Section 3
Project Description

Preamble

This section introduces the Proponent's objectives for the Narrabri Coal Seam Gas Utilisation Project and describes the various Project components and how they will be constructed, installed and used. This section also describes the proposed hours of operation and employment during the construction and operational phases. Planned rehabilitation is also described.

This section concludes with an outline of the Project alternatives considered during the description of the Project together with an overview of the type of development that may ultimately eventuate if the results of the Bibblewindi and Bohena CSG Pilot testing is successful and ongoing exploration identifies economically recoverable quantities of CSG throughout PEL 238.

The Project is described in sufficient detail to provide the reader with an overall understanding of the nature and extent of activities proposed and to provide the basis for assessing the potential environmental impacts of the activities. Where dimensional information is provided about the various Project components, it needs to be recognised as indicative only.

Details of the safeguards and management measures that the Proponent intends to adopt to minimise or avoid potential impacts relating to surface water, soils, air quality, groundwater, Aboriginal heritage or ecology are provided in Section 5 of this document.

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3.1 Introduction

A range of short-term strategic, environmental and socio-economic objectives have been integrated into the Project in support of the longer term goal to develop a sustainable and commercially viable gas field and transmission infrastructure in the Narrabri region. The Project objectives include the following.

- The ongoing assessment and development of both conventional petroleum and CSG potential of PAL2 and PEL238.
- The conduct of the Project in line with statutory and regulatory requirements.
- The cultivation of best practice cultures both internally and for external contractors and service providers.
- The mitigation of cumulative environmental impacts associated with this activity with a specific focus on biotic and air quality/greenhouse gas impact minimisation.
- The cost effective production and transmission of CSG to the Wilga Park Power Station.
- The provision of socio-economic benefits to the Narrabri region through goods and services supply and direct/indirect employment.

The Narrabri CSG Utilisation Project comprises four main components, the locations of which are illustrated in **Figure 3.1**.

1. A gas gathering system at the Bibblewindi and Bohena CSG Pilots.
2. Gas compression facilities at the Bibblewindi and Bohena CSG Pilots.
3. A 32km long buried gas flow line.
4. The expansion of the Wilga Park Power Station.

3.2 Overview and Location of the Project Components

The Project will encompass the following components positioned at the locations indicated in the nominated figures.

3.2.1 Gas Gathering Systems

Bibblewindi CSG Pilot

An underground, low pressure gas gathering system (GGS) comprising a network of small diameter (maximum 200mm) high density polyethylene flow lines (PE 100) is required to transport gas from the nine individual wells to the inlet hub and gas compression facility located at Bibblewindi-5, as illustrated in **Figure 3.2a**. The GGS will be laid in a trench with a minimum 750mm earth cover. Approximately 3.5km of piping will be required to link the wells to the gas flow line inlet hub and compression facility. All components will be manufactured and installed in accordance with the relevant Australian Standards.

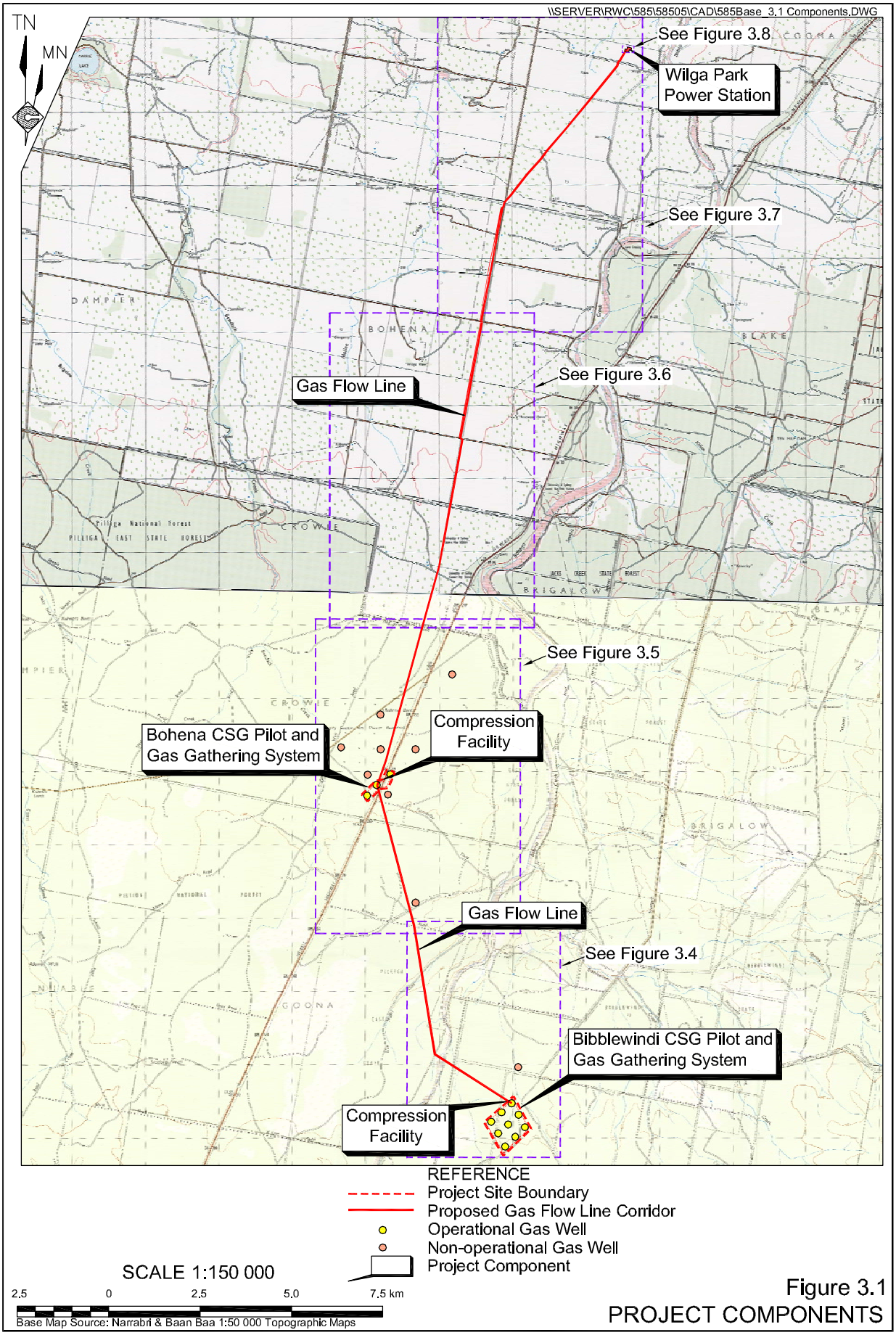
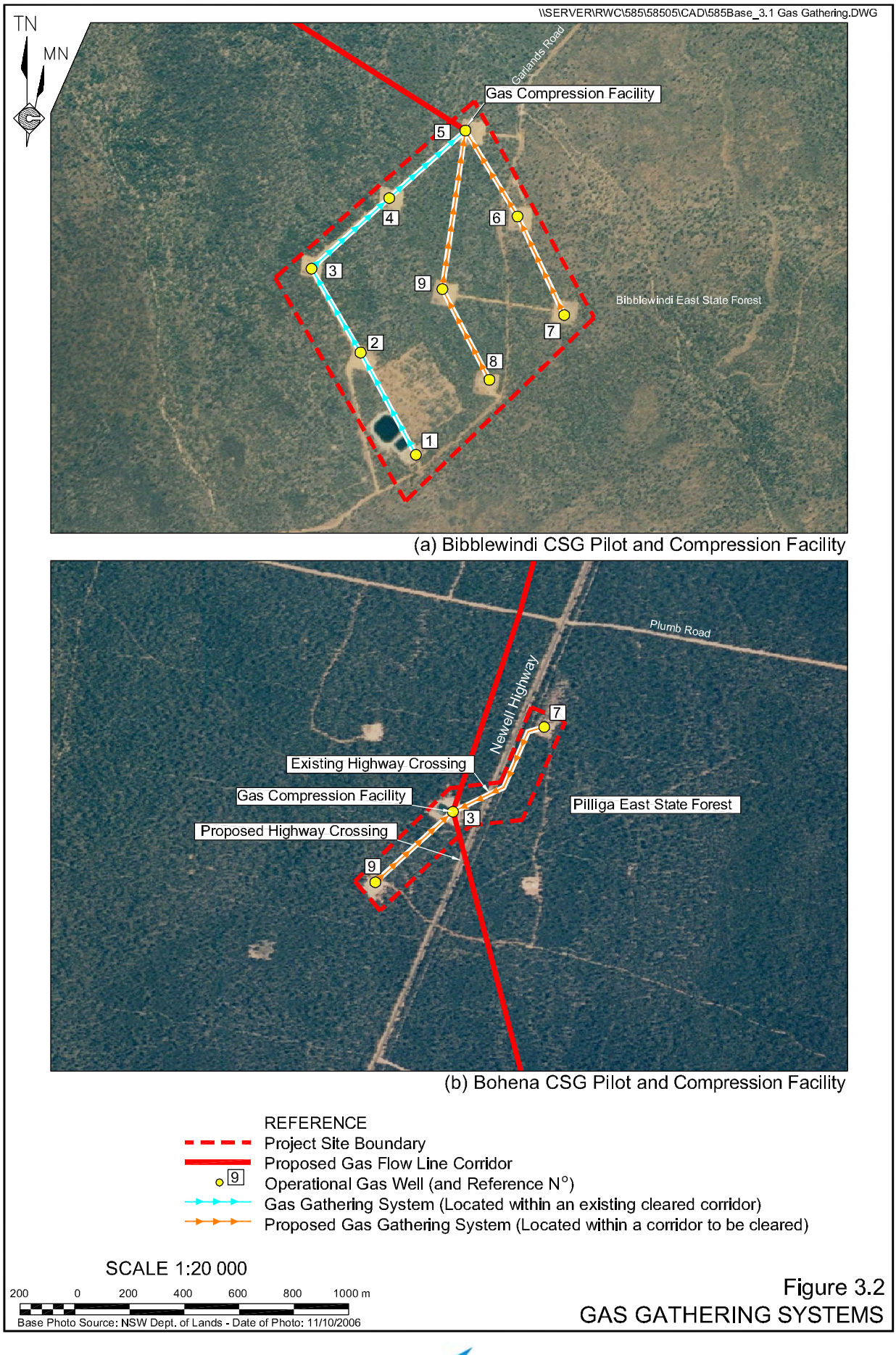


Figure 3.1
PROJECT COMPONENTS



(a) Bibblewindi CSG Pilot and Compression Facility

(b) Bohena CSG Pilot and Compression Facility

Figure 3.2
GAS GATHERING SYSTEMS

Bohena CSG Pilot

A similar gas gathering system will be installed at the Bohena CSG pilot linking Bohena-7 and 9 to the inlet manifold and gas compression unit located at Bohena-3 as illustrated in **Figure 3.2b**.

