplied by Stapleton Transportation & Planning Pty Ltd, in their *"Shoalhaven Starches, Bomaderry Proposed Gas Pipeline Construction Traffic Impact Assessment*" dated December 2010.

Section 2.1.1 of the traffic assessment reports a total of 25 staff vehicle movements per peak arrival or departure hour. Details of designated parking areas along the route have not yet been finalised although it is assumed temporary 'work-zones' will be established along the route as works progress.

Based on the assumption that an average of 8 staff vehicles arrive or leave any particular work-zone in any given 15 minute period, the predicted $L_{eq,\ 15\ minute}$ noise level is **45 dBA** at, for example, a distance of 20 metres. This is based on a 15 minute sound power level ($L_{w,\ 15\ minute}$) for one vehicle as shown in Table 6.1 and the predicted level will vary depending on the distance to residences (e.g. at a distance of 35 metres the predicted level is 40 dBA $L_{eq,\ 15\ minute}$).

A minimum distance of 35 metres from any staff parking area to any residence will ensure the noise management levels are met at all receptor areas from staff vehicle noise emission.

Recommendations to minimise the noise impact from motor vehicles accessing the site during the construction works are provided in Section 7.2 below.

6.5 Fixed Plant Noise Emission

There is no significant noise producing fixed plant associated with the ongoing operation of the gas pipeline. A pressure reduction facility will be located opposite Shoalhaven Starches complex on the northern side of Bolong Road, adjacent to the train line as shown on the attached Figure 1.

An existing pressure reduction facility is located at the Pestells Lane Meter Station and is reported to be indicative of that which is proposed on the Shoalhaven Starches site. Measurements of the existing pressure reduction facility have been used to calculate the L_{10} octave band, and overall 'A' frequency weighted, sound power levels, in decibels re: 1 pW, shown in Table 6.6 below. Measurements were conducted by the author in December 2011 using instrumentation shown in Table 4.1.

Table 6.6 Pressure Reduction Facility L_{10} Sound Power Levels

Description	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	63	125	250	500	1k	2k	4k	8k
Pressure Reduction Facility	**76**	84	80	69	63	63	67	71	71

Shoalhaven Starches operates under Environment Protection Licence 883 issued by the NSW Office of Environment and Heritage. The licence sets acceptable $L_{10,\ 15\ minute}$ noise limits at various receptor locations that are not to be exceeded for the overall, ongoing operation of the entire complex.

In order for any new items of fixed plant not to increase existing levels to beyond acceptable limits, design goals of a minimum 10 dB below the OEH criteria are set. These are as follows:-

- *28 dBA ($L_{10,\ 15\ minute}$) at locations in Terara on the south side of the Shoalhaven River;*
- *28 dBA ($L_{10,\ 15\ minute}$) at locations in Nowra on the south side of the Shoalhaven River;*
- *32 dBA ($L_{10,\ 15\ minute}$) at locations in Meroo Street, Bomaderry;*
- *30 dBA ($L_{10,\ 15\ minute}$) at other locations in Bomaderry.*

Based on an indicative sound power level, shown in Table 6.6, for the proposed gas pressure reduction facility, the calculated sound pressure level is less than **15 dBA** at the nearest residential receptor location (Meroo Street) and less than **5 dBA** at each of the other locations.

Noise emission from the pressure reduction facility will be inaudible at all residential receptors and as such, no further consideration is given to fixed plant noise emission in this report.

7.0 NOISE CONTROL RECOMMENDATIONS

The predicted level of noise emission from the construction activities is likely to be in excess of the noise management levels established in Section 5.3 of this report, at least on some occasions.

It should be noted however, that individual residences along the route, will only be affected by noise emission for a short period of time compared to the total 10 week construction period. For instance the installation works will move at approximately 500 to 800 metres per day for up to approximately 5 weeks. As such any single residence will be exposed to noise emission from various items of plant for less than one week.

In order to minimise the noise impact from all construction activities at any single residence, we recommend the following engineering and management noise controls be implemented.

7.1 Engineering and Practical Noise Controls

Australian Standard AS2436-2010, Appendix C, Table C3 provides the relative effectiveness of various forms of noise control that may be applicable and implemented on various construction sites and projects. Table C3 is replicated in Table 7.1 below.

Table 7.1 Relative Effectiveness of Various Forms of Noise Control

Control by	Nominal Noise Reduction Possible, dB
Distance	Approximately 6 dB for each doubling of distance
Screening	Normally 5 dB to 10 dB maximum 15 dB
Enclosure	Normally 5 dB to 25 dB maximum 50 dB
Silencing	Normally 5 dB to 10 dB maximum 20 dB

Generally, erecting temporary sound barrier screens around construction sites is an effective way of reducing noise emission. However, in this instance, given the short duration of works and the short time activities will occur near to any given residences, it is not practicable to construct temporary sound barriers along the construction route to minimise pipe installation works. The time taken to erect and dismantle barriers is likely to be as long as, or longer than individual construction activities passing any given property. However, if rock hammering or drilling is to occur in any one location for more than 3 or 4 days consideration may be given to erecting, for example, timber hoardings around the site.

Engine exhaust silencers may be fitted to the mobile plant such as the loader, trencher, backhoe and the truck and consideration should be given to any plant already acoustically treated when assessing tenders. All plant and machinery should be selected with consideration to low noise options where practicable and available.

Care should be taken to ensure that not more than one item of plant is operating simultaneously within close proximity of any given residence. This will reduce the combined noise levels shown in Tables 6.2 to 6.5 by a further 3 to 5 dB.

Tables 7.2 to 7.5 below show the predicted levels of noise emission from each item of plant following the implementation of practical noise controls such as screening around fixed plant and fitting silencers or selecting silenced mobile plant.

Table 7.2 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 1
(With Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 1 (Pestells Lane)	Drilling (Princes Highway crossing)	**42**	**47**	Yes
	Backhoe	30	**47**	Yes
	Trencher	**46**	**47**	Yes
	Loader	**42**	**47**	Yes
	Welding Rig (Diesel)	38	**47**	Yes
	Dewatering Pump	27	**47**	Yes
	Truck	**44**	**47**	Yes

Table 7.3 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 2
(With Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 2 (Fletchers Lane)	Drilling (Meroo Road crossing)	**48**	**42**	**No** + 6 dB
	Drilling (at Railway Line)	**52**	**42**	**No** + 10 dB
	Backhoe	**53**	**42**	**No** + 11 dB
	Trencher	**68**	**42**	**No** + 26 dB
	Loader	**64**	**42**	**No** + 22 dB
	Welding Rig (Diesel)	**54**	**42**	**No** + 12 dB
	Dewatering Pump	**49**	**42**	**No** + 7 dB
	Truck	**67**	**42**	**No** + 25 dB

Table 7.4 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 3
(With Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 3 (residences on the eastern side of Meroo Road, south of Fletchers Lane)	Drilling (Meroo Road crossing)	**38**	**42**	Yes
	Drilling (at Railway Line)	**39**	**42**	Yes
	Backhoe	31	**42**	Yes
	Trencher	**48**	**42**	**No** + 6 dB
	Loader	**42**	**42**	Yes
	Welding Rig (Diesel)	32	**42**	Yes
	Dewatering Pump	27	**42**	Yes
	Truck	**44**	**42**	**No** + 2 dB

Table 7.5 Predicted $L_{eq\ 15\ minute}$ Construction Noise Levels – Receptor Area 4
(With Noise Control)

Receptor Locations	Activity	Predicted Sound Level (dBA)	Noise Management Level (dBA)	Compliance (Yes/No)
Receptor Area 4 (residences in Edwards Avenue and south e.g. Alfred Street and Lillian Place)	Drilling (Edwards Avenue Crossing)	**54 to 65**	**40**	**No** + 14 to 25 dB
	Backhoe	**53**	**40**	**No** + 13 dB
	Trencher	**68**	**40**	**No** + 28 dB
	Loader	**64**	**40**	**No** + 24 dB
	Welding Rig (Diesel)	**54**	**40**	**No** + 14 dB
	Dewatering Pump	**49**	**40**	**No** + 9 dB
	Truck	**67**	**40**	**No** + 27 dB
	Rock Hammering (if required)	**68**	**40**	**No** + 28 dB

The above predictions assume a conservative reduction of a maximum 7 dB from either screening around fixed plant or silencing mobile plant. These predictions are an estimate only and greater attenuation may be achieved in practice once full details of all plant and equipment are known.

