5.0 DESCRIPTION OF THE PROJECT

5.1 Characteristics of the Gas

The product specification for the gas to be transported to Secunda from the Central Processing Facility at Temane is presented in Table 5-1. (Foster Wheeler, Overall Design Basis Document, Ref: 8456-8110-PD-0001).

TABLE 5-1: *Characteristics of gas to be transported in the pipeline*

ITEM	VALUE	
Gas heating value:	42.6MJ per normal cubic metre (±6%)	
Dewpoint control (water content):	106mg per normal cubic metre	
Hydrocarbon dewpoint:	-6,8°C at 6,25barg	
Other specifications:		
- design and operating temperatures	Design: not greater than 60°C Normal operating: 5°C or more lower than design	
- maximum maintainable operating pressure	125barg	
Contaminants and Inerts:	**Actual[1]**	**Recommended Specification Level**
- Nitrogen (N_2)	2.2 vol%	3 mol %
- Carbon Dioxide (CO_2)	0.01 vol%	2 mol %
- Total Inerts (Ar, He, CO_2 & N_2)	12.8 ppmv	5 mol %
- Hydrogen Sulphide (H_2S)	No trace	1 ppmv[2]
- Sulphur	<0.5mg/m_3 (LDL)	15 ppmv
- Oxygen (O_2)	10.9 – 12.8 ppmv	0.0 mol %
- Mercury[3]	0.17 ppbv[4]	0.2 ppmv
- Sodium	<0.5 ppmv (LDL)	0.5 ppmv
- Potassium	<0.3 ppmv (LDL)	0.3 ppmv
- Vanadium	<0.3 ppmv (LDL)	0.3 ppmv
- Zinc	<0.2 ppmv (LDL)	0.2 ppmv
- Aluminium	<0.5 ppmv (LDL)	0.5 ppmv
- Nickel	<0.2 ppmv (LDL)	0.2 ppmv
- Arsenic	<0.2 ppmv (LDL)	0.2 ppmv

1 Measured in well streams
2 ppmv mean parts per million (volume based)
3 All metals except mercury are below the Lower Detectable Limit (LDL)
4 ppbv mean parts per billion (volume based)

PHOTO 5-1: *Typical Clearing Activities*

PHOTO 5-2: *Bedding Machine used to compact the spoil*

5.2 Pipeline Specifications

Pipe Diameter:	DN650 (660,4mm).
Specifications:	
- Pipe Grade:	Either API 5L X65 or X70.
- Wall Thickness:	Dependent on grade and pressure class, but could be predominantly about 11mm (X70).
- Pressure Class	The major portion of the route is expected to be Class 1 Div 1 with the above wall thickness. The remaining sections will be Classes 2 & 3. The wall thickness will also depend on investigations underway about fracture control planes and external interference design.
- Pipe depth:	Pipeline Code: American Society of Mechanical Engineers B31.8 (1999). A minimum of 0.9m below surface. Increased depth, or above ground, in special circumstances. These may include areas where deep ploughing is practiced for agriculture or in areas of increased risk of natural hazard, such as river crossings.
Pipeline bedding:	The pipe is laid on a prepared bedding layer of selected excavated material approximately 150mm thick. The pipe is then covered with the same material. The remainder of the trench is then backfilled with the excavated material and the top mounded to allow for settlement. All unwanted material such as rubble, stones, rocks, boulders and any other waste is removed from the work area. Any infrastructure damaged during construction is then repaired.
Markers:	Inter-visible concrete markers on straight sections and at changes in direction indicating the new alignment. Aerial markers every 1 to 2 kilometres.
Corrosion Protection (internal):	A typical natural gas consists of a mixture of gases like methane and ethane with minimal carbon dioxide and nitrogen. These gases are all non-corrosive. The natural gas is also very dry with a dewpoint of less than -20°C. Conditions are therefore not conducive to internal corrosion. The characteristics of the gas that will be inserted into the pipeline at Temane are described in Table 5-1.
Corrosion Protection (external):	A cross-country pipeline is generally designed for a lifespan of 40 years. If corrosion-protective measures are maintained there is no reason why a buried pipeline cannot render service for a hundred years or more.The first measure against external corrosion is the application of the FBE (Fusion Bonded Epoxy) or other approved system on the outside surface of the pipe. This system is applied either in the pipe mill or at the port of arrival under strict conditions and quality assurance surveillance. The FBE coating system is a high quality surface protection and offers good insulation between the pipe and surrounding soil. The second protection system is referred to as Cathodic Protection (CP). With a CP system, a direct electric current is induced into the pipe at intervals to maintain a soil pipe potential of between -0,85 and -2,0 volts. The potential difference is too low to be a threat to human or animal life. The normal corrosion of steel is a process where the electron flows from the steel surface towards the surrounding medium (soil). With a CP system this process is reversed and this prevents corrosion.