3.2.2 Gas Compression Facilities

Field gas compression facilities will be installed at both the Bibblewindi and Bohena CSG Pilots at the locations shown on **Figure 3.2a** and **3.2b**. Each unit will increase the gas pressure from approximately 100 KPa to 750 to 1000 KPa to permit the efficient transportation of CSG to the Wilga Park Power Station. The trailer or skid-mounted design will allow easy relocation or re-sizing of the compressors to accommodate changes in gas quantities to be compressed into the gas flow line. The gas compressors will operate continuously, apart from maintenance outages. All equipment required for operation of each compressor (eg. gas filtration and fuel-gas system) will be located within the enclosed unit. The oil-flooded screw compressor will be driven by a gas engine using the in-line gas from the gas wells and develop up to 1 100kW of power – although initial power requirements will typically be only 100kW. **Figure 3.3** displays an isometric sketch of the internal components of the facility.

The facilities incorporate a gravity separation system to separate any water from the gas. Further, the free water (moisture) is removed at the inlet filter separator and during the heating of the gas product prior to compression and transport.

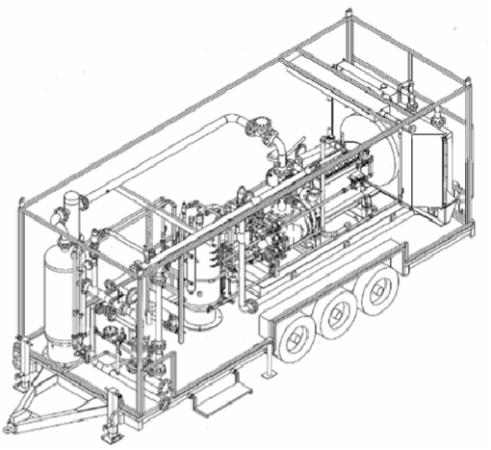


Figure 3.3
Trailer – mounted Field Gas Compressor – Isometric View

3.2.3 Gas Flow Line

3.2.3.1 Gas Flow Line Corridor

Approximately 32km of gas flow line will be installed to deliver the compressed gas from the Bibblewindi and Bohena CSG Pilots to the Wilga Park Power Station.

The proposed route as shown on **Figures 3.4** to **3.7** has been selected with due consideration of land use, environmental, cultural heritage and available access.

A 20m wide corridor has been nominated for the gas flow line although a disturbance corridor typically 10m wide is sufficient to accommodate all construction activities. Only in those areas where there is above normal quantities of brush vegetation to be stored will it be necessary to extend the width of disturbance corridor to greater than 10m.

The opportunity to make use of existing forestry tracks, fence lines and Shire road clearance envelopes for the gas flow line were investigated and adopted wherever practicable. The proposed route intersects a number of existing cleared corridors through the forested section, however, in most cases there remains little opportunity to exploit existing clearances as they tend to diverge away from the intended route.

Section 1 – 0km to 6.1km

The gas flow line corridor begins at the edge of the Bibblewindi-5 well pad (Point A) and heads west-northwest towards across moderate to heavily vegetated country passing to the south of the intersection of McFarlanes Road and Boundary Road. Heading further west-northwest, the gas flow line passes though approximately 150m of riparian vegetation before crossing Bohena Creek, exiting the western bank riparian zone and intersecting Bohena Creek Road (Point B). The corridor turns more northerly at this point utilising the Worombi and Brandons Road intersection (Point C) as a general target. (**Figure 3.4**).

Section 2 – 6.1km to 14.6km

From the Worombi Road/Brandons Road intersection (Point C), the corridor heads northwest towards Bohena-3 (Point D). From Bohena-3, the corridor heads north before intersecting Dog Fence Road (Point E) at the edge of the forested zone (**Figure 3.5**).

Section 3 – 14.6km to 23.1km

The corridor exits the forested zone (Point E) and heads in a northerly direction across open cleared pasture along existing fence lines. The corridor intersects an east/west trending road corridor (Point F) and on-farm shelter belts until it reaches Glenwood Lane (Point G). Utilising this road crossing, the corridor moves onto the western side of the shelterbelt and crosses Yarrie Lake Road (Point H) (**Figure 3.6**).

Section 4 – 23.1km to 32km

From the Yarrie Lake Road crossing (Point H), the corridor follows the eastern edges of three private property boundaries until it reaches the southwest/northeast oriented 66kV Country Energy power transmission lines (Point I). The gas flow line at this point turns to the northeast and runs adjacent to the power line corridor across freehold lands for approximately 5.3km until it reaches the Wilga Park Power Station (Point J) (**Figure 3.7**).

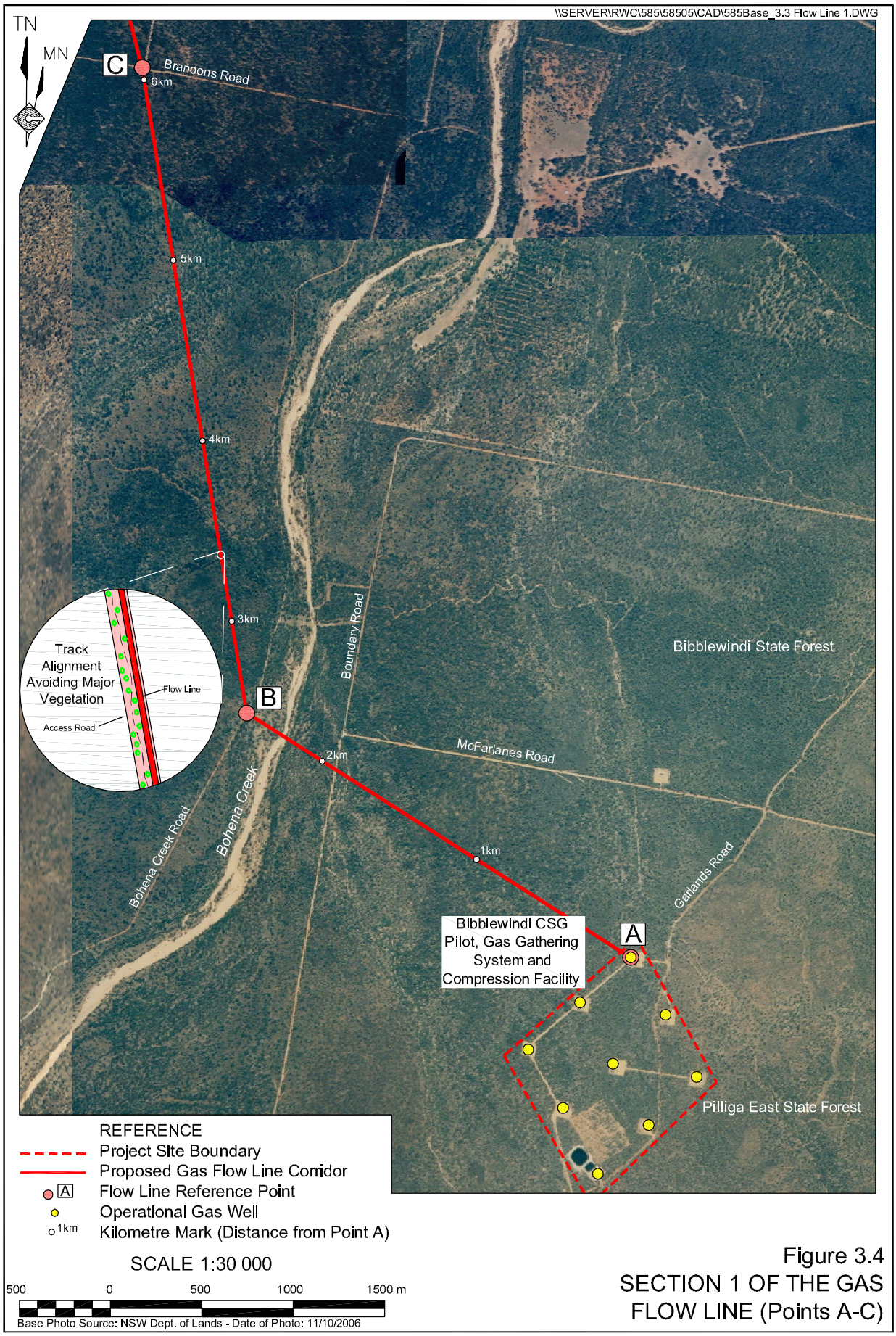


Figure 3.4
SECTION 1 OF THE GAS FLOW LINE (Points A-C)