It can be seen from Tables 7.2 to 7.5 that predicted noise levels are well below the 'highly noise affected' level of 75 dBA above which there may be strong community reaction to noise at all receiver locations.

There is still potential for noise management levels to be exceeded on some occasions and we therefore recommended the following noise management controls to minimise the impact on residential receivers.

7.2 Noise Management Controls

The following noise management controls are derived from or are in accordance with recommendations given in Australian Standard AS2436-2010 and the OEH's *Interim Construction Noise Guideline*.

Periods of Respite

We recommend that noisy construction activities such as rock hammering or drilling at the Edwards Avenue intersection only operate for 2 to 3 hours at a time. This will reduce the noise impact at the nearby residences. Ensure activities in any one location are staggered, for instance, if rock hammering or drilling is occurring at one location, do not operate additional excavators or other noisy plant at the same location until the activity is complete.

Work Practices

We recommend that workers and contractors be trained in work practices to minimise noise emission such as the following:

- Employ the use of broadband audible reversing alarms on all mobile plant.
- Avoid dropping materials from a height.
- Avoid shouting and talking loudly outdoors.
- Avoid the use of radios outdoors that can be heard at the boundary of residences.
- Turn off equipment when not being used.
- Carry out work only within the recommended hours of operation (see Section 5.3).

Heavy Vehicles and Staff Vehicles

- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (for example, minimising the use of engine brakes, and no extended periods of engine idling).
- Locate site vehicle entrances away from residences where practicable.
- Optimise the number of vehicle trips to and from the site – movements can be organised to amalgamate loads rather than using a number of vehicles with smaller loads.
- Staff parking areas should be located as far from residential receiver locations as practicable.
- No motor vehicles should access the site via, or park within, residential areas prior to 7 am in order avoid sleep disturbance. For example whilst works progress through receptor area 4 from north of Roseville Road to south of Alfred Street (see Figure 4).

Community Relations

A Liaison Officer should maintain liaison between the neighbouring community and the contractor and communication lines should be opened early, prior to commencement of any works. Communication should be made with all affected residences via a range of media including, for example, individual contact and letter box drops.

Inform the neighbours about the nature of the construction stages. The neighbours should be notified when the excessively noisy operations (such as the use of the drilling rig) are to be carried out.

Consultation and cooperation between the contractor and the neighbours and the removal of uncertainty and rumour can help to reduce adverse reaction to noise.

Managing a Noise Complaint

The Liaison Officer should receive and manage noise complaints. All complaints should be treated promptly and with courtesy. Should a justified noise complaint not be resolved, noise monitoring may be carried out at the affected receptor location and appropriate measures be taken to reduce the noise emission as far as reasonably practicable.

Where it is not practicable to stop the noise, or reduce the noise, a full explanation of the event taking place, the reason for the noise and times when it will stop should be given to the complainant.

The following guidelines are recommended in Section 6 of the *Interim Construction Noise Guideline* to manage a noise complaint:

- Provide a readily accessible contact point, for example, through a 24 hour toll-free information and complaints line.
- Give complaints a fair hearing.
- Have a documented complaints process, including an escalation procedure so that if a complainant is not satisfied there is a clear path to follow.
- Call back as soon as possible to keep people informed of action to be taken to address noise problems. Call back at night-time only if requested by the complainant to avoid further disturbance.
- Provide a quick response to complaints, with complaint handling staff having both a good knowledge of the project and ready access to information.
- Implement all feasible and reasonable measures to address the source of complaint.
- Keep a register of any complaints, including details of the complaint such as date, time, person receiving complaint, complainant's contact number, person referred to, description of the complaint, work area (for larger projects), time of verbal response and timeframe for written response where appropriate.

7.3 Vibration Monitoring

We recommend that the level of vibration be measured during the rock hammering and trenching in the event that rock hammering is required or complaints arise regarding vibration from any nearby residences.

The vibration measurements can be carried out using either an attended or an unattended vibration monitor. An unattended vibration monitor should be fitted with an alarm in the form of a strobe light or siren to make the plant operator aware immediately when the vibration limit is

exceeded. The vibration monitor should be set to trigger the alarm when the overall Peak Particle Velocity (PPV) exceeds **15 mm/s** at the nearest residential building.

Dilapidation reports may be commissioned for potentially affected residential premises prior to any rock hammering being undertaken. This may be finalised once the extent of rock hammering, if any, is known.

7.4 Construction Disclaimer

Recommendations made in this report are intended to resolve acoustical problems only and we make no claim of expertise in other areas.

8.0 DEPARTMENT OF PLANNING AND INFRASTRUCTURE ADEQUACY REVIEW

Following the submission of the original Construction Noise and Vibration Management Plan in August 2011, the NSW Department of Planning and Infrastructure, as part of their Environmental Assessment adequacy review, has requested additional information. Following our review of the Department's comments and discussions with departmental staff, this revised report addresses each of the issues raised, as detailed below:-

1. *The noise assessment predicts the level for each item of plant and equipment to be used during construction individually and compares each noise source to the relevant criteria in OEH's Interim Construction Noise Guideline (ICNG). In order to ensure that the highest potential level of noise is presented, all items of plant and equipment should be added together and remodelled collectively.*

In order to address the Department's request we calculated the combined level of all plant at each receptor location in Tables 6.2 to 6.5 inclusive.

This combined noise impact significantly overstates the potential noise impact as this will never occur in practice.

The works will progress at a rate of approximately 500 to 800 metres per day, consequently different items of plant will be at different locations at any given time, affecting different receptors. The predicted noise level shown in each table, for each individual item of plant is based on that item being as close as possible to the respective receptor at the time. The cumulative impact will therefore not be the acoustic sum of the individual levels predicted for each item of plant. The cumulative level of noise at each receptor will not be significantly greater than the highest individual level represented in each table.

In any event additional recommendations are made in Section 7.1 and 7.2 'periods of respite' in relation to managing the potential for cumulative impacts.

2. *The EA predicts a number of exceedences of the relevant ICNG criteria (and in some cases emissions could be up to a level where there could be strong community reaction). The EA proposes a number of source controls to mitigate these impacts (e.g. exhaust silencers and use low noise machinery) but does not quantify how effective these measures would be at attenuating noise. When the noise emissions are remodelled, it should take into account these measures.*

To address the department's request Tables 7.2 to 7.5 inclusive show estimated noise levels following a conservative reduction from source noise controls. Actual attenuation from these measures or the reasonability and feasibility of implementing them over such a short project should be determined once the contractor and exact items of plant have been selected.

Recommendations made in Section 7.2, under work practices are examples of ways of minimising noise emission from construction activities, where practicable. The objective of the OEH's ICNG is to implement all feasible and reasonable work practices to minimise noise impacts, providing a holistic and pragmatic approach to noise reduction without prescribing specific noise controls.

Selecting quieter, low noise machinery is a good way to reduce noise, for example using a 12 tonne excavator in preference to a 30 tonne excavator if it is capable of doing the task and is economically viable. It is difficult to quantify a reduction like this without knowing the proposed plant however, noise reductions of 10 dB are likely.

Similarly low noise / alternative work practices could reduce the noise impact by, for example, using concrete saws in preference to rock breaking machinery.

The level of attenuation achieved from mobile plant exhaust silencers, can vary considerably, depending on the cost, age of the plant, etc. This project is of relatively short duration and it may not be reasonable to expect a fleet of plant to be fitted with silencers for the sake of the project, however, should any plant already be fitted with silencers this may be a consideration when selecting tenders or individual items of plant from a fleet.