PHOTO 5-3: *Bush Clearer*

PHOTO 5-4: *Pipe Stringing*

PHOTO 5-5: *Lowering In*

PHOTO 5-6: *Stockpiled Dirt*

5.3 Pipe Supply and Delivery

Supply of pipe:

A number of alternatives for the production and supply of pipe for the project are under consideration. These include:

- Supply of all pipe by international manufacturers;
- Supply of pipe by international and South African manufacturers;

The final coating of the pipe could be applied at a plant to be established in Mozambique or in the country of origin. This is being considered so as to improve socio-economic spin-offs for the host country and to minimize transport damage to the coating.

Delivery of pipe and equipment:

Much of the equipment and material used in the construction of the pipeline will be pre-constructed in modular and transportable packages and then delivered to the site by means of a combination of sea, rail and road transportation.To accommodate the delivery of equipment by sea, temporary "Instant Ports" may be developed on Mozambique's coastline (very unlikely at this stage for the pipeline project, possibly still an option for the field). An investigation is being undertaken by Sasol to determine whether to build temporary landing facilities or whether to use existing ports. On the basis of present knowledge the temporary landing sites are not favoured by Sasol and the use of existing port infrastructure is likely to be the preferred option. However, the joint use of beach landing sites for equipment supply or removal at, for example, Inhassoro, remains an option.

5.4 Pipeline Route Alignment

Proposed Corridor:

The proposed corridor for the pipeline route is presented in the Land Type maps in Appendix A. The corridor is approximately 4km wide and is the area within which a route has been selected, subject to the verification of the absence of any fatal environmental flaws along the alignment.

Alternatives:

Three broad alternatives were examined in the Corridor Screening Report accompanying the Terms of Reference for the EIS (refer to Section 8). Local alternatives within the 4km corridor have been examined in the EIS specialist studies and will be considered further during the investigation undertaken for the Environmental Management Plan.

Detailed Alignment:

Details of the pipeline alignment are presented in the Land Type maps in Appendix A.

5.5 Pipeline Right of Way (ROW) and Land Use Restrictions

Temporary ROW:

Under typical circumstances a right of way 25-30m wide (for Mozambique) is required for the construction of the pipeline. This may increase in areas of obstacle crossings.

Permanent Rights:

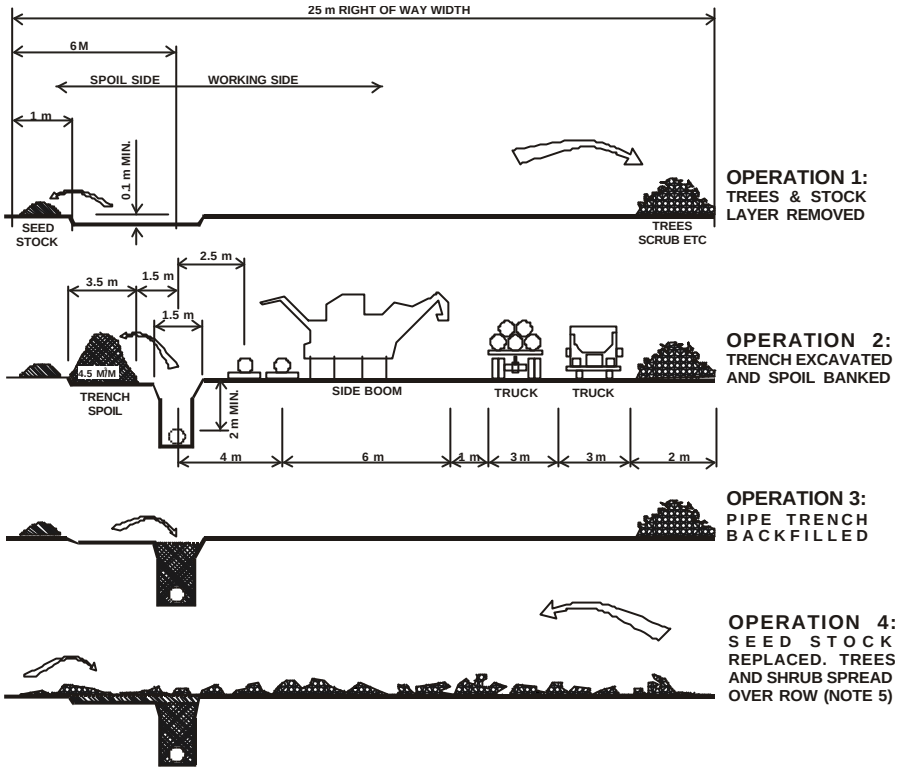
The permanent rights defined by the agreement between the Government of Mozambique and Sasol, are as follows:

400 metres wide. Area across which construction of large buildings and large amounts of buildings are restricted.

100 metres wide. Area across which construction of new buildings will be prohibited.

30 metres wide. Area through which existing buildings and population will be relocated.

FIGURE 5-1: *Pipeline Construction Train*



THE FOLLOWING ITEMS OCCUR AT REGULAR INTERVALS AND IMPACT ON THE WIDTH OF THE EASEMENT:

1: TURNING CIRCLE (30m WIDTH) FOR PIPE TRUCKS EVERY 30 m

2: DUMPS FOR IMPORTED MATERIAL ALONG RIGHT OF WAY IN ROCK AREAS REQUIRED TO BE 5-7 m WIDE .

3: TREES AND SCRUB PILES VARY FROM 3m TO 8m WIDE DEPENDING ON VEGETATION COVER.

4: TIE-IN SPOOLS ARE WELDED AND LAID NEXT TO MAIN PIPELINE ALLOWING A SPACING OF 1.5 m.

5: SUBJECT TO INDIVIDUAL OWNERS' REQUIREMENTS.

6: FOR 25 m ROW. RAKE TREES AND SCRUB INTO PILES AT 1m INTERVALS OFF ROW.

Land use restrictions:

The agreement between Sasol and the Government of Mozambique specifies that *following the signing of the agreement*, no settlement (the definition of which includes buildings, offices factories, educational facilities or other structures where people congregate) of more than five people will be permitted within the safety zone of the pipeline (200m on either side of the centreline).

No restrictions on agricultural use are specified in the Sasol/GOM agreement, nor in the Petroleum Law (Law 3/2001 of 21 February) or the Regulations under the Law (Draft 4d, March 2001). Land use restrictions adjacent to pipelines are specified in the Land Law (Law 19/97 of 7 October) and the Rural Land Regulations under the Land Law (Law 66/98 of 8 December). In accordance with these regulations, the zone of 50m on either side of a pipeline is designated a 'Partial Protection Zone (PPZ)' in which no right to land use by third parties exists and in which the exercise of any activity other than that for which the PPZ was defined, must be licensed.

Sasol themselves place few restrictions over the use of land for agricultural purposes over their pipeline servitudes. Sasol servitude agreements typically exclude the re-establishment of deep-rooted vegetation, but otherwise permit most agricultural activities without restriction.

TABLE 5-2: *Permissible Arable Uses over the Pipeline*

FARMING TYPE	ACCEPTABLE SERVITUDE USES	UNACCEPTABLE SERVITUDE USES
Grazing	✍	
Sugar Cane	✍	
Rice	✍	
Maize	✍	
Groundnuts	✍	
Cassava	✍	
Beans, Cowpeas	✍	
Tropical Fruits	✍	
Citrus		✍
Nuts		✍
Forestry		✍

5.6 Typical Steps in Pipeline Construction

Surveying and Route Pegging:

Surveyors mark the centerline of the pipeline and the boundaries of the construction working area.