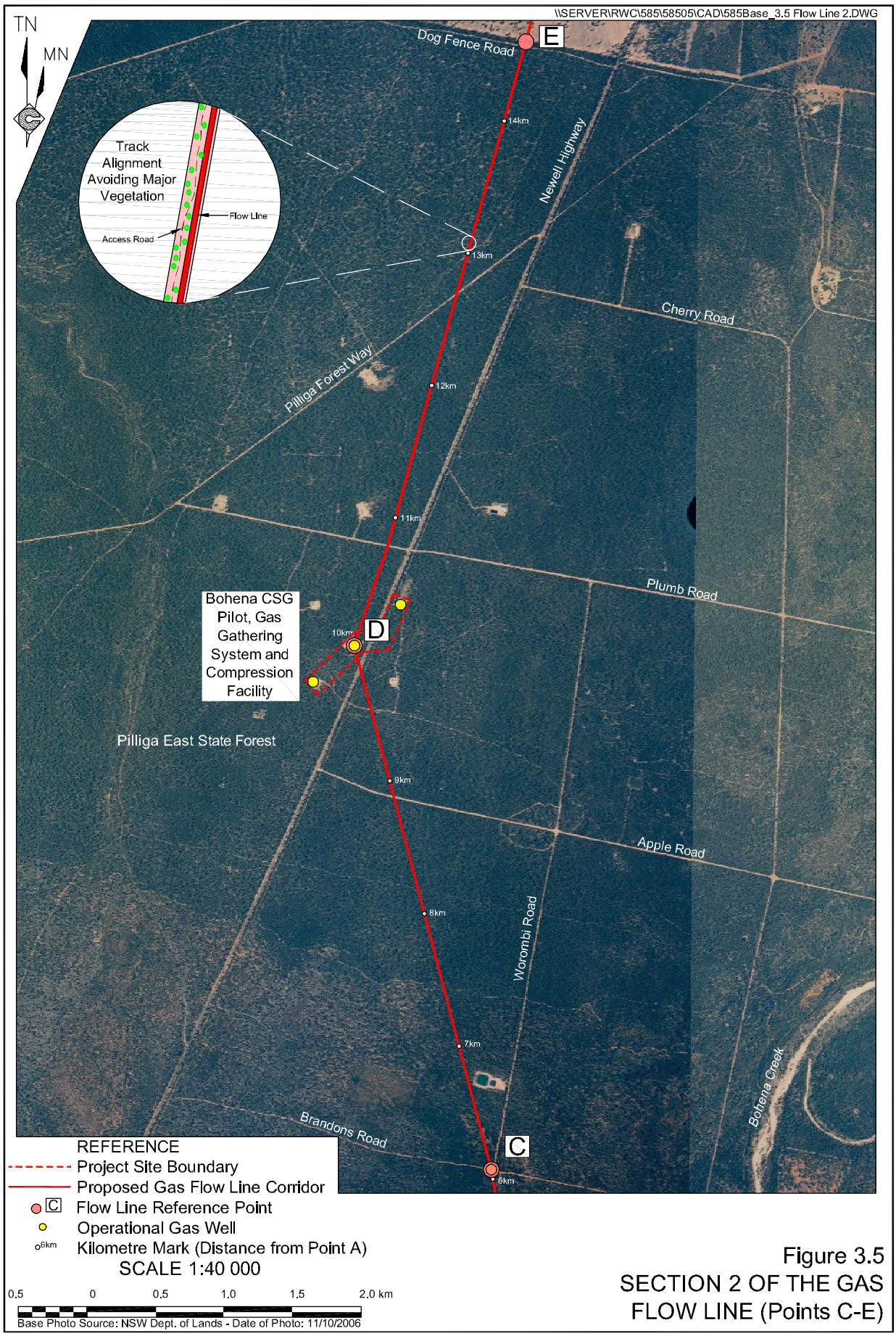


Figure 3.5
SECTION 2 OF THE GAS FLOW LINE (Points C-E)

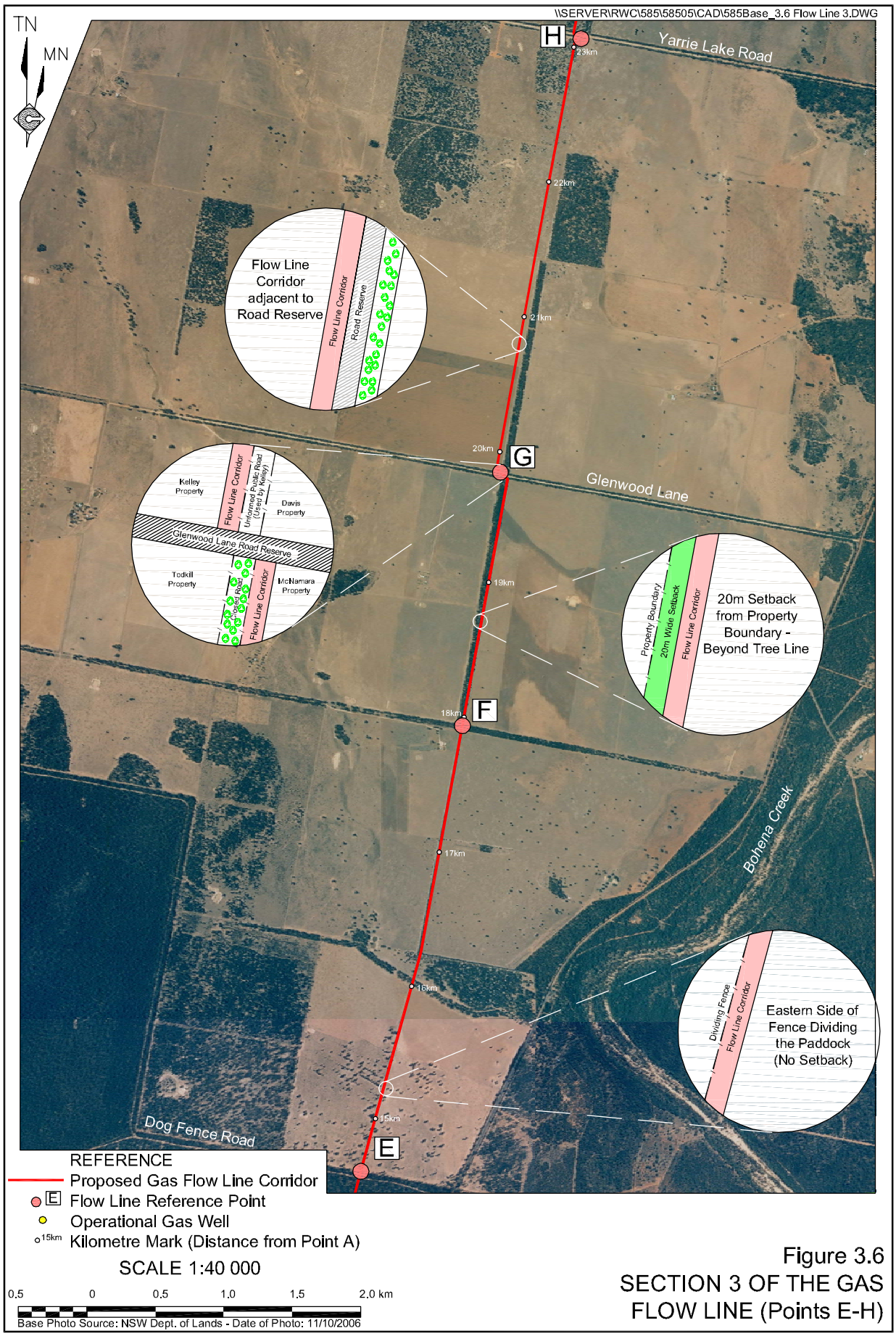


Figure 3.6
SECTION 3 OF THE GAS FLOW LINE (Points E-H)

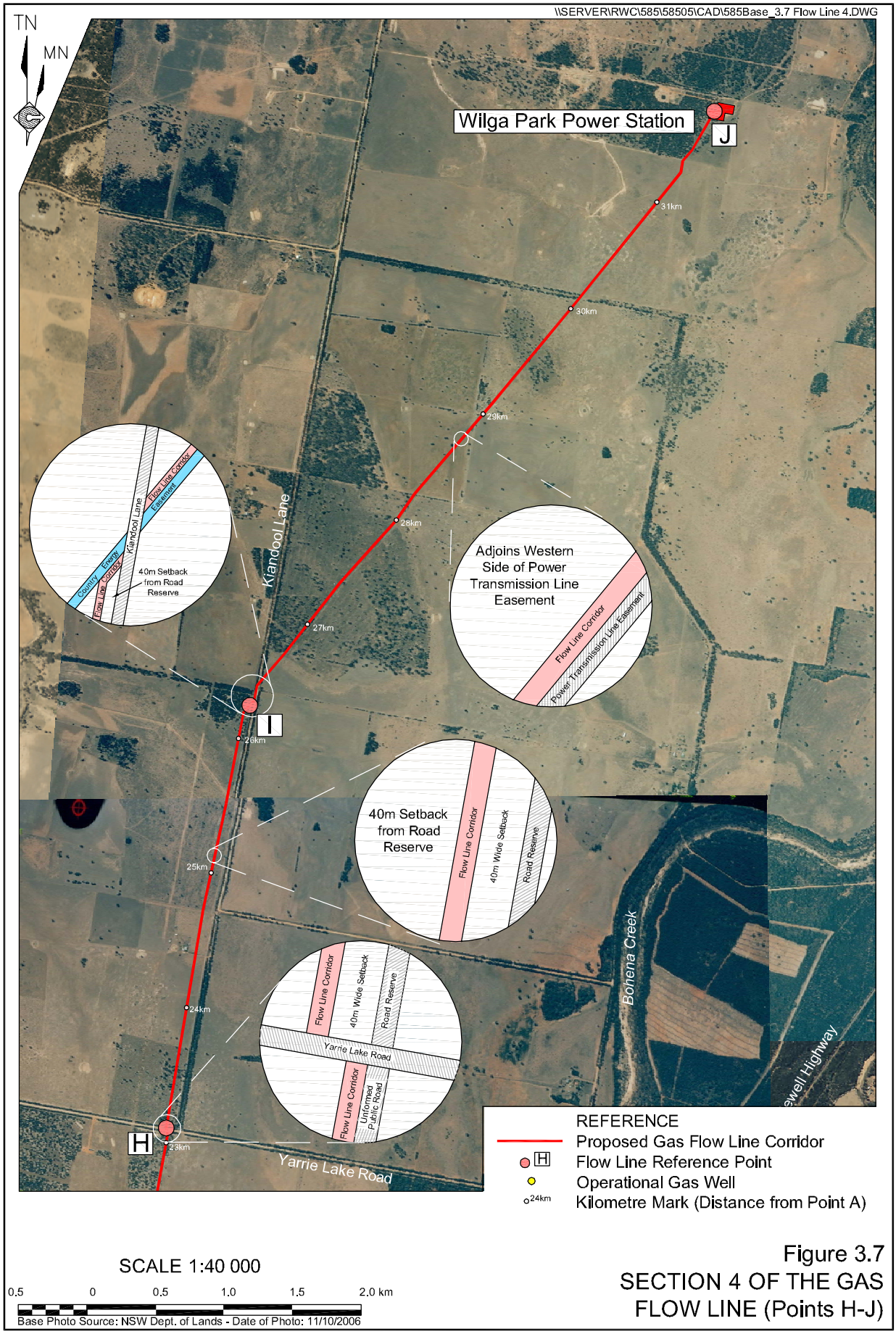


Figure 3.7
SECTION 4 OF THE GAS FLOW LINE (Points H-J)

3.2.3.2 Access to the Gas Flow Line Corridor

Access to the various sections of the disturbance corridor will be obtained via the extensive network of forestry tracks, internal property access tracks and Shire roads that service the area. Further access to the construction zone within the forested zone will be made possible by the actual corridor itself. A 3m to 4m section of the cleared area within the corridor will be made available for the movement of machinery and transport vehicles. A series of defined turning areas and staging areas will be identified along the gas flow line corridor early during the life of the Project.

3.2.3.3 Gas Flow Line Design Specifications

Table 3.1 lists the proposed specifications for the gas flow line.