3. *If there are still exceedences of the relevant ICNG criteria once the construction noise levels have been remodelled, the company should consider what other reasonable and feasible noise management and mitigation measures it could implement to further reduce construction noise and/or what community consultation activities it would carry out to reduce these impacts on surrounding receivers.*

Any exceedences of the noise management levels will be for a relatively short duration at any effected residence, specifically less than a total of one week (see Section 7).

Advice is given in Section 7.2 under 'community relations' and 'managing a noise complaint' for examples of carrying out community consultation.

With the potential for rock hammering it is particularly important to inform all potentially affected residences on the southern side of Edwards Avenue, for example between 72B to the east and Samuel Street to west as well as all residences in Lillian Place and on the eastern side

of Alfred Street. This should be confirmed once the location and extent of rock hammering is known.

Consultation should be via letter box drops initially, several weeks prior to commencement, detailing the reason for hammering, the date/s hammering will occur, the duration and between which hours. The letter should contain a contact name and number for queries or complaints and follow up letters should be delivered closer to the time. The company's liaison officer should visit the homes in the immediate vicinity of the rock hammering works and discuss the details with the owners.

If a temporary site office is established on the job, a notice board should be placed prominently outside and updated regularly with details of noisy events and contact details of a liaison officer for members of the community.

If there is potential for rock hammering to continue at one location for more than 3 or 4 days, consideration may be given to temporary noise barriers and a determination may be made once the extent of hammering is known.

4. *The noise assessment indicates that no rock hammering equipment would be used during construction whereas the geotechnical report states that a 20 tonne excavator equipped with rock bucket, rock hammer or ripping tyne would be used to penetrate highly weathered (Class V) sandstone during construction. The revised EA must clarify whether or not rock hammering equipment would be used during construction and, if so, the noise impacts of this must be assessed.*

An assessment of the potential noise impacts associated with potential rock hammering activities has been addressed in this revision. Please see Section 3 page 5, Table 6.5, Section 6.3 and the response to point 3 above.

5. *Finally, the revised EA should clarify whether the proposed pressure reduction facility would generate noise and, if so, the noise impacts of this must be assessed.*

Please refer to Section 6.5.

9.0 CONSTRUCTION NOISE IMPACT STATEMENT

The predicted level of noise emission from the construction activities is likely to be in excess of the noise management levels, at least on some occasions. Provided the recommendations in Section 7 of this report are implemented and adhered to, the level of noise and vibration from the construction works for the Shoalhaven Starches Gas Pipeline Project will be minimised in accordance with the NSW Office of Environment and Heritage's *Interim Construction Noise Guideline* and Australian Standard AS2436 – 2010 as detailed in Section 5 of this report.

Matthew Harwood, MAAS

Senior Acoustical Consultant
for and on behalf of Day Design Pty Ltd.

A.A.A.C. MEMBERSHIP
Day Design Pty Ltd is a member company of the Association of Australian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

Attachments:

- Figure 1 – Proposed Pipeline Route
- Figure 2 – Receptor Area 1
- Figure 3 – Receptor Areas 2 and 3
- Figure 4 – Receptor Area 4
- Figure 5 – Ambient Noise Levels – Location A
- Figure 6 – Ambient Noise Levels – Location B
- Figure 7 – Ambient Noise Levels – Location C

ANNEXURE 17

Air Quality Impact Assessment

prepared by

Stephenson Environmental Management Australia

ANNEXURE 17

Stephenson

Environmental Management Australia

AIR QUALITY IMPACT ASSESSMENT

GAS PIPELINE UPGRADE PROJECT

SHOALHAVEN STARCHES PTY LTD

BOMADERRY NSW

PROJECT NO.: 4725A/S18303/10

FINAL ISSUE DATE: 30 JUNE 2011

REVISION ISSUE DATE 25 JANUARY 2012

PREPARED FOR THE MANILDRA GROUP

P W STEPHENSON

B BEUDEKER

Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

Newington Business Park
Unit 7/2 Holker Street
Newington NSW 2127 Australia
Tel: (02) 9737 9991
Fax: (02) 9737 9993
E-Mail: info@stephensonenv.com.au

AIR QUALITY IMPACT ASSESSMENT

GAS PIPELINE UPGRADE PROJECT

SHOALHAVEN STARCHES PTY LTD

BOMADERRY NSW

PROJECT NO.: **4725A/S18303/10**

FINAL ISSUE DATE: **30 JUNE 2011**

REVISION ISSUE DATE **25 JANUARY 2012**

PREPARED FOR THE MANILDRA GROUP

P W STEPHENSON

B BEUDEKER

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF PHOTOGRAPHS

1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was engaged by Cowman Stoddart Pty Ltd on behalf of Shoalhaven Starches Pty Ltd to undertake an air quality impact assessment for a proposed 5.5 kilometre gas pipeline from the Eastern Gas Pipeline to their factory site at Bomaderry, New South Wales (NSW) as shown in Figure 1-1. This report forms part of the Environmental Assessment (EA) for the proposed pipeline, Shoalhaven Starches Pipeline Project (MP 10_0108) being prepared by Cowman Stoddart Pty Ltd for submission to NSW Planning.

1.1 DIRECTOR GENERAL REQUIREMENTS FOR THE ENVIRONMENTAL ASSESSMENT

As part of the Environmental Assessment (EA) process, Planning NSW, along with other government authorities, was consulted to ascertain their requirements for the EA. The Director General of Planning NSW then issued the requirements for the EA in a letter entitled: *Director General's Requirements Shoalhaven Starches Pipeline Project (MP 10_0108).* The objective of this report is to comply with the Director-General's requirements as summarised in Table 1-1 for the air quality assessment.

TABLE 1-1 SUMMARY OF DIRECTOR-GENERAL'S EA REQUIREMENTS FOR AIR QUALITY

Director-Generals Requirements as per MP10_0108	Refer Section of this Air Quality Impact Assessment
General Requirements The Environmental Assessment must include: • A detailed description of the Project including: - existing site and environmental features - construction and operation details that clearly define the proposed corridor; • an assessment of the key issues and potential impacts outlined below, during construction and during operation; • a draft Statement of Commitments outlining environmental management, mitigation and monitoring measures.	Section 2 Section 3 & 4 Part of Environmental Assessment Report
Key Issues • Air Quality – including - an air quality impact assessment, including an assessment of the predicted dust emissions during construction;	Section 3 & 4