Delivery of Pipe and Equipment:

The line pipe is transported from the port of entry to the site. Contractor's equipment and other imported materials also require transport to the site.

Establishment of Camp sites and Lay Down areas:

Campsites in Mozambique will be located approximately every 100km in order to minimize driving from the work site to the camp each day. Campsite locations have not been determined yet but the preference will be to locate close to existing towns, where this is possible. Ressano Garcia, Chokwè and Vilanculos are therefore likely sites with the other two sites in between. Lay down areas will be situated as close to the ROW and existing road and rail as possible.

Right of Way Clearing:

Clearing and grading of the right of way involves the removal of trees, vegetation and topsoil using a bulldozer and grader. Depending on the circumstances, a brush cutter may be used instead of a bulldozer.

Trench Digging:

The trench for the pipe is excavated using a rotational digger or excavator.

PHOTO 5-7: *Typical Open Trench Construction across a Wetland*

Obstacles:	The main obstacles along the proposed pipeline in Mozambique are river crossings. A directional drilling technique is being considered to cross the Limpopo River. Directional drilling involves the trenchless installation of the pipe, using drilling methods. The other river crossings are likely to be installed using the open cut method during the winter season.
Pipe Stringing:	Pipe is moved from the truck to the right of way with an excavator with a magnetic or vacuum attachment.
Welding:	This is one of the key operations on the pipeline. Welding will probably be automatic or mechanised and may be supported by sidebooms.
Inspection:	The pipeline and welds are visually inspected and non-destructive testing is used to check the integrity of the welds (either X-ray or automatic UT).
Weld Coating:	The welds are coated to protect the pipe from abrasion and corrosion.
Lowering in:	The pipe is lowered into the trench. The equipment necessary to complete this operation includes sidebooms and excavators.
Backfilling:	A graded spoil is compacted around the pipe to prevent damage to the pipe. Where possible, this is material taken from the trench excavation. Where this material is unsuitable, then a suitable cohesionless sand is imported. Rock spoil may be crushed and replaced in the trench or in some circumstances, dumped in rock fills (very little rock spoil is anticipated for the proposed pipeline).
Rate of Construction:	Main Crews: 0.5 - 4 km/day. Obstacle Crews: 0,5km/week or less.
Topsoil Re-instatement:	Topsoil stripped from the trench and corridor is replaced over the backfill and is spread.
Rehabilitation:	Re-seeding normally depends on the circumstances and may or may not be done depending on the specification supplied by the environmental team.

5.7 Construction Camps

Location:	Described above under Section 5.6.
Size:	Approximately 4500m^2 in area (0,45ha).
Land Preparation:	Clearing and fencing.
Accommodation & Camp Facilities:	Each construction team consists of approximately one hundred and fifty people. Accommodation will comprise about twenty porta-home units (each unit houses six people). In addition each camp will have one canteen, three ablution blocks, a water tank, a power generator and diesel storage. Sewage treatment will be by portable sewage treatment plant. Domestic solid waste will be trucked out, buried or incinerated in accordance with sound practices.

5.8 Lay Down Areas

Location:	Described above under section 5.6.
Size:	Approximately 1200m^2 per stack. Stacks north of Limpopo (near Macarretane) and near Temane. Others may be considered along route depending upon logistics.
Land Preparation:	Clearing and fencing.

5.9 Accessibility

Road Upgrading: It is likely that some local road upgrading will be done in order to provide improved access to the pipeline route in places. Most access, however, particularly the more remote sections of the pipeline route will be along the right of way corridor.

Trafficability: Significant sections of the route experience seasonal flooding. Depending on more detailed investigations being undertaken to establish seasonal variations of water levels in these areas, special equipment suited to wet conditions may be required for sections of the route.

PHOTO 5-8: *Stacked Pipes in a Lay Down Area*