Table 3.1
Gas Flow Line Specifications

Gas Flow Line Component	Design Specifications
Length	≈ 32km
Diameter	256mm Outer Diameter
Wall Thickness	4.3 mm
Material	Glass fibre reinforced epoxy (GRE)
Static Pressure Rating	450 psi at 52°C (3150kPa)
Depth Cover	750mm (minimum)
Construction Right Of Way	10m typical maximum
Pressure Testing Parameters	1.5 x standard operating pressure

3.2.4 Wilga Park Power Station Expansion and Substation Upgrade

The Wilga Park Power Station will be expanded to a capacity of 40MW by installation of additional reciprocating engine driven generators. The installed cost of generators in the 3MW size range exceeds $1,100 per kW of capacity giving a total cost for the 30MW expansion of approximately $33 million.

Figure 3.8 displays the expanded layout of the Wilga Park Power Station. Essentially, the fenced compound will be increased in area by approximately 0.5ha to provide for the following new buildings and structures.

- 10 x 3MW Generators (15m x 4m x 5m).
- 1 x New Workshop (12m x 9m x 4.5m).
- 1 x New Control Room (18m x 8m x 3.2m).
- 1 x New Amenities (8.4m x 4m x 2.8m).
- 1 x New Gas Slab (15m x 12m).

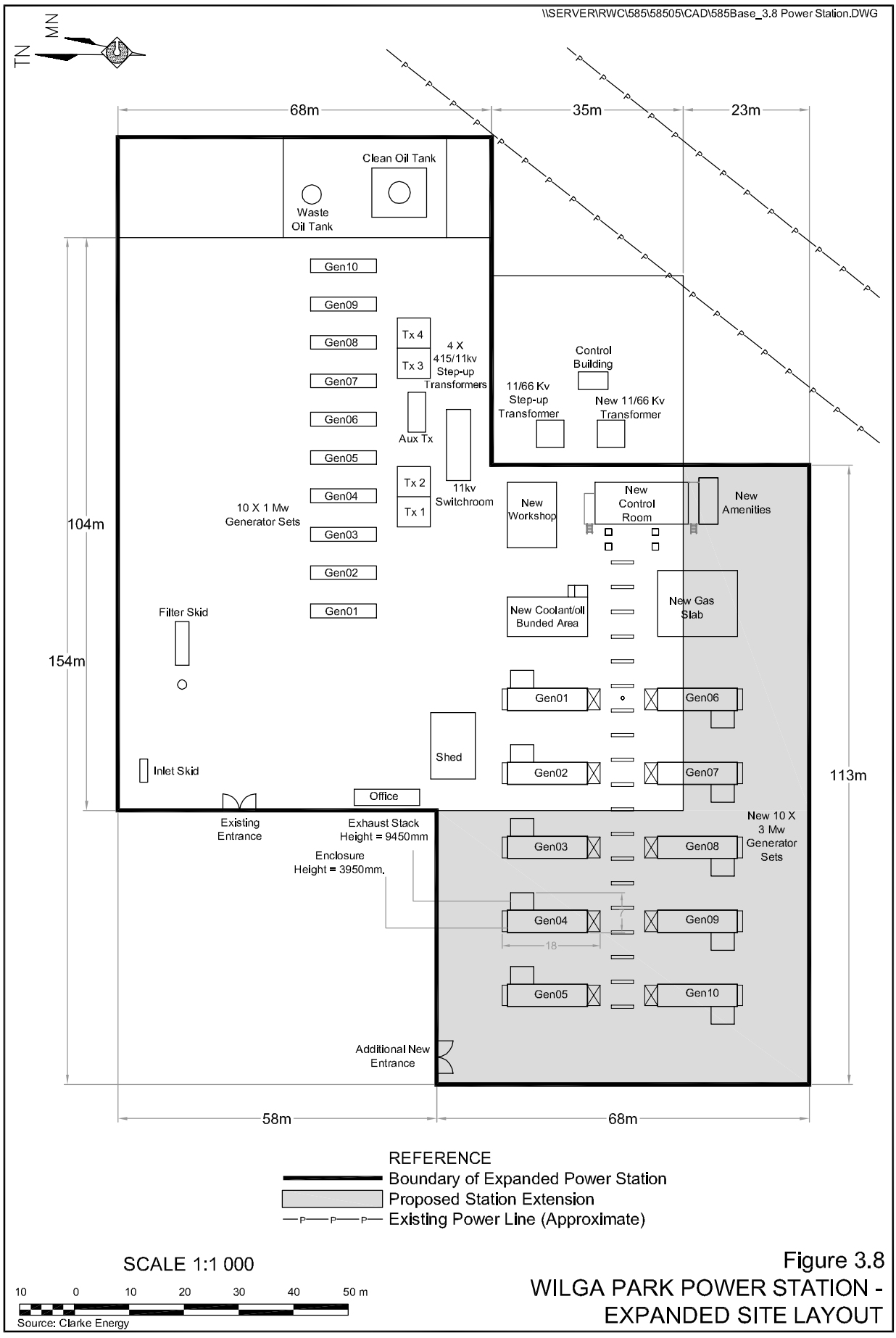


Figure 3.8
WILGA PARK POWER STATION - EXPANDED SITE LAYOUT

Plates 3.1 and **3.2** respectively display a single 3MW generator and a bank of 3MW generators, comparable to those to be installed at the Wilga Park Power Station.

A new separate entrance and lockable gate will be provided near the northwestern corner of the new compound area. Two existing pads for generating sets 11 and 12 will be removed. All other features of the existing power station will be retained.

The Wilga Park Power Station supplies electricity into the 66kV network through a substation adjacent to the power station. The substation will be upgraded to accept the increased output from the power station and will involve the installation of a larger transformer and additional circuit breaker equipment.

3.3 Approvals Required

In order for the expansion of the Wilga Park Power Station to proceed, the Proponent will require project approval from the Minister for Planning in accordance with Part 3A of the *Environmental Planning & Assessment Act, 1979*. No further approvals, leases and licences are required to complete this component of the project.

Pursuant to S138 of the *Roads Act 1993*, an application has been made to the Narrabri Shire Council to install the flow line under various Shire roads. These activities would be subject to the conditions and restrictions outlined in Shire's "*Agreement for construction of a pipeline across a Shire road*", a copy of which is reproduced as **Appendix 4**.

The crossing of Bohena Creek will require the Proponent to obtain a Controlled Activity Approval under the *Water Management Act 2000*.

It is noted that the proposed gas flowline is not a "distribution pipeline" as defined by the *Gas Supply Act 1996*.

Rather, the proposed gas pipeline is to be constructed for the purposes of conveying petroleum for the purposes of recovery of petroleum and therefore does not attract a licensing requirement under the *Pipelines Act 1967*. Confirmation of this interpretation has been provided to the Department of Planning by the Deputy Director-General of the Department of Primary Industries - Mineral Resources (**Appendix 6A**).

3.4 Construction Activities

3.4.1 Introduction

The Project construction activities will involve the following.

1. Installation of the GGS and gas flow line in both Forestry lands and cleared agricultural lands.
2. Crossing of the Newell Highway and Shire Roads.
3. Crossing of Bohena Creek.
4. The expansion of the Wilga Park Power Station

Plate 3.1 A 3MW Generator

Plate 3.2 A bank of 3MW Generators

Each of these activities are described in the following subsections.

3.4.2 Installation of the Gas Gathering System and Gas Flow Line

Figure 3.9 displays the sequence of activities required to install the gas gathering system and gas flow line.

Those component activities involving vegetation clearing and replacement will not be required on open agricultural lands (steps 1 & 2, **Figure 3.9**).

Surveying the Gas Flow Line Corridor

The proposed gas flow line corridor will be surveyed by a registered surveyor before any preparatory activities take place. Within the forested area, the corridor will be marked clearly to avoid wherever possible any substantial trees, particularly hollow-bearing trees on or near the proposed route. In the event the alignment of either the trench or adjoining access road cannot avoid a mature tree, it will be clearly marked for later removal and relocation to an adjacent area.

Vegetation Clearance

Within either the Bibblewindi or Pilliga East State Forests, all commercial forestry products will be removed and stored in the closest staging area for later collection by Forestry NSW or its contractors. All hollow-bearing trees felled will be relocated to adjacent bushland. All remaining vegetation will be cleared from the corridor with limited quantities stockpiled at the extreme edge of the corridor and the remainder removed for mulching (see **Figure 3.9**).

Topsoil Stripping and Stockpiling

The topsoil within the corridor will be stripped to a depth of at least 100mm and stockpiled next to the retained vegetation

Trench Surveying

The location of the trench centreline will be marked within the surveyed corridor.

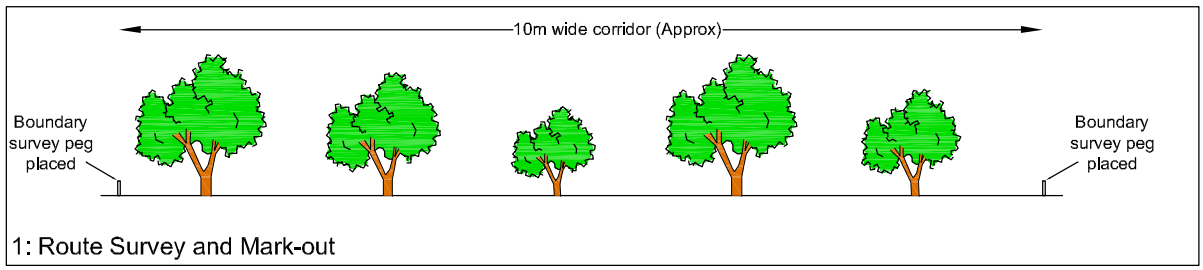
Trenching

The trench will be formed by wheel or chain trencher or excavator (see **Plate 3.3**). Subsoils will be stockpiled in a windrow on the opposite side of the corridor to the topsoils. In the event that any hard rock or hardpan layer is encountered during trenching, a rock saw or other suitable machinery will be employed to achieve and maintain the correct trench depth.

Flow Line Jointing

The individual lengths of gas flow line lying alongside the trench will be picked up by the jointing crew and placed onto the Adtech installation machine.