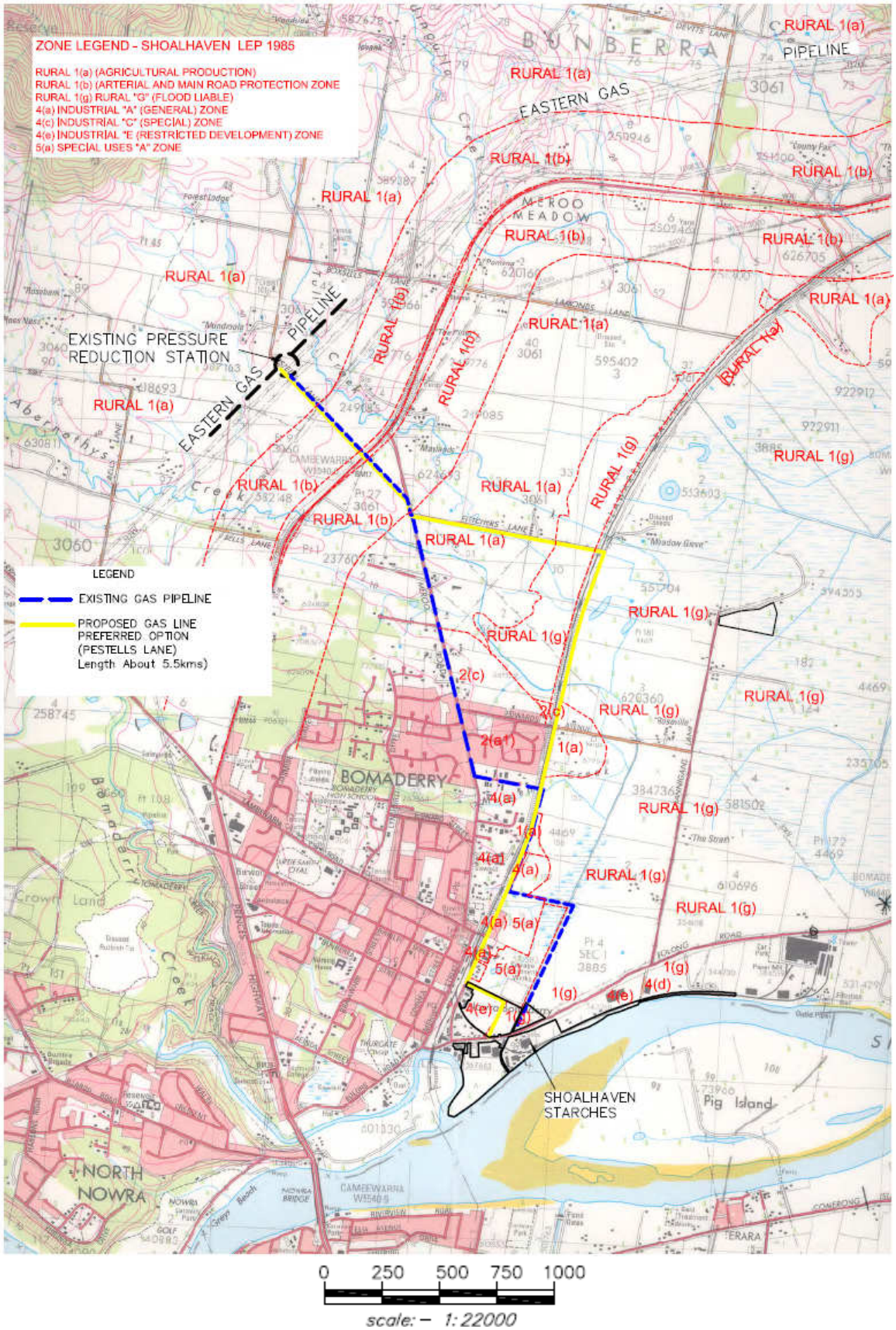
The following Policies, Guidelines, Methods & Plans were consulted with during the preparation of this Air Quality Assessment:-

- Protection of the Environment Operations (Clean Air) Regulation 2010

- Approved Methods for the Modelling & Assessment of Air Pollutants in NSW (DEC)

- Approved Methods for the Sampling & Analysis of Air Pollutants in NSW (DEC).

FIGURE 1-1 PREFERRED ROUTE OPTION FOR PROPOSED GAS PIPELINE WITH ZONINGS



2 PROJECT DESCRIPTION

2.1 OVERVIEW OF PROPOSAL

The Shoalhaven Starches factory located on Bolong Road, Bomaderry produces a range of products for the food, beverage, confectionary, paper and motor transport industries including; starch, gluten, glucose and ethanol. At present energy used at the Shoalhaven Starches operations can be summarised as follows:

- Coal – 2,943,000 Gigajoules per annum (GJ/a)
- Natural Gas – 1,158,000 GJ/a
- Diesel on site – 25,476 GJ/a
- Electricity – 589,406 GJ/a

Following the approval in 2009 by the Minister for Planning for a major expansion at the Company's Bomaderry plant, it is anticipated that production of ethanol at the plant will increase in a staged manner from the current approved 126 million litres per year to 300 million litres per year. The increase in ethanol production is required to ensure the NSW 10% biofuel ethanol in unleaded petrol mandate can be met, which will have indirect benefits in improving vehicle emissions across NSW and reducing greenhouse Australia's greenhouse emissions.

This approval will include a general increase in energy requirements associated with an increase in plant on the site required by such expansions.

However, the expansion approval includes the development of an efficient gas fired co-generation plant, which would supply electricity and steam to the factory that will assist in reducing greenhouse gas emissions. Electric power would be generated using two natural gas turbine generators to deliver a net power output of 40 MW.

Following the approved expansion in production at Shoalhaven Starches, the increased energy requirements will be as follows:

- Coal – 2,943,000 GJ/a: No Change in consumption
- Natural gas – 6,800,000 GJ/a: Increase
- Diesel on site – 25,476 GJ/a: No Change
- Electricity – 50,400 GJ/a: Decrease

Therefore, as shown, Shoalhaven Starches operations will experience a significant increase in consumption of natural gas as a result of the recently approved plant expansion approved by the Minister.

To meet this increase in gas consumption, Shoalhaven Starches propose to construct a 5.5 km pipeline to connect the Shoalhaven Starches factory directly into the Eastern Gas Pipeline (EGP) at a point at Meroo Meadow to the north east of the factory site. By undertaking this project Shoalhaven Starches will be able to gain direct access to the EGP, and the various gas retailers who are able to transport gas along this pipeline. As a result Shoalhaven Starches will be able to take advantage of any reduced cost of supply of gas for their operations and a guaranteed gas supply along a pipeline of sufficient capacity.

The proposed pipeline route has been designed to minimise impact on the broader community with the chosen route being generally located away from residential areas. In addition the design of the route will minimise environmental impacts. The route selected passes mainly along existing cleared road reserves and the main Bomaderry to Kiama rail corridor.

2.2 EXISTING ENVIRONMENT

The primary air pollution sources, that influence local air quality in the vicinity of the pipeline route, are likely to be minor emissions of dust and some minor stack and fugitive air emissions from:

- Agricultural activities
- The Shoalhaven Starches factory
- Other local industries in the vicinity of the southern section of the route along Meroo Road and Railway Street,
- To a lesser extent vehicle exhaust emissions, from the local road network and heavy vehicle bypass route between Bombaderry and the Princes Highway.

The nearest sensitive receptors to the Project, with respect to potential air quality impacts from construction are residential properties along the route of the pipeline, in particular:

- along Railway Street,
- where the pipeline crosses Edwards Avenue, and
- properties along Alfred Street that back on to South Coast Railway line.

The majority of the pipeline route runs through open rural land in the north through Pestells Lane and Fletchers Lane and then follows the South Coast Railway, where it is mostly shielded from the neighbouring residences by the rail corridor and a strip of bushland. The corridor and bushland will provide some physical shielding with respect to any fugitive dust emissions from construction as well as some visual screening during construction.

Figures 2-1 and 2-2 are aerial photographs of proposed gas pipeline route. Figure 2-2 shows the nearest sensitive receptors adjacent to the South Coast Railway line.

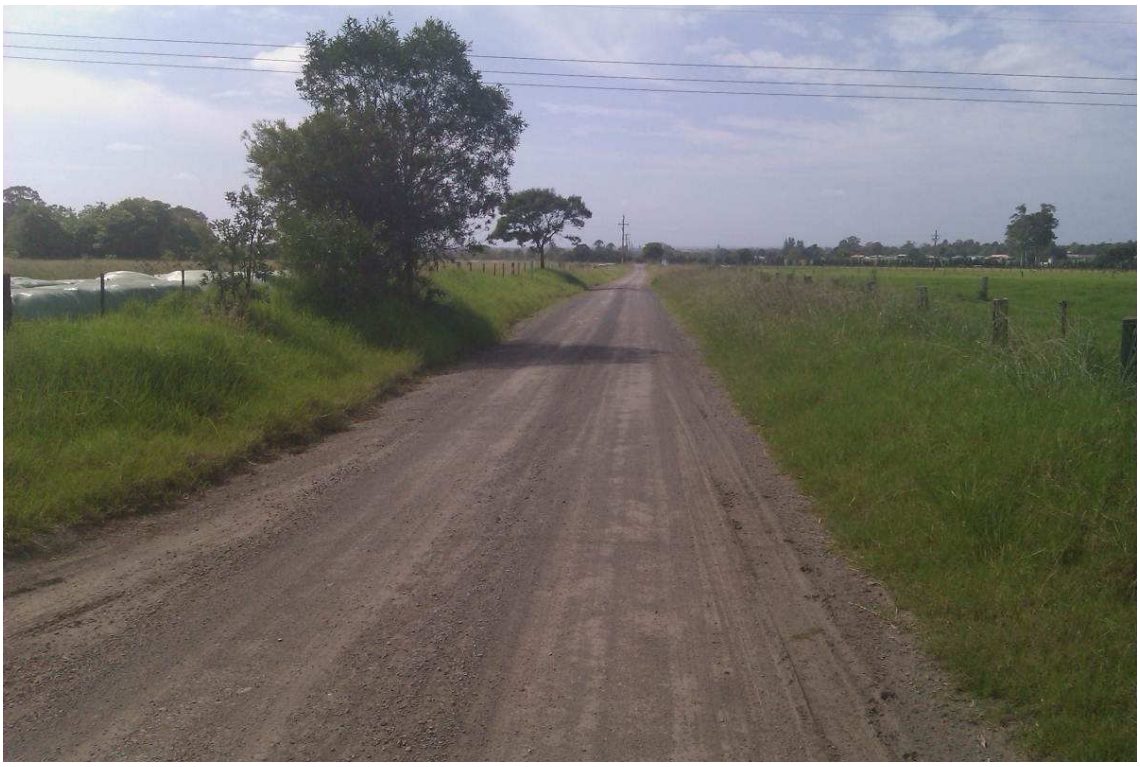
FIGURE 2-1 AERIAL PHOTOGRAPH OF THE PREFERRED GAS PIPELINE LOCATION (NORTHERN AREA)