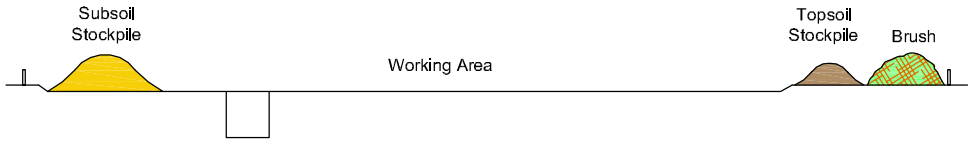
\\SERVER\RWC\585\58505\CAD\585Base1_3.9 Gas Flow.DWG



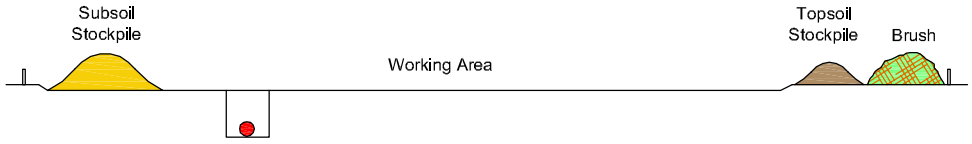
1: Route Survey and Mark-out

2: Vegetation Clearing and Stacking

3: Topsoil Stripping and Stockpiling

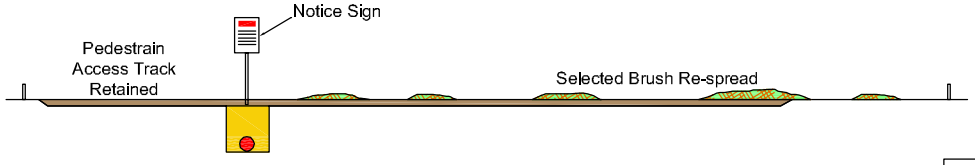


4: Trench Excavation



5: Flow Line Placed and Hydro-tested

6: Flow Line Buried and Soils Replaced



7: Site Rehabilitated / Flow Line Location Signage Installed

Figure 3.9
INDICATIVE GAS FLOW LINE INSTALLATION SEQUENCE- FORESTRY LANDS

Plate 3.3 Trenching Process

Plate 3.4 Adtech Installation Machine

Plate 3.5 Gas Flow Line Placement

The jointing crew will prepare the threaded sections of the two lengths of pipe and the installation machine screws them together with a predetermined level of force.

The completed flow line is run off the back of the installation machine and directly into the trench as shown in **Plate 3.5**.

Pipe Hydrotesting

At regular intervals during the gas flow line construction period, sections of the gas flow line will be filled with water and pressurised to 125% of its design pressure for a minimum three hour period. In addition to computerised monitoring of the pressure test, each joint along the testing section will be inspected for visible leaks.

The water utilised for hydrotesting purposes will be sourced from the water treatment plant located at Bibblewindi-1 or from an alternate suitable supply. At the completion of the test, the water can be reused for further sectional Hydrotesting or transported to the nearest on farm dam for stock consumption. The fibreglass pipe does not contain any agents that will contaminate the Hydrotesting water and render it unsuitable for reuse in this manner.

Backfilling and Restoration

The backfilling of the trench will commence at the completion of the Hydrotesting procedures. A magnetic identification/warning tape will be installed approximately 300mm above the gas flow line itself. The compaction of the backfilled subsoil will be closely monitored to minimise the chances of subsequent settling within the trench. Additional fill may be imported from suitable local supplies (subject to landholder approval). The topsoil stockpile will only be accessed once the trench has undergone sufficient backfilling and compaction. The respreading of topsoil will be closely followed by the respreading of retained vegetative material (where available) to assist in soil stabilisation in accordance with agreed forestry protocols for site rehabilitation.

3.4.3 Newell Highway Crossing

Reliance will be made upon an existing piped crossing beneath the Newell Highway between Bohena-3 and 7 at the Bohena CSG Pilot for the proposed GGS to be installed between these two wells.

The proposed new crossing of the Newell Highway adjacent to the Bohena CSG Pilot for the flow line from the Bibblewindi CSG Pilot will be carried out using a mechanical horizontal boring technique in accordance with RTA requirements. Mechanical boring in this manner is a well recognised low impact construction technique that involves drilling short distances below ground surface to avoid unnecessary impact on traffic flow. The process will involve the following steps.

1. Access pits will be established on both sides of the road reserve. The drilling pits will be approximately 25m x 5m and the receiving pits approximately 5m x 3m. Topsoils and subsoils will be handled in the manner nominated in the soil management plan.

2. A steel sleeve will be placed a minimum 1.2m below the road lowest point in the road reserve.
3. The pipes will be passed through the sleeve and joined to the main gas flow line.
4. The access pits will be backfilled and the surface area re-instated in accordance with the approved rehabilitation plans.

Figure 3.10 displays schematically the configuration of the crossing beneath the Newell Highway.

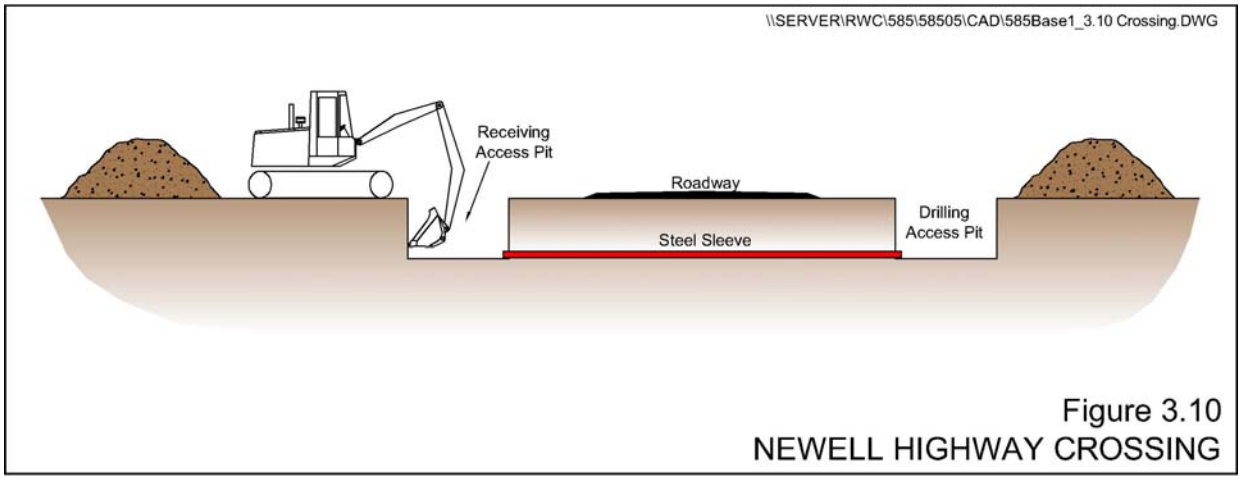


Figure 3.10
NEWELL HIGHWAY CROSSING

3.4.4 Bohena Creek Crossing

The crossing of Bohena Creek will involve either a similar open trench installation procedure to that outlined above or the horizontal directional drilling procedure used beneath the Newell Highway. It is recognised the water-bearing, unconsolidated sand creek bed could pose some constraints to the open trench method, however, the adopted procedure will depend upon the contractor selected and the status of the creek bed at the time of installation.

The open trench procedure involving the installation of the pre-joined and hydrotested gas flow line within the creek margin will be completed according to the following construction program.

1. The trench within the sand bed will be formed with an excavator to achieve the increased trench depth (at least 2m). The trench may be up to 4m in width due to the angle of repose caused by the large grained sands within the creek bed. All excavated material will be stockpiled as a single windrow on the non-operational side of the trench.
2. Subsurface water flowing into the trench will be controlled with the installation of spear pumps upstream of the trenching zone. The water will be transferred an appropriate distance downstream of the working area.

3. The pre-joined and hydrotested gas flow line will be placed within the trench and anchored with concrete ballast to prevent the pipe from floating (rising to the surface of the sand creek bed.
4. The trench will be backfilled with the spoil and smoothed over as the excavator vacates the construction zone.
5. Rehabilitation will involve relacing the sand within the creek bed itself and paying particular attention to the river banks traversed by the trench and gas flow line.

Figure 3.11 displays the planned cross-section through the Bohena Creek crossing using an open trench.

The procedure involving horizontal directional drilling, if used, will be undertaken in the same manner as that intended to install the flow line beneath the Newell Highway (see Section 3.4.3). The drilling and receiving access pits will be of similar dimensions and located in a stable area set back from the creek embankment.

3.4.5 Shire Road Crossings

The installation of the gas flow line across existing Shire Roads will occur in accordance with Council's requirements provided to the Proponent (see **Appendix 4**).

The planned Shire road crossings will be carried out with a minimal disruption to local traffic and nearby residents.

3.4.6 Wilga Park Power Station Expansion

The expansion of the Wilga Park Power Station will involve the following component activities.

- Importation and compaction of approximately 1500m^3 of suitable base material to create the compound surface within the extended site.
- Excavation, construction / installation of all subsurface pipe work.
- Construction of concrete foundations for all generators and new buildings.
- Construction of all new buildings.
- Placement and connection of all new generators.
- Installation of upgraded transformers and related electrical equipment.
- Erection of a perimeter fence.

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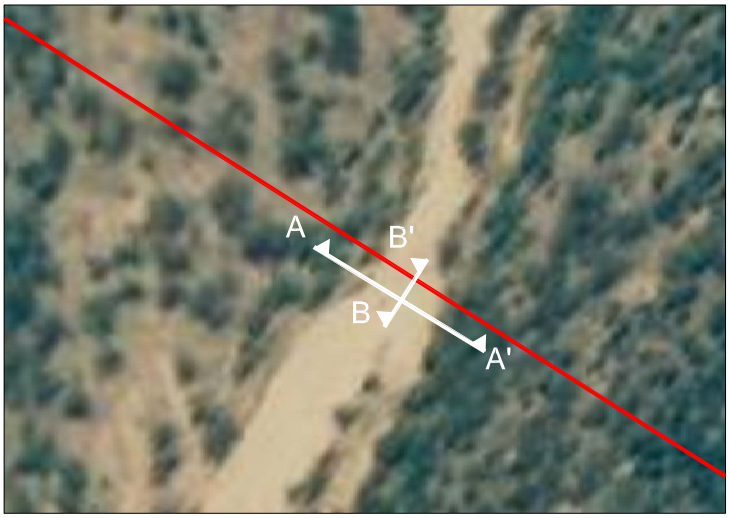
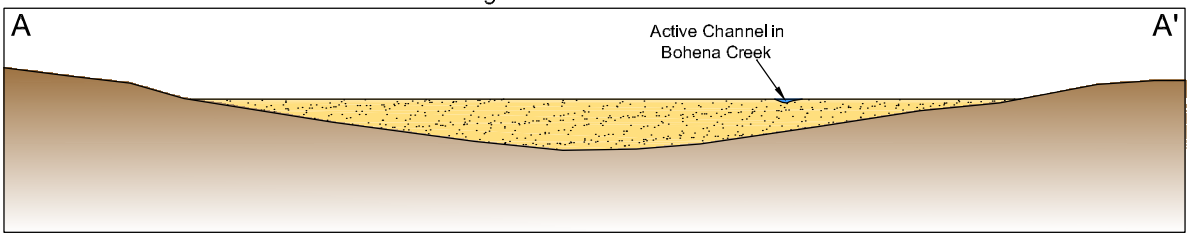
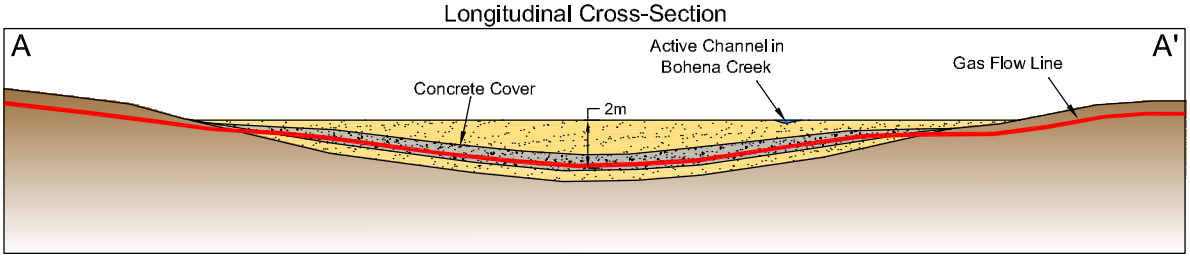


Longitudinal Cross-Section



Longitudinal Cross-Section



Transverse Cross-Section

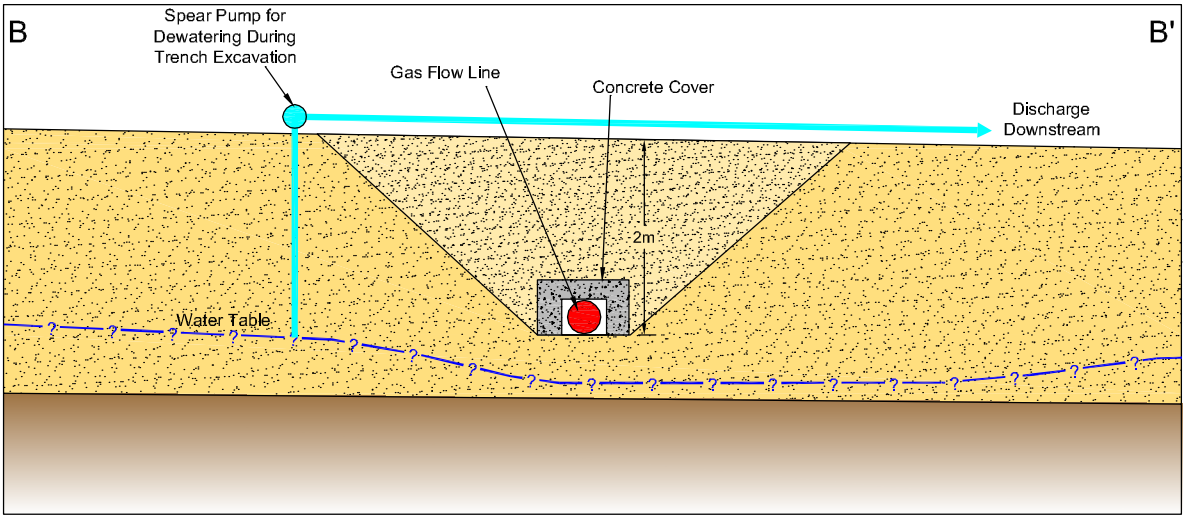


Figure 3.11
INDICATIVE BOHENA CREEK CROSSING

3.4.7 Equipment

Equipment required for the construction / installation of the gas gathering system and gas flow line is outlined in **Table 3.2**.

Table 3.2
Equipment and Machinery List

Proposed Use	Machinery / Equipment
Logging/Vegetation Removal	2-5 x Husqvarna 375 or Stihl 044 Chainsaws
	1x Bell 125 Ultra Logger
Corridor Preparation	1 x Caterpillar D6N Bulldozer
	1 x Caterpillar 140G Motor Grader
	1 x Hyundai 210C Excavator
	1 x Bobcat Skid Steer Loader
Pipe / Gas Flow Line Trenching	1 x Trencor 760 HDA Chain Trencher
	1 x Directional Drilling Machine
Gas Flow Line Installation	1 x Adtech Pipeline Installer
Transport/Support	2 x Prime Movers & Low Loaders
	1 x 10 000L Water Cart
	12 x Light 4WD Vehicles (Patrol/LandCruiser or eqiv)
	1 x Off-road forklift/front-end loader
	2 x Truck mounted HiAb flat-bed trucks

3.4.8 Pipe Delivery and Bulk Materials Supply

The materials required to construction and installation of the gas flow line will include:

- bulk supply of the 250 mm GRE Pipe; and
- materials required for the operation of the Adtech Installer

The pipe material will begin arriving on site once the gas flow line corridor preparation is nearing completion and be delivered to pre-determined drop-off points or staging areas. Each transport container will carry 500m of pipe. The pipe will be removed from the containers and loaded onto the HiAb by forklift for distribution along the work zone, where required.

3.4.9 Utilities and Services

3.4.9.1 Water

The suppression of dust along the disturbance corridor will be a key issue to be managed during the construction period. At the completion of the activities required to prepare the gas flow line corridor, the likelihood of fugitive dusts being generated by the movements of vehicles and other construction-based activities within the corridor increases. However, the working of excessively damp or wet soils across all SMU's during this period can present issues to the effective protection of soil structure as described in section 7.3.2 of the soils assessment report (see Part 4 of the *Specialist Consultant Studies Compendium*).

For the duration of the construction period, a water cart will be located near to site to provide adequate dust suppression along access and egress pathways where required.

Water required for various construction activities and for dust suppression will be sourced from (in order of preference):

- water treatment pilot plant located at Bibblewindi-1;
- licensed (DWE) groundwater bores at Bibblewindi-1 and Bibblewindi-5 well pads;
- Narrabri Shire Council supplies; or
- from a suitable alternative local supply.

The estimated quantities of water required for the duration of the construction period are based upon the deployment of the 10 000 L water carts. Working on access and egress pathways close to the active section, the maximum quantities of water consumed per day is unlikely to exceed 20 000L based upon a twice daily deployment. Based on the estimated 90 day construction period from vegetation clearance to the completion of rehabilitation, at a rate of 20 000L per day the water requirements for the Project's dust suppression program will approximate 1.8 ML.

3.4.9.2 Power

All power requirements during the construction period will be obtained using small mobile generators and / or mobile earthmoving equipment. Limited mains power will be available for use during the expansion of the Wilga Park Power Station.

3.4.9.3 Communications

Reliance will be placed upon mobile phone coverage and VHF radio during the construction period.

3.4.10 Waste Management

Waste materials generated during the construction period will include:

- construction materials waste such as timber, plastic and small amounts of metals.
- general domestic refuse; and
- wastes such as engine lubricants and coolant fluids.

In accordance with good field practice, work crews will be required to contain waste materials within rubbish cages located at regular points along the active construction zone. Wherever possible, waste materials will be collected for recycling and/or reuse or otherwise be transported for disposal at the Narrabri Waste Depot.

3.5 Project Operations

3.5.1 Gas Gathering System and Gas Flow Line

3.5.1.1 Operations

The operation of the GGS and gas flow line does not require any specific operational activities on behalf of the Proponent. Once the GGS connects the CSG wells to the gas flow line inlet and compression unit, operation is automatic. The main operational focus will be monitoring of the CSG wells and the compression units.

3.5.1.2 Utilities and Services

No specific utilities or services are commonly required to permit the operation of the GGS and gas flow line. The field compression units are powered by the gas within the gas flow line. Periodic maintenance of surface equipment will occur in accordance with manufacturer's recommendations; however, the specific requirements for any such programs will be met by the Proponent's field staff.

3.5.1.3 Waste Management

No specific waste management plan is required for the operation of the GGS and gas flow line infrastructure.

3.5.2 Wilga Park Power Station

3.5.2.1 Operations

The operation of the power station involves predominantly monitoring and planned maintenance activities on the gas driven engines. The Proponent employs two full time power station attendants to complete all activities associated with the operation of the facility.

3.5.2.2 Utilities and Services

Service requirements for the power station include the delivery of material supplies including engine lubricants and other consumable items provided by specialist vendors.

All other service and supply activities are assumed by employees of the Proponent.

3.5.2.3 Waste Management

The generation of waste materials during the continued operation of the gas flow line and power station will comprise predominantly of those materials utilised in the operation and maintenance of the gas driven engines.

The disposal of engine lubricants and coolant fluids is currently completed by a licensed service agent. All used lubricants are collected from the dedicated used oil storage tanks and transported off site for recycling.

Other non-recyclable rubbish including putrescible wastes, are stored in appropriate rubbish receptacles on site for later collection by a local rubbish removal contractor.

3.6 Hours of Operation and Project Timetable

3.6.1 Construction Phase

Hours of operation during the construction period will be between 7am and 6pm, seven days per week.

Table 3.3 lists the indicative timetable for the construction phase.

Table 3.3
Construction Phase Indicative Timetable

Activity	Weeks										
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55
Construction / Installation of the Gas Flow Line.											
Installation and Testing of Gas Gathering System.											
Installation and Commissioning of Field Compression Facilities.											
Wilga Park Power Station Expansion and Substation Upgrade.											

3.6.2 Operating Phase

The GGS, gas flow line and expanded power station development will be in operation over a 24hr/7 day cycle.

3.7 Employment

3.7.1 Construction Phase

The construction of the Project will involve up to 30 individuals working in small groups along various sections of the Project Site. Most general contracting (corridor preparation, fencing and rehabilitation) will be sought from local service providers. Specialist services are likely to be sourced from outside the Narrabri region, however, all attempts will be made to maximise the employment of local contractors.

3.7.2 Operating Phase

As the Project is designed to generally operate automatically, most operational phase employment will concentrate on the maintenance of the two CSG pilots (wells and surface facilities) and various other Project-related infrastructure. A total of 10 personnel are likely to be directly employed to carry out daily operations.

3.8 Rehabilitation

The rehabilitation of the gas flow line corridor will commence as soon as practicable after the construction activities have ceased.

There is no rehabilitation planned for the current or expanded Wilga Park Power Station facility.