FIGURE 2-2 AERIAL PHOTOGRAPH OF THE PREFERRED GAS PIPELINE LOCATION (SOUTHERN AREA)

The existing environment along the pipeline route is shown in Photographs 2-1 to 2-12 below. The sequence of photographs commences at the EGP connection station and finishes at Bolong Road, Bomaderry.

PHOTOGRAPH 2-1 EASTERN GAS PIPELINE OFF-TAKE JUNCTION FOR BEGINNING OF PIPELINE

PHOTOGRAPH 2-2 PIPELINE ROUTE ALONG PESTELLS LANE (LOOKING SOUTHEAST)



PHOTOGRAPH 2-3 PIPELINE ROUTE LOOKING SOUTHEAST DOWN PESTELLS LANE CORRIDOR/EASEMENT

PHOTOGRAPH 2-4 PIPELINE ROUTE LOOKING EAST DOWN FLETCHERS LANE

PHOTOGRAPH 2-5 PIPELINE ROUTE ALONG SOUTH COAST RAILWAY (LOOKING SOUTH)

PHOTOGRAPH 2-6 PIPELINE ROUTE ALONG RAIL CORRIDOR LOOKING SOUTH FROM EDWARDS AVENUE

PHOTOGRAPH 2-7PIPELINE ROUTE LOOKING NORTH UP RAILWAY STREET CORRIDOR

PHOTOGRAPH 2-8 PIPELINE ROUTE LOOKING SOUTH DOWN RAILWAY STREET

PHOTOGRAPH 2-9 PIPELINE ROUTE LOOKING SOUTH DOWN RAILWAY STREET

PHOTOGRAPH 2-10 PIPELINE ROUTE DEVIATION POINT OFF RAILWAY STREET LOOKING EAST

PHOTOGRAPH 2-11 PIPELINE ROUTE LOOKING SOUTH TOWARDS SHOALHAVEN STARCHES

PHOTOGRAPH 2-12 PIPELINE ROUTE FINISHING POINT ON BOLONG ROAD LOOKING NORTHWEST ALONG RAILWAY BRANCH LINE

2.3 EXISTING CLIMATE

This section describes the general climate and air quality in the study area and includes information on prevailing wind patterns, historical data on temperature, humidity and rainfall.

2.3.1 WINDS

Wind data was collected on-site (factory) for 2004 and is presented as windroses shown in Figure 2-3. The predominant winds are from the west-north-west to west for most of the year. In summer there is also dominance of north-easterlies and westerlies. In winter the westerlies are the most common.

This on-site monitoring was conducted for a number of reasons, not the least of which, was the closure of the Bureau of Meteorology Station (BOM) RAN Nowra site.

2.3.2 TEMPERATURE AND RAINFALL

Table 2-1 presents the statistical temperature and rainfall data for the BOM Nowra site, which is the closest site to the project. This site, however, was closed in 2000. Presented are monthly averages of maximum and minimum temperatures. Rainfall data consisting of mean monthly rainfall and the average number of raindays per month.

From temperature data recorded over 45 years, the annual average maximum and minimum temperatures experienced are 21.3°C and 11.3°C, respectively. The maximum monthly average temperatures are recorded in January and February at 25.8°C. July is the coldest month, with an average minimum temperature of 6.2°C.

The annual average humidity reading from 45 years of collected data at 9 am is 70%. The month with the highest 9 am humidity on average is February with 76%. At 3 pm the annual average humidity reading is 58%, with the highest average humidity being in February and March with 63%.

Rainfall data collected over 58 years show that March is on average the wettest month, with a mean rainfall reading of 130.4 mm. The average number of raindays for March is 12. July is the driest month with an average rainfall of 55.7 mm. The average annual rainfall is 1135 mm and the average number of raindays is 130.

2.3.3 EXISTING AIR QUALITY

There has been no monitoring undertaken specifically for this project, but data is available from the NSW Office of Heritage and Environment (OEH) formerly the Environment and Protection Authority (EPA) monitoring network. The station that is closest to the project site is at Albion Park South, approximately 50 kilometres to the north of the proposed route. It is situated in a semi-rural area in the south of the Illawarra basin and the air quality is expected to be similar to the project site.

A review of the most recent data for 2010 and 2011 indicates that the air quality is typically very good with no exceedances of the ambient air quality goals for nitrogen dioxide, particulate matter (less than 10 microns), ozone and sulphur dioxide.