3.8.1 Rehabilitation Objectives

The main objective of the rehabilitation program will be to return the disturbed land back to its previous land use as soon as practicable after the cessation of construction activities. Due to the differences in the land use activities between the State forest and farmland zones, the rehabilitation activities will vary slightly.

3.8.1.1 Forestry Lands

The rehabilitation program within the Forestry land will focus on the GGS route and gas flow line corridor. The GGS route will, where required, be rehabilitated in full while the gas flow line route will be reduced from the maximum 10m width required for construction to a narrow track suitable for ongoing pedestrian or 4WD access (see **Figure 3.9 step 7**). The retention of this narrow track will permit access for future monitoring and maintenance, if required. The track width through Forestry Lands would be discussed with Forestry NSW, however, it is the Proponent's intention to maximise the length of pedestrian tracks along the GGS route and gas flow line corridor through Forestry Lands.

Along this section of the disturbance corridor, where soils are less fertile and are likely to contain seed stocks of slower growing native species, the primary goal will be the stabilisation of topsoils and therefore the minimisation of incidental erosion by surface flows during and after rainfall and wind. Utilising a method known as 'brushing', a proportion of stems, branches and foliage harvested and stockpile along the edge of the disturbance corridor during clearing will be replaced over the cleared area after the respreading of topsoil stocks. The method is quick, provides a physical barrier to incidental erosion, yet, with limited placement of brush will not introduce unmanageable quantities of combustible material to the forestry lands.

This method will not introduce any new materials that may harbour weeds and diseases and facilitates the germination and establishment seed stored in the retained brush. It will be used together with retention and replacement of topsoil, and will also facilitate germination and establishment of seed from the soil seed bank. No additional oversowing of the disturbance corridor is planned.

No additional tree or shrub planting scheme is planned within the Forestry lands. Previous experience with the introduction of seedlings in a rehabilitation effort at Bohena-2 suggests natural regeneration is more successful as it generally initiated and supported by natural rainfall patterns. The rehabilitation of the Jacks Creek North-1 well site utilised the brushing technique described above. This example provides the basis for the rehabilitation of the disturbance corridor within the East Pilliga and Bibblewindi State Forests.

3.8.1.2 Farmland

The rehabilitation of open agricultural areas in the freehold farmlands will commence as soon as practicable once the construction activities have been completed.

While the specific terms of the corridor and access agreements with each private landholder will detail the specific rehabilitation strategy more clearly and with regard to summer/winter cropping or planned pasture improvements, the following general actions will be undertaken:

- Topsoils and subsoils will be strictly segregated during the construction process;
- Preparatory activities (ploughing, harrowing, tilling and fertiliser application) will be undertaken along the disturbed zone, where directed;
- Appropriate pasture seed mixtures will be applied where required; and
- The area within the corridor will be returned to the landholder as soon as practicable.

3.8.2 Monitoring and Maintenance

As part of the agreed access agreements with each landowner, there is an ongoing commitment to monitor the disturbed/rehabilitated corridor for the duration of the rehabilitation program. Aspects of the rehabilitation program that will be monitored on a minimum quarterly basis, or as required by the landholder, and will include:

- evidence of slumping within the flow line trench;
- suggestion of excessive erosion or topsoil instability; and
- issues with natural or improved drainage.

Remedial action will be taken where issues such as described or otherwise are evident and in consultation with the landholder. No time limit will be placed upon the monitoring and maintenance program.

3.9 Project Alternatives

3.9.1 Introduction

In general terms, the Project relates directly to the utilisation of the initially small volumes of natural gas produced from the Bibblewindi and Bohena CSG Pilots whilst undergoing production testing. Further to the development of additional CSG production wells across PAL2, the CSG produced during the early stages of production will supplement the gas from Bibblewindi and Bohena, assisting with the proposed expansion of the Wilga Park Power Station.

The Project alternatives considered, and rejected in favour of the proposed activities, relate to flaring and/or venting of produced gas or the "do nothing" approach. Each of these alternatives is discussed in the following subsections.

3.9.2 Flaring and / or Venting of Produced Gas

The flaring and/or venting of gases from petroleum wells are standard operational activities whilst the wells are being drilled. Any gas flows encountered during drilling that cannot be controlled by the drilling mud system are alternatively controlled by the blow out prevention system and diverters on drill rigs. Often the gases are ignited for short periods in the field to assess their quality and composition.

CSG production generally requires the installation and operation of pumps at or below the target coal seams to permit a reduction of hydrostatic pressure and encourage the generation of gases adsorbed to the coals surfaces. During the early stages of production, small but increasing quantities of gas are desorbed from the coal, brought to the surface as a gas/water mixture that is then separated. The water fraction is collected for treatment, impoundment and evaporation and the gas vented to atmosphere or reused to power the surface equipment and pumping systems.

The venting of small volumes of gases during the production phase is inevitable. The nature of CSG production aims to increase rates of gas production over the longer term and while some gas can be captured and reused for power generation or other purposes on site, once the rates of production exceed potential consumption from integrated power generation units, the remainder is vented to atmosphere or flared on an as needs basis.

Venting to Atmosphere

The volumes of gas being generated at the Bibblewindi and Bohena CSG Pilots are significantly greater than will be expected from single, unconfined wells. As discussed previously, the reservoir modelling and predictions of well performance anticipate that CSG will be available from the Bibblewindi CSG pilot at an aggregate rate approaching 7 to 10TJ/d, with an additional 0.1 to 0.5TJ/d of gas supplied by the Bohena CSG Pilot.

The integrated power generation units installed at each well site consume approximately 0.03TJ/d and provide power to the pumps, controls, metering and telemetry systems located at each CSG well. Gas produced above the small volume required at each site is then vented to atmosphere.

As discussed in Section 2.5, methane is a highly effective greenhouse gas with a global warming potential some 25 times than carbon dioxide. The venting of gases from the CSG pilots presents a significant environmental issue that in the presence of a viable alternative is clearly undesirable. .

Flaring

The Project Site, and more specifically the CSG wells, are located predominantly within the boundary of the Pilliga East and Bibblewindi State Forests of which Forestry NSW is the landholder. The risk of bushfire posed by the flaring of natural gas in this environment cannot be mitigated to a sufficient degree and hence the flaring of natural gas produced from the Bohena and Bibblewindi CSG pilots is not considered an appropriate alternative to the Project due to the constraints imposed by the operational environment.

The "Do Nothing" Alternative

The implementation of the Narrabri Coal Seam Gas Utilisation Project is a small, integral part of the overall objective of developing a proportion of the estimated 17 TCF of gas-in-place within PEL238. As a means to facilitate further development of the resource, the proposed gas utilisation Project is designed to capitalise on the gas generated during the production testing phases of the Bibblewindi and Bohena CSG Pilots and furthermore mitigate the greenhouse gas impacts of the exploration and appraisal process.

The NSW Government has highlighted a critical need for additional electricity generation capacity to meet peak load demands across the State. Additionally, with no indigenous gas resources capable of supplying growing industrial and domestic energy demands along the eastern seaboard, the reliance on gas transported from the Cooper Basin and offshore Otway will continue to increase.

The operation of the Wilga Park Power Station utilising the natural gas produced from the Coonarah Gas Filed represents a sound strategy for the monetisation of essentially a stranded gas resource. With no transmission flow lines in the area, the "gas to embedded power" business model was considered an ideal strategy with which to provide a stable platform for the ongoing exploration and development of a commercial reserves base to support large scale exports of gas to major consumers and possibly metropolitan centres. The Wilga Park Power Station is now in its fourth year of operation; however, power output has been limited by a gradual decline in gas deliverability from the Coonarah Gas Field. Based upon these factors, the strong strategic relationship between the Wilga Park Power Station and the CSG Project is quite clear and the opportunity to supply gas from the Bohena and Bibblewindi CSG Pilots presents a range of economic and social benefits.

From an environmental standpoint, the continued operation of the existing CSG pilots and the venting of gases to atmosphere produces a relatively large environmental footprint for what is generally a very low impact activity. Without due consideration of the role the two pilots play in the strategic development of the Joint Venture primary objectives, with no viable alternative for the consumption of CSG *in situ* nor alternatives such as combustion through flaring, the full impact of the current strategy will continue to be realised.

It is for these reasons that the 'do nothing' alternative is considered unviable.

3.9.3 Gas Flow Line Route Alternatives

A number of route alternatives for the flow line were investigated taking into account various strategic objectives, route selection criteria, economic considerations, social and environmental impacts. **Figure 3.12** presents the alternatives routes considered, namely the:

- preferred route (Route Option 1);
- non-preferred route (Route Option 2); and
- an early alternative pipeline route.

The preferred route has been selected following a number of revisions that have taken into account:

- the collection and supply of CSG to the Wilga Park facility;
- its proximity to ESG's current CSG exploration areas;
- economic and construction feasibility;
- consideration of environmental, heritage and social impacts;
- acceptable transmission costs; and
- acceptable environmental, heritage and social impacts.

Table 3.4 lists the rationale relevant to each of the selection criteria for the flow line route.

Table 3.4
Selection Criteria for Flow Line Route

Route Selection Criteria	Rationale
Most direct route	Minimising the length of the route may offer significant economic, environmental, social and logistical benefits
Location of existing disturbances	May provide some reductions in cumulative impacts or avoid sensitive areas
Land Use	Minimise the impacts on existing and future potential land use
Topography	Avoidance of landforms likely to cause logistical and construction issues would reduce the difficulty and cost of project
Areas of cultural/heritage significance	Avoiding route options that do not respect sites of significance will limit possibility of delays and other ongoing constraints
Infrastructure construction	The route needs to consider any and all aspects likely to influence the design and construction of the pipeline

Following a preliminary desktop-based assessment of potential gas flow line routes linking the CSG pilots to the Wilga Park Power Station, a series of field based environmental surveys were conducted to further identify any constraints associated with each potential option. The survey efforts included:

- two separate flora surveys by Mr Greg Elks of Idyll Spaces Ecological Consultants;
- one fauna survey by Mr Keith Kendall of Kendall and Kendall Ecological Consultants;
- one Aboriginal heritage survey by Trindall (Pilliga Forest Aboriginal Management Committee); and
- an informal pipeline construction feasibility survey carried out by Eastern Star and Adtech FRP Pty Ltd.

These desktop and field based investigations focused on the following:

Actual and potential impacts on the biotic (flora and fauna) environment including the extent of vegetation modification and clearance.

- Idyll Spaces (2008) indicates that the main vegetation community encountered between the Bibblewindi CSG Pilot and the edge of the forested zone is the regionally common and widespread *Eucalyptus crebra* (Ironbark) Dry Open Forest. Smaller areas of forest where Pilliga Box and Redgum are more common where identified closer to Bibblewindi. No threatened species or endangered ecological communities were identified within the State Forest lands. No obvious constraint in this regard were identified, however, the route selected focused on minimising the cumulative clearance impacts (i.e. the most direct route).
- The possibility of reducing the cumulative area of native vegetation cleared was investigated through utilising existing roads and clearances within the forested zone. This can be identified by the divergence of the two route options approximately 6km from the Bibblewindi CSG Pilot/compression facility (Point C on **Figure 3.5**). The alternate route follows an existing forestry road and was believed to offer a small reduction in the extent of vegetation modification by utilising the road as the construction working area. However, the cumulative area of vegetation impacted by Route Option 1 and Option 2 is 13.1ha and 13.8ha respectively due to Route Option 2 encountering a densely vegetated Travelling Stock Route north of the forested zone (due east of Point E along Dog Fence Road - **Figure 3.5**). This effectively consumed the savings made further south.

Actual and potential impacts on the abiotic (soils, water and geotechnical) environment.

- The location and method of crossing Bohena Creek and the sometimes extensive geomorphic features within the riparian zone was discussed and investigated with the pipeline contractor. Notwithstanding the construction issues identified with traversing an unconsolidated sand creek bed, the width of the riparian zone and the creek bed itself varies significantly. The proposed and alternate routes both cross the creek at an area where the width of the creek and riparian zone are comparatively small and where an existing road on the western bank provides good access to the crossing point.

Actual and potential impacts in culturally significant sites.

- The desktop investigations completed prior to the Aboriginal heritage survey efforts indicated that a cluster of Aboriginal cultural sites had been identified near Bohena Creek within a reasonable distance of the Bibblewindi CSG Pilot. Discussions with the PFAMC heritage officer and external environmental consultants concluded that the plans to cross the riparian zone at the proposed point would observe an extended buffer zone around the known sites and any undiscovered sites on or near this area.
- The possible scarred tree identified during the Aboriginal heritage survey is located to the north of the Bohena CSG Pilot. The route prior to this discovery used the Bohena-4L well site (west of 11km mark on **Figure 3.5**) as a waypoint between the Bohena-3 well site/inlet manifold/compression facility (Point D - **Figure 3.5**). A revision of the route now avoids Bohena-4L and the heritage site to permit the inclusion of an adequate buffer zone for its protection.

Land use constraints associated with operating within Crown Land State Forests and freehold lands zoned under local environmental plans (corridor creation, occupation permitting, access agreements and compensation).

- Consideration of future Forestry NSW commercial activities. No current or near future commercial harvesting plans are in effect for the forestry compartments encountered along the proposed or alternate routes, however, these factors were considered during desktop investigations.
- Consideration of freehold land owners outside of the forested zone and any possible conflict with current and future land uses. The private access and corridor agreements negotiated with each landholder impacted by the proposal followed an inclusive, consultative process designed to minimise the impact of construction and operation on land use practices. The placement of the pipeline along fence lines and paddock margins achieves this objective.

Capital and operating expenditure estimates.

- The overall length of the pipeline was a significant consideration for all options considered including the final two options. Route Option 1 is approximately 4km shorter than Route Option 2 due to the latter's indirect pathway via the Travelling Stock Reserve. Route Option 2 would also have required the installation of a gas 'spur line' that would deliver gas from the Bohena CSG Pilot to the main flow line east of Point D (**Figure 3.5**). The cost estimates for the additional 4km of main pipeline plus the spur line required for Route Option 2 approximated $1 million, hence the reversion to Route Option 1 exclusively.
- The consideration of all aspects likely to influence of cost of construction stemmed from consultation with Adtech FRP, in particular the crossing of Bohena Creek. Minimising where possible the length of pipeline located within the unconsolidated sand creek bed would reduce the construction time and costs considerably and would also open up the possibility of horizontal directional drilling to achieve the crossing.

Local and State planning legislation.

- The acquisition of both approval to construct/operate and an appropriate occupation permit from Forestry NSW required the Proponent to request an assessment of the proposed route by Forestry for both commercial and environmental/heritage factors (i.e. Cultural heritage).
- The permissibility of the Project on lands identified as Crown Lands State Forests was discussed in terms of the *Forestry Act 1916* and the manner in which the proposed development was to be approved by the notional landholder under it governing legislation.
- The acceptability of the Project in regard to freehold land owners was discussed during the negotiation of access and corridor agreements.
- The permissibility of the Project on lands zoned under Narrabri LEP year was considered during the desktop investigations as the zoning of lands under the LEP may have influenced its possible pathway through the private freehold lands.

In summary, a range of strategic, environmental, heritage and social factors influenced the alternative route options considered and ultimately selected.

The potential route options are illustrated in **Figure 3.12**.

During the early stages of project scoping, other route options were considered. An alternative route that proceeded directly north from Bibblewindi along existing roads before utilising an existing Country Energy power line corridor to bring the line back towards the Newell Highway was investigated, however, was discounted as unsuitable as it made no use of the CSG being produced at the Bohena CSG Pilot. This route is shown in **Figure 3.12** and referred to as the "Early Alternative Pipeline Route".

No other options were considered.

The proposed route (red line) is clearly the most desirable from a number of reasons, namely, it results in the least overall impact on land resources, requires the smallest capital expenditure on gas flow line materials and additionally directly passes the Bohena CSG Pilot.

The alternative route (green/yellow line) makes some use of existing roads and access tracks across the State Forest land however, is generally a less desirable route for the following reasons.

- Increased capital costs from the additional 4km of gas flow line required.
- Does not intersect the Bohena CSG pilot and will therefore require an additional 1500m of gathering system to connect it to the main gas flow line.
- Results in higher cumulative vegetation clearance including direct impacts on a remnant of an *Ecological Endangered Community* outside of the State Forest where the route follows an uncleared travelling stock route.

3.9.4 Conclusions

The Project represents the most attractive option for the utilisation of CSG generated during extended production testing of the Bibblewindi and Bohena CSG Pilots. The consumption of the gas at the Wilga Park Power Station offers numerous economic and environmental benefits that compliment the strategic direction of the Joint Venture to develop a sustainable gas resource within NSW. The overall benefits include:

- the supply of gas from the CSG pilots will permit the return to continuous 24 hr operation of the power generation facility which is currently operating at less than maximum capacity;
- the development of the Project facilitates the ongoing exploration and production appraisal of PAL2 as a precursor to larger scale gas production and exports to other regional centres, industrial users and for electricity co-generation within NSW; and
- the collection of natural gas from the CSG pilots for use at the Wilga Park Power Station offers a significant environmental benefit than does the deleterious activity of venting of gas to atmosphere.

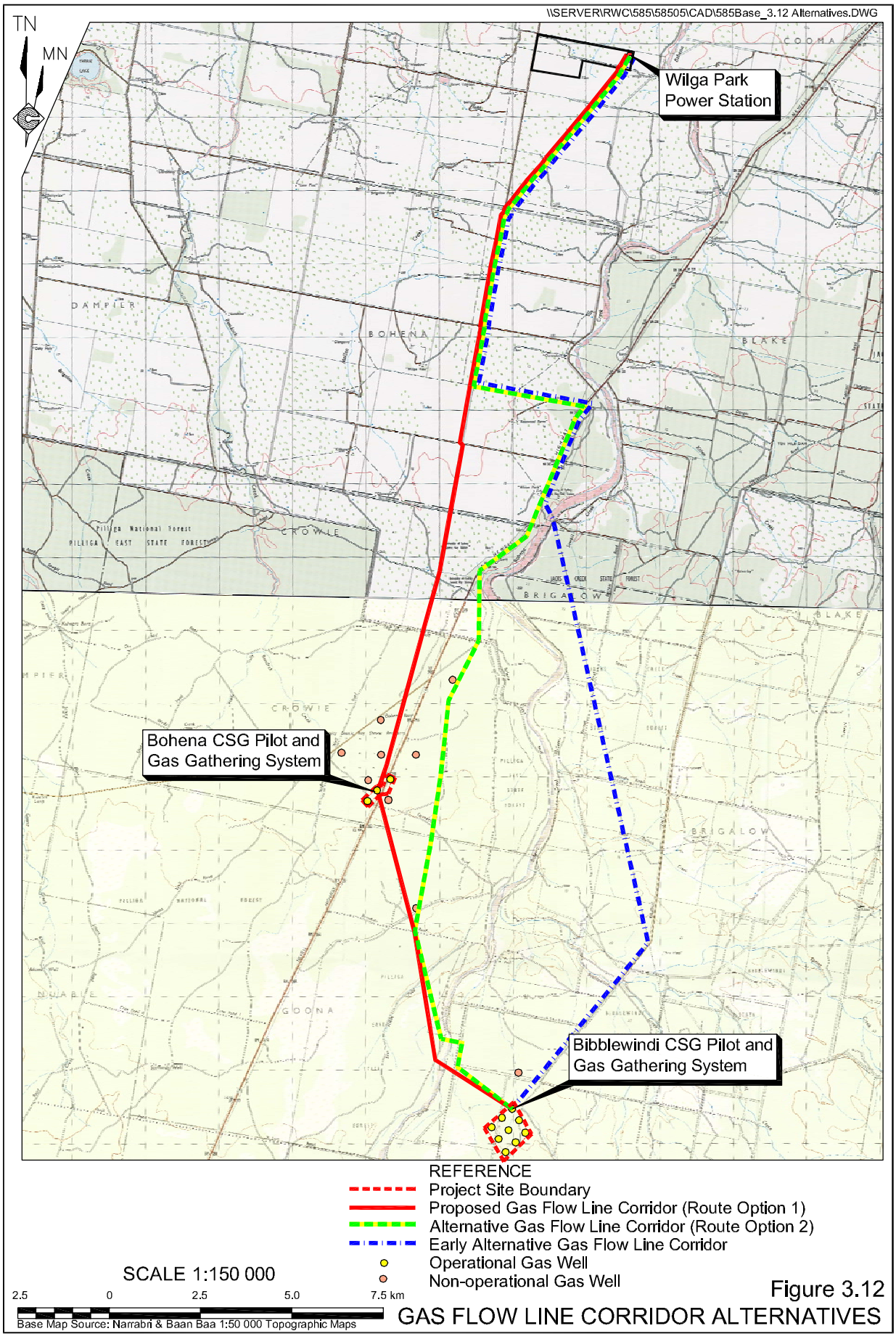


Figure 3.12
GAS FLOW LINE CORRIDOR ALTERNATIVES