FIGURE 2-3 WINDROSES FROM FACTORY SITE 2004

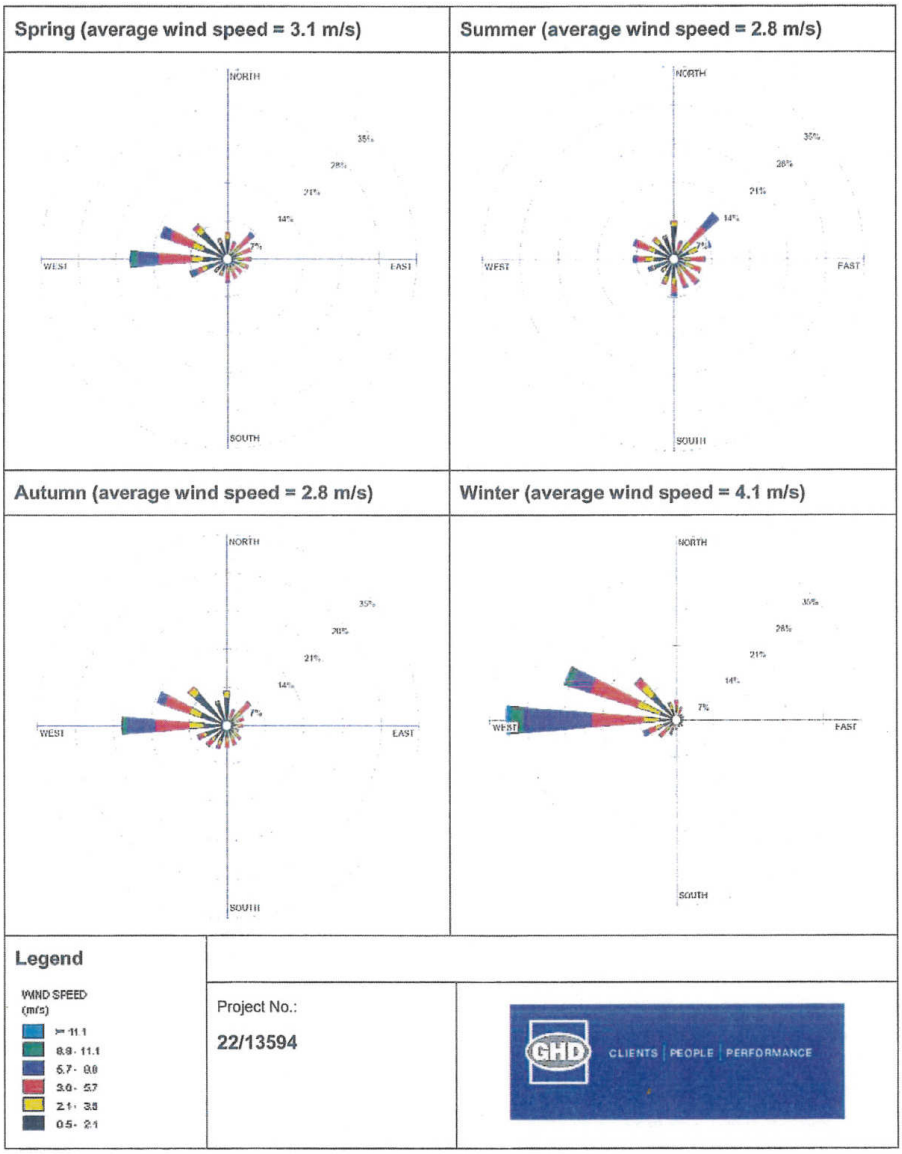


Figure 7-6 Factory Seasonal Wind Roses - Year 2004

56 Ethanol Upgrade
Air Quality Assessment
22/13594/81099 R0

TABLE 2-1 TEMPERATURE AND RAINFALL DATA FOR

BUREAU OF METEOROLOGY RAN STATION AT NOWRA ROYAL AUSTRALIAN NAVY BASE

Temperature and rainfall data for Nowra RAN Air Station (Station Number 068076 Latitude 34 Deg 57 Min S Longitude 150 Deg 33 Min E Elevation 109 m)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Daily Maximum Temperature (C) (45 Years of record 1955 - 2000)													
Mean	25.8	25.8	24.5	22.1	19	16.4	15.8	17.1	19.4	21.5	23.1	25.1	21.3
Daily Minimum Temperature (C) (45 Years of record 1955 -2000)													
Mean	15.9	16.3	14.8	12.1	9.7	7.5	6.2	6.7	8.3	10.6	12.6	14.6	11.3
Rainfall (mm) (58 Years of record 1942 - 2000)													
Mean	95.8	125.7	130.4	100.6	92.5	110.9	55.7	67.7	68	113.3	100.4	73.7	1134.7
Median	73.3	70.9	76.6	51.6	72.2	62.1	40.5	35.2	47.7	68.8	64.4	63.1	1092.8
Raindays (Number) (58 Years of record 1942 -2000)													
Mean	12.8	12.1	12.3	9.6	10.1	10.1	7.6	8.7	9.9	12.5	13	11.2	129.8

Source: Bureau of Meteorology website 2011

3 CONSTRUCTION IMPACT ASSESSMENT

3.1 CONSTRUCTION SOURCES

The most significant types of emissions to air during the construction phase of pipeline construction that have the potential to impact on air quality of neighbouring residences if not managed would primarily consist of:

- Dust emissions from both the mechanical disturbance and wind erosion of exposed soil piles during the digging of trenches to lay the pipeline
- Wind blown road dust from vehicles traversing unsealed access roads and tracks
- Exhaust emissions from the range of motor vehicle and mobile plant required for excavation laying of the pipe for the Project.

Specifically, the major potential dust sources during the construction phase are expected to include:

- Clearance of vegetation, rock and soil material
- General surface earthworks and excavation works
- Top soil and soil handling (stockpiling, loading, dumping)
- Levelling and grading of disturbed soil surfaces
- Passage of construction and administrative vehicles over unsealed sections of road or localised unconsolidated soil surfaces
- Wind erosion of unstable/uncovered surfaces and stockpiles and other unconsolidated surfaces.

3.2 POTENTIAL FOR CONSTRUCTION AIR QUALITY IMPACT

Airborne particles (dust) are typically less than 100 micrometres in aerodynamic diameter and are referred to as Total Suspended Particulates (TSP). The fraction of these particles that are less than 10 micrometres in equivalent aerodynamic diameter is referred to as PM_{10}. The impact of dust emissions principally relates to the potential effect on human health on inhalation of particles in the air, and it is the finer fraction that has the greater potential to cause respiratory health effects.

A secondary effect relates to the deposition of the course fraction of dust onto surfaces (soiling of material surfaces), which is an impact on amenity and considered a nuisance. Typical, depositions effects are confined to short ranges, as the high settling velocity of the course particles means that the larger particulate matter sediments out from the dust plume in the near vicinity of the operations.

Construction activities will create particulate (dust) emissions which, if uncontrolled, will be additive to those levels resulting from other activities in the area, particularly agricultural activities. The construction dust emissions are expected to be relatively minor given the duration and location of the pipeline. These emissions will still be controlled and managed in accordance with good dust management practices. These practices are discussed in Section 3.3 of this report.

Table 3-1 presents a preliminary construction schedule based on discussions with construction contractors and assumes geotechnical conditions of the land/soil are satisfactory for construction. The schedule does not account for significant weather delays. As can be seen the construction time will be of relatively short duration.

TABLE 3-1 PRELIMINARY CONSTRUCTION SCHEDULE

Weeks	Description
1 - 2	Mobilisation, safety inductions, location of third party infrastructure
3 - 7	Pipeline installation (stringing, excavating, welding, lowering in, tie-ins, backfill, hydrotest)
8 - 9	Right-of-way restoration, begin demobilisation
10	Demobilisation complete

Analysis of the local wind climate indicates that the prevailing winds are typically from the west sector, which means that the majority of sensitive receptors to the west of the pipeline will have less potential for exposure to any uncontrolled emissions. However, it is expected that the resultant offsite impacts on the nearest sensitive receptors, will be negligible with the implementation of good dust management practices.

3.3 CONSTRUCTION MITIGATION AND MANAGEMENT MEASURES

Good dust management practices will be adopted where necessary during the construction phase. Some typical dust control practices include:

- Construction or erection of drift fencing (that is; fences fitted with shade cloth)
- Where possible, minimise disturbed and exposed areas
- Locate stockpiles as far away from public and residential areas as possible
- Dust control on short term stockpiles (project duration is less than 3 months) will be controlled using water sprays, drift fencing and/or daily inspections
- Progressively revegetate disturbed and exposed areas as soon as possible
- Restrict construction traffic to defined areas and speed limits
- Where possible, seal internal construction related roads with road base rock or gravel or use of water sprays if this is impracticable

- Install and use rumble grids at site exit points to minimise dust and mud on public roads
- Cover all truck loads that enter or leave the site
- Inspect equipment and vehicle exhaust emissions at start-up and during pipeline laying program
- No fires – burning of any material is not permitted
- Properly maintain dust control structures and processes
- During dry and windy conditions spray water over road surfaces to prevent wind erosion
- Cease or limit relevant excavation and construction activities when winds are strong and from an unfavourable direction. This will ensure that, if uncontrollable, excessive dust generated cannot impact on sensitive receptors.

4 OPERATIONAL IMPACT ASSESSMENT

4.1 OPERATIONAL SOURCES

The pipeline will be mostly buried without any release points under normal circumstances. A pressure reduction facility will be located at the end of the pipeline, opposite the Manildra facility on Bolong Road. The purpose of the facility is to reduce gas pressure from approximately 10,000 kPa to 3,500 kPa. As result of the pressure reduction a significant drop in gas temperature will occur. Therefore, in order to prevent liquids forming in the gas stream, a gas heater will be utilised, which will emit mainly oxides of nitrogen and carbon dioxide.

The gas heater will be similar to the existing ACTEWAGL gas heater approximately 500 metres to the east along Bolong Road, shown in Photograph 4-1.

The operator of the gas pipeline, ACTEWAGL, advises that their operational procedures for the pressure reduction facility are to minimise fugitive discharge of natural gas from the pipeline at all times. ACTEWAGL also confirms that this facility is for pressure reduction purposes rather than as an emergency gas pressure release to atmosphere or as a flare. The natural gas contained in the pressure reduction facility is the product for which ACTEWAGL receive revenue for conveying intact inside the pipe and not releasing to atmosphere.

Therefore, the small amount of gas that would ever be released from this facility during a maintenance procedure would be considered a negligible emission. When this emission is combined with the remote location and prevailing winds it would be considered to have a minimal impact on air quality in the immediate area; and no regional greenhouse gas emission impact.

PHOTOGRAPH 4-1 ACTEWAGL GAS HEATER

4.2 POTENTIAL OPERATIONAL AIR QUALITY IMPACTS

The gas heater will be a bath type and installed just upstream of the pressure reduction skid. The heater will be located on Manildra vacant land on the north side of Bolong Road at least 500 metres from the nearest sensitive receptors to the west. The emissions from the gas heater will be relatively minor by comparison to the existing emission from the Manildra facility and motor vehicle traffic. These emissions combined with the remote location and prevailing winds are anticipated to have negligible impact on the air quality in the area.

5 CONCLUSIONS

This air quality impact assessment has identified negligible air quality impacts associated with the construction and operation of the proposed gas pipeline.

Dust emissions during the construction phase will be managed by implementing best practice dust control measures such as minimising exposed areas, rehabilitation and revegetation upon completion of work and using water sprays if required.

Exhaust emissions from mobile plant during construction are expected to be minor. These emissions combined with the relatively remote location and buffer distances are expected to have negligible air quality impacts on neighbouring sensitive receptors.

Dust monitoring has not been considered for this project because of the short term nature and the narrow corridor of disturbance. However, if the best practice dust control measures were not implemented then this decision may need to be revisited.

During the operational phase of the pipeline, there will be emissions from the gas heater and infrequent gas venting for maintenance and emergency purposes at the gas reduction facility. However, given the relatively remote location and prevailing westerly winds the impacts of these events are also expected to be negligible at the nearest sensitive receptors.

Therefore, it is concluded that there would not be any significant air or greenhouse gas emission from this pressure reduction facility during normal operations or routine maintenance. In emergency situations the pressure would be relieved using standard procedures. This would not involve the pressure reduction facility.

In addition, the construction of the pipeline will allow Shoalhaven Starches to proceed with the development of an efficient gas fired co-generation plant to supply electricity and steam to the factory, which will assist in reducing greenhouse gas emissions by reducing the requirements for less efficiently produced energy supplied from the grid. The additional gas supply will also facilitate a reduction in the future reliance on coal fired energy when further plant upgrades are required.

ANNEXURE 18

Easement over Lot 4 DP 249085
enabling

Pipeline to Tie-in to EGP

ANNEXURE 18

Form: 01TG
Release: 2.1
www.lpma.nsw.gov.au

TRANSFER GRANTING EASEMENT

New South Wales
Real Property Act 1900

Leave this space clear. Affix additional pages to the top left-hand corner.

PRIVACY NOTE: Section 31B of the Real Property Act 1900 (RP Act) authorises the Registrar General to collect the information required by this form for the establishment and maintenance of the Real Property Act Register. Section 96B RP Act requires that the Register is made available to any person for search upon payment of a fee, if any.

(A) **TORRENS TITLE**

Servient Tenement	Dominant Tenement
4/249085	Easement is in gross

(B) **LODGED BY**

Document Collection Box	Name, Address or DX, Telephone, and Customer Account Number if any	CODE
	Reference:	TG

(C) **TRANSFEROR**

WJ & HL CRITTLE PTY LIMITED ACN 084 533 282

(D) The transferor acknowledges receipt of the consideration of $ 220,000.00

and transfers and grants—

(E) **DESCRIPTION OF EASEMENT**

Easements identified in the plan marked "Annexure A" and Instrument marked "Annexure B"

out of the servient tenement and appurtenant to the dominant tenement.

(F) Encumbrances (if applicable):

(G) **TRANSFEREE**

Manildra Energy Australia Pty Limited ACN 000 027 261

DATE

(H) Certified correct for the purposes of the Real Property Act 1900 and executed on behalf of the corporation named below by the authorised person(s) whose signature(s) appear(s) below pursuant to the authority specified.

Corporation: WJ & HL CRITTLE PTY LIMITED ACN 084 533 282
Authority: section 127 of the Corporations Act 2001

Signature of authorised person:
Name of authorised person: Helen Lisa Crittle
Office held: Secretary

Signature of authorised person:
Name of authorised person: Warren John Crittle
Office held: Director

Certified correct for the purposes of the Real Property Act 1900 and executed on behalf of the corporation named below by the authorised person(s) whose signature(s) appear(s) below pursuant to the authority specified.

Corporation: MANILDRA ENERGY AUSTRALIA PTY LIMITED ACN 000 027 261
Authority: section 127 of the Corporations Act 2001

Signature of authorised person:
Name of authorised person: PETER STRETTON
Office held: Director

Signature of authorised person:
Name of authorised person:
Office held: ~~Director~~ Company Secretary

GILBERT & H BRATBY

ALL HANDWRITING MUST BE IN BLOCK CAPITALS.
0911

LAND AND PROPERTY MANAGEMENT AUTHORITY

PLAN OF PROPOSED EASEMENT FOR GAS FACILITIES 19 WIDE AND PROPOSED EASEMENT FOR PIPELINE 8 WIDE AFFECTING LOT 4 DP 249085

LGA: SHOALHAVEN
LOCALITY: MEROO MEADOW
PARISH: BUNBERRA
COUNTY: CAMDEN

Ⓣ EASEMENT FOR TRANSMISSION LINE 30.48 WIDE (VIDE DEALING G858188)

Ⓤ EASEMENT FOR TRANSMISSION LINE 45.72 WIDE (VIDE DEALING K560855)

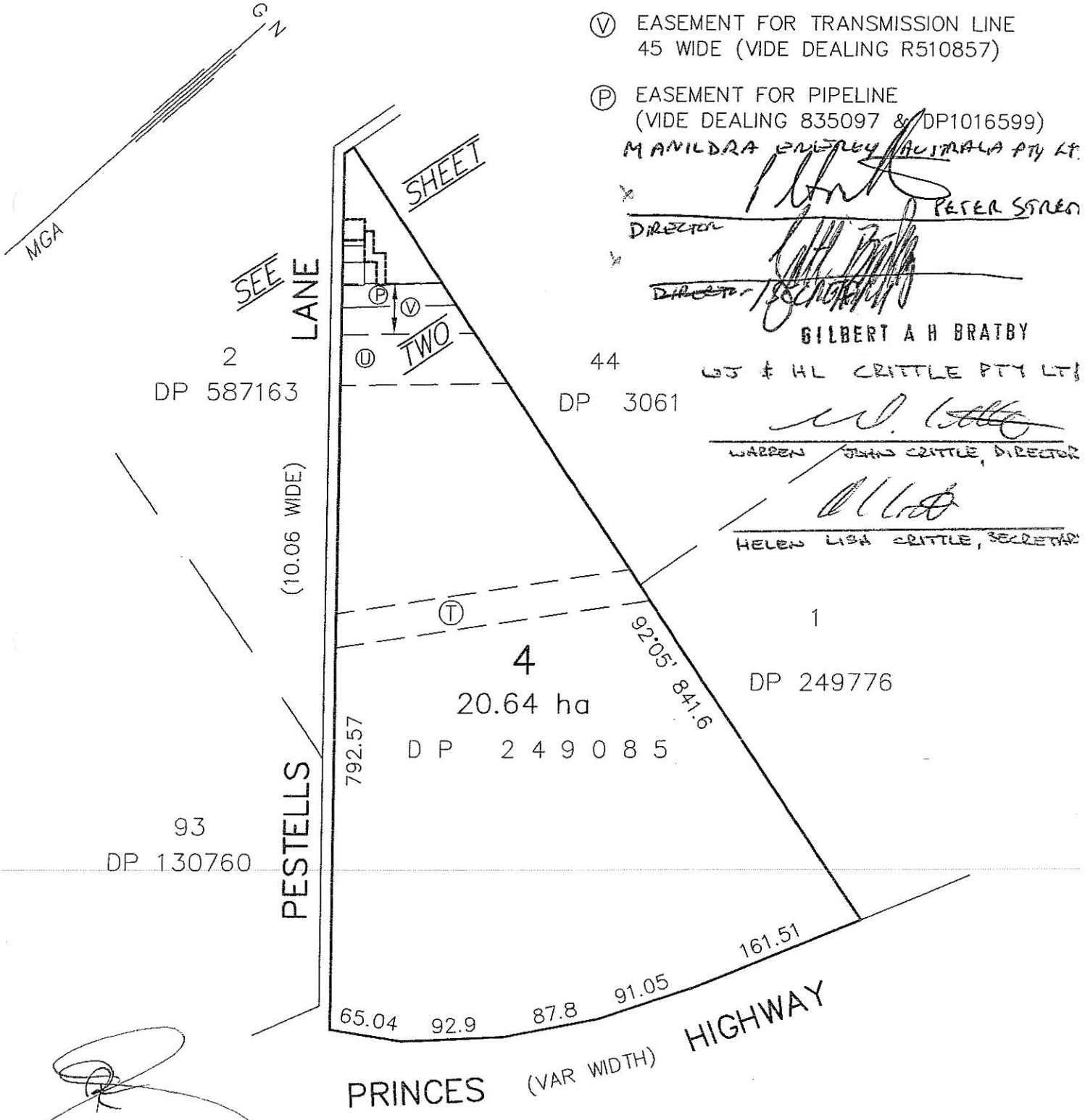
Ⓥ EASEMENT FOR TRANSMISSION LINE 45 WIDE (VIDE DEALING R510857)

Ⓟ EASEMENT FOR PIPELINE (VIDE DEALING 835097 & DP1016599)

MANILDRA ENERGY AUSTRALIA PTY LTD
PETER SOREN
DIRECTOR
DIRECTOR / SECRETARY

GILBERT A H BRATBY

WJ & HL CRITTLE PTY LTD
WARREN JOHN CRITTLE, DIRECTOR
HELEN LISA CRITTLE, SECRETARY



ROSS J DOUGLAS
REGISTERED SURVEYOR

DATE: 11.7.2011 RATIO 1:5000 SHEET 1 OF 2 SHEETS
SURVEYORS REF: 24710 2011M7100(1262) Comp.

PLAN OF PROPOSED EASEMENT FOR GAS FACILITIES 19 WIDE AND PROPOSED EASEMENT FOR PIPELINE 8 WIDE AFFECTING LOT 4 DP 249085

LGA: SHOALHAVEN
LOCALITY: MEROO MEADOW
PARISH: BUNBERRA
COUNTY: CAMDEN

Ⓣ EASEMENT FOR TRANSMISSION LINE 30.48 WIDE (VIDE DEALING G858188)

Ⓤ EASEMENT FOR TRANSMISSION LINE 45.72 WIDE (VIDE DEALING K560855)

Ⓥ EASEMENT FOR TRANSMISSION LINE 45 WIDE (VIDE DEALING R510857)

Ⓟ EASEMENT FOR PIPELINE (VIDE DEALING 835097 & DP1016599)

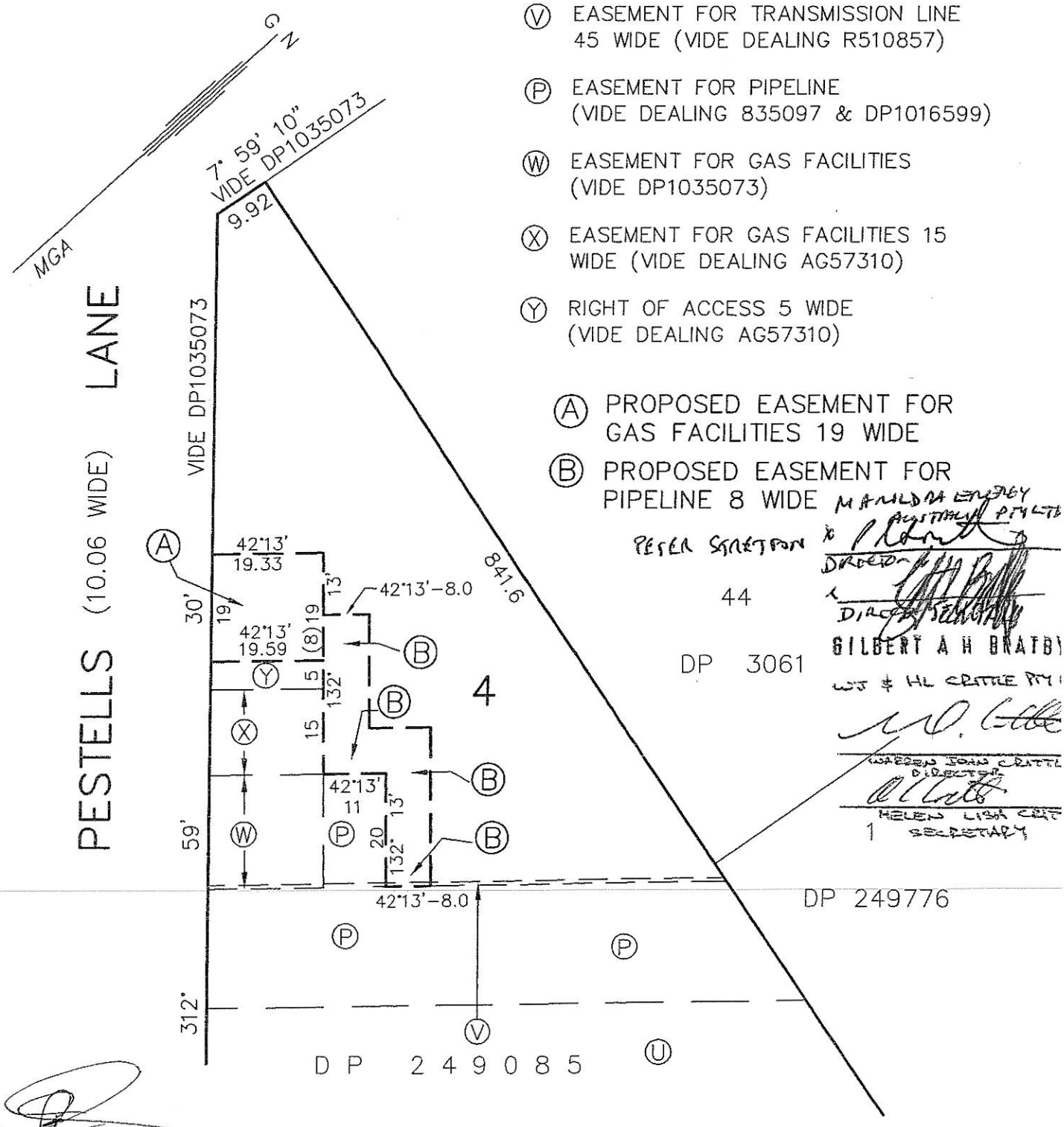
Ⓦ EASEMENT FOR GAS FACILITIES (VIDE DP1035073)

Ⓧ EASEMENT FOR GAS FACILITIES 15 WIDE (VIDE DEALING AG57310)

Ⓨ RIGHT OF ACCESS 5 WIDE (VIDE DEALING AG57310)

Ⓐ PROPOSED EASEMENT FOR GAS FACILITIES 19 WIDE

Ⓑ PROPOSED EASEMENT FOR PIPELINE 8 WIDE



MANILDRA ENERGY AUSTRALIA PTY LTD
PETER SKRETTON
DIRECTOR
DIRECTOR/SECRETARY
GILBERT A H BRATBY
WJ & HL CRITTLE PTY
WARREN JOHN CRITTLE
DIRECTOR
HELEN LIGH CRITTLE
SECRETARY

ROSS J DOUGLAS
REGISTERED SURVEYOR

DATE: 11.7.2011 RATIO 1:5000 SHEET 2 OF 2 SHEETS
SURVEYORS REF: 24710 2011M7100(1262) Comp.

DA# 30 of